Manfred SCHRENK, Vasily V. POPOVICH, Peter ZEILE, Pietro ELISEI, Clemens BEYER (Eds.)

REAL CORP 2015

PLAN TOGETHER RIGHT NOW OVERALL

From Vision to Reality for Vibrant Cities and Regions

5-7 MAY 2015, VAC GENT, BELGIUM

PROCEEDINGS

of the 20th International Conference on Urban Planning, Regional Development and Information Society

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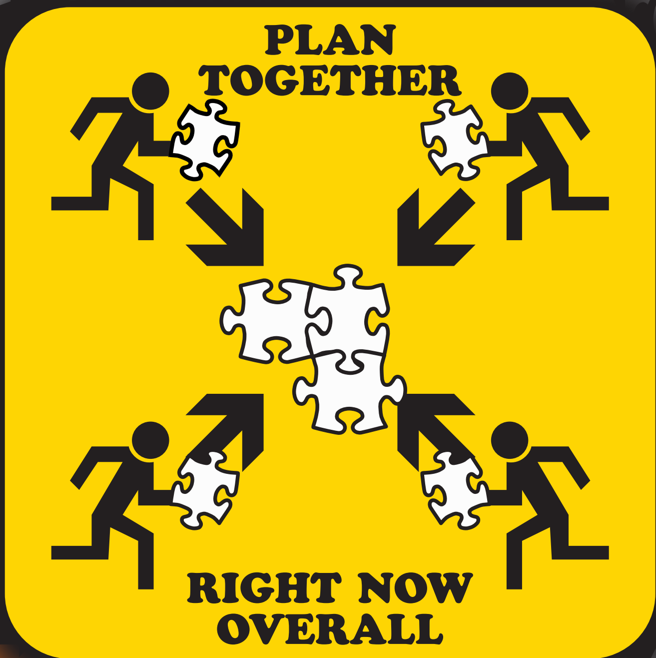

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Proceedings of

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Beiträge zur

20. internationalen Konferenz zu Stadtplanung, Regionalentwicklung und Informationsgesellschaft

Edited by

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CORP – Competence Center of Urban and Regional Planning

Kompetenzzentrum für Stadtplanung und Regionalentwicklung

Klosterneuburger Straße 121/36, A-1200 Wien

office@corp.at, http://www.corp.at

TEAM

Manfred SCHRENK
Clemens BEYER
Wolfgang W. WASSERBURGER

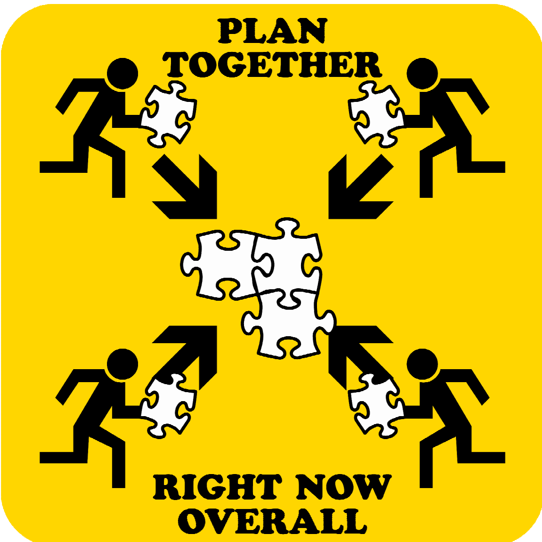
Ann Pisman
Jan Zaman
Peter Zeile
Jan-Philipp Exner

PREFACE

Manfred SCHRENK,

Conference Director,
President CORP – Competence Center of Urban and Regional Planning

WELCOME to REAL CORP 2015, the
20th International Conference on Urban & Regional Development and Spatial Planning in the Information Society!



Cities full of life, commited citizens, visionary politicians, a strong economy, attractive universities, a rich arts and cultural scene, joy and fun in the streets, prosperity, curiosity, inclusiveness – dynamic and stable and of course everything sustainable and resilient and "smart" ...
What are the ingredients for VIBRANT CITIES and REGIONS? And how to make them a REALITY?

Cities and regions are and always have been in permanent transition. Ghent, the second largest city in Belgium with a population of approx. 250,000, has been in a leading position regarding smart city planning. The Flemish newspaper "De Standaard" announced "Ghent is the smartest city" in January 2013, and Daniël Termont was elected first runner-up in the 2014 World Mayor Prize competition and therefore was awarded the World Mayor Commendation for services to European cities.

The City of Ghent uses a system called "Ghent 2030" for their long term sustainable urban development. The Smart city development in Ghent is based on participation so that the local government is more an equal partner than a director. Ghent wants their people to be smart citizens;

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they are encouraged to contribute to the development of their own living environment and also have multiple chances to forward their ideas to a bigger scale level. To achieve this goal, Ghent also acts as a Living Lab (which is a user-centred, open-innovation ecosystem integrating concurrent research and innovation processes within a various forms of public-private partnership models). The Ghent Living Lab is an open collaborative network led by the City of Ghent. The Living Lab focuses on e-inclusion, e-government, e-participation, digital innovation and green digital development (energy efficiency, smart energy).

What is the role of planning and planners in such a smart environment aiming to development a vibrant contemporary and future city? During the international conference REAL CORP 2015 some 300 experts coming from 60 countries all over the world are exchanging their knowledge and discussing how to manage spatial transitions of the 21^{st} century or how financial instruments for cities, regions and area specific development can be optimised in the background of ubiquitous budget austerity. These fields of expertise will be the leading topics of REAL CORP 2015 on “Plan Together – Right Now – Overall. From Vision to Reality for Vibrant Cities and Regions”. The proceedings comprise about 1,000 pages of hand-picked and mainly double-stage peer reviewed knowledge for planners and for cities.

More than 100 expert presentations and keynote speeches, a round table discussion on “Urban Living Labs for Vibrant Cities” in cooperation with Ghent University as well as an extensive range of excursions to historic and future development sites of the city of Ghent complete the programme of this year’s conference which is the 20th edition of the annual REAL CORP series. It all started 1996 with a handful of presentations on computer-aided spatial planning at Vienna University of Technology. Over the years, REAL CORP became one of the most important conferences for planners, stakeholders from governmental, non-governental and research organisations and related professions around the world.

What makes REAL CORP unique is the interdisciplinary and highly international approach of our partners, speakers and participants. Welcome to three days of world-wide networking, sharing of thoughts and development of project ideas in the wonderful smart city of Ghent.

Have a great conference!

Manfred SCHRENK, Clemens BEYER & the REAL CORP Team

Editors – Herausgeber:
DI Manfred SCHRENK, President CORP – Competence Center of Urban and Regional Planning, Vienna, Austria
Prof. Dr. Vasily V. POPOVICH, SPIIRAS, St. Petersburg, Russia
Dr.-Ing. Peter ZEILE, TU Kaiserslautern, Kaiserslautern, Germany
Dr.-Ing. Pietro ELISEI, URBASOFIA, Bucharest, Romania
Dipl.-Ing. Clemens BEYER, MULTIMEDIAPLAN.AT, Vienna, Austria

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CORP – Competence Center of Urban and Regional Planning
Kompetenzzentrum für Stadtplanung und Regionalentwicklung
Klosterneuburger Straße 121/36, 1200 Vienna, Austria
office@corp.at, http://www.corp.at

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reviewed paper

A Different Perspective on Garden Grabbing: Mapping the Adaptive Capacity of Home Food Production

Valerie Dewaelheyns, Frederik Lerouge, Elke Rogge, Liesbet Vranken

(PhD Valerie Dewaelheyns, Institute for Agricultural and Fisheries research, Social Sciences Unit, Burgemeester van Gansberghelaan 115, Box 2, 9820 Merelbeke, Belgium; Division of Forest, Nature and Landscape, Department of Earth and Environmental Sciences, KU Leuven, Celestijnenlaan 200E, 3001 Heverlee, valerie.dewaelheyns@ees.kuleuven.be)

(Msc Frederik Lerouge, Division of Bio-economics, Department of Earth and Environmental Sciences, KU Leuven, Celestijnenlaan 200E, 3001 Heverlee, frederik.lerouge@ees.kuleuven.be)

(PhD Elke Rogge, Institute for Agricultural and Fisheries research, Social Sciences Unit, Burgemeester van Gansberghelaan 115, Box 2, 9820 Merelbeke, Belgium, elke.rogge@ilvo.vlaanderen.be)

(PhD Liesbet Vranken, Division of Bio-economics, Department of Earth and Environmental Sciences, KU Leuven, Celestijnenlaan 200E, 3001 Heverlee, liesbet.vranken@ees.kuleuven.be)titel

1 ABSTRACT

Current trends in urban development strive for the densification of existing urban areas. This densification can be operationalized by the decrease and intake of domestic garden area. Yet, such densification projects may result in potential losses with regards to the support of ecosystem services and the safeguarding of urban adaptive capacity. The manifold of multifunctional garden spaces present worldwide offers for example interesting perspectives for food provisioning. By developing a theoretical model to capture, quantify and interrelate the most relevant variables and constraints of potential food production in domestic gardens, insight is gained in the food production potential of domestic gardens. Also the influence of utility on the household's decision on how much space and time to devote to food production was incorporated. The model development was fostered by quantitative and qualitative data collection for the case study Flanders. These data allowed to gain insights in the current food production and potential for food production in Flemish domestic gardens. Such insights allow the exploration of spatial and temporal constraints of individual domestic gardens for food production. This contributes to a better understanding of the adaptive capacity of garden space interwoven within the urban fabric. As such, the qualities and potentials enclosed within the existing garden area can be put next to the benefits of building these areas. Moreover, insights are gained in points of attention when private garden areas would be addressed for food provisioning.

2 INTRODUCTION

There is an increasing attention for food production outside the traditional agricultural area (Algert, Baameur, & Renvall, 2014), but t his attention largely bypasses domestic gardens (Taylor & Lovell, 2014). Also other services delivered by garden space fail to receive proper attention (Davies, Edmondson, Heinemeyer, Leake, & Gaston, 2011).

Domestic gardens constitute a significant amount of the space that is not built-on (Dewaelheyns, Rogge, & Gulinck, 2014). Their coverage in urban areas ranges between 22 % for cities in the UK (Loram, Tratalos, Warren, & Gaston, 2007) and 46 % for residential areas in New Zealand (Mathieu, Freeman, & Aryal, 2007). But they are also a non-negligible land use in the countryside (Antrop & Van Eetvelde, 2008). With continuing urbanization ahead, the total area of domestic gardens worldwide is expected to increase by planned and unplanned urbanization processes (Dewaelheyns, et al., 2014).

Domestic gardens can be interpreted as multifunctional micro-spaces, with trade-offs and synergies between functions (Stoorvogel, Antle, Crissman, & Bowen, 2004). Throughout history, food production has been a most important part of gardening practices worldwide, in developing (WinklerPrins, 2002) and developed countries (Taylor & Lovell, 2014). Domestic gardens can be seen as an adaptable and accessible land resource for food production worldwide, holding potential to reduce vulnerability and improve personal food security (Barthel & Isendahl, 2013; Buchmann, 2009).

During the past decades home food production regained attention from policy (Ghosh, 2012) and from research (Taylor & Lovell, 2014). Some recent studies, mainly from the US, use scenario’s to assess the contribution of private land and residential gardens to the total food production area and food needs (Grewal & Grewal, 2012; McClintock, Cooper, & Khandeshi, 2013). Others deal with food self-provisioning by exploring the motivations of individuals and limitations imposed by policies (Alber & Kohler, 2008; Jehlicka, Kostelecký, & Smith, 2013).

The contribution of domestic gardens to food production has proven difficult to measure (Kortright & Wakefield, 2011). Their private character (Kortright & Wakefield, 2011; Phillips, Page, Saratsi, Tansey, & Moore, 2008), limited accessibility (Pérez Campaña & Valenzuela Montes, 2012) and large variation in appearance, management and use (Dewaelheyns, Elsen, Vandendriessche, & Gulinck, 2013) impedes surveying and research efforts. Consequently, insights in the food production potential of gardens remains limited.

Domestic gardens are also complex social-ecological systems (Barthel, Folke, & Colding, 2010). The choices and actions of gardeners are influenced by a variety of drivers and constraints, which can be individual and social in nature (like culture, personal ideals, preferences and beliefs (Cook, Hall, & Larson, 2012), or imposed by the biophysical context (like climate, soil characteristics, hydrology, ecology (Kaye, Groffman, Grimm, Baker, & Pouyat, 2006) and the social context (like income, informal institutions in the neighborhood (Nassauer, Wang, & Dayrell, 2009).

Cleveland and Soleri (1987) stressed the necessity of analyzing internal dynamics of both gardens and households, the relationship between the two, and the relationships of both with external social, economic, political and environmental issues which determine the households' control over resources for and production from gardens.

Therefore, this paper aims to gain insight in the food production potential of domestic gardens and in the households' decision to allocate space and time to food production. The specific objective is to develop a methodological framework to capture, quantify and interrelate the most relevant determinants and constraints of potential food production in domestic gardens.

We investigate the degrees of freedom in the decision space of a household, giving food for thought on the adaptive capacity of domestic gardens for food production at the household level. This model should facilitate the discussion on the inclusion of domestic vegetable gardens within food strategies.

3 CONCEPTUAL MODEL AND HYPOTHESES

3.1 Defining the domestic garden

We define a domestic garden as the residential parcel, owned or rented, with exclusion of the associated house. The term 'domestic garden' is preferred rather than the term 'private garden', since the latter can be any privately owned garden that is not necessarily spatially linked to a dwelling. The term 'kitchen garden' refers to the vegetable and fruit productive part of the garden. Domestic gardens associated with the dwellings of farmers are included, as well as small greenhouses not used for the commercial production of food or ornamental plants. Excluded from the definition is the area used for professional agriculture, storage space for building materials or refuse, greenhouses used for commercial production and extensive woodlots. Also, gardens that are spatially not directly linked to housing, like dispersed single-plot gardens in agricultural land and allotment gardens are not considered as domestic gardens (Dewaelheyns et al., 2014).

3.2 Theoretical model and hypotheses

3.2.1 Theoretical model

A theoretical model (Chen & Wang, 2013; Vranken & Swinnen, 2006) is developed that describes trade-offs and synergies in area and time between food production and other functions in domestic gardens. With "food" we refer here to vegetables and fruit.

In this model we use utility theory to analyze the choice problem of households when they are confronted with the questions if and how much area and time they would allocate to domestic food production in the garden. In econometric terms, the choice problem for a consumer-producer is presented as a problem of maximizing a utility function subject to one or more constraints.

The model includes five main variables: time (T), area (L), consumed produce (C), utility (U) and input (z). Each variable is broken down into several components. We describe their interrelations at a household level.

The total available time of a household is represented by the variable time $\bar{T}$, and is divided in three components. The total time available for the household includes time used for producing home grown food in the garden t_h, the time used for working (i.e. earning a wage) t_w, and all the remaining time available for all other non-wage earning activities t_o (e.g. leisure, housekeeping, socializing, resting, non-food gardening...).

$$\bar{T} = t_w + t_h + t_o$$

A household's capital contains an endowment M (real estate, savings,...) and a wage income determined by the wage w and t_w.

The total domestic garden area available to a household $\bar{L}$ can be used either for food production or non-food related activities. The area assigned to food production is denoted L_h, while L_o is the area assigned to all other activities.

$$\bar{L} = L_o + L_h$$

The total food consumption used by the household C includes food bought on the market (in general terms) c_1 as well as home garden produce c_2. Home garden produce c_2 can be inserted in the model as the difference between the total food consumption C and bought food c_1. If the household is completely self-sustainable through home produce, c_1 equals 0 and no additional food needs to be bought from the market.

$$C = c_1 + c_2$$

Utility is defined as the whole of material and non-material benefits from a garden and from food consumption. The utility U of a household owning a garden is considered as function of the food consumed by the household C, and of the remaining area and time available for providing other leisure uses and services, Lo and to respectively. In other words, the household utility depends on food consumption, and the area and time allocated to other services consumed by the household.

$$U(c_1, c_2, t_o, t_h, L_o, L_h)$$

Households maximize their utility subject to some constraints. Household members divide their available time $\bar{T}$ between time for working t_w, time for other, non-wage earning, activities t_o, and time spent producing home grown food t_h. Time spent earning a wage t_w can be expressed in function of the total available time minus the time spent for home food production and for other activities. Due to a limited amount of wage employment opportunities ($\bar{T}_w^{max}$), there is a maximum amount of time that can that can be allocated to earning an income t_w.

$$t_w = \bar{T} - t_h - t_o$$

$$\bar{T}_w^{max} \geq t_w$$

Also the garden area $\bar{L}$ is constrained. The total amount of area that each household can allocate to either food production or provision of other services, is limited. In the model, the available garden space is either allocated to food production L_h or to other uses L_o and we assume both to be mutually exclusive.

Growing fruit and vegetables in the garden requires an amount of material input (z). This input is defined as the aggregated cost for variable inputs such as seeds, fertilizers and pesticides used for home food production. As such, domestic produce c_2 is considered a positive function of area L_h and time t_h allocated to production, and of input z.

$$c_2(L_h, t_h, z)$$

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A final constraint is defined by the assumption that the overall household budget allocated to buying food from the market at a price p should not exceed the sum of endowment M and wage income as a product of wage w and t_w.

$$M + w[\bar{T} - t_h - t_o] \geq pc_1$$

$$M + w[\bar{T} - t_h - t_o] \geq pC - pc_2(L_h, t_h, z)$$

To understand how constraints influence the households decisions on home food production, we need to solve this constrained extremum problem. Therefore we apply the Lagrange multiplier method (Chiang, 1984). This approach by-passes the need to explicitly solve the constraints. The problem is reformulated into a free extremum problem, which can be solved using relatively simple derivatives. The Lagrange multiplier itself has an economic interpretation as the marginal utilities associated with the constraints. A marginal utility is the gain from an increase in the consumption of that good or service.

The Lagrange form Z of the utility function contains the function and the constraints on capital, area and time, which are multiplied by the Lagrange multipliers λ, μ and γ. These respectively represent capital constraints (λ), area constraints (μ) and time constraints (γ).

$$Z = U\big(C, t_o, t_h, L_o, L_h\big) + \lambda[M + w[\bar{T} - t_h - t_o] - pC + pc_2(L_h, t_h, z)] + \mu[\bar{L} - L_h - L_o] + \gamma[\bar{T}_w^{max} - T + t_h + t_o]$$

To solve the constrained extremum problem, this Lagrange form of the utility function Z is derived to the Lagrange multipliers, as well as to the principal factors of the model L_h and t_h. As such, the first-order condition for the free extremum problem consists of the following five equations:

(1) $Z_\lambda = M + w[\bar{T} - t_h - t_o] - pC + pc_2(L_h, t_h, z) = 0$

(2) $Z_\mu = \bar{L} - L_h - L_o$

(3) $Z_\gamma = \bar{T}_w^{max} - T + t_h + t_o$

(4) $Z_{L_h} = \frac{\partial U}{\partial L_h} + \frac{\partial U}{\partial c_2} . \frac{\partial c_2}{\partial L_h} + \frac{\partial U}{\partial L_o} . \frac{\partial L_o}{\partial L_h} + \lambda p \frac{\partial c_2}{\partial L_h} - \mu = 0$

(5) $Z_{t_h} = \frac{\partial U}{\partial t_h} + \frac{\partial U}{\partial c_2} . \frac{\partial c_2}{\partial t_h} \mp \frac{\partial U}{\partial t_o} . \frac{\partial t_o}{\partial t_h} + \frac{\partial U}{\partial t_h} + \lambda\left[-w + p\frac{\partial c_2}{\partial t_h}\right] + \gamma = 0$

3.2.2 Hypotheses

The first condition explores the relation between income and consumption. Lower financial means are associated with a general lower consumption. The second and third conditions reflect the spatial and temporal constraints, respectively.

The fourth condition explores the relation between garden space and domestic food consumption, and can be expressed as follows:

$$\frac{\partial c_2}{\partial L_h}[U_{c_2} + \lambda p] + U_{L_h} \geq \mu + U_{L_o}$$

with U_{c_2} the marginal utility of the consumption of home garden produce and U_{L_h} and U_{L_o} the marginal utility of allocating domestic garden area to respectively food production or other activities. The above equation learns that a household allocates more space to food production in its domestic garden as long as the left hand side of the equation is larger than the right hand side. This implies that a more binding capital constraint (λ) leads to more area being allocated to home grown production. In addition, increasing food prices (p) and a higher marginal utility of consuming home grown produce (i.e. the more one enjoys consuming home grown produce for example because it is considered more tasty or healthy) lead to more area being allocated to home grown production. Also, a higher partial productivity of home production and the higher the marginal utility of space being allocated to home grown production (i.e. the more one enjoys the visual appearance of a kitchen garden), the more it repays to allocate more garden space to food production. In addition, a higher marginal utility of L_o (i.e. the more one enjoys the visual appearance of, for example, an ornamental garden) and a more binding area constraint (μ) lead to less garden area allocated to home production.

The fifth condition explores the relation between time allocation and domestic food consumption, and can be expressed as follows:

$$\frac{\partial c_2}{\partial t_h}[U_{c_2} + \lambda p] + U_{t_h} \geq U_{t_o} + \lambda w - \gamma$$

with U_{t_h} and U_{t_o} the marginal utility of allocating time to respectively home grown food production or other non-wage earning activities. The above equation learns that a household allocates more time to food production in its domestic garden as long as the left hand side of the equation is larger than the right hand side. Less income opportunities (higher λ) and lower wages increase the time invested in home food production t_h, and the other way around. In addition, a higher partial productivity of home food production, higher food prices and a higher marginal utility of devoting time to home food production (i.e. the more one enjoys working in the kitchen garden) will also increase the time invested in home food production t_h. Finally, a higher marginal utility of to will decrease the amount of time spent on home grown production, while a higher marginal utility of consuming home grown produce will increase the time invested in home food production.

A more binding capital constraint (λ) will also affect the decision on how much time to spend on home grown food production. The impact is however not clear ex ante and depends on the magnitude of the wage the garden owner can earn as well as the labor productivity of home grown food production. A very productive gardener who can only earn a relatively low wage will increase its time allocated to home grown food production when faced with an more binding capital constraint. On the other hand, an unproductive gardener with high wage earning opportunity will spend more time on wage earning activities than on home food production when confronted with a more binding capital constraint. Now, t_h and L_h are tightly related to each other. Increasing L_h by expanding the kitchen garden is often associated with an increase in t_h, as one needs to invest more time to maintain this larger garden. Even so, the emphasis can be on increasing L_h if time restrictions (γ) are more binding, increasing t_h if spatial constraints (μ) are more binding, or both.

3.3 Scaling up to the garden complex

The private and small scaled character of domestic gardens leads to the routinely consideration of gardens as individual 'objects'. The concept of the 'garden complex' considers the totality of domestic gardens in a certain area as a region-wide landscape structure (Dewaelheyns et al., 2013; Dewaelheyns et al., 2014, masked for blind review).

More specifically, the garden complex sums of all single domestic gardens within a certain area. From a spatial viewpoint, this is the whole of individual garden areas $\sum_1^n \bar{L}$, comprising all area used for food production $\sum_1^n L_h$, and all area for other uses $\sum_1^n L_o$. The consumption of produce of all gardens can be summed $\sum_1^n c_2$. Similarly, all time spent on home food production can be summed as $\sum_1^n t_h$. As such, this concept allows for a straightforward up-scaling. While the garden complex as a whole ($\sum_1^n \bar{L}$) can be an extensive interconnected area, the decision space of the individual households is often strictly confined to the physical space of the households' property $\bar{L}$.

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4 DATA

To test the hypotheses coming out of the model, we collected both quantitative and qualitative data on the spatial composition, food productivity and gardening practices within domestic gardens.

4.1 Case study Flanders

All data are collected in Flanders, the northern region of the federal state of Belgium. Criteria used by OECD and EUROSTAT label Flanders as mainly (peri-) urban. Being present throughout the urban-rural continuum, domestic gardens are part of this peri-urban landscape. They cover in total 110.000 ha or 8 % of the Flemish territory (Dewaelheyns, et al., 2014). This is substantially more than the 200 ha covered by allotment gardens (Allaert, Leinfelder, & Verhoestrate, 2007).

We see Flanders as a case study that can inspire other peri-urban regions. Food production has been one of the historical drivers behind the Belgium urbanization model of single family dwellings with a garden in the nineteenth and twentieth century (De Decker, 2011; Meeus, De Decker, & Claessens, 2013). The government considered and promoted this model as an important safety net to counteract periods of industrial unemployment, since people maintaining a small private garden at home could produce fruit and vegetables. Before the blessings of post-war prosperity, having or renting a garden was vital for the food provisioning g of Flemish households (De Decker, 2011; Meert, 2000).

4.2 Quantitative data

Quantitative data is used to evaluate and discuss variables of the model. Data on food production and garden management were collected by an anonymous online survey among garden owners in Flanders. From the 285 variables collected within the full survey, 47 were specifically related to food production. The drop-out rate of the internet survey was 38 %. A total of 1,138 respondents were withheld for further analysis.

More detailed quantitative data on garden design and food production was collected by face-to-face survey during garden visits within the case municipality of Herent (Flanders) in 2007. Herent is characterized by a strong morphological but rather weak functional urbanization (Mérenne-Schoumaker, Van der Haegen, & Van Hecke, 1998). A stratified random sampling (Lauridsen, 2004) based on geographical data was used to define which neighborhoods would be visited. In total, 25 garden visits were conducted and analyzed. A socio-demographic profile of the respondents for both surveys is provided in Appendix A.

4.3 Qualitative data

Qualitative data is used to illustrate to what extent the constraints are binding and effecting the decisions on the amount of land and time allocated to home garden production. The qualitative data also allow to investigate the marginal utility of L_h and t_h.

A total of 37 respondents were consulted, including 21 experts and 16 garden owners. The experts are all professionally active in the broad field of action related to domestic gardens (public servants at the municipal, provincial and Flemish level working on public green, spatial planning and urbanism; staff members of interest groups on rural development, agriculture and ecological gardening; etc.). They were questioned through open in-depth interviews of about one hour, conducted between June 2013 and January 2014. Private garden owners were involved by two focus groups, each consulting 8 participants. The focus groups were moderated by an experienced moderator and took place January 27th, 2014. They lasted each about two hours.

The qualitative data were analyzed according to the grounded theory approach, using inductive open and axial coding (Strauss & Corbin, 1998). During the coding process data were broken down into discrete objects or 'concepts' like ideas, phenomena, feelings,... and named. These concepts were further analyzed and aggregated into distinct categories. Finally, the concepts and categories were re-assembled by identifying links and cross-cuts. The authors used several techniques to ensure neutrality throughout the data collection and analysis and to prevent bias that could result from the work of one single researcher. These techniques included triangulation, a multi-staged process, partly collective data analysis and validation.

5 EMPIRICAL RESULTS AND DISCUSSION

5.1 Current home food production and its share in the household consumption

Some degree of measurement error is assumed on the survey results, e.g. due to difficulties to accurately estimate production quantities. The production figures and their financial values reported are estimates. Nevertheless, they provide a good starting point to test the validity of assumptions underlying the model and the hypotheses coming out of the model.

5.1.1 Current food production in domestic gardens

First, we discuss food production in Flemish domestic gardens(c_2), based on results for Flanders from the internet survey (Table 1). Vegetable gardens are present in 37 % and fruit production in 51 % of the surveyed gardens. Nuts are the third most represented produce group with 31 %. Only 28 % of the surveyed gardens has a food productivity (c_2) of zero, meaning that a vast majority of gardens delivers some kind of nutritional produce. In terms of productivity, 1,310 kg of vegetables were produced in 2007 per ha of vegetable garden as well as 216 kg of fruits per ha of garden (Table 2).

In 73 % of the surveyed gardens producing food, the produce is mainly for home consumption. Home consumption with occasional distributing or selling to other households occurs in 20 % of the producing gardens. Therefore, for the application of the model to the case of Flanders we assume home produce to equal home consumption c_2. This contrasts for example to Brazil, where a majority of the households (71 %) indicated that products from gardens are given away to a network of family, neighbors and friends (WinklerPrins, 2002).

Second, we discuss the results from the garden visits in Herent (Table 3). A total of 664 kg of vegetables was produced within the 25 surveyed gardens of Herent, corresponding to a productivity of 178 kg per ha of surveyed garden and 2.3 tons per ha of vegetable garden. These garden productivity figures (surveyed for vegetables, potatoes and fruit separately) are solely based on the quantities given by those respondents able to identify and quantify their yields in 2007.

Produce	**Gardens with presence**	**Total quantity removed from the gardens**
Vegetables	37 %	13 tonnes
Fruit	51 %	21 tonnes
Potatoes	20 %	1.7 tonnes
Nuts	31 %	3.4 tonnes
Eggs	25 %	69,100.00 pieces
Meat	5 %	808.00 kg
Fire wood	29 %	4,100 m³
No production	28 %	

Table 1 Domestic garden output, based on the internet survey results (N=1,138)

Produce	**Productivity of kitchen gardens [unit/ha] (2007)**	**Extrapolation for Flanders (based on area of garden and kitchen garden)**
Vegetables	1,310 kg/ha vegetable garden	11,251 tons
Fruit	216 kg/ha garden	25,896tons
Potatoes	2,566 kg/ha vegetable garden	22,042tons
Nuts	83 kg/ha garden	9 tons

Table 2 Productivity of kitchen gardens, based on the internet survey results (N=1,138)

Produce from the vegetable garden	**Total**	**Per garden**	**Per ha garden[a]**	**Per ha vegetable garden[b]**	***Per family member (N=64)***
Vegetables [kg]	664.5	26.58	177.7	2,292.5	*10.4*
Fruit [kg]	295	11.8	78.9		*4.6*
Potatoes [kg]	*680*	*27.2*	*181.8*	*2,346*	*10.6*

[a] total garden area of 3.74 ha, [b] total vegetable garden area of 0.26 ha

Table 3 Productivity of kitchen gardens, based on the results from the garden visits in Herent (N=25)

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5.1.2 Share of the home produce within the household consumption of fruit and vegetables

The Herent garden visits provide figures on the output per type of produce, allowing to calculate the share of garden output within household consumption in terms of weight (Table 4).

Compared to the produce bought for home consumption by Flemish households in 2007, the garden produce in Herent amounts to 28 % of the household vegetables consumption and 29 % of the household potatoes consumption (Table 4). Home garden produce (c_2) of vegetables and potatoes thus covers about one third of the amount bought at the market (c_1). For fruit this is much less, as many popular fruits (e.g. bananas, oranges and mandarins) are difficult to grow in temperate climates.

5.1.3 Monetary values of food production in domestic gardens

For a select number of products, the Herent visits allow to calculate the monetary value of the output and its share within household consumption and expenses based on output per type of produce. These data give insights in the monetary significance of c_2.

The monetary market value of the yearly output lies between 17.64 euro for carrots and 700.40 euro for potatoes for 2007 (Table 5). For five of the eight products, the equivalent financial value of the home produce exceeds 20% of the total household expenses, with apples (27.5 %), tomatoes (26.9 %) and potatoes (25.2 %) as front runners (Table 6).

Compared to the results from Reyes-García et al. (2012) for home vegetable gardens in the Iberian Peninsula, the gross monetary value (pc_2) realized within the analyzed gardens in Herent were overall lower.

We believe that the financial profile of the gardeners can be one of the reasons for the differences. The gross financial value of home gardens per manager in the Iberian peninsula represents almost three months of the official minimum salary in Spain (Reyes-García, et al., 2012), whereas the respondents from Herent have relatively high wages so that the value of the garden produce relative to their income is much smaller.

A second explanation could be the rather low number of different vegetable types cultivated per garden in Herent compared the Iberian gardens. Reyes-García et al. (2012) found that garden managers do not seem to organize their gardens and cultivation plans in order to maximize monetary benefits (pc_2). Knowing that the vegetable garden L_h covers a mere 10 % of the garden area $\bar{L}$, indicates that also the respondents from Herent do not strive for maximizing the monetary benefits from their garden.

Produce [kg]		**Produce per family member**	**Produce bought for home consumption per person by Flemish households in 2007**	**Percentage of the home grown produce in total vegetable consumption**
General	Vegetables	10.4	36.6	22.1
	Fruit	4.6	54.8	7.7
	Potatoes	10.6	36.1	22.7
Specific fruits and vegetables	Onion	0.4	4.3	8.5
	Beans	1	0.6	62.5
	Paprika	1	1.3	43.5
	Tomato	3.4	3.2	51.5
	Carrot	0.3	5.9	4.8
	Apple[b]	2.9	6.5	30.9
	Pear[c]	1.2	2.5	32.4

[a] Flemish Centre for Agriculture and Fisheries marketing (VLAM), bron: GfK PanelServices Benelux for VLAM, [b] reference is Jonagold, [c] reference is Conference.

Table 4 Share of vegetable garden produce of the produce of the gardens of Herent in respect to the Flemish consumption in 2007, based on the surveyed gardens in Herent (N=25 gardens surveyed; in total covering 64 family members)

Produce N=25 gardens	**Total output in kg in 2007**	**Average product prices per kg in 2007[a] [euro]**	**Total output in euro in 2007**	**Number of gardens where the produce is grown**	**Output in euro per garden where the produce is grown in 2007**
Potato	680	1.030	700.40	6	117
Onion	25	0.937	23.43	4	6

Beans	65.5	4.48	293.44	8	37
Paprika	64	3.486	223.10	4	56
Tomato	220	2.172	477.84	4	119
Carrot	23	0.767	17.64	8	2
Apple	185	1.947 [b]	360.20	5	72
Pear	80	1.549 [c]	123.92	1	124

[a] Based on the average product prices in 2007, source: NIS Household budget survey 2007, reference value for fresh vegetables, [b] reference price for Jonagold, [c] reference price for Conference

Table 5 Economic value of domestic garden produce, based on the surveyed gardens in Herent (N=25)

Produce (N=25)	**Financial value of the total output [euro]**	**Total expenses for N=25 households in Herent[a]**	**Percentage of the financial value of home grown produce versus average expenses**
Potato	700.40	2,075	25.2
Onion	23.43	600	3.8
Beans	293.44	1,100	21.1
Tomato	477.84	1,300	26.9
Carrot	17.64	525	3.3
Apple[b]	360.20	950	27.5
Pear[c]	123.92	725	14.6

[a] Based on the average expenses per Flemish household in 2007, source: NIS Household budget survey 2007, reference value for fresh vegetables

Table 6 Comparison of the average expenses of Flemish households for purchased produce with the monetary value of home grown produce, based on the surveyed gardens in Herent (N=25)

5.2 Non-productive use value of gardening

Gardens do not only provide utility because of home production, but also because of leisure activities. The qualitative data provides insights in the non-production use value (aesthetic and recreational value) of a garden for a household. This use value is defined by consumer preferences. We discuss the value of having an own garden the consideration of gardening as a burden or a hobby and motivations for home food gardening.

5.2.1 The own garden: a valuable space

For the majority of the Flemish households, it is important to have a garden. Being or becoming a owner of a house with a garden is an integral part of the way of life for a Belgian household (De Decker, 2011). The significance of a garden contains multiple aspects of experience, like relaxation, contact with nature, relation with food and prestige (Table 7). This experience is not solely considered from the individual perspective. The garden is also seen as a nourishing meeting place for family, friends and neighbors.

Categories	**Concepts**	
Gardening is personal	Individual experience, philosophy, identity, taste	
	Collective experience	
	Considerations on the multifunctional lay-out	
		Different life phases require different needs
	Unlocking hidden capacities	
Contact with nature	Contact with green and nature	
	Being outside	
	Independence	
Relation with food and food quality		
Prestige		
Freedom		
The garden is a place to relax		
The garden is a place to work		

Table 7 Categories and concepts related to the significance of domestic gardens for garden owners, based on the qualitative data

The most prominent association garden owners made with the domestic garden was ‘freedom’. This freedom is reflected in the autonomy Flemish gardeners have in deciding which services and functions are present in the garden, and how the garden is managed. Such gardening autonomy has been illustrated (Goddard, Dougill, & Benton, 2010).

Respondents indicated that no tradition exists in top-down (governmental) interfering with garden design and management in Flanders. This implies that the consideration of which trade-offs are made between food production and other services provided by the domestic garden is a personal one, influencing the magnitude of U_{L_h} and U_{L_o}. Such considerations are determined by the utility of gardening perceived by the household, what is reflected in consumer preferences.

"So, where for one [person] the visual aspects are important, the other [person] values the significance of the garden. The way someone lives and experiences everything is expressed within the garden." *(Employee of a NGO concerned with rural development)*

Consumer preferences are a major factor in determining the use of the garden space. This is in line with Kortright and Wakefield (2011) who found out that it is not the available garden area $\bar{L}$ that is the determining factor in enabling food growing in the garden, but the priorities the household expresses over the garden area. Depending on the stage in their life, households express different requirements for their garden space, L_o or L_h.

Also context is a determining factor in decision making. Context-dependent effects were observed by Kortright and Wakefield (2011) who found that access to a nearby communal playground for children allowed relatively more garden space to be allocated to food production L_h or to aesthetic functions, which forms part of L_o. In addition, informal institutions and neighborhood norms are powerful determinants for the individual choices on garden lay-out and management (Thompson, 2004).

5.2.2 Food gardening: a hobby or a burden?

We hypothesized that people who perceive kitchen gardening as a pleasant occupation will increase their utility by producing extra food in their garden. This is reflected in U_{t_h} and U_{t_o} in the fifth condition. People gaining utility from spending time or land to vegetable gardening are expected to make different choices in the allocation of t_h and L_h compared to people experiencing home food gardening as a burden, or than people gaining more utility from ornamental gardening. Several studies consider food production in domestic gardens in developed countries to be a sheer recreational rather than an economic activity (Jehlicka, et al., 2013; Reyes-García, et al., 2012).

5.2.3 Motivations for home food production

The qualitative data indicated specific motivations for having an own kitchen garden (Table 8). These include self-sufficiency and tradition. The relevance of tradition should not be surprising since having a vegetable garden was deliberately stimulated by housing policies and government incentives (De Decker, 2011; Meert, 2000; Meeus, et al., 2013).

"I inherited the practice of vegetable gardening." *(Man, 60 years, municipal worker)*

The respondents did not mention the quality of garden produce as a motivation. Yet, according to literature home food produce is stimulated by the perception that own food is better than commercial fruit and vegetables in terms of taste and nutrition (Jehlicka, et al., 2013). Food sovereignty and economic independence are also important reasons (Calvet-Mir, Gómez-Baggethun, & Reyes-García, 2012).

Categories	**Concepts**	
Own vegetable garden	Motivators	Tradition and past obligations (e.g. 'kleine landeigendom'
		Yields
		Being self-sufficient
		Search for authenticity
	Characteristics	Short supply chain
		Food safety
	In need for an economic valuation of home-grown produce	
Relation with food	Barbeque with family and friends	
	Food processing, for example for the freezer	
Place within food strategies for cities and food planning		

Table 8 Categories and concepts related to motivations for home food production, based on the qualitative data

5.3 Use of garden space

The results from the Flemish internet survey indicate that for a third of the surveyed gardens, the area of vegetable garden L_h covers up to one fourth of the garden area $\bar{L}$ (Table 9). Almost half of the gardens holds a vegetable garden. Also, half of the respondents has fruit trees in the garden.

The results from the garden visits of Herent (Table 10) fit these results for Flanders in terms of magnitude. The spatial dominance of lawn relative to other garden components, including vegetable garden and sealed space, is apparent in the visualization based on the Herent survey data (Figure 1). Presence of and coverage by vegetable gardens roughly match the results from Belém (Brasil), where 22 % of the garden space was devoted to vegetables (Madaleno, 2000).

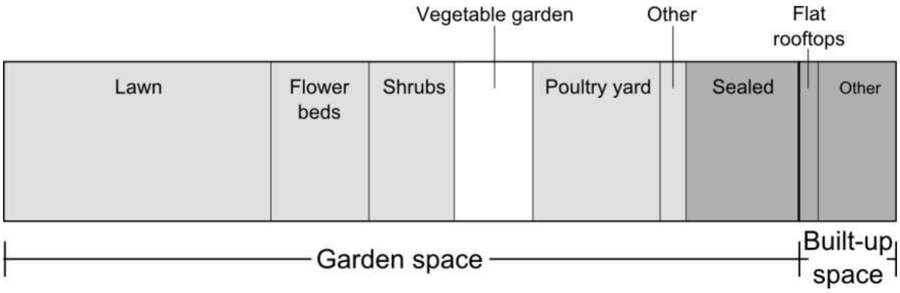

Figure 1 Summarizing use profile of the domestic gardens in Herent, based on the average area per garden component (N=25)

An extrapolation of the area of actual productive vegetable gardens L_h can be made for Flanders. Based on the internet survey (n=1,138), the total garden area $\bar{L}$ containing a vegetable garden is calculated. First, the estimated average size for a vegetable garden is calculated using the lower and upper limit of the area classes. Then, this average size is multiplied by the garden area percentages containing vegetable gardens. This results in an estimated $\sum_1^n \bar{L}_h$ area of 86 km² of vegetable garden for Flanders.

6 THE IMPACT OF CONSTRAINTS ON THE ALLOCATION OF LAND AND TIME FOR FOOD PRODUCTION IN HOME GARDENS

The interrelation between the allocation of area and time invites to further explore how capital, area and time constraints are affecting decision on the area (L_h) and time (t_h) for food production in domestic gardens (all in ceteris paribus terms).

Given the emphasis of this paper on the spatial perspective, we discuss three strategies to by-pass the spatial constraints represented by μ (Figure 2). We solely consider area-bound solutions. We associate time constraints (represented by γ to each of the three strategies.

6.1 Stock of food productive space within the single garden

While in principle the total garden space can be used for home garden production, this is seldom the case in reality. Part of the non-productive garden space is transformable to home garden production while other parts are less (or not) transformable. The smaller the non-transformable part of the garden, the less likely the area constraint will become effectively binding.

In Flanders, the main components of non-productive garden space (L_o) are lawn and sealed surface (Table 9). A lawn is an example of transformable garden space because its transformation requires virtually no cost and effort. Combined with its omnipresence, large spatial coverage, uniform and unsealed character, but also its rather negative environmental reputation (Giner, Polsky, Pontius Jr, & Runfola, 2013) (in terms nutrient and other inputs and of quantities of mowing), it represents the most prominent transformable space in a typical garden. Transitions from lawn towards more food productive vegetable gardens are realistic (Haeg, 2008). An extrapolation similar to the one for vegetable gardens results in a total lawn area of 435 km² in Flanders showing potential for food production.

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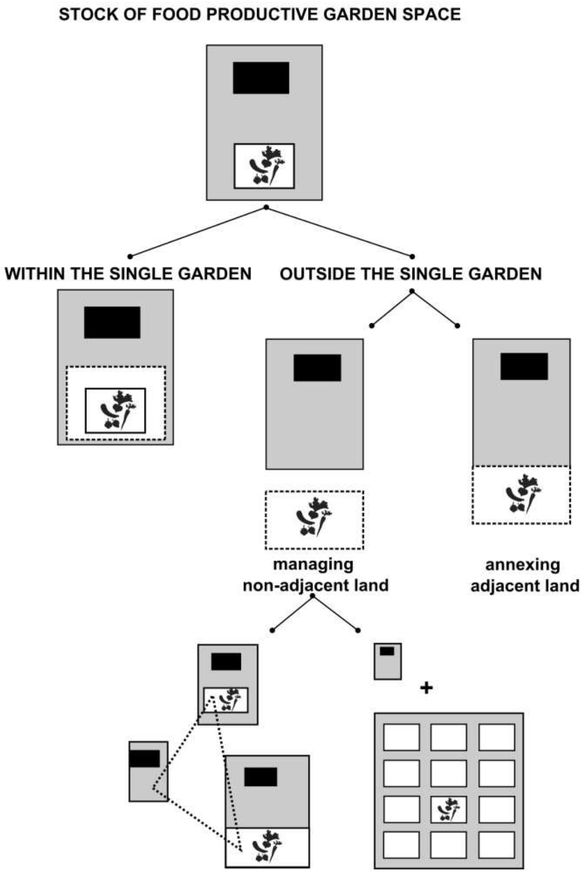

Figure 2 Summarizing the spatial potential for home food production. The discussed strategies are visualized within a response tree.

In terms of coverage, sealed surfaces are the second most important garden component (Table 9). We assume that these sealed surfaces are a non-transformable part of the garden L_o, i.e. that garden owners will not easily break out their terraces, driveways and garden paths. Therefore, the area of sealed surfaces puts a distinct physical constraint on the decision space of a household. An increase of the sealed surface would substantially limit spatial adaptation possibilities. Verbeeck et al. (2011) found an average increase of impervious area by 1.3 m² per year for residential parcels due to gradual autonomous development for Flanders. This sealing evolution restricts the potential for increasing L_h within the own garden. If the area of non-transformable garden space is low, it becomes less likely that area constraint will be binding and the larger the decision space of the household on how much time to allocate to home gardening and on how much food to buy or produce themselves.

Garden components	**Flanders** Percentage of the surveyed garden area					
	Absent [%]	<25%	25-49%	50%	50-75%	>75%
Lawn	0.5	17	29.8	21.1	24.6	6.9
Flowerbeds	3.9	67.4	24.3	2.3	1.6	0.4
Vegetable garden	58.3	33.1	6.7	1.1	0.4	0.3
Poultry yard	67.8	28.4	2.5	0.5	0.4	0.3
Sealed surfaces	3.3	83.7	11.2	1.1	0.4	0.2

Table 9 Relative spatial coverage by garden components for Flanders, based on the internet survey (N=1,138)

	Herent	
Garden component	**Presence** (% gardens)	**Mean area** (m^2)
Lawn	100	515.4
Flower beds	96	99.5
Shrubs	80	105.9
Vegetable garden	56	187.4
Poultry yard	36	549.7
Sealed surfaces	100	144.2

Table 10 Presence and mean area of garden components for Herent, based on the garden visits (N=25)

6.2 Stock of food productive space outside the single garden

In practice, the finite single garden space $\bar{L}$ is not always an absolute limitation. The individual land constraints (represented in the model by μ) may be bypassed by available L_h outside the own garden.

6.2.1 Managing non-adjacent land

We present two different strategies to increase L_h with non-adjacent land outside the own garden.

The first strategy is managing the vegetable garden of family, friends and neighbors. This strategy can be considered as a response within the garden complex, as it involves existing domestic gardens.

Capability for garden management can decrease due to time constraints γ, for example when the available time for gardening (t_o and t_h) decreases. Possible reasons are an increase of t_w, for example in the two-income family model, or a decrease of t_h as soon as it becomes difficult to maintain the garden yourself, for example in an ageing household. Likewise, a decreasing t_w causes the available time t_o and t_h to increase, for example at retirement or when becoming unemployed. This time can then be spent in the own garden, or in the garden of others. Several studies indicate that home gardening is mainly conducted by retired people (Domene & Saurí, 2007; Reyes-García, et al., 2012) as this group has not only time but also knowledge (Madaleno, 2000).

There is an interaction with the available t_w, t_o and t_h over different households. The garden owner can rent out part of the garden to others. Garden produce might be shared amongst the garden owner and garden manager which can be considered as an in-kind rental payment. In-kind rental payment is a payment in a form other than cash, in this case garden produce. Such renting is illustrated by Meert (2000) with the example of a grandson maintaining his grandmother's vegetable garden in exchange for a part of the produce.

"In [...] there are many elderly that have a garden but who can't manage it. They can give loan that garden to people that would want to manage it." *(Head of a city green management department of a medium scaled city)*

The second strategy is joining a co-gardening project or allotment garden. Within such projects, the social interactions and the distribution of the gardening (and the time it allocates t_h) amongst several households are seen as important surplus values (Table 11). This second strategy thus includes land outside the garden complex.

"The new allotment gardens in the city increasingly have a communal character […] you have the 'garden clusters', where one cluster is jointly managed by 4 to 5 families. The obvious advantage for young families is that you only have to go there once or twice a week" *(Staff member of the city spatial planning department)*

Categories	**Concepts**	
Interaction	Sharing and exchanging	Gardening material
		Yields
		Seeds
		Knowledge and experiences
		Garden: garden sharing
	Social contact	
	Temporary gardening support	
Search for collectivity		

Table 11 Categories and concepts related to the social surplus for garden owners when joining co-gardening projects, based on the qualitative data

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6.2.2 Annexing adjacent land

The individual extension of the total garden area $\bar{L}$ is also possible by annexing adjacent land through renting or buying. The annexed land may or may not be part of the garden complex, e.g. when buying garden space from neighbors.

We discuss further the annexing of non-garden space, and focus on agricultural land. Gardens in the Flemish countryside or peri-urban areas are currently being expanded by annexing (a part of) an adjacent agricultural parcel to the garden (Dewaelheyns, et al., 2014).

7 GENERAL DISCUSSION AND CONCLUSION

Increasing demand for food, raising energy prices, growing land scarcity, climate change and other factors put pressure on food systems (Fraser, Simelton, Termansen, Gosling, & South, 2013). As food security is an essential point of interest with respect to the adaptive capacity of our society, the strategic importance of local food systems cannot be ignored.

In this paper, we want to reinforce insights in the potential contribution of domestic gardens to the adaptive capacity of (local, urban, …) food systems. Attention for the food productive role of domestic gardens is rather limited, especially in the developed world. The intrinsic complexity of functions and services provided by domestic gardens may be one of the reasons. Their fragmented and private character impedes a comprehensive understanding of their relevance. A few studies, however, have gained insights in the productivity and gross financial benefits of vegetable gardening (Algert, et al., 2014; Reyes-García, et al., 2012). Understanding the potential of the garden complex in building adaptive capacity requires insights in food production decisions within the garden complex.

This is captured in the model by exploring direct linkages between the household utility and constraints in land and time with respect to home food production. Utility theory helps to understand consumer preferences and provides insights on how to unlock or at least safeguard the existing food productive potential, in financial and spatial terms, of domestic gardens. The most noted result was for vegetables and potatoes, where the amount of home garden produce is equivalent to about one third of the amount of these products bought at the market.

Land potentially available for food production could increase within and outside the individual garden. In order to provide the vegetable needs for a household of four persons, it is estimated that about 350 m² of vegetable garden is needed (Seymour, 1976). For the 6 million inhabitants of Flanders, this translates to 525°km² of vegetable garden. Currently 86 km² of the Flemish garden space is used for vegetable production. Using an additional 439 km² (or 39 %) of the Flemish garden space for garden food production theoretically allows Flemish households to become self-sufficient in vegetables consumption.

Technically spoken, lawn could be easily transformed into vegetable gardens. The estimations of lawn area for Flanders (435 km²) can be added up to the current estimated area of vegetable gardens. This results in a potentially food productive area of 521°km², almost equivalent to the required area of 525°km². The spatial potential exists to nearly provide in the vegetable needs of all Flemish inhabitants depending solely on domestic gardens.

This reflection obviously applies to the larger spatial level of the garden complex and ignores some aspects of demand. At the household level, the available garden area is unequally distributed. It is also impossible to grow the entire diversity of preferred vegetables and fruits in the garden, e.g. because of climatological limitations. There are also additional constraints on the available garden space, like historical pollution with heavy metals.

Despite these restrictions we can state however that the potential of domestic garden area for food provision is far from marginal. This fits the statement from Kortright and Wakefield (2011) that the potential land for food production from domestic gardens is likely to be far more than from community gardens in the near future.

The insights in the spatial potential for food production in domestic gardens indicate that domestic gardens should not be neglected within discourses on adaptive capacity of urbanized areas. For example, the model shows how increasing food prices or increasing preferences with home grown produce (because for example its low carbon footprint) may lead to more garden area to be allocated for food production. This adaptive response is subject to the constraints and preferences of the household and is reduced when more garden space is sealed and not or not easy transformable to home garden production. In that way, safeguarding the unsealed space which is easily transformable to home grown food production increases the adaptive capacity and hence the resilience of the social-ecological system in question.

The ‘victory gardens’ clearly illustrate the contribution of home food systems to adaptive capacity of the society. During World War II, the victory gardens provided in 44% of the fresh produce in the US (Pothukuchi & Kaufman, 1999). They were an effective response initiated and stimulated by policy (Ginn, 2012) to a heavy shock in the society. Part of the adaptive capacity lies in the short feedback loops between production and consumption, also present in domestic gardens. Producing your own vegetables can be implemented at short notice, on the precondition that sufficient space remains available and the effort is effectively coordinated.

“If we go to a period in which attention for food production in the garden is really needed, as it was the case for the generation of our grandparents, it remains to be seen of we are doing well with those very small gardens.” *(Staff member of the city spatial planning department of a large-scaled city)*

Sufficient transformable garden space is not the only precondition of mobilizing the adaptive capacity of home food gardening. Gardening requires gardening knowledge as this influences the land and labor productivity of home grown food production. Safeguarding this knowledge and its exchange amongst family and neighbors increases the adaptive capacity. The case of Cuban urban agriculture illustrates this (Buchmann, 2009). During the communist regime, the agricultural system in Cuba was determined by a high wealth, high degree of connectedness, a low diversity and high dependence of the international economy all preconditions for a high vulnerability to shocks (Fraser, Mabee, & Figge, 2005; Rodríguez, 1987). The collapse of the Soviet Union, being Cuba’s most important trading partner, has lead to the implosion of Cuban food systems due to the loss of high-tech agricultural practices (Febles-González, Tolón-Becerra, Lastra-Bravo, & Acosta-Valdés, 2011; Maal-Bared, 2006). Subsequently, this lead to the start of the ‘Special Period’, marking a clear shift in household decision-making towards home garden food production in order to increase the individual adaptive capacity (Buchmann, 2009). This evolution was part of the Economic Reanimation (Febles-González, et al., 2011). The emergence of private markets provided an incentive to cultivate formerly barren patches of land and gardens (Alvarez & Puerta, 1994). To be able to cultivate, local gardening knowledge had to be rebuilt again through collective learning, which allowed an increase in food production a few years after the collapse in the early 1990s and resulted in a reorientation toward agroecology (Palma, Toral, Parra Vázquez, Fuentes, & Hernández).

Capturing and exchanging information between actors in a social-ecological system can be defined as safeguarding the social-ecological memory, and is a major source of community resilience (Barthel, et al., 2010). In Flanders, the housing policy in the twentieth century (par. 3.1) was accompanied by the dissemination of gardening knowledge amongst the population, especially in the post world war II period. A number of organizations were established to that end. Men had to learn modern horticultural techniques and how to make cultivation plans, while women followed cooking lessons and learned how to preserve vegetables through brining and sterilization (Segers & Hermans, 2011). These educational goals were pursued by a range of levers, including lectures and the publication of books and brochures, model gardens and the mobilization of status and identity through shows and competitions (Segers & Hermans, 2011). With the decline of such dissemination efforts, gardening knowledge is diminishing, with negative consequence for the resilience of social-ecological systems.

8 FUTURE RESEARCH

This paper illustrates the productive potential of domestic gardens and their potential contribution to the adaptive capacity of food systems. A more comprehensive database on garden produce c_2 is needed to better assess the food production potential and adaptive capacity of domestic gardens. There is a lack of monitoring of home grown food production and consumption. A continued assessment of the adaptive capacity of food provisioning within domestic gardens needs comprehensive panel data, which could be gathered during monitoring programs. Logbooks kept in a (semi-) autonomous way and calibrated portable scales (Algert, et al., 2014) could be useful. Survey efforts should be spread in time or at least supplemented with alternative approaches to assess garden production (Niñez, 1987).

To safeguard the productive and adaptive potential of domestic gardens, it is also crucial to understand households' decision to allocate space and time to home grown food production. More information about household preferences to allocate time and space to a kitchen garden or to other activities would help to refine the model developed in this paper. One could for example rely on choice experiments for this. Such experiments could quantify the households marginal utility in relation to area and time allocated to home produced food.

Input (z) is another important variable that we currently could not unravel due to lack of data. Yet, it is a crucial variable to evaluate sustainability questions. Several studies indicate negative environmental impacts from the (mis-)use of inputs (Robbins, Polderman, & Birkenholtz, 2001; Syme, Shao, Po, & Campbell, 2004). Where home food production is part of a food strategy, the environmental aspects of production are of special interest (Kortright & Wakefield, 2011; Madaleno, 2000). Especially since garden management is not monitored nor regulated for the use of fertilizers and chemicals, as is the case for agriculture (Dewaelheyns, et al., 2013). Future research should aim at raising understanding in input usage and its environmental impact.

Input use is influenced by habits, the available gardening knowledge and experiences. We believe that the exchange of knowledge in society plays an essential role. Gaining insights in the capturing, organization, prevalence and exchange of gardening knowledge is a crucial research track to better understand the input variable. Cleveland and Soleri (1987) already found that a lack of understanding of, and adaptation to local conditions results in garden design and management strategies unsuited for the local environmental and social conditions.

"My daughter also gardens, as long as it goes wells. As soon as something goes wrong, I have to solve it" *(Man, 67 years, retired)*

Throughout the acquisition of new data, the model developed in this paper can be refined and inform policy on the potential role of domestic gardens in food strategies, as well as on opportunities and pitfalls that have to be considered. When provided with the proper data, the model should be able to deliver quantitative estimates of the identified trade-offs. Although developed based on insights generated from a case in the developed world, we think that this model –when tweaked– could also be applicable in developing countries.

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A Digital Platform for the Monitoring of HCB based upon the Reflections of its Conservation Practice in China

Yecheng Liu, Jin Shang, Gong Zhang

(MSc Yecheng Liu, Tsinghua Tongheng Urban Planning and Design Institute, liuyecheng@thupdi.com)
(MSc Jin Shang, Tsinghua Tongheng Urban Planning and Design Institute, shangjin@thupdi.com)
(MSc Gong Zhang, Tsinghua Tongheng Urban Planning and Design Institute, zhanggong@thupdi.com)

1 ABSTRACT

The Historic and Cultural Block (HCB) is a national designation for the conservation of settlement heritage in China, where groups of significant historic buildings have been preserved within their fabric. Recent years, with rapid urbanization and development, there has been a great threat to various historic centers all around the country. Throughout conservation practice in the past 20 years, there have been three major issues in the information collection, storage and daily management: (1) poor datamation and standardization of information collection; (2) inefficient supervision and management mechanism; and (3) lack of dissemination and communication channels, therefore, insufficient public participation.

In order to improve the conservation of HCB, a pilot monitoring platform is proposed in this paper, which is based on the WebGIS technology. This platform digitally monitors and manages the object with a standardized information system. Data captured from site survey can be used to support analysis, planning, decision-making and management in a visualized, dynamic and cost-efficient manner. Besides, potential functions andapplications are discussed.

2 THE DEVELOPMENT OF CONSERVATION OF HCB IN CHINA

2.1 Origin of conservation system

The conservation of HCB originated from archaeological research in the 1920s in China. In the 60s, the Chinese cultural relic preservation system has been formed. However, until the early 80s, the mainstream of settlement heritage conservation was limited to cultural relics and sites alone, lacking the understanding of overall and systematic preservation measures. In 1982, the first batch of 24 national historic and cultural cities, including Beijing and Nanjing, was released by the government, marking the birth of the historic settlement conservation system, represented by the designation of "National Historical and Cultural City". In June 1996, the historic block conservation symposium was held in the city of Huangshan, Anhui, and in August 1997, the Ministry of Construction (Ministry of Housing and Urban-Rural Development from 2008) issued the “The Interim Conservation Management Measures of Tunxi HCB in Huangshan”, which marked the foundation of Chinese HCB conservation system.[1]

2.2 Status of conservation

The title of “Historic and Cultural Block”, which is approved by the government of provincial level, requires extremely abundant cultural relics and concentrated historic buildings that could completely and truly embody the traditional pattern and historical features in an area of a certain scale. In China, those blocks are significant in the conservation system of settlement heritage.[2] According to the “Regulation of conservation for historic and cultural city, town and village”, cities, to be qualified as “Historic and Cultural City”, should possess more than two HCBs. As a result, the HCB has always been the core of the conservation of historic and cultural city.

In recent years, with China's high-speed urbanization process, the conservation of settlement heritage has been facing great threat, and many HCBs have been severely disrupted throughout the country. In May 2011, the nationwide inspection, launched by the Ministry of Housing and Urban-Rural Development, revealed that there were 13 Historic and Cultural Cities having no HCB, and other 18 cities retaining 1 HCB only. Thus, the situation of conservation for HCBs is highly grim.

[1] WANG Jinghui, On the Different Levels of Historic and Cultural Relic Conservation, In: Proceedings of the 2001 Annual National Planning Conference, 2001

[2] State Regulation of the Conservation for Historic and Cultural City, Town and Village, State Council Decree 524, 2008

This situation is caused by many factors which could be summarized objectively and subjectively. Objectively, HCBs are always located in the center old town, where, for one thing, the land price could be relatively high, with potential appreciation; and, for another, buildings there are old, mixed, disordered and of high density, where infrastructure is poor that many blocks have become literally "slum" or "shanty towns". In such a complex case, with improper reconstructions, it is likely to cause irreparable damage. Subjectively, the conservation supervising system of HCB is still defective.[3]

3 PROBLEMS OF INFORMATION COLLECTION, MANAGEMENT AND DYNAMIC SUPERVISION

3.1 Poor datamation and standardization of information collection

According to the traditional workflow, information collection of HCB is mainly composed of two phases, field work and office work. Field work is based on the papery topographic map, to evaluate the style, quality and age of architecture, and to document the location and status of each kind of cultural heritage, while at the same time photographing the identified historic buildings. Office work processes the assessment information and photos, generate building evaluation CAD drawings, nevertheless, by means of checking inventory numbers, forming a Word or paper file of cultural heritage that need to focus on.

There are three main disadvantages of the traditional information collection workflow:

3.1.1 <u>Cumbersome and inefficient</u>

Since only paper document is available during field work, large amounts of data sorting and matching treatment are required to be manually input later.

3.1.2 <u>High data error rate</u>

Manual identification of paper drawing, document and photograph need to be checked and matched artificially, which is prone to data errors. On the other hand, evaluation of collected field information is based on individuals rather than a unified standard. Moreover, lack of convenient photograph query system, data error is difficult to find and correct.

3.1.3 <u>Narrow information application scope</u>

Independent paper document not only limits the sharing of information, but also restricts further work such as data analysis, dynamic assessment and so on.

3.2 Inefficient supervision and management mechanism

Due to the isolated paper files or CAD drawings, rather than a unified database, it is difficult for precise spatial query of each building’s original status and planning control requirements in the planning implementation and supervision phases. The absence of long-term dynamic monitoring and digital construction project approval system seriously affects the efficiency and effectiveness of the management of HCBs.

3.3 Lack of announcement and communication channel, insufficient public participation

Due to the lack of dissemination and communication channel, data tend to be only available for the urban planning department and design institutions while developing conservation plans. Even after the plan was substantially completed, a small amount of content is published on paper document or web site in the required publicizing phase. In the follow-up implementation process, the measures for public participation are relatively inadequate.

3.4 The goal of the Historic and Cultural Block Supervising Platform (HCBSP)

In order to improve the information collection, dynamic monitoring, elaborating management and such issues, the Historic and Cultural City Institute (Beijing Tsinghua Tongheng Urban Plan &Design Institute) and the School of Architecture (Tsinghua University) initiated the establishment of HCBSP in 2010.

[3] LIU Yecheng, The Challenge and Opportunity of Settlement Heritage Conservation, World Heritages, 2014 vol.6

Based on the fundamental data acquired during both field and office work, the platform is heading towards comprehensive informationization. Besides, the Platform provides different authorization accesses for users according to their professional background and permissions, therefore providing personalized/custom services. By insuring the sustainable monitoring mechanism, the Platform achieves a kind of management which is focusing on unity, real-time operation and economically efficiency.

4 FRAMEWORK AND WORKFLOW OF HCBSP

This platform consists of the server and mobile terminal. The main functions of mobile terminal are map display, editing and operating, data acquisition, editing and inquiry, GPS positioning, thematic drawing display, etc. The server-side handles data pre-processing and post-processing, drawing setup and output, data storage and dissemination, data inquiry and analysis, digital approval, etc.

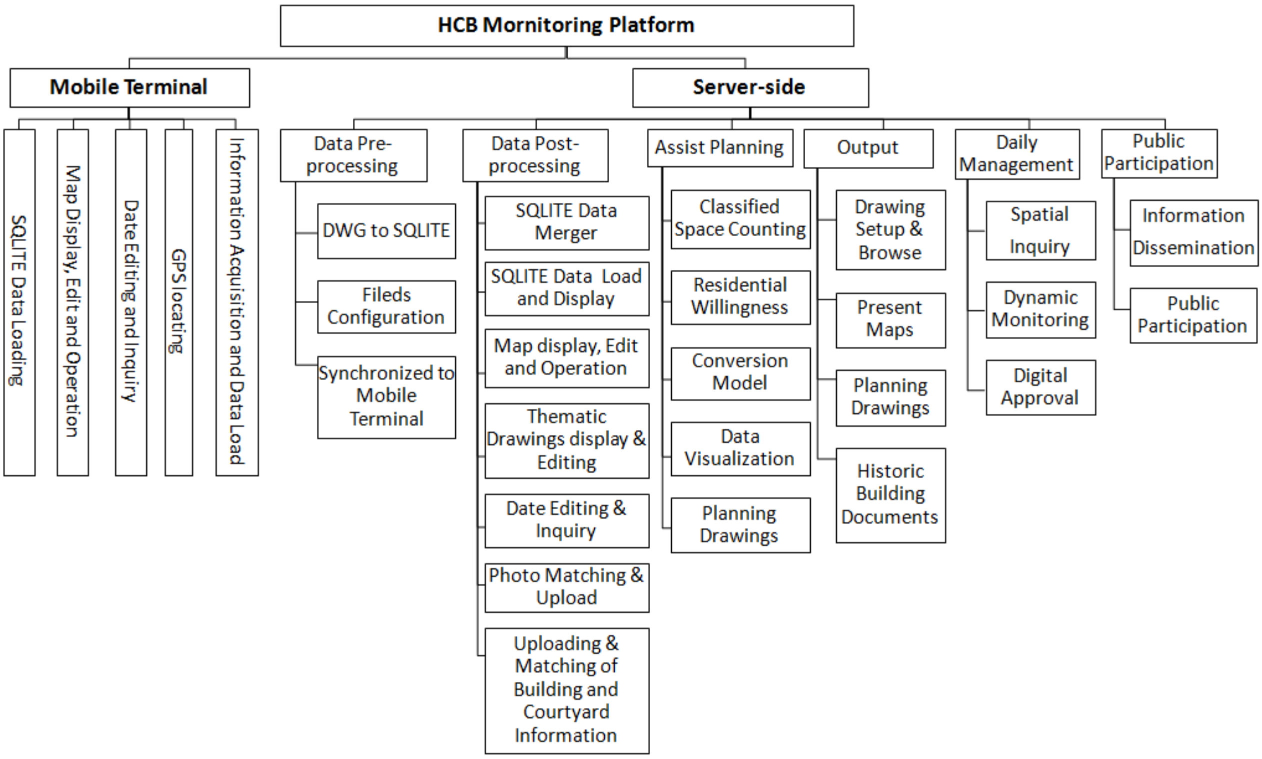

Fig 1: Framework and Functions of HCB Monitoring Platform

Based on the platform, the information collection process of HCB can be divided into five stages:

(1) Convert the original CAD map file into ArcGIS SHP file in servers;

(2) Convert the SHP file into SQLITE database and PNG background file in servers;

(3) Download the processed data to mobile terminals, which are distributed to each survey team;

(4) Each team input information unto mobile terminals and servers are updated;

(5) The data, including SQLITE database, MOV, MP3 and JPG format files, are processed and integrated to form a comprehensive database on the server.

Based on the platform, the conservation planning process can be modified into two stages:

(1) Integrating the comprehensive database, formed after the information acquisition process, with conversion intents form local residents and economic statistics, and taking full advantages of the space and cost analysis tools, administrators and planners are able to make planning decisions efficiently.

(2) On the platform, administrators and planners are also able to deal with preservation zoning decision and block conservation strategy, and thematic maps of present condition, conservation planning and historic architecture archives, etc. could be generated conveniently.

Based on the comprehensive information including status quo, preservation requirement and conservation measures, all of which integrates with the GIS database, such work like spatial inquiry, digital project

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approval, information dissemination, public participation, etc. is going to be conducted. Making use of mobile terminals, local surveyors and administrators are able to identify illegal constructions by means of photographs uploaded to servers.

5 FUNCTIONAL MODULES OF HCBSP

5.1 Server-side data pre-processing module

The data Pre-processing module is capable of CAD file conversion, entry field configuration, initial database and export of configuration to mobile terminal.

To initiate this function, click “Pre-processing” on the server software toolbar, a dialogue box will appear which performs conversion of multiple selected map layers of Building, Text, Road, etc., from CAD file to SQLITE database format. During the conversion, users may configure the entry fields, for example, to add a Property Owner field or Ming Dynasty (1368–1644) and Qing Dynasty (1644-1912) to the Built Year field. Moreover, converted SQLite database file can be synchronized to mobile terminal.

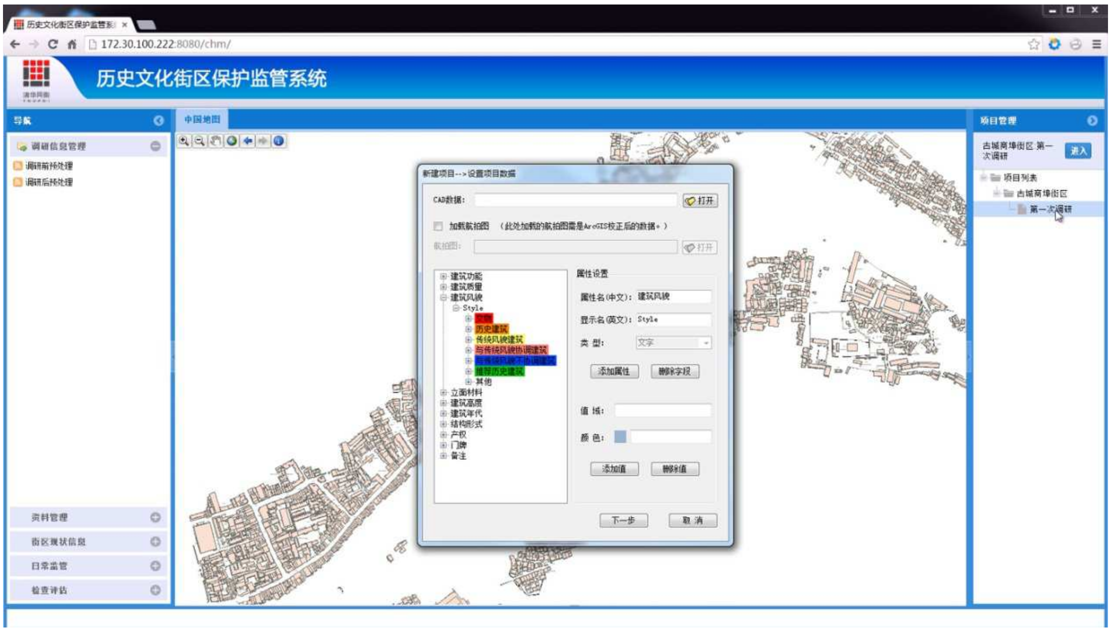

Figure 2, Server-side UI and Data Processing

5.2 Mobile Terminal Module

The mobile terminal software is preliminarily iOS-based and operates on iPad, and the core of which is an independently developed mobile GIS engine with Objective-C language. Here are the main functions:

5.2.1 Map Loading, Displaying and Editing

Pre-processed SQLite database file can be loaded from mobile terminals for actions of Display, Pan, Zoom In/Out on maps. Users can add new buildings or remove existing buildings to update with the latest status, therefore, greatly enhancing heritage information acquisition.

5.2.2 GPS Positioning

The Platform is capable of GPS positioning and itinerary tracing for the information captured in site to be geo-referenced. Meanwhile, GPS tracing can free the surveyor of unnecessary map actions of Pan and Zoom on a small screen, therefore improve the efficiency of field work.

5.2.3 Data Editing and Inquiry

The Inquiry function allows users to input specific information according to pre-processed configurations, and some can have default values. Data input will be transferred into the SQLITE database in a real-time manner to facilitate immediate field-office feedback and interaction. Building blocks with data input are indicated by the color of blue while those without are yellow, which informs the surveyors of the working progress. Tapping the blue block, input data will show up for reviewing or editing.

The old problem of matching photos with respective buildings has been successfully solved in HCBSP by timing. When synchronized with the digital camera, HCBSP will automatically keep track of each group of photos with the set period of Group Photo Time. Later in the office, the EXIF time of photos will be matched with the time of the database automatically, and all the photos are organized into the database according to the object structure.

5.2.4 Data Upload

Data input can be uploaded to server by connecting with the mobile terminal.

Figure 3, Mobile Terminal UI

5.3 Data post-processing module

When field survey is finished, all contents from the SQLITE database is uploaded to server. Post-processing module will merge the discrete SQLITE database to generate a complete database of this HCB. This module contains the following functions:

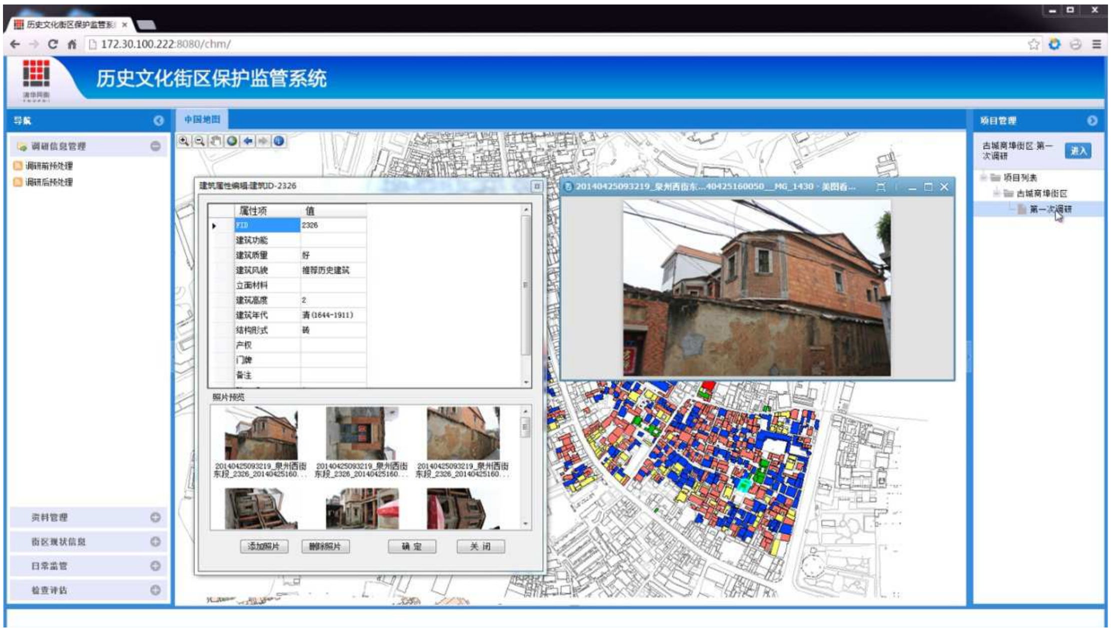

Figure 4, Server-side Post-processing UI

5.3.1 Courtyard Information Import & Matching

Data acquisition of HCB always incorporates three aspects, Building, Courtyard, and Historic Elements. Attributes of Architectural Style, Built Year, Building Quality, Structural Form, and Building Story are associated with Buildings, while those of Address, Ownership/Owner, Use, Occupant, Household, Land Area, Built Area, Heritage Valorization, and Conservation Status are associated with Courtyards. Since those information can be offered by the local government, courtyard boundary and related information can be dealt

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with at Post-process stage. The courtyard boundary can be selected in a CAD file and imported into the database where it is associated with building groups. After the import, information of a specific courtyard can be input and enquired by selecting it first.

5.3.2 Photo Matching & Upload

Photos taken in situ are automatically matched to the corresponding structures according to their EXIF time and loaded to the database.

5.3.3 Database Display& Inquiry

By selecting a Building or Courtyard, a dialog box with related information and photos will display for review or inquiry. Input data can also be cross-checked with photos so surveyors can correct it more conveniently when necessary.

5.4 Assisting Planning & Decision-Making Module

Geo-information analysis and digital mapping modules, integrated in the server, will provide the government agency and professional planners with data of Buildings, Courtyards and other relevant information to assist special analysis and so as to decision-making on a web browser interface.

5.4.1 Conservation Area Designation & Conservation Measures

Acquired data of Architectural Style, Conservation Status, Built Year, and Building Height can be used to analyze the distribution of different types of buildings in HCB. By selecting groups of buildings in an area, a real-time analysis of the proportions of various designation types will be generated, which, combined with the boundaries of both natural features and properties, and the Core Conservation Area and Control Zones are created. This database can also help planners to develop conservation requirements and intervention measures.

5.4.2 Conversion Model & Implementation Sequence

Government agency and planners can get the conversion intents and preferences of local residents by mobile terminals in the first time, and, combining with Built Area and other data in the server, total conversion cost can be calculated, so as to determine the conversion model and implementation sequence.

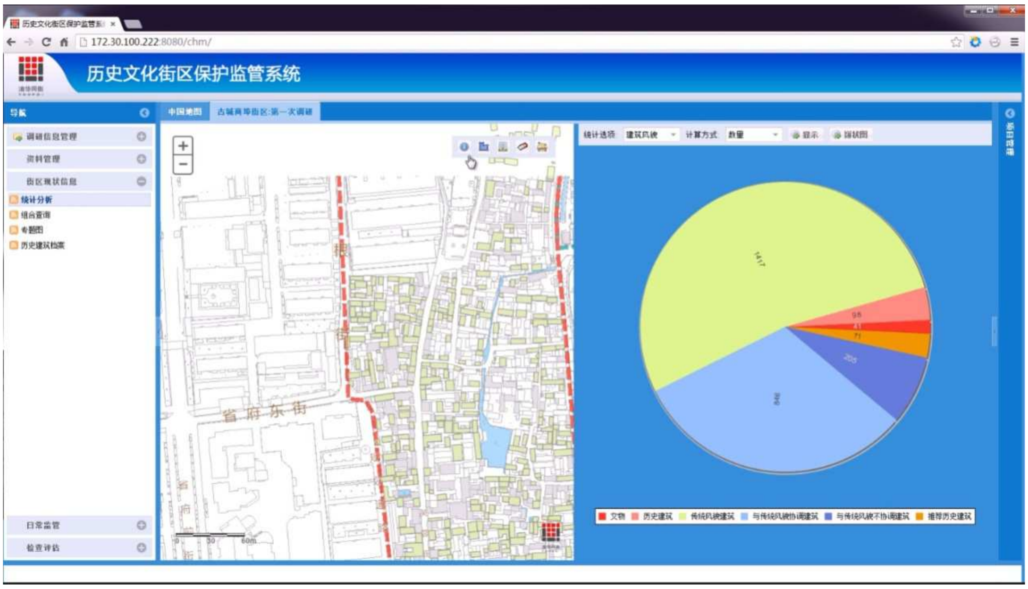

Figure 5, Assisting Planning & Decision-Making UI

5.5 Output Module

5.5.1 Drawing Setup & Output

Thematic drawings are setup with conservation area boundaries, current state and intervention measures, with various overlapping layers of planning information, i.e. Architectural Style, Conservation Status, Built

Year, and Property Ownership. Drawing keys, wind rose, and scales are automatically generated in the CAD or JPG files.

5.5.2 Historic Building Document Output

Documents of buildings with different heritage value ratings, especially historic buildings, are created from a preset document template based on Courtyards with computer generated metadata and details. The output DOC files can be edited whenever update occurs, therefore efficiently building up a comprehensive archive for the future.

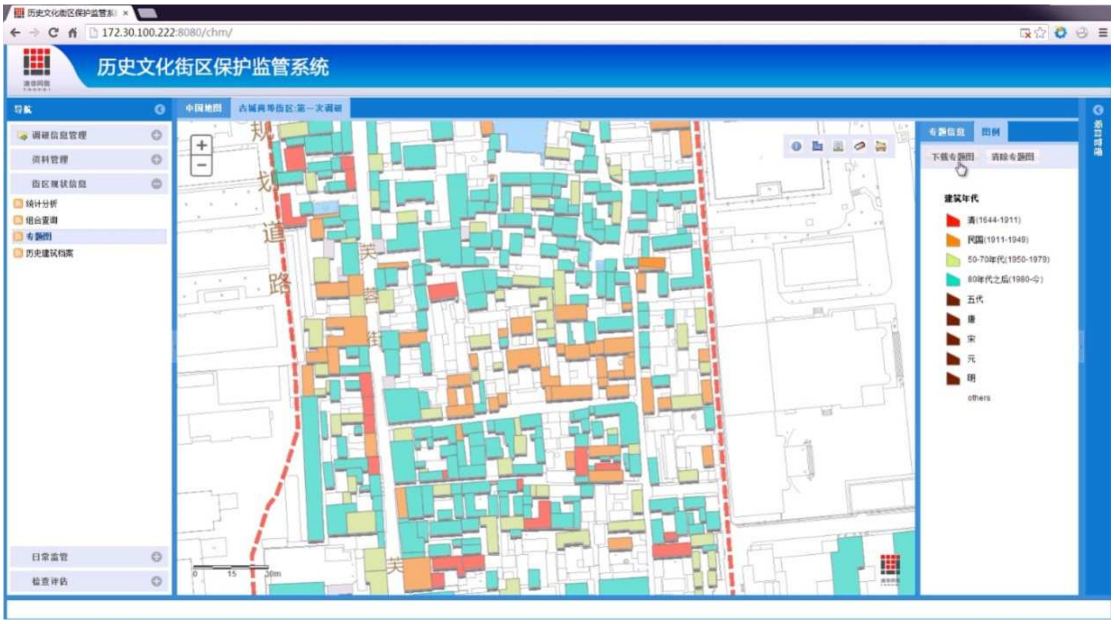

Figure 6, Output UI

5.6 Day-to-day Management Module

All related information is stored in the geo-information database which facilitates smart management by means of geo-referenced inquiry, dynamic monitoring and digital approval.

5.6.1 Geo-referenced Inquiry

Traditional archive usually takes the form of isolated textual materials and drawings, while some of which are even paper files only. This is inconvenient for inquiry, reproduction, and dissemination. To overcome such defects, the Platform integrates the current state, plans, and all related information into a single geo-information database. Users with different access authorizations will get corresponding information on the website, therefore greatly enhancing the efficiency of comprehensive and geo-referenced inquiries.

5.6.2 Dynamic Monitoring

Local surveyor and management staff, by means of a friendly UI on the tablet, can effectively document the Buildings, Courtyards, and Streets by means of photograph as well as audio/video recordings. These multimedia files can be associated with heritage information and then uploaded to the server to inform local management.

5.6.3 Digital Approval

Based on the acquired information of the conservation status and established planning criteria, stored in servers, project approval matrix will be automatically generated to inform administration.

5.7 Dissemination & Public Participation Module

5.7.1 Dissemination

General information about the sector and significant updates of the planning process are publicized on the website, to support the dissemination of the historic and cultural values, conservation status, planning

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progress and approval result, which will improve the understanding between the public, the professional, and the authority.

5.7.2 Public Participation

Public opinions are collected, whether at the website or from a mobile App on a smart phone or tablet, so that the general public can participate in conservation. Photos of the streetscape taken by the public can also be uploaded into HCBSP to monitor the conservation status.

6 TECHNICAL INNOVATION &PROSPECTION

HCBSP is the first to incorporate mobile GIS technology into the practical field of human settlement heritage conservation in China. Integrated process of historic sector data acquisition, conservation planning and monitoring has given rise to effective real-time information acquisition and management as well as smart conservation planning and monitoring. Preset interfaces can be used for various forms of historic and cultural presentation by means of 3D point cloud-based models, holograms, and historic and cultural interpretations, providing comprehensive professional cultural heritage user experiences. HCBSP is to become the leading integrated solution of the conservation, interpretation, presentation and management of historic sectors for a greater audience in the future.

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A New Tool for Assessment of Contextuality of Architecture

Milena Vukmirovic, Eva Vanista Lazarevic, Jelena Maric

(Research Associate, Dr Milena Vukmirovic, University of Belgrade – Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, Belgrade, Serbia, milena.vukmirovic@urbanlab.org.rs)

(Professor Dr Eva Vanista Lazarevic, University of Belgrade – Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, Belgrade, Serbia, eva.vanistalazarevic@gmail.com)

(Teaching Assistant, Jelena Maric, MArch, University of Belgrade – Faculty of Architecture, Blvd. Kralja Aleksandra 73/II, Belgrade, Serbia, jelena.maric1989@yahoo.com)

1 ABSTRACT

The purpose of this paper is in presenting a proposal for set of methods in evaluation of contextuality in architecture as a quality assessment of new buildings in particular urban areas as well as a guiding framework in urban design and urban transformation processes. Research has been done at the University of Belgrade – Faculty of Architecture with the students at the Master and PhD course „Contextual Architecture“ at the polygon of the Quarter of Vracar in Belgrade, Serbia. We propose the approach that consisted of two parts that were taking place consecutively. The first part was conducted with PhD students. The result was a product of the content analysis of existing contextuality of architecture theories and evaluation apparatuses. The second part of the research was realised with students of master studies who had the task to define indicators grounded on the results of the case studies of individual object in the environment, by following the criteria-based structure of the research. Comparing and overlapping the obtained results the new tool - proposal for the assessment of contextuality of architecture is made and it could be used as a base in generating recommendations and guidelines for future interventions for the same or similar urban environments.

2 THEORETICAL BACKGROUND - INTRODUCTION

Contextualism as a philosophical term flourished especially at the end of the 20-century. We could distinguish a broader aspect of term Contextualism as a choice of separate paradigms in philosophy – supported in architecture by postmodern philosophy and movement and its theoretical approaches. Postmodern movement allows and even promotes broader view on any problem or constatation under the pretext of contextualism.

Although under the scope of architecture we have to reflect on philosophy and relativism of any utterance. Situational ethics promoted by Jean Paul Sartre and Simone de Bouvoir and their followers takes into account a whole range of context elements when and while judging or evaluating. There is not a universal law that is to be followed but law of love, sometimes even unconditional love – they say. Their literature but also their huge and continuing influence deal with moral doubts of existentialism's movement - which gave impact and made references to today's theoretical thinking. On the other side, moral relativism characterize the fact that nobody is objectively right or wrong and that especially context like place, different people from different culture perceive their entourage totally different. Rootless and left on their own to judge and estimate, it seems that people from the end of the Century lost their steadfast, their „Bible“. The loos of family values more contributed a sense of uncertainty and benchmarks for evaluating.

2.1 Context in Architecture

The research is focused on quality assessment guidelines for infill development in specific urban areas that often have historic, as well as architectural and cultural value. In order to establish a new method for evaluating contextuality of architecture of new buildings it is necessary to consider them within the context they belong to. The importance of design in context is widely recognized as a key objective in retaining identity and character of a city. In the XIX Congress of the International Union of Architects (1996), Ignasi de Solá-Morales spoke about the importance of context and relations between city and architecture. He argued that „cities are undergoing genuine mutations, in which the principal line of development proceeds from within the process itself rather than from any demands or restrictions imposed by the existing environment“. To support this statement we need a better insight in theories of context. Academics and practitioners use numerous definitions, but there is a joint agreement that the notion of context determines the style, texture, material selection, orientation and proportion of a building as well as site layout, which are very important in creating an effective design. All these promote continuity between the development and local circumstances. Separate building elements are “incomplete expressions”, we can only speak of them from the point of view of a complete building and its surroundings (Taurens, 2008). The term “context” in architecture has wide range of meanings. It could be addressed from different approaches or considered in different situations. According to an expert from Analysing Architecture, Simon Unwin, „architecture is neither a cursory attention nor a radical innovation, but a strong and eloquent visual relationship to the surrounding“. There is no design without detailed analysis of site, landscape and built structures (McHard, 1969), an individual building is always seen first as a part of the whole. Roger Trancik in his book: “Finding Lost Space: Theories of Urban Design” (1986) considers context as one of three major elements that will dominate postmodern city design. In this research the analytical procedure was applied to an evaluation based on key principles of design in context.

2.2 Principles of design in context

Contextual design – the concept that new projects should fit into their context of old settings has been and is a major planning principle in contemporary architecture. U.S. planning departments are evaluating new buildings using a general criterion on how well the building would fit into its context. There are many different studies that are focused on determining the principles of building in context. These principles or guidelines, in forms of recommendations, resolutions, declarations or statements, were drafted and adopted firstly by international organisations, such as UNESCO and ICOMOS. The variety of these design guidelines are showing us that there are not simple rules for achieving quality of design, although a clear and coherent relationship between all parts of the new building to the hole, as well as to their surroundings is essential (Sotoudeh &Abdullah, 2013). These principles are mainly about compatibility of new buildings with old structures through evaluating features, size, scale, proportions and massing in order to protect the integrity of the property and its environment (Penn, 2007).

Here is an overview of 6 key design criteria/principles for building in context, which are used as guidelines in creating specific set of criteria for this research. According to NSW Heritage Office and Royal Institute of Architects to achieve a successful infill design new development must be appropriate under the following design criteria: 1) Character, 2) Scale, 3) Form, 4) Setting, 5) Materials and 6) Detailing. Each of these criteria has specific and measurable set of indicators used to closely and accurately evaluate new building design. Character is defined by the combination of the particular characteristics and qualities of urban areas and is an important criterion for preserving the identity of place, harmony and unity. Indicators for these particular criteria are: topography of site and its surroundings; distinctive landscape elements; date and style of built form; views, vistas and skylines; local cultures and traditions; uses etc. Scale and form of infill buildings, its overall shape and volume are defined by predominant height, bulk, density, proportions, rhythm and grain of existing setting, as well as the ratio of solid and void surfaces in a building. Sitting as a criterion determines position, location and orientation of a new building. Retention of views and vistas, significant natural features and characteristics of landscape are required in infill design. Finally, good infill buildings should recognize characteristic materials, colour and detailing used in existing buildings.

3 METHODOLOGY AND MATERIAL

Concerning methodological framework used in this research, almost for two decades Prof. Dr Eva Vanista Lazarevic is researching a topic of contextual architecture at the University of Belgrade - Faculty of Architecture at the academic courses titled „Contextual Architecture“ on Bachelor, Master and PhD studies.

Also, her PhD Thesis (Vanista Lazarevic 1997) has been relied on the hypothesis that reflecting on architecture can be indeed based through the prism of architecture as an art conclusion, relied on knowledge of golden section, Gestalt theory and facing to an obvious subjectivity. In the scope of urban regeneration we focused to an infill process as the most active one of all urban renewal methods usually used. Contextuality in architecture seemed to be elected and stemmed out as the most logical and important table for general approach on complexity and diversity.

Based on long experience (Vanista Lazarevic 2014) we can conclude that we could not enter this diverse multileveled scientific area without the few bottom-top elements: general good knowledge and a broader view position as a foundation, style upon it and finally on the top: refinement, taste and finesse – difficult to obtain! It is difficult to educate after these guidelines because we as educators have to initiate a sense for evaluation and rafinity refinement even in case if future architects have no enough initial talent. To be more precise, in analyzing and dealing with the meaning of contextual architecture there is a need to handle a whole network of contextual types, aspects and parameters, intertwined between in different layers. The precise analyze of a whole set of indicators could help to develop a final evaluation decisions of students and PhD students, in a way to become one day good analysts and critics by recognizing values as well as through enabling them to acquire knowledge and understanding for further creative professional work.

At the beginning, we can easily distinguish a physical context, which consists of architectural and urban one, new in old settlements segment and urban recycling method. On the other hand we have diverse aspects throughout we build the process: historical, economical, political, ecological, sustainable, in the scope of art, social, philosophical, global, integrative and so on approach to the Context - as a term.

Furthermore, we can observe the Context through several prisms and through the aspects of identity, comfort, safety and security, public health, new technologies, sociological and anthropological aspects, etc. By intersection of elected parameters we could make a general initiative for searching a red line which could approach us near any indication of final result of evaluation or conclusion. Subjectivity is the most burdensome element in this process and we could be hardly rid of it – it represents the real nature of human complexity in evaluation process of art. As we consider the architecture as an art, it is easy to conclude that we could hardly be precise in a measurable way. And maybe we have to count on this fact as on constant threat for sharp definition, but also to consider it as a creative impulse.

However, the parameters to measure the quality of any physical infill method through elected, above mentioned, aspects could help to rely on some trustful imputes. We could decide to elect the adjustment as our choice. We could also confront as the authors – architects against our physical context. Wishing to elaborate something new, completely unique. We can use the charm more and less successful. We can copy other materials just to be polite and to respect the context, but maybe it is not always the right path to call. In the same time, we have to be economically afforded as a „new in old settlement“ expensive project, but never stop to believe we are seeking for even higher levels: something surprisingly fresh, unusual/never seen before, unique, one of a kind or exquisite.

How to measure the „harmony level“ in the process? How to evaluate the quality of infill that lay in all these mix of parameters, grades, inputs etc?

Basically, we have some usually known parameters – Aesthetics elements used as indices in History and theory of art (Kjellman-Chapin 2013, Mako 2009) which consist of measuring the level of: (1) order, (2) unity, (3) relationship, (4) proportion, (5) ratio, (6) hierarchy, (7) symmetry, (8) rhythm, (9) detail, (10) texture, (11) harmony and (12) beauty order. By using them randomly or sometimes in priority way we can measure the level of success of any case study elaborated and analysed numerously, as far as it is possible under the circumstances.

Finally measured or evaluated, the case study could staidly being put in some order and frame, but we have to face another possible obstacle, a Kitsch product and how to measure it and evaluate it. „Kitsch is, unlike art, a utilitarian object lacking all critical distance between object and observer; offers instantaneous emotional gratification without intellectual effort, without the requirement of distance, without sublimation“ (Kjellman-Chapin 2013).

Only through over viewing of immense number of examples and cases we could maybe obtain a power comparison of the evaluators based upon „a posterior“ knowledge. Bad cases could be sometimes more educative and practically useful then some rare high-level quality forms. Although, nice entourage statistically proves upgrading of mental and physical sense of aesthetic of each human individual. So why we should avoid the best possible solutions and do not seek for excellence?

In order to test the defined criteria the research has been done at the University of Belgrade – Faculty of Architecture with the students at the Master and PhD course „Contextual Architecture“ at the research territory of the Vracar Municipality in Belgrade, Serbia. We propose the approach that consisted of two parts that were taking place consecutively.

The first part was conducted with PhD students. The result was a product of the content analysis of existing contextuality of architecture theories and evaluation apparatuses. This part of the research is presented in section titled theoretical background. The second part of the research was realised with students of master studies who had the task to define indicators grounded on the results of the case studies of individual object in the environment, by following the criteria-based structure of the research. For those purpose twenty nine buildings constructed after the 2000th were identified. Case studies have been done on the basis of made catalogue sheets. Accordingly for each of 29 objects is made a mini catalogue where is presented textual and graphical part of the evaluation (see Fig. 1).

Fig. 1: Examples of filled catalogue sheets (Maksic 2015)

Comparing and overlapping the results of those consecutively conducted analysis the new tool for the assessment of contextuality of architecture is produced.

4 RESULTS

Proposal for a tool for assessment a contextuality in architecture, which is elaborated as a set of chosen elements, monitored and checked over years of educational work in „Contextual Architecture“ class, covers following criteria: (1) Order, (2) Unity, (3) Ratio, (4) Proportion, (5) Scale, (6) Hierarchy, (7) Symmetry, (8) Rhythm, (9) Detail, (10) Texture, (11) Harmony and (12) Beauty. Based on a thorough literature research each criterion is clearly defined in order to determine its meaning in relation the main topic of architecture in the context. Given the above meaning and validated on specific case studies for each criterion were identified a range of measurable indicators that aimed at improving the exactness of the evaluation procedure.

4.1 Order

Order represents an establishing a harmonious relationship between elements that make it. Regardless of how many elements make it, it is always possible to add a new element or to repeal the existing. The only requirement is that it needs to happen on already defined rules dictated by the existing environment.

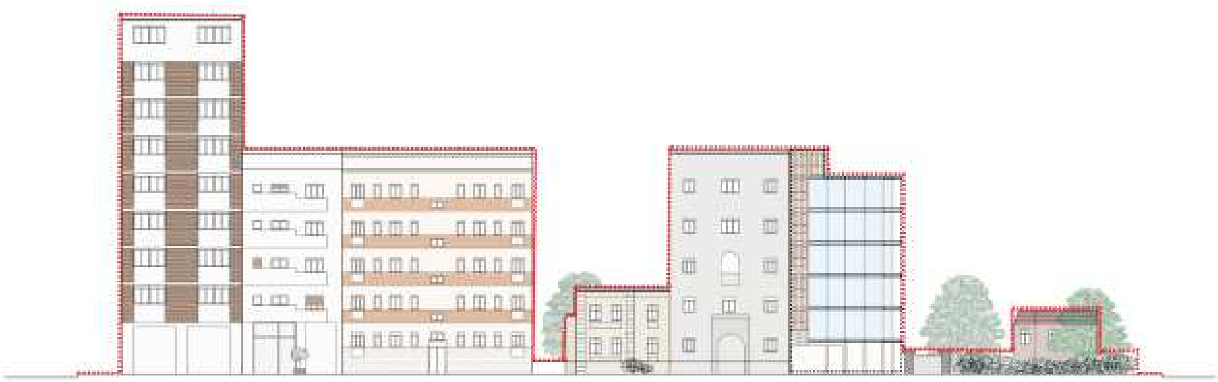

Fig. 2: Order analysed by the 1) vertical regulation, 2) horizontal regulation and 3) building contents (Maksic 2015)

Order could be analysed and measured using the following indicators: 1) vertical regulation expressed and compared by the number of building stories and total height of the building (see Fig. 2), 2) horizontal regulation by comparing the relationship between the positions of construction and regulation lines, 3) the position of the building on the plot, 4) planning regulation – the analysis of what is determined by the plan for a given parcel, 5) the relationship between built and unbuilt compared with the determined construction index and plot occupancy, 6) the existence of greenery and 7) relationship with the present environment.

4.2 Unity

Similarly with the order criteria, the unity implies the achievement of harmony between the elements. While the order is determined by the relationship between elements and allows its differences, the unity is determined by the characteristics of the elements themselves which should be related in order to form a unified whole.

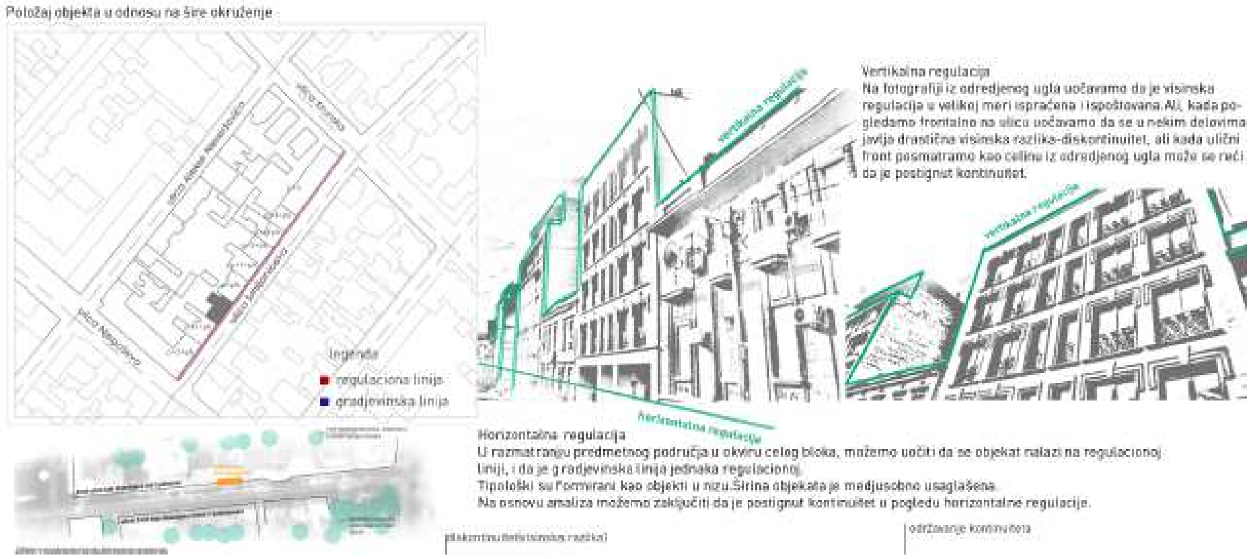

Fig. 3: Unity analysed by the 1) vertical regulation, 2) horizontal regulation and 3) building form and design. (Vartonjic 2015)

This contextual characteristics of the buildings could be evaluated using the following indicators: 1) width of the parcels and street fronts, 2) continuity in terms of establishing harmony between horizontal and vertical regulation and ground floor transparency (see Fig. 3), 3) building shape and form expressed by the geometry of the base footprint, 4) presence of different building contents, 5) coherence of building colours and 6) compatibility of materialisation.

4.3 Ratio

Ratio is defined as establishment of contact, exchange or interaction of elements and it is more general than other criteria. On the other side it could be used as an indicator as well in every of the specified criteria. In accordance with that, ratio would be interpreted only through the physical parameters – width of the buildings footprint ratio, etc.

Fig. 4: Ratio analysed on the basis of 1) width of the buildings and 2) footprint ratio (Vasilev 2105)

Ratio could be analysed using the following indicators: 1) street profile expressed by comparison between the height of the buildings and width of the street (see Fig.), 2) building dimensions expressed by the comparison of the height of the building and its width, 3) ratio of the built and unbuilt and 4) ratio and the position of the building openings.

4.4 Proportion

The proportion criterion defines as relationship between parts (particular elements), but also as the relationship of parts to the whole. Accordingly, this criterion covers two levels of the research: measurement of the established relations and evaluation of the quality of the established relations.

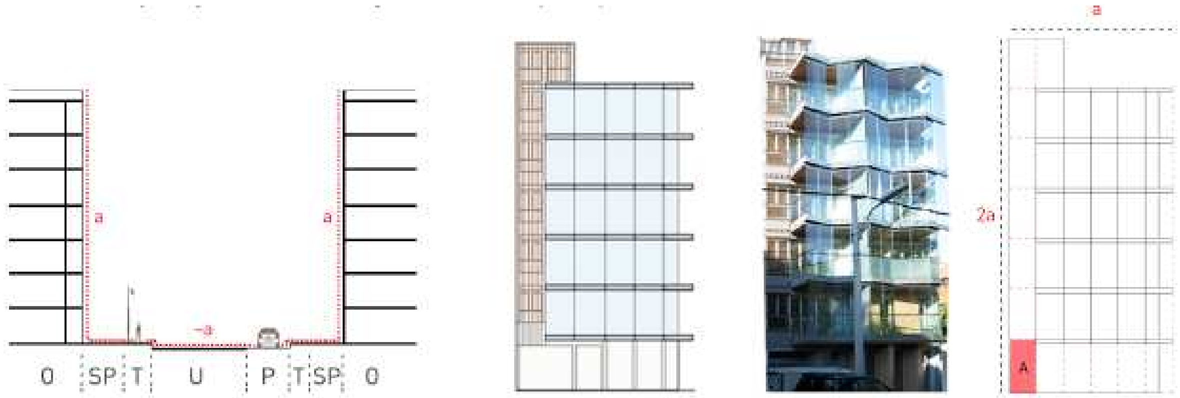

Fig. 5: Proportion analysed as a relationship between particular elements (Maksic 2015)

Proportion could be expressed by following indicators: 1) street profile as a street cross-section where is presented the relation between building height and street width, 2) building dimensions expressed by the comparison of the height of the building and its width (see Fig. 5), 3) continuity of building widths, 4) part and whole expressed by the percent of the particular object footprint in relation to the other objects and 5) dimensions and distance of the openings.

4.5 Scale

In the domain of the architecture in context the scale includes the relation between elements' sizes (height, width, footprint, etc.). These elements should be appropriately sized in order to establish an adequate relationship with other elements.

Fig. 6: Scale expressed by the relation between elements and their sizes (Vratonjic 2015)

The analysis of the scale should cover the measures and evaluation relative to the following indicators: 1) building sizes, 2) element sizes, 3) materialisation expressed by the size of the used materials, 4) the volume of the object, 5) human scale and 6) ambient compliance of the buildings (see Fig. 6).

4.6 Hierarchy

Hierarchy is defined as the ranked order in which each element is subordinate to that above it. In spatial terms it may imply the existence of plans giving the impression of depth as well as adequate relationship of elements to enhance legibility of place and its particular segments.

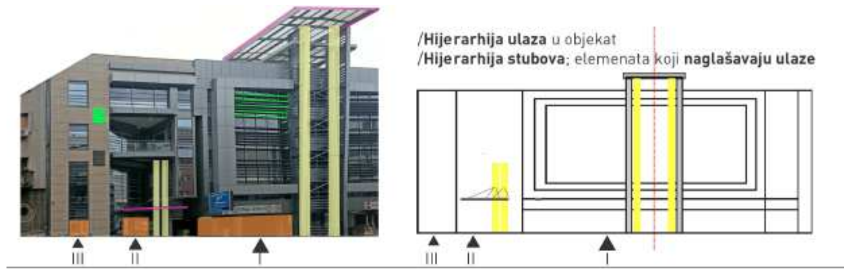

Fig. 7: Hooray of elements of the analysed object (Vasilev 2015)

This criterion covers four indicators: 1) position of the building and position of the element (see Fig. 7), 2) transparency of the ground floor, 3) transparency of the building and 4) the importance of the public space where the building is situated, analysed by the measures of public spaces and the distances of the potential perceptions.

4.7 Symmetry

In the field of geometry the symmetry is a reproduction of objects in relation to the point, line or plane. Symmetry of objects generally implies the existence of the axis of symmetry in respect of which the two parts of the building are equal. The main character of the symmetrical architectural and urban compositions is that they seem static, steady and composure. Symmetry psyhologically represents positive appearance, on the contrary absence of symmetry could often be linked with feeling of unharmony, disorganization and even ugliness.

Fig. 8: The axis of symmetry on the street cross-section indicates the same height of the buildings across the street (Vasilev 2015)

The analysis of the symmetry should cover following indicators: 1) object distance from the axis of the street, 2) object geometry in relation to the reference point, line or plane, 3) street cross-section character in relation to the height, similar elements and existence of tree lines, street lighting, urban furniture, etc. (see Fig. 8), 4) character and form of the roofs and 5 symmetry of the street frontage.

4.8 Rhythm

In music, rhythm is a series of tones and pauses of different durations in the music section. On the other side, in the domain of visual arts, rhythm is regular shift of the prominent and subordinate motives, or their repetition. In architecture, it is the repetition of elements in equal intervals, like repetition of solid and empty, repeating of openings, colours, lights and shadows, etc.

Fig. 9: Rhythm of openings (Maksic 2015)

Fig. 10: Details on the analysed object and details along the street (Vratonjic 2015)

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This criterion covers three indicators: 1) distance between the buildings, 2) building modularity and 3) segment, object and element repetition or redundancy (see Fig. 9).

4.9 Detail

In architecture, detail can be interpreted in several ways, but it general it means a particular, but important item which contributes to the overall picture, or perception.

The analysis of the detail should cover the measures and evaluation relative to the following indicators: 1) colour and materialisation of the particular elements – details (see Fig. 10), 2) uncommonness of the construction solution, 3) footprint dominance and 4) unique form of the building.

4.10 Texture

Texture as a visual element implies the structural composition and the material surface of objects. It could be determined visually as well as by the since of touch, which is of primary importance for the interpretation of textures.

Fig. 11: Different textures identified along the street (Maksic 2015)

The criterion of texture covers seven indicators: 1) character of the finishing (see Fig. 11), 2) reflection, 3) transparency, 4) treatment of the surface (printing, painting etc.), 5) perception distances, 6) personal visual experience and 7) personal tactile experience.

4.11 Harmony

Harmony criterion is determined by the unity and gradient of the parts and segments that are the integral parts of the whole. It involves compliance interaction of the different elements and factors.

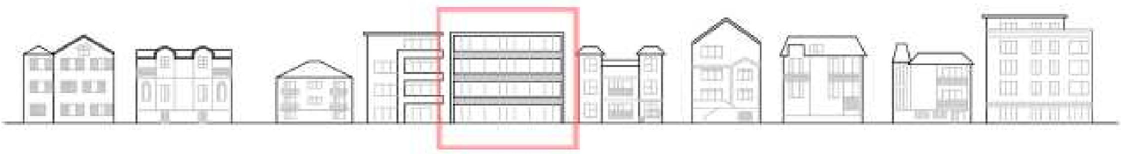

Fig. 12: Harmony expressed as an interaction between different buildings along the street (Milanovic 2015)

This criterion of the contextuality of architecture includes four indicators: 1) integration with neighbouring buildings, street and urban block (see Fig. 12), 2) the relationship of the new facility to the existing environment, 3) legibility and 4) the possibility of identifying the harmonious relations among the elements.

Fig. 13: Beauty as a personal feeling of comfort and pleasure (Maksic 2015)

4.12 Beauty

Beauty is an aesthetic category, which means the perfection of harmony. It depends on the cultural context and is prone to change during the time. Beauty is something that fills us with a sense of comfort and pleasure and it is related to the criterion of harmony.

This criterion is the most complex of all the above and it could be analysed as a summary evaluation of all previous criteria. However, if we look at it separately, it covers five measurable indicators: 1) design qualities, 2) quality of fine works and details, 3) liveability measured by the intensity of use of the particular building and public space, 4) additional effects like lighting, greenery, water effects, colours, smell, etc. and 5) personal, subjective attitude of the of users and observers (see Fig. 13) which are pshylogically often linked with 2 attributes: recognisability and comfort.

On the basis of the presented criteria and indicators a unites table (table 1) is formed after fundamental researches and pedagogical work in the studio "Contextual Architecture" leaded by Prof. Eva V. Lazarevic. It is presented below in a form of easy comparable table the possible framework/tool for assessment of the contextuality on architecture which could be used as a raw model:

ORDER	UNITY	RATIO	PROPORTION
• Vertical regulation • Horizontal regulation • The position of the building on the plot, • Planning regulation • The relationship between built and unbuilt • The existence of greenery • Relationship with the present environment	• Width of the parcels and street fronts, • Continuity • Building shape and form • Presence of different building contents, • Coherence of building colours • Compatibility of materialisation.	• Street profile • Building dimensions • Ratio of the built and unbuilt • Ratio and the position of the building openings	• Street profile • Building dimensions • Continuity of building widths, • Part and whole • Dimensions and distance of the openings.

SCALE	HIERACHY	SYMMETRY	RHYTHM
• Building sizes • Element sizes • Materialisation • Volume of the object, • Human scale • Ambient compliance of the buildings	• Position of the building and position of the element, • Transparency of the ground floor, • Transparency of the building • The importance of the public space where the building is situated	• Object distance from the axis of the street, • Object geometry • Street cross-section character • Character and form of the roofs • Symmetry of the street frontage.	• Distance between the buildings, • Building modularity • Segment, object and element redundancy.

DETAIL	TEXTURE	HARMONY	BEAUTY
• Colour and materialisation • Uncommonness of the construction solution, • Footprint dominance • Unique form of the building	• Character of the finishing, • Reflection, • Transparency • Treatment of the surface • Perception distances • Personal visual experience • Personal tactile experience.	• Integration with neighbouring buildings, street and urban block • Relationship of the new facility to the existing environment, • Legibility • Possibility of identifying the harmonious relations among the elements.	• Design qualities, • Quality of fine works and details, • Liveability • Additional effects like lighting, greenery, water effects, colours, smell, etc. • Personal, subjective attitude of the of users and observers.

Table 1: New tool for assessment the contextuality of architecture

5 DISCUSSION AND CONCLUSION

After all, we can conclude that is difficult to found out the exact level for context-sensitive: the right boarder between sensitive and not sensitive. Debating the context of architecture, from the room micro cell to the macro-geographical urbanism, one arrives to problematise of how different cultural identities are constituted, reflected or presented in a specific artificial space (Šuvaković, 2009). Gaston Bachelar (1985) theory of equal importance of empirical, theoretical and abstract approach to evaluating can be very meaningfully for understanding of context. For Bachelard, rationalism makes equal reference to all three systems of thinking.

Renzo Piano once said: "I stick to the rule that I have never broken. Do not start a project without seeing the place of construction. Places talk to you, they guide you, and they give you ideas" (cited in Bojanic/Djokic 2011). Our experience a priori and a posterior while evaluating has to be taken in consideration. We can

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feel, abstractly, something while judging which we cannot rationally explain. But based upon the understanding of knowledge, everything concerning evaluating could be much easier. Contextual philosophy (in term of different layers) could be linked with most difficult valuation, especially of art. As we consider architecture as an art we could suggest that only after profound analytical consideration and a posterior experience based upon knowledge we might be sure about our better and more certain conclusions about any fact including architecture evaluation.

Different approaches in valuing infill development are mentioned in this paper, but considering evaluating approach and process resulting in both creating unique set of specific criteria and indicators and conducting thorough quality assessment of infill development in quarter of Vracar in Belgrade we could argue that this research represents some useful findings in order to upgrade our scientific contribution as the Faculty Educators but also to be of practical use. Quarter of Vracar is already familiar with those researches and would be more than happy to use it in near future.

Quality assessment presented in this paper could be important for future infill development in Belgrade. According to historian and philosopher Miško Šuvaković (2009) architecture in Serbia after the year 2000 was executed as a discursive, ideological and political historically and geographically determined practise within transitional society . In this shifting environment defined by individual projects driven by profit, infill development in Serbia, Belgrade has been neglecting tradition, continuity, identity and character of a place.

The presented framework, after our experiences, could be considered as a foundation in determining the normative framework for evaluating the contextuality in architecture relying on network of architecture elements which are easy comparable and measurable. On the other side, it could be used as a base in generating recommendations and guidelines for future interventions for the same or similar urban environments. It could be of practical value and general benefit to follow these guidelines in order to minimize further „mutations“ of a city of Belgrade but also in other environments & cities.

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reviewed paper

A Toolkit for Resilience Evaluation of Land Use Alternatives in a Multifunctional Peri-Urban Landscape

Frederik Lerouge, Hubert Gulinck, Liesbet Vranken

(ir. Frederik Lerouge, KU Leuven, Department of Earth and Environmental Sciences, Division Bio-Economics, Celestijnenlaan 200E, 3001 Heverlee, Belgium, frederik.lerouge@ees.kuleuven.be)
(Prof. Hubert Gulinck, KU Leuven, Department of Earth and Environmental Sciences, Division Forest, Nature and Landscape, Celestijnenlaan 200E, 3001 Heverlee, Belgium, hubert.gulinck@ees.kuleuven.be)
(Prof. Liesbet Vranken, KU Leuven, Department of Earth and Environmental Sciences, Division Bio-Economics, Celestijnenlaan 200E, 3001 Heverlee, Belgium, Liesbet.vranken@ees.kuleuven.be)

1 ABSTRACT

Translating the concept of social-ecological resilience to practical applications in spatial planning remains challenging. The aim of this paper is to contribute to the scientific approach of spatial aspects of social-ecological resilience and adaptive capacity related to bioproductive space, with particular attention to food systems. We define 'bioproductive space' as all space providing ecosystem services through primary production processes and includes semi-natural as well as agricultural ecosystems. We argue that bioproductive space is resilient if it continues in delivering similar levels of ecosystem services under changing conditions.

A toolkit was developed to explore spatial resilience of bioproductive space. The first stage in the toolkit is a spatially explicit evaluation of various ecosystem services for different land uses. In a second stage, bio-physical and socio-economic drivers or shocks are introduced that can influence the value society attributes to specific ecosystem services. Some of these variations are mostly society driven, e.g. changing bioenergy demand or more restrictive air quality targets. Others are rather driven by biophysical factors, like increasing need for buffering of extreme weather events under the impulse of global change. The third stage of the toolkit takes policy priorities into account. In a final stage, the output of the tool is synthesised by ranking the analysis results for different scnearios and policy priority settings. This toolkit allows spatial planners to explore and evaluate policy decisions against trade-offs between various land use alternatives, while taking ecosystem services into account. The toolkit is applied to a case study to demonstrate its use. Besides the potential for supporting policy makers, the toolkit provides useful feedback for adaptive farm and landscape management.

2 INTRODUCTION

Land is becoming an increasingly scarce resource, because of increasing population pressure and associated urbanization, coupled with the increasing demand for food and (bio)energy products (Meyfroidt et al. 2013; Tscharntke et al. 2012). This relative scarceness becomes more apparent with progressing insights that productive space worldwide delivers many functions and services (Lambin 2012), expressed by a.o. the concept of ecosystem services (Millennium Ecosystem Assessment 2005). Meanwhile, injudicious use of remaining available space puts constraints on its provision of ecosystem services (Stoate et al. 2009). Urbanization leads to an increasing competition for the remaining open space (Kerselaers et al. 2013), limiting the adaptive capacity of food systems in peri-urban areas. The ecosystem service concept may contribute to an adaptive spatial planning paradigm, and as such, to more resilient land use. Adaptive management comprises combined insight in the system vulnerability, the detection of system crossing thresholds, and the presence of feedback loops towards an adequate (pro-active) response (Benson & Garmestani 2011). A framework for detecting early warning signals for regime shifts has been developed by Scheffer et al. (2009; 2012). A model concept for the assessment of threshold in various interacting scales ('cascading thresholds') was developed by Kinzig et al. (2006), and has seen some applications (e.g. van Apeldoorn et al. 2011). Nonetheless, the need for practical tools to incorporate resilience thinking in adaptive planning remains.

Resilience is quickly gaining momentum as a concept for understanding the dynamics of sustainability in social-ecological systems (SES) (Folke 2006; Turner II 2010), and the response of these systems to environmental and societal changes (Adger 2006). Resilience is defined in terms of the capacity to reorganize, renew and redevelop (Gunderson & Holling 2002). Essential to the concept of ecological resilience is the presence of several alternative stable states for an ecological system (Holling 1973). Within the theoretical space defined by all possible values of the variables that constitute a system, several stability

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domains may be found. These can be seen as more or less distinct sets of system states that are highly similar in structure and function. These stability domains demarcate alternate 'regimes', separated by thresholds (Scheffer et al. 2001). Phase shifts across these thresholds are well-known from resilience research on ecosystems (Zell & Hubbart 2013), most notably marine ecosystems like coral reefs (e.g. Bellwood et al. 2004; Hughes et al. 2005) and pelagic species assemblages (Daskalov et al. 2007), as well as freshwater ecosystems (Reynolds 2002; Carpenter et al. 2001).

Translating the concept of resilience to practical applications in spatial planning remains challenging. It can be applied to relatively simple and well controlled systems, but often fails to grasp disturbance dynamics in more complex social-ecological systems. When talking about social-ecological resilience (Davoudi et al. 2012), the idea of more or less static stability domains is questioned, as the system itself can be able to adapt (even pro-actively) to external and internal drivers (Carpenter & Folke 2006; Folke 2006). Social-ecological resilience recognizes the intrinsic complexity, uncertain and dynamic character of SES, and moves away from a linear cause-consequence reasoning (Kinzig et al. 2006). The social and biophysical components of the system are intimately linked, and can not be treated separately.

3 RESILIENCE OF BIOPRODUCTIVE SPACE

The aim of this paper is to contribute to the scientific approach of resilience and adaptive capacity related to bioproductive space, with particular attention to food systems. We define 'bioproductive space' as all space providing ecosystem services through primary production processes in both (semi-)natural and agricultural ecosystems. These ecosystem services include food and biomass production, as well as regulating (e.g. climate regulation, pollination) and cultural (e.g. recreation, landscape amenity) services (Haines-Young & Potschin 2010).

The approach is based on an appraisal of the ecosystem services provided by bioproductive space, irrespective of sectoral boundaries. This implies that agricultural areas can not only be seen as spaces for the production of food, fuel and fiber, but that associated non-provisioning ecosystem services are also to be recognized. On the other hand, there is potential for food and biomass production outside of the statutory agricultural area, for example on road verges, in natural areas and in residential gardens. In analogy with Zell & Hubbart (2013), we argue that bioproductive space is resilient if it continues in delivering similar levels of ecosystem services under changing conditions. As such, we define spatial resilience as "the capacity of social-ecological systems to buffer space-bound functions and services against internal and external shocks, by using adaptive forms of land use and configuration".

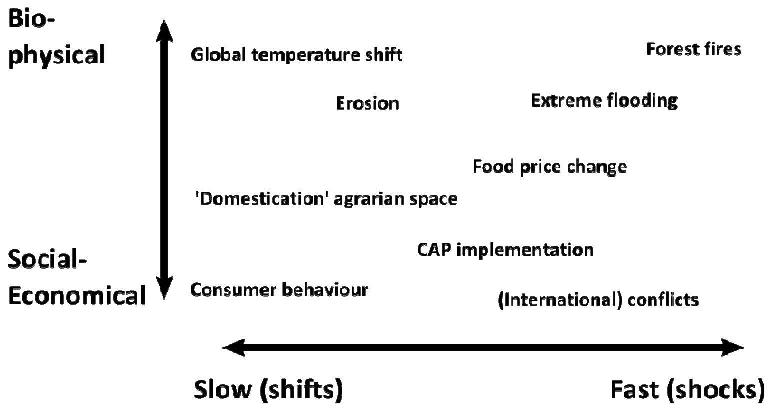

Figure 1. Drivers

Resilience aspects can be described on various spatial scales, and from interaction between these scales. Cumming (2011) points out the contribution of location, connectivity and context for adaptive forms of land use under the umbrella term 'spatial resilience'. The capacity for adaptation has a social and biophysical component, the latter depending greatly on biodiversity (Zell & Hubbart 2013; Colding & Barthel 2013). Biodiversity increases functional redundancy in a system, as well as the number of potential development paths, both to the benefit of the response diversity of the system to shocks. Also Walker & Salt (2006) list diversity as one of the principal criteria for the development of resilience of social-economic systems. Although functional diversity and variability within and across different spatial scales is a major component of resilience indeed, this is mainly so where it goes hand in hand with functional redundancy (Peterson et al. 1998) and high levels of response diversity (Bellwood et al. 2004).

4 DRIVERS AFFECTING FOOD PRODUCTION SYSTEM RESILIENCE IN FLANDERS

Resilience is meaningful only when described as a specific system's property relative to a specific driver (Carpenter et al. 2001). Drivers generate shifts (slow) or shocks (fast), and can can be of bio-physical or socio-economic nature (Figure 1). A driver may cause a directional change to the social-ecological system, driving alteration of the use of space within that system. Examples of slow shifts are land speculation and privatisation, or ageing of the farmer population leading to farm size increase and the emergence of non-agricultural land use on farmland. Examples of faster shocks are exteme weather events, market price fluctuations or international conflicts.

As part of the Millennium Ecosystem Assessment (2005), Nelson et al. (2006) provide an overview of relevant direct and indirect drivers for global ecosystem change. Direct drivers cited are climate variability and change, drivers related to exploitation, land conversions, and biological invasions and diseases. Indirect drives cited are demographics, economics, socio-politics, science and technology, and culture and religion. For Flanders, conversion of land from agricultural use into other uses is a relevant driver that is easily overlooked, because the total area of statutory agricultural land remained relatively constant during the last decades. Nonetheless, recent research points out that an estimated 10% of the agricultural land is used for non-agricultural purposes (Verhoeve et al. 2015). Land 'horsification', i.e. use for recreational horsekeeping is part of this driver (Bomans et al. 2010), as well as competition for hobby animal feed production (Van Gossum et al. 2014). Also exploitation is considered a major driver in Flanders, with soil degradation, compaction and potential water shortage as major aspects (Van Gossum et al. 2014). Similarly, climate variability and change is an important driver. Although several benefits can be associated with climate change for Flemish food production, for most crop and livestock production systems a net productivity loss is expected, even when measures for adaptation are taken into account (Gobin et al. 2008). However, the relative productivity loss is expected to be less for agro-ecological production models, characterized by higher intrinsic tolerance levels to stress (Ulanowicz et al. 2009).

5 DEVELOPING A TOOLKIT FOR EVALUATING LAND USE ALTERNATIVES

The diagram in Figure 2 shows the design of the toolkit. On the input side is an assesment of the land use and possible land use alternatives, based on spatially explicit datasets of the biophysical system. The differences in ecosystem services delivered by these alternatives in comparison to the actual land use are quantified and valued. The assigned values are recalculated for different driver scenarios, weighted according to policy preferences, and aggregated. Adding drivers and policy priorities quickly leads to a large output matrix, making the output difficult to grasp. In terms of resilience, we are mainly interested in identifying these land use alternatives that provide, on average, the highest value of ecosystem services under various shock scenarios. Calculating rankings provides an elegant way to extract this information from this large output matrix. Therefore, all land use alternatives are ranked relative to the baseline land use, and for each land use alternative, the weighted mean rank is calculated. This means that, if a land use alternative is consistently preferred over the others in different driver scenarios, both the mean ranking and standard deviation of this land use alternative will be low. A low mean ranking is indicative for a high relative preference for the alternative. A low standard deviation in turn, is indicative for a high spatial resilience of the alternative, in the light of the driver scenarios, and in comparison with the other alternatives. This toolkit allows spatial planners to explore trade-offs between various land use alternatives, taking ecosystem services into account. The toolkit is applied to a case study to demonstrate its use.

5.1 Stage 1: Spatial explicit ecosystem service evaluation

Central in the toolkit is a spatially explicit evaluation of various ecosystem services for different land use alternatives. This evaluation should be quantitiative and allow for aggregation of the ecosystem services, i.e. that different ecosystem services can be combined and compared. For this purpose, we use monetary valuation. The differences in ecosystem service delivery are calculated between a baseline land use, e.g. the actual land use, and a land use alternative. The land use alternatives ideally correspond to real stability domains of the social-ecological system. The alternatives can reflect biophysical changes, landscape

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management changes, or combinations of both. Also, they might represent corner solutions. Corner solutions are extreme alternatives, not necessarily feasible but rather aiming at exploring the edges of the decision space for the social-ecological system.

A spatially explicit approach has the advantage that spatial variations in ecosystem services valuation can be taken into account. An example is a higher recreational value attributed to open space in more densely populated areas, or where substitues are rare.

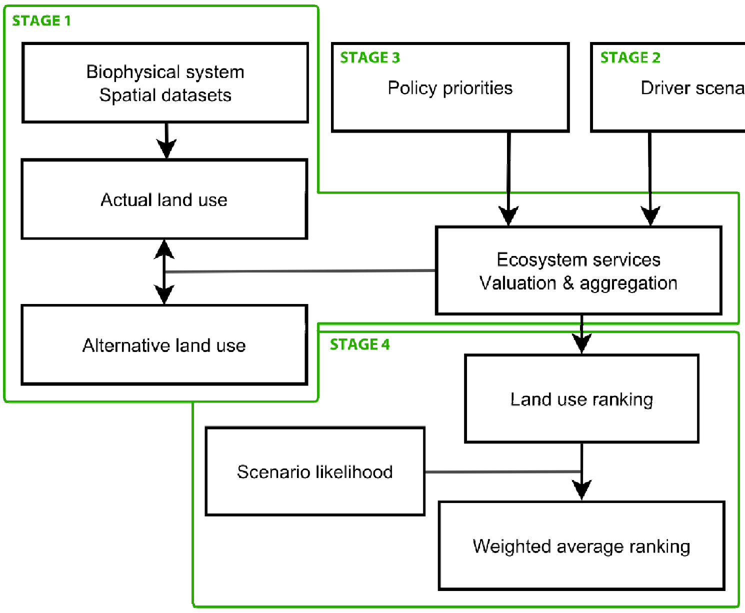

Figure 2. The structure of the toolkit.

5.2 Stage 2: Scenarios of slow and fast shocks

Bio-physical and socio-economic shocks can influence the value society attributes to specific ecosystem services. Examples are changing demand for local or organic food products, for recreational space, or for regulating services, such as water storage or fine particle filtration. Changes in demand and supply will typically affect the value of a good or service. Some of these variations are essetially driven by society, e.g. changed bioenergy demand or more restrictive air quality targets. Other variations are rather induced by biophysical factors, like increased need for buffering of extreme weather events.

To allow these drivers to be taken into account, a factor reflecting a change in valuation is introduced in the valuation step for each ecosystem service. While the biophysical output of different land use alternatives may not change, the value attached to the output may change due to changing societal demand for the services deleivered. A SES is considered to be resilient if it maintains the capacity to provide services that affect human well being, even when the SES is affected by a shock. The more a SES is capable to deliver positive services to human well-being despite socio-economic or biophysical factors affecting their demand and value, the more resilient it is. In this stage, the value of ecosystem services for different land use alternatives is calculated and this for different scenarios of changing demand and hence valuation of ecosystem services.

5.3 Stage 3: accounting for planning priorities

The previous stages allow for the calculation and aggregation of ecosystem services for various land use alternatives. However, spatial planners may decide to attach higher importance to certain ecosystem services because they consider the valuation over- or underestimates their importance. They may for example assume the valuation does not properly take into account future impacts. They may also take into account that there is a minimum quantity of ecosystem structure and proces required to maintain a well-functioning ecosystem capable of supplying services. Below this threshold, the SES might collapse and the economic value below this safe minimum standard drops to zero or becomes negative. Also, there may be high uncertainty as to the exact value of this threshold. However, if one fears that the ecosystem state is approaching a minimum standard of functioning, one might attach more importance to the associated ecosystem services in order to conserve the ecosystem structure and functions. Therefore, the toolkit allows for assigning weights to individual ecosystem services. Alternatively, this can also be a means to explore the influence of various policy priorities. For example, one can increase the weight of regulating services in the case of a landscape where buffering against disturbances is of great importance. Or, where climate neutrality is a priority, the importance attached to carbon sequestration in soil and biomass can be increased.

5.4 Stage 4: ranking land use alternatives

For each shock scenario, we rank the land use alternatives according to the value of ecosystem services that they supply. A ranking of 1 is assigned to the land use alternative delivering the most societal benefits under the scenario in question. The second best land use alternative is ranked 2, and so on. This is done for each scenario. Subsequently, a mean ranking is calculated for each land use alternative. This ranking will change if the policy priorties change, because the aggregate values of the ecosystems services delivered by each land use alternative also change. The ranking may also change if it is considered that some future scenarios of drivers and shocks are more likely than others. In the latter case, the different scenarios get a unequal weight, e.g. proportional to their likelihood to occur, when calculating the average ranking of the land use alternatives. Finally, when more schock scenarios are considered, the mean ranking may also change individual drivers.

6 APPLICATION TO A CASE OF EXTENSIVE MEAT PRODUCTION IN FLANDERS

6.1 Case: extensive livestock production combined with nature development

This case comprises an extensive livestock farming in two subcatchments of the Demer catchment in Flanders. The region of Flanders, Belgium, has an outspoken peri-urban character (Kerselaers et al. 2013; Lenders et al. 2005). The farm started in 2001 by taking over a conventional dairy farm, but has since then followed an unconventional development path, aiming at reconciling organic meat production with nature management. This agro-ecological production strategy aims to close cycles as much as possible , and to adapt to both the local biophysical conditions and biodiversity targets. The extraction of nutrients is an important aspect of ecological grassland management for reaching these biodiversity targets, mainly due to the high background deposition of nutrients (Stevens et al. 2011; Oelmann et al. 2009). As such, nature management in Flanders generates a biomass waste stream. This waste stream is spatially and temporally spread, making adequate removal and processing a challenge. Grazing is an option, but most of the biomass is of inferior quality as feed and therefore requires adapted breeds which are less productive. An outline of the production system is given in Fig. 3.

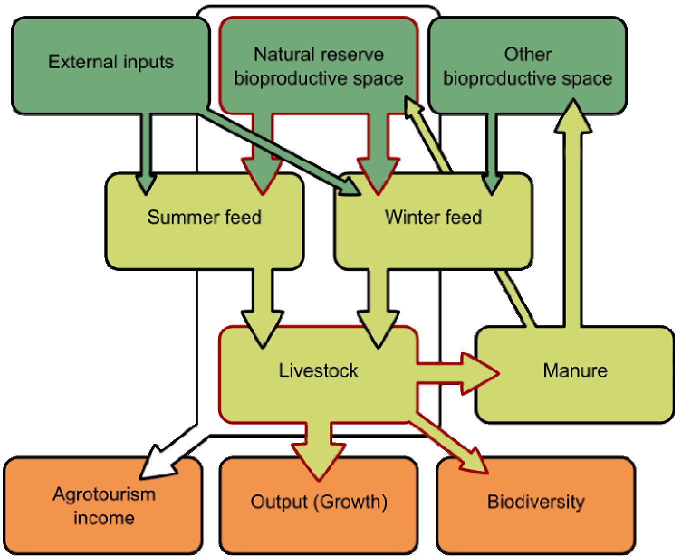

Figure 3. The livestock production system of the case farm is largely based on feed from a natural reserve.

Central in this diagram are two key components of the livestock production system, i.e. the bioproductive space of the farm, and the livestock itself. The bioproductive space used comprises 44 parcels covering about 113 ha in total. The farm uses relatively rare local breeds, namely the cattle breed Kempisch Roodbont, and the sheep breed Ardense Voskop. These breeds are sturdy and self-reliant, as well as able to digest the low-quality feed from extensive grasslands within the natural reserve. This low-quality feed forms the mayor

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component of the animals' diet, either by directly grazing the parcels, or cutting the grasslands for feed production. The choice for grazing or cutting specific parcels is largely determined by nature management targets. In addition, a number of parcels with a more intensive grass-clover cultivation are strategically included in the bioproductive space. The purpose of these parcels is twofold: (1) adding a nutritious share the animals' diets, and (2) providing space to spread manure. In doing so, the farm effectively extracts nutrients out of the natural reserve, contributing to reaching its biodiversity targets. Through both on-farm diversification and collaboration with other farms, the farmer is able to adapt to the specific requirements of the nature management plans. The productivity of these breeds is higher compared to some other typical breeds used in nature management, such as Galloway. This contributes to the economic potential of the farm.

6.2 Methodology

6.2.1 Stage 1: Spatial explicit ecosystem service evaluation

All parcels of the case farm were digitized in a GIS (ArcGIS 10.1), based on the farm registry. Attributes like land use, production, grazing and mowing intensity were added from the farm registry. The land use was verified using aerial imagery (Aerodata International Surveys 2007) combined with fieldwork (early 2013). Using spatial overlays, additional data was attributed to the parcels: the Biological Valuation Map (AGIV 2010); soil texture and moisture data (AGIV 2006); the Habitat map v5.2 indicating habitats of the EU Habitat Directive (INBO 2010); flooding risk zones (VMM 2006); and prevalence of woody vegetation based on the 'Groenkaart' (ANB 2010; ANB 2013).

The actual land use was used as the Reference scenario. On a parcel by parcel basis and in collaboration with the farmer, land use alternatives were formulated corresponding to different farm management choices: IntensiveMIN is a land use alternative that corresponds to a conventional livestock farming within the limits posed by the biophysical system. IntensiveMAX, a corner solution, corresponds to a land use alternative that results from intensive livestock farming, ignoring local biophysical constraints. IntensiveSRC is a land use alternative that represents a mixed farming for livestock and woody biomass production. It assumes short rotation coppice on the most humid parcels near the farm. We subsequently compared the capacity of actual land use to supply ecosystem services with the capacity of each of these alternatives. To allow for an aggregation of the ecosystem services, monetary valuation was used. We relied on the methodology developed by Broekx et al. (2013), which is available in an online tool 'Nature Value Explorer'. This tool does not allow to calculate absolute values. Instead differences in value of ecosystem services supplied by the land use alternatives were calculated.

As such this analysis, described in detail in (Lerouge et al, submitted), yields differential estimates for the land use alternatives for a number of ecosystem services, namely crop & livestock production, woody biomass production, fine particle filtration (PM10), carbon sequestration in soil and biomass, nitrogen and phosphorous sequestration in soil, and cultural services using a stated preference method. The tool used provides lower and upper estimates for the differential values. To avoid overestimating the differential ecosystem services, we work with the lower estimates.

6.2.2 Stage 2: formulating driver and shock scenarios

For demonstrative purposes, five shock scenarios were formulated, including a baseline scenario for comparison (Table 1). The Baseline scenario assumes no changes in the demand for and hence valuation of ecosystem services, and can be used as a reference to evaluate the influence of the other driver scenarios. Three scenarios were included to explore the effect of an increasing valuation of food produce: FoodValueGlobal, assuming a general increase of food valuation to the level of 150% of the original value; FoodValueConv, assuming this increase only to apply to conventional food products, and FoodValueOrg, assuming this value increase only to apply to organic food products. This last driver scenario correspond for example with the emergence of a local market for organic produce, offering higher prices to the farmers involved. Finally, we formulated the RecValue scenario, assigning a valuation increase for cultural services (i.e., recreation value of green open space). Such a scenario is likely to occur in any peri-urban context where a population increase is associated with a net decrease of open space available for outdoor recreation.

Each of driver or shock scenario results in change in the valuation of a particular ecosystem service. For every driver scenario the relative value of ecosystem services supplied under different land use alternatives was calculated. In addition, four different sets of likelihood figures for these scenarios are formulated.

(A) ‘equal’: assuming all of the scenarios are equally likely to occur, i.e. no weighting is applied in calculating the mean ranking;

(B) ‘organic’: assuming scenarios in which demand for and hence valuation of organic food increases, are relatively more likely to occur. A larger weight is attributed to the FoodValueOrg and FoodValueGlobal drivers, as well as to the baseline scenario ;

(C) ‘conventional’: similar to the previous, but assuming scenarios in which the valuation of more conventional produce increases, are more likely to occur;

(D) ‘recreation’, assuming increasing demand for recreational services due to population pressure and increased urbanisation.

These will be used as weighting factors in calculating the mean ranking in stage 4.

Scenario	Description	Likelihood			
		A	B	C	D
Baseline	Original comparison for reference.	0.17	0.3	0.1	0.05
FoodValueGlobal	Increased valuation of food (150%)	0.17	0.2	0.3	0.05
FoodValueConv	Increased valuation of conventional food (150%), status quo for organic food	0.17	0.05	0.2	0.05
FoodValueOrg	Increased valuation of organic food (150%), status quo for conventional food	0.17	0.25	0.05	0.2
RecValue	Increased valuation of recreational services (150%)	0.17	0.15	0.15	0.5

Table 1. Overview of scenarios and the likelihood distributions used for the demonstration

6.2.3 Stage 3: Policy priorities

The aggregated value for the ecosystem services supplied by different land use alternatives was initially calculated as the unweighted sum of the value of individual ecosystem services. However, in correspondence to policy priority settings, we assigned more weight to certain individual ecosystem services during the aggregation. For demonstrative purposes, we used the weighting matrix provided in Table 2.

Ecosystem service	Equal importance	More importance attached to…				
		Regulating services	Provisioning services	Cultural services	Carbon sequestration	Bioenergy production
Cultural services	1	0.8	0.8	1.7	0.7	0.6
P storage (soil)	1	1.12	0.8	0.9	0.7	0.6
N storage (soil)	1	1.12	0.8	0.9	0.7	0.6
C storage (biomass)	1	1.12	0.8	0.9	1.9	1.4
C storage (soil)	1	1.12	0.8	0.9	1.9	1.4
Air quality	1	1.12	0.8	0.9	0.7	1.4
Wood	1	0.8	1.6	0.9	0.7	1.4
Crop & Livestock	1	0.8	1.6	0.9	0.7	0.6

Table 2. Weights assigned to individual ecosystem services during aggregation to explore the impact of policy priorities

Once again, a baseline is included in which all ecosystem services are weighted equally, to allow for comparison between weighted and non-weighted analysis. The policy priority setting ‘Regulation’ implies regulating services to be assigned a larger importance by policy makers. Similarly, the setting ‘Production’ puts emphasis on provisioning services, ‘Recreation’ on cultural services, ‘Carbon’ on carbon storage in soil and biomass, and ‘Bioenergy’ on ecosystem services provided by woody biomass.

6.2.4 Stage 4: Ranking

The aggregated values are calculated for five policy priorities, over six driver scenarios, for 3 land use alternatives. This yields an output matrix of 5x6x3 comparison results indicating in Euros whether the land use alternative in its respective context represents societal benefits (positive balance) or costs (negative balance).

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For each of the driver scenario, land use alternatives were ranked based on the amount of aggregated ecosystem services that they supplied. For this particular case this means we end up with a table ranking the land use alternatives from 1 to 4 in order of preference, for each driver scenario. Next, the mean rank was calculated for each land use alternatives, and weighted according to the likelihood that a scenario occurs (Table 1).

7 RESULTS AND DISCUSSION

7.1 Stage 1: Spatial explicit ecosystem service evaluation

The intermediary output of stage 1 is an evaluation of the differential ecosystem services provided by the land use alternatives (Lerouge et al, submitted), and is here updated using the most recent estimates from the case farm registry. The actual land use (Reference) is used as a reference for benchmarking (Figure 4). As expected, the conventional production-oriented scenarios IntensiveMIN and IntensiveMAX perform better for provisioning services, but worse for nearly all other ecosystem services evaluated. The IntensiveSRC scenario performs relatively well in the analysis, offsetting losses of provisioning services by increased fine particle filtration and cultural services. The aggregated estimates position the actual scenario as delivering more societal benefits than the more intensive farming models, but less than a model including woody biomass production.

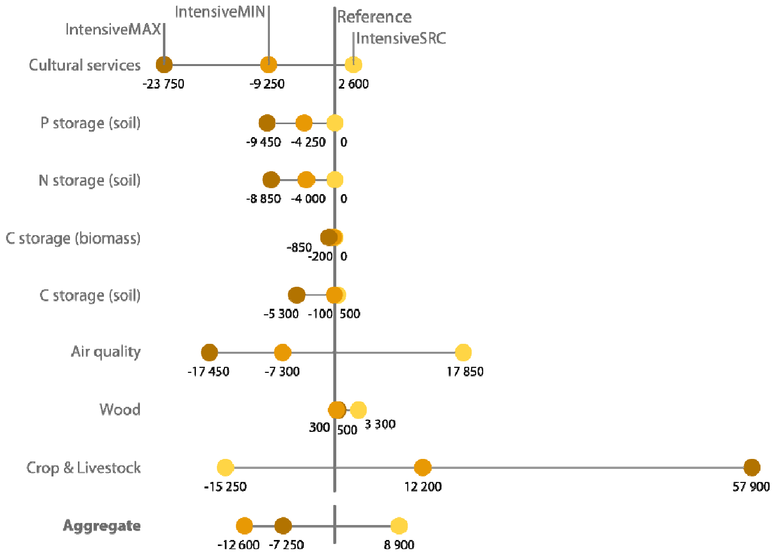

Figure 4. The evaluation of ecosystem services indicates relative societal benefits provided by the studied land use alternatives (baseline scenario, no weighting applied).

The fine particle filtration ('air quality') in particular contributes to the overall positive assessment of the IntensiveSRC land use alternative. Fine particle filtration however, is a positive externality that is difficult to internalize in a production system. Moreover, the productivity for woody biomass in the case area is relatively low, and short rotation coppice is largely in contradiction with local biodiversity targets. All these factors partially explaining why this land use is not adopted by the case farm. We have to point out that the assessment of ecosystem services is at this stage relatively rough, in particular with respect to cultural services. Moreover for the IntensiveSRC alternative, the ecosystem service estimations are based on a young monoculture of either willow or poplar species as a proxy for short rotation coppice. Because a short rotation coppice stand is likely to be visually less appealing compared to a young forest stand, for example due to the strict geometric pattern of the plantation, the result for cultural benefits is likely to be an overestimation.

The results of the comparisons in this stage will improve considerably as scientific work on the quantitative assessment and valuation of ecosystem services advances. The analysis presented in this paper is predominantly based on a Flemish evaluation framework, the Nature Value Explorer (v2, Broekx et al. 2013) that is also accessible to policy makers and spatial planners and is continuously in development. The development of this valuation tool explicitly takes into account the tradeoff between sophistication and ease of use.

While an assessment of the accuracy of the tool is beyond the scope of this research, a number of shortcomings at this stage could be identified. Mainly for regulating and cultural services, spatially explicit land use complementarities are insufficiently taken into account. This makes evaluating land use configuration alternatives impossible, while they might constitute a major opportunity to improve the overall societal benefits generated by a land use system, in particular in a highly used, peri-urban landscape (Colding 2007). Another challenge to improve on valuation tools, lies in the importance to take social-ecological innovations into account, many of which rely on spatial complementarities. For the case farm studied in this research, the principal social-ecological innovation is the explicit association between the traditionally segregated sectors of farming and nature management. Also, a number of ecosystem services are not yet included in the valuation tool. Adding additional ecosystem services to the assessment has the potential benefit to incorporate more of the positive and negative externalities, but at the risk of increased double counting (Loomis et al. 2000; Ninan & Inoue 2013).

7.2 Stage 2: Driver scenarios

In Figure 5, we illustrate the amount of ecosystem services supplied under different land use alternatives for different driver scenarios, i.e. for different changes in the changes in demand for and hence valuation of ecosystem services. Initially, we simply aggregated all individual ecosystem services, i.e. equal importance was attached to each of them. These results demonstrate how certain drivers or shocks cause thresholds to be crossed, whenever land use alternatives switch position relative to the Reference alternative or to each other. A general increase in the demand for food and in the food value as simulated by the FoodValueGlobal scenario, generates a relative increased preference for conventional intensive land use alternatives. When the value increase is constricted to conventional produce, the extensive land use scenario becomes the least preferred. In contrast, a selective increase in the demand for and value of organic produce, which could for example be caused by the emergence of a market for locally produced organic food, has the opposite effect. Increasing demand for open recreational space might contribute to the emergence of extensive production systems, as illustrated by the RecValue scenario.

For this demonstration, we assumed all defined scenarios are equally likely to occur and we assumed that individual ecosystem services are simply aggregated (i.e. without attaching more importance to one of the ecosystem services).

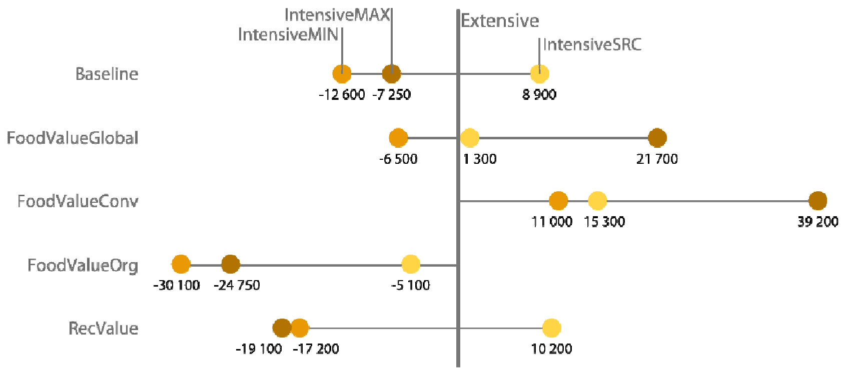

Figure 5. Relative performance (in terms of ecosystem services) of land use alternatives for each of the driver scenarios.

7.3 Stage 3: Applying policy priority settings

Figure 6 illustrates how thresholds might be crossed when policy priorities are incorporated into the calculation. This is of particular interest in spatial planning when the policy priorities are formulated in a spatially explicit way, or rooted in spatial analysis. For example, a community deciding to strive for carbon neutrality might increase the weight of carbon sequestration in the toolkit. The spatial focus can be more selective, for example in an analysis where water buffering capacity is weighted more in catchments that are upstream of problematic flooding areas. Ideally, the user will incorporate such spatial heterogeneity in the first stage, during assessment and valuation of the ecosystem services.

If more importance is attached to food production, then the IntensiveMAX land use alternative is performing best. When interpreting the results, one should however bear in mind that the IntensiveMAX land use alternative is a corner solution that does not take local biophysical constraints into account. The more importance one attaches to cultural services, the less well the IntensiveMIN and IntensiveMAX land use

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alternatives are performing. More focus on bio-energy production or on the supply of regulating services increases the performance of IntensiveSRC land use alternative.

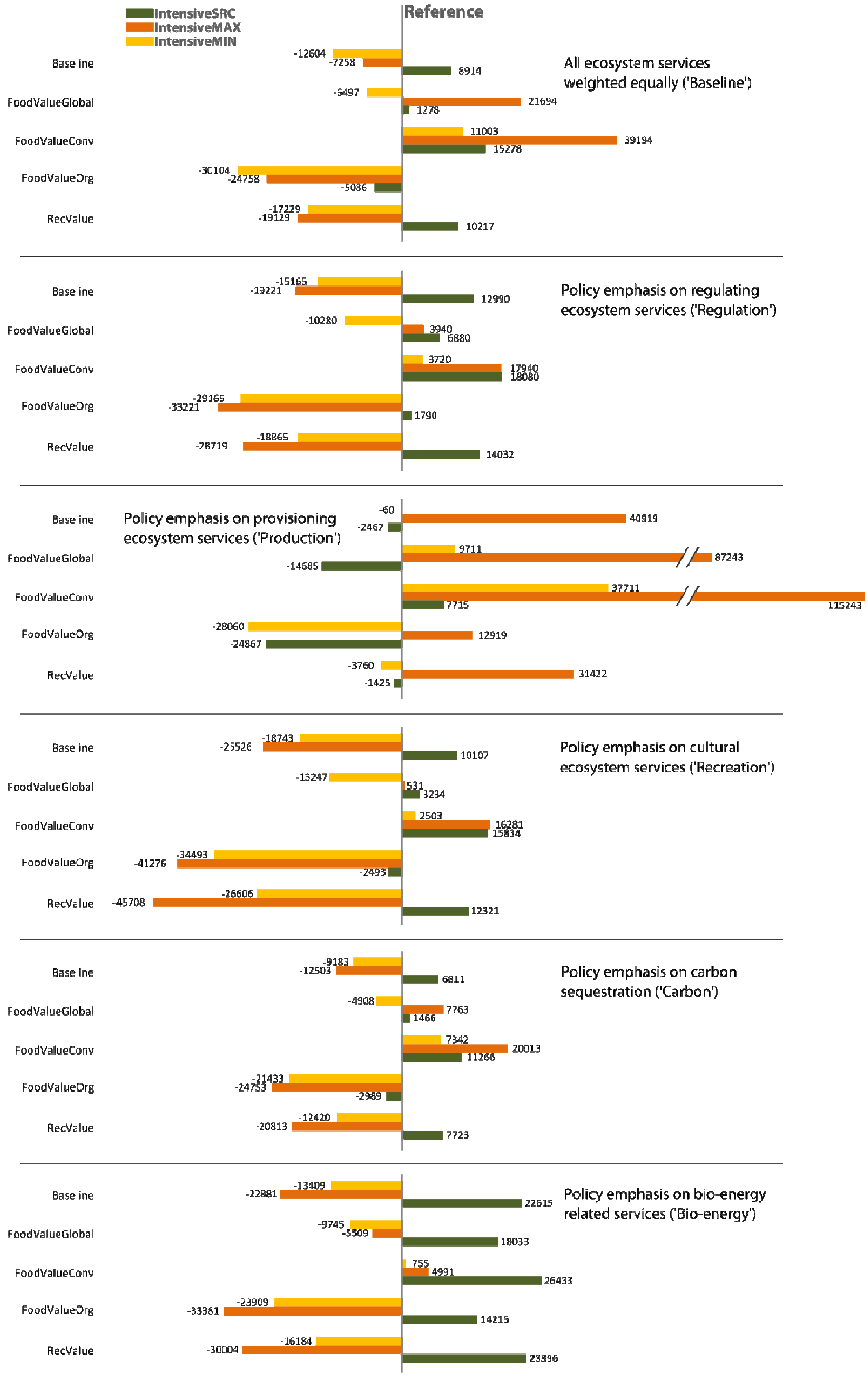

Figure 6. Relative performance (in terms of ecosystem services) of land use alternatives for each of the driver scenarios and for different policy priorities

7.4 Stage 4: ranking land use alternatives

Ranking the land use alternatives is a meaningful way to summarize the results from the scenario analysis. Changes in the ranking of land use alternatives under various scenarios are indicative for the spatial resilience of these land uses under the shifts and shocks the scenarios represent. In particular when a ranking is consistent, e.g. when one land use alternative is systematically higher, combined with a low variation of the mean ranking, the land use can said to be spatially resilient. It is useful to explore how the ranking of specific land use alternatives changes when one considers a specific future scenario more likely than another, or when one attaches more importance to specific ecosystem services.

For the demonstrative evaluation of the case farm, both the IntensiveSRC and IntensiveMIN mean scenario rankings are relatively consistent. Even for varying likelihood of the scenarios factors, they generally rank as the most and least preferred land use alternative, respectively. This in contrast to Reference and IntensiveMAX, showing more variability in their respective ranking.

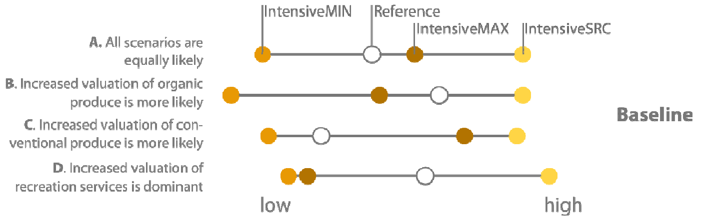

Figure 7. Ranking of land use scenarios with no specific policy priorities formulated ('baseline').

If policy emphasizes regulating services, extensive land use alternative is systematically ranked second, while the IntensiveSRC alternative would be highly preferred and resilient.

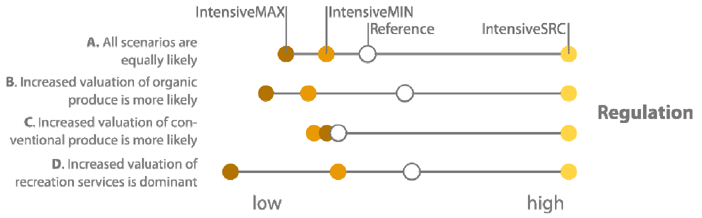

Figure 8. Ranking of land use scenarios with policy priority for regulating ecosystem services.

If policy emphasizes provisioning services, the ranking shifts completely. The IntensiveSRC alternative becomes the least optimal. Surprisingly, even under these priority setting, the Reference alternative shows higher societal benefits than the IntensiveMIN alternative.

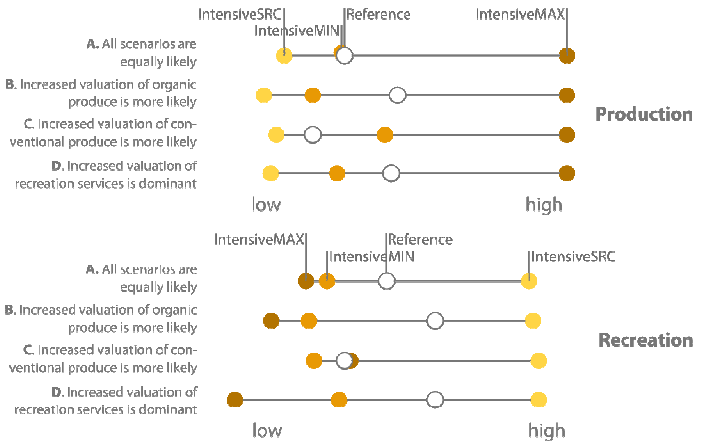

Figure 9. Ranking of land use scenarios with policy priority for provisioning and cultural ecosystem services.

Emphasizing cultural benefits increases the consistency of the Reference alternative slightly. Here too, if one assumes an increased demand for organic produce rather than an increased demand for conventional food, then the Reference alternative outperforms the IntensiveMIN and IntensiveMAX scenario. However, if one assumes an increased demand for conventional food more likely, then the Reference alternative is ranked third after IntensiveMAX alternative. However, one should take into account that the IntensiveMAX scenario is a corner solution that does not take the local biophysical conditions into account.

The impact of a policy towards carbon sequestration on the ranking is limited. This is not the case for the policy priority setting towards bio energy, which not surprisingly pushes the intensive production alternatives to the end of the ranking.

Although these summarizing rankings provide a clear and simple way of interpreting the scenario evaluation, they do not contain all information and should be interpreted with care. For each scenario – policy priority combination of interest, it is recommended to look at the rankings of the individual scenarios. As such, we see the aggregated ranking output at this phase as a useful way of exploring the results of the toolkit.

However, comparison of the ranking value with the consistency and standard deviation of the ranking can be used as an indication for the relative spatial resilience of the land use scenario in question.

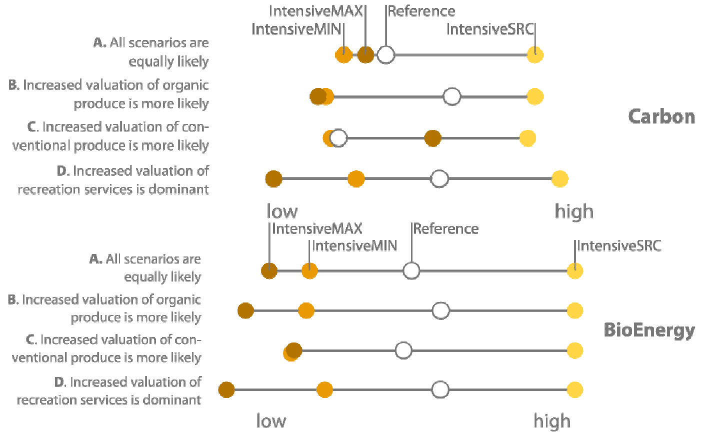

Figure 9. Ranking of land use scenarios with policy priority for carbon storage and bio-energy production.

8 CONCLUSIONS

The need for improving the capacity of agricultural systems to ensure ecosystem services has been thoroughly recognized (Stoate et al. 2009; Swinton et al. 2007; Zhang et al. 2007; Firbank et al. 2012). The term Ecological intensification" comprises a varied set of principles to achieve this (see Doré et al. 2011). It is defined by the FAO as the "maximization of primary production per unit area without compromising the ability of the system to sustain its productive capacity" (FAO, 2009). But also in an urbanized context, the importance of ecosystem services delivered by bioproductive space gains attention as a vital component of (cognitive) resilience building (Colding & Barthel 2013).

This research aims at developing a toolkit for planners to incorporate ecosystem services in the decision making process. The conceptual toolkit was demonstrated using an actual case farm, applying a variety of illustrative scenarios. Besides the potential for supporting policy makers, the toolkit provides useful feedback for adaptive management of other stakeholders. For the example of the case farm, including more standing woody biomass in the production model is highlighted as a potential means towards increasing the total societal benefits delivered by the farm.

Once the toolkit is sufficiently solid and validated, this comparison might assist in determining the required valuation changes (e.g. by organizing local food chains and aggregating demand) or levels of subsidies required to bring about land use changes. Another useful application might be in determining crucial unresolved positive externalities, e.g. in the framework of organizing payments for ecosystem services. Coupled with a monitoring network, the toolkit can assist in evaluating and providing a feedback loop to adapt such schemes. In particular when the underlying ecosystem service assessment tools become more spatially explicit, the toolkit can a valuable contribution to the adaptive management of bioproductive space.

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Analysis on Financial Consequences of Spatial Decisions: Framework and Case Studies

Ann Pisman, Leo De Nocker, Marten Dugernier, Inge Pennincx, Liesbeth Van Damme

(dr. Prof. ir.-arch. Ann Pisman, Ruimte Vlaanderen, ann.pisman@rwo.vlaanderen.be)
(MSc Leo De Nocker, VITO, leo.denocker@vito.be)
(MSc Marten Dugernier, AnteaGroup, marten.dugernier@anteagroup.com)
(MSc Inge Pennincx, Ruimte Vlaanderen, inge.pennincx@rwo.vlaanderen.be)
(MSc Liesbeth Van Damme, Ruimte Vlaanderen, liesbeth.vandamme@rwo.vlaanderen.be)

1 ABSTRACT

A large number of policy decisions at both the spatial and other policy departments have an effect on the financial value of an individual property. In the current society the economic crisis and the debate about the position of governments have changed the conditions for spatial policies and realization of real estate projects. Arguing about the financial impact of spatial policy decisions is more than ever relevant.

In 2014 the Flemish spatial development department initiated a research on financial consequences of spatial decisions for private owners and on the actual performance of existing financial compensation mechanisms. The study also defined and operationalized the concept of real estate value and made an in-depth analysis of thirteen cases and their impact on the total real estate value within a defined time period. The cases used a wide variation of financial valuation techniques (comparative method, hedonic method, capitalization rental income, residual value method).

The cases illustrate that the current compensation mechanisms in Flanders are mainly focused on the 'zoning' of properties. Changes to generic regulations or changes to the floor space of a property (e.g. limit/ increase number of floors) have also significant effects on the real estate value but are not captured within the actual regulations.

Flanders intends to implement these new insights on financial impacts of spatial development and planning in the new Spatial Policy Plan. Increasing spatial efficiency and further exploring and harmonizing compensation mechanisms are two major challenges.

2 INTRODUCTION

A large number of policy decisions at spatial and other policy departments have an effect on the financial value of an individual property. In the current society the economic crisis and the debate about the position of governments have changed the conditions for spatial policies and realization of real estate projects. Arguing about the financial impact of spatial policy decisions is more than ever relevant.

Spatial planning policy in Flanders, as in many West European countries, intervenes in the development possibilities of land. In the context of an initially Belgian spatial planning policy, area-covering regional plans have been approved since the 1970s which stipulate the allocation of land and make a distinction between land that can be built on and land that has an open spatial allocation (Albrechts & Meuris, 2000; Liekens, 2012). Existing built-up areas were hereby largely confirmed, and in addition generous expansion possibilities were provided for new housing, industrial estates, roads, etc. Regional plans in Flanders created a stock market, specifically for residential building (Frank Vastmans, de Vries, & Buyst, 2011). Economically this market functions in a different way from supply markets in countries with less strict spatial planning policies. In the years following the approval of the regional plans, various schemes were moreover developed which allowed development on land that, according to the regional plan, wasn't initially meant for development (see ‚fill-in scheme', ‚waiting wall scheme', ‚mini decree', etc.) (Desmet, 2012). As a consequence of these spatial and political decisions, Flanders became an extremely fragmented area with specific problems such as traffic noise, an ever-increasing number of vehicle movements, lack of ground water infiltration, etc (Coppens et al., 2014).

The government quickly realised that these zoning plans had a financial impact that could not be overestimated. In 1962 they installed a mechanism to compensate financial losses from private owners who were disadvantaged by a change in zonation (Albrechts & Meuris, 2000; Hubeau, Defoort, Debersaques, & Vandevyvere, 2012; Liekens, 2012). More recently, in the decree amendment of 1999 (Departement RWO, 2009), the plan income charge was introduced. This is a taxation on the added value created by a change in zoning plans (Hubeau et al., 2012) and applies to plans approved after 1 September 2009.

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For years, the absence of a plan income charge meant that the government was under pressure to approve expansion plans, which directly resulted in profits for the owners involved.

The spatial planning system in Flanders is, however, not limited to determining the allocation of land. Since the reconstruction in the wake of the First World War, there have been other instruments that determine the future development of land (Hubeau et al., 2012). These are instruments that give the government a role in determining the (size of) the programme and ancillary conditions for development and layout, important for safeguarding spatial, environmental, economical and social quality. Examples are the building permit (including a permit to change the parcellation), and different types of zoning plans (Albrechts & Meuris, 2000; Hubeau et al., 2012; Liekens, 2012). These instruments raise or lower the value from a parcel, that one can expect based on the initial zoning typology. Specifying, for example, the maximum building height or a minimum percentage of unpaved space. No compensation mechanism has been developed for this, neither for taxing the added value nor for compensating the loss in value. The absence of effective compensation mechanisms means that when several owners develop an area together, the costs and benefits are badly divided. Such lopsided divisions form the basis for many cases brought to court against governmental spatial planning decisions. Ultimately, many projects are never implemented. At the same time, these financial discussions between owners frequently impede the actual mission of spatial planning: creating a social added value by ensuring high spatial quality.

The global economic context and the more specific policy context in Flanders resulted in a study assignment from the Flemish government. In 2014 the Flemish spatial development department initiated a study on the financial consequences of spatial decisions regarding private owners and into the actual performance of the existing financial compensation systems in Flanders (Dugernier, De Nocker, Broeckx, & Bosmans, 2014). The ultimate intention, but for this a follow-up study is necessary, is to achieve a clear policy framework from which policy concepts can be developed for arangements between owners from parcels with added or reduced value.

The research questions dealt with in this paper are:

- Which elements determine the economic value of a parcel? How can we estimate / calculate the value of a property?
- How and why does this value evolves during time in different cases? Are there any financial compensations involved?
- What can we learn from this situation? How can we adapt the planning system to this financial context?

The various study questions will be answered in this paper. Part 3 of the paper shows how the financial value of projects is determined. The following chapter is a summary of the case study. Three cases were studied: a change of allocation from agriculture land to natural area, a residential project and a brownfield development. Finally, these concrete cases were related to the Flemish planning system and a system was sought for monitoring various events. This analysis finally leads to a number of conclusions and recommendations for the Flemish government, which is currently reworking both its planning system and the content of spatial planning. Setting up a monitoring of value gain and reduction and aligning existing compensation systems are important building bricks in this.

3 ESTIMATION OF ECONOMIC VALUES

The fair economic value of a parcel is the unbiased estimate of the potential market price of this parcel, if it was to be sold on a good working market between two independent and well informed parties (IASB, 2014). In this case, price will reflect the economic value of the current use of the parcel and of alternative legitimate uses. More restrictions and conditions for future land uses and programs will increase risks for potential investors and lower economic value. The economic value will depend on (Sirmans, MacDonald, Macpherson, & Zietz, 2006; Visser & Van Dam, 2006; Kroll & Cray, 2010; Damen, Vastmans, & Buyst, 2014)

(1) current land uses (natural areas, agriculture, residential, industry),

(2) characteristics of the specific uses (e.g. crops, type of buildings, m² floor area),

(3) construction costs and adaptation costs ,

(4) perception of the market parties for potential land uses, programs and related risks,

(5) location of the parcel and characteristics of the surroundings (functional, landscape),

(6) macro-economic factors (income, expected inflation, interest rate, tax systems).

Spatial policies may affect the factors 1 to 4. Factors 5 and 6 indicate that the impact of a spatial policy measure is likely to be location- and time-specific (context). The assessment of the impact of spatial policies requires the comparison of the economic value of a parcel in the reference situation (= current situation) and the policy scenario. As a change in economic value depends on various elements, the assessment requires a detailed, location and context specific assessment, and assumptions on how the new opportunities or restrictions created by the spatial policy measure can affect the program on a parcel. Consequently, the impact of spatial policy measures is assessed based on case studies, that illustrate mechanisms and their relative importance. These cases use a generic approach based on the best available data for each case.

The first best method is to build on a hedonic studies that estimate the impact from spatial policy measures and regulations on market price for real estate. In Flanders there is only research available on the impact of legal status for land use destination (agricultural versus natural area) on the market price for land. This method is used in the first case study. For other cases, the generic approach is based on the residual method for real estate appraisal, that estimates the value of the land on the net income that can be generated on the parcel with a specific program, and the expected return on investment, given macro-economic conditions and specific opportunities and risks (Uittenbogaard & Vos, 1996). For residential or industrial use, we can estimate this value by the gross income from renting floor space minus all building and other costs. The data (gross income per m² floor space and building costs) are based on studies of market prices and are discussed in case studies 2 and 3.

4 VALUE ANALYSIS IN DIFFERENT CASES

4.1 Case 1: changing land use destination from agriculture to natural area

4.1.1 Description of the case

In this case study, we look at a spatial zoning plan (RUP) that changes land use destination from agriculture to natural area in a small river valley east of Brussels. The parcels can be used for agriculture, but the change in zoning can lead to additional restrictions and obligations for the users, either immediately or in the future. This will affect the economic return of agricultural activities on these parcels and limits future potential uses. It has been observed in Flanders that this change in legal status lowers the market price of agricultural land. Consequently, the law foresees in a financial compensation for the landowner to compensate this loss(‚kapitaalschade‘). In addition, a compensation for the users of the parcels is foreseen, depending on additional restrictions for the users. As impacts and financial compensations can differ for different parcels within the same project area, we focus on a specific parcel of 0,3 ha, a typical size for that area.

4.1.2 Methods, data and assumptions

The size of the compensation depends on the expected impact on the market value of the land, which is estimated following a specific methodology, discussed below. Second, there are additional criteria to be met, e.g. related to a minimum size of parcels affected per landowner (0,5 ha).

The impact on the market value of the parcel is based on a site specific hedonic study by the Flemish Land Agency, that accounts for the agricultural value for that location (e.g. related to soil quality) and parcel specific characteristics (e.g. size and shape) (Vlaamse Landmaatschappij, 2014). Based on data for local market transactions for land used for agriculture, this study estimates how the legal status of the parcels (agriculture versus natural area) affects the market price. For this project area, it is estimated that a change of destination from agriculture to natural area lowers market prices with 17 % or – given current market prices for that region – 0,65 €/m². In addition, the study estimates the use value of the parcels, which is expressed as a % related to a best case situation, and estimates that a 1 % decrease in use value lowers market prices with 0,012 €/m². Furthermore, it is estimated that for the selected parcel, the use value will decline from 80 % to 24%, which results in a loss of market value of 0,66 €/m². The total impact of the spatial planning project for this parcel is a decline in value from 12 k€ to 8,1 k€, or a loss of 3,9 k€ (see table 1).

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As the selected parcel is 0,3 ha, the landowner will only receive compensation if (s)he owns other parcels within the same project area. In that case, the maximum compensation is set at 80 % of the estimated loss of market value, or 3,1 k€ for the selected parcel.

4.1.3 Results and conclusions

This case study illustrates that the market value of agricultural land is affected by spatial policies, irrespective of its actual use. Although the compensation mechanism is based on sound theoretical studies and local data, a full compensation is not guaranteed, due to specific provisions.

		Before plan (ref) Land use destination Agriculture	After plan Land use destination Natural area
(1)	Market value parcel 0,3 ha (k€)	12	8,1
(2)	Change in market value (k€)		-3,9
(3)	Compensations (k€)		
	Min		0
	Max (80 %)		3,1
(4) Change for landowner, after comp. (k€)			
	Min		- 3,9
	Max		-0,8

Table 1: Impact of change in land use destination from agriculture to natural land on market prices and compensations for land owner, data for case study for selected parcel.
(1) Data for selected parcel of 0,3 ha, based on VLM, 2014.
(2) Estimated impact on market price (= price before plan – price after plan)
(3) Compensations for landowner as foreseen in law 27-03-2009 (kapitaal schade regeling)

4.2 Case 2 affecting the building program in residential zones

4.2.1 Description of the case

In this case study we look at a change in spatial policies that give greater flexibility to landowners regarding the program that can be built in a residential zone. Spatial planning regulates the maximum size and height of buildings in residential areas. In general, the number of floors is limited to 2 (not counting the attic or basement floors). In the Brussels Periphery, where older buildings have often more floors, a specific provision allows up to 4 floors. The case study looks at a small vacant parcel (270 m²) in a nice residential area with higher buildings (4 to 5 floors) in the urban fringe. We examine the impact of the greater flexibility from 2 (reference) to 4 floors (policy scenario). This allows the creation of an additional apartment of 125 m² floor space in this building, as illustrated in the application for a building permit for this parcel.

4.2.2 Methods, data and assumptions

The economic value in the two scenario's is based on the residual value method and we use a low and high estimate. Gross income is based on simulations of expected rents for houses and apartments using a tool developed for the Flemish government (www.huurschatter.be) and based on the hedonic study from Vastmans (Frank Vastmans, Helgers, & Buyst, 2012). The simulation accounts for the exact location of the building and the most relevant characteristics. Building costs are based on a simulation using a web-based tool (www.paulvanwelden.be) and data on building costs (www.aspen-index.be). The driving factors in this tool are m² living area, level of completion, type of building and quality of construction and workmanship and are based on unit costs for the building sector in Flanders. Costs are independent of location, and indicate an uncertainty +/-10%. We use a simplified residual value approach, assuming 12 months of rent and no maintenance costs and we account for local and national taxes on real estate but not the fiscal incentives. We estimate the current value of future rents using a discount rate (required return on investment) of 3% and 4 %. This reflects the current macro-economic conditions with low mortgage rates and inflation, high fiscal incentives and the perception of real estate as low-risk investment (Damen et al., 2014). To validate our approach and data, we compare the outcomes (€/m² land) with the market prices for vacant land plots in that community. The simulated values of land plots fall within the 15 % range of the Q75 indicator for recent market prices (2010-2014) for vacant land plots in that community (economie, 2014).

4.2.3 Results

In this case a general rule (2 instead of 4 floors) leads to a doubling of rentable floor size, and as the local market appreciates this type of small apartments as high as single family houses, total gross income doubles.

Compared to a single family house, a building with two apartments implies costs savings and additional costs, that, in this case and our assumptions, compensate each other. As a result, the residual value of the parcel increases with 50 % to 100 %, depending on assumptions. It is expected that this increase in value will be reflected in market prices. This extra value for the landowner, is not subject to specific taxes on surplus value (apart from the generic 12 % sales tax (registration taxes)).

	Steps in the analysis	**Reference scenario 2 floors**		**Policy scenario 4 floors**	
		low	High	low	High
1	Floor space (m^2)	125	125	250	250
2	Rent (€/year/m^2)	5,9	8,6	7,1	8,6
3	Gross income (k€/year)	8	12	20	24
4	Discount rate	3%	3%	4%	3%
5	Current value future rents (k€)	266	393	484	787
6	Building costs (k€)	-163	-201	-325	-401
7	Residual value parcel (k€)	92	172	142	344
8	(€/m^2)	341	637	525	1.275
	Change in value			Additional value	
	For parcel (k€)			50	172
	€/m^2			185	637
	%			54 %	100 %

Table 2: Impact of program flexibility (4 floors) on economic value of residential land (k€)
(1) based on building plans for the parcel and own assumptions
(2) based on simulations using huurschatter.be for that parcel (hedonic analysis)
(3) Gross income for renting family house (ref) or 2 apartments (policy scenario), accounting for floor space, rent and taxes on rateable value of real estate
(5) Current value of future rents, using a 3 % and 4 % discount rate (for policy scenario).
(6) based on simulations tool for cost calculations paulvanwellen.be
(7) residual value of the parcel, based on (3) and (4) and 12 % sales tax (registration tax)
(8) parcel size = 270 m^2

4.3 Case 3: brown field development

4.3.1 Description of the case

The third case looks into impacts of potential land uses and programs in the case of a brownfield development. A former industrial site of 4 ha is partly affected by groundwater pollution and soil pollution. The site is located in a rural area, nearby the river Scheldt (see figure 1). The policy scenario covers 5 alternative types of land use and programs, including residential use (with high and low density), industrial use (small and medium size enterprises (SME) and waterfront industries (Waterind)) and a combination of land uses (Maring et al., 2015). The paper does not focus on costs of remediation.

Fig. 1: Example of two land use scenario's (residential (low density) and SME) (Maring, 2015)

4.3.2 Methods, data and assumptions

We use the same generic method as for case 2 with different data for each specific context and use. It has to be noted that the rent per m² is lower for this rural location compared to case study 2 (urban fringe). The costs in the residential scenario include additional costs for the development of the site: grey infrastructure (streets, parking) and green infrastructure (small parks). Costs are based on key figures for typical projects in Flanders (STADIM, 2008). Rents and building costs for the SME-scenario are based on literature studies (International, 2006). Land lots for waterfront industries in Flanders are not sold but rented out by water

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management agencies in long term contracts. In this context, development costs of the site are for the tenant but we account for the 80 % subsidy given to the tenant for the construction of quays. As development on industrial land involves public partners to promote economic activities, it is appropriate to use the social discount rate of 4 %, in line with recommendations of the Flemish government. To ease comparison, we use the same discount rate for the residential and mixed scenario. We only report average values, calculated as the average of the low and high estimates.

4.3.3 Results

Table 3 lists the data and results for the 5 alternatives. The residential scenario's offer more floor space, which is rented out at a higher rent compared to the industrial scenario's. Although it requires higher investments, including those for green infrastructure on the site, the net income is higher. Excluding remediation costs, the net value varies a factor four between scenario's (from 30 €/m² to 120 €/m²). These values per m² are lower compared to case study 2, also for residential uses. This is due to lower rents (rural location), lower density (m² floor space/m² project area) and costs for grey and green infrastructure.

These results can further be compared with costs for remediation, estimated at 12 million € (before subsidy for remediation) to 1.8 million € (after subsidy) (Maring, 2015). It shows that only scenario's that maximize residential floor area would generate enough income to pay for full remediation costs. Most scenario's would be able to generate enough money for remediation after government subsidy, but for industrial scenario's the net value of the land would become very low.

The case study illustrates the complexities involved in brownfield development and shows that a common understanding of the elements that contribute to income and costs can contribute to a common understanding of potential land uses and programs.

Indicator	**Unit**	**Residential**		**Industry**		**Mix**
		High	Low	SME	WaterInd	Mix
		1	2	3	4	5
Land uses						
m² floor area	1000 m²	18	14	13	21*	11
Grey infrastructure	1000 m²	30	30	13	21*	26
Green infrastructure	1000 m²	4	4	16	14	8
Gross income						
m² floor area *	1000 m²	18	14	13	21*	11
Rent €/year/m²	€/m²	5,9	5,9	3,3	4,5	5,6
Total rent year	k€/year	1.288	952	507	94	663
Current Value future rents (4 %)	million €	32	24	13	2	18
Costs		-	-	-	-	-
Building costs	million €	26	19	7,6	0,57	14
Grey infrastructure	million €	0,5	0,5	2,4	-	1,2
Green infrastructure	million €	0,9	0,9	0,4	0,6	0,8
Total costs	million €	27	21	10	1,2	16
Net income	million €	5,0	3,3	2,3	1,2	2,0
	€/m²	120	79	55	29	48

Table 3: Impact of different land uses and programs on economic value in brownfield redevelopment case
* m² floor area for waterfront industry is building and grey infrastructure

5 PROPERTY VALUE AND COMPENSATION MECHANISMS IN RELATIONSHIP TO THE FLEMISH PLANNING SYSTEM

The cases illustrate that the property value of a certain object or plot is not constant throughout time, which is logical since the property value is dependent on evolving factors such as allocation, building costs, risks, etc. (see 3. Estimation of economic values). Each of these factors can change through decisions that are taken by both government and private persons. Legislation and regulations drawn up by the government have an impact on environmental factors and/or development rights, and the resulting value of land and buildings. Decisions in building permits, certain architectural choices or initiatives for selling land, are generally initiated by private individuals but equally determine the property value.

Generally there are various parties involved and/or affected by spatial decisions. Owners can change, owners may or may not be able to make use of the land or goods concerned themselves, owners can set the property fo rent or make a lease agreement, etc. In addition, an owner may or may not act as developer and so, de facto, achieve and/or exploit the change in value. This interaction between the parties involved (government and private individuals, owners and users) can give rise to mutual 'transfers' linked to a change in value for the property concerned, resulting in added or reduced value for the parties involved.

A first category of spatial events is taking generic decisions 'by a government': drawing up generic rules for spatial planning. The generic rules clarify who sets the rules, who assesses them and how the information about the rules is distributed. Generic means that they are applicable everywhere, the rule is in itself the same for all of Flanders.

The clearest example of this is the "basic right for constructions not conform to regional urban planning guidelines ": the existing function of a building has priority over the attributed functions within a zoning plan, ‚badly zoned constructions' can receive a permanent building permit. A permitted dwelling is valued financially in a different way from a non-permitted dwelling: a permitted dwelling in an agricultural area has quite a few generic extension possibilities and has a high financial value (notwithstanding the fact that it is located in an area in which residential use is not confirmed in the allocation plan).

A second category of spatial events with an effect on property values is an area-driven policy initiated by the government. The vision of the desired development of an area is translated into laws that only apply for a part of the land area and that are stipulated in spatial implementation plans, regulations, parcelling and building line plans. The plans stipulate where infrastructure will be laid, where and how many buildings can be built and where green should be provided. The value of building land depends to a very large degree on building regulations (Ryckewaert and Vastmans, 2011). The number of buildings that may be built on a plot of land helps determine the value offered by the land. An important principle is creating area-driven spatial quality. The scenarios of the brownfield covenant (case 3) illustrate the effect of different programmes on the property value of the project, and thus the feasibility within specific financial parameters. These regulatory plans influence at the same time the possibilities of the developer but also his risks.

The third category of spatial events is assessing actual projects. A developper applies for a permit or certificate and the government decides whether this project satisfies the rules or not (or only under certain conditions). The moment the permit is provided, the decision is taken and the programme becomes irreversible (if the decision is not contested) and uncertainties cease to exist. From that moment, there is clarity about burdens and conditions and where they are located.

Implementations and environmental factors can be changed by government and private partners and are very difficult to estimate. The image and thus the financial value of neighbourhoods changes, building prices rise, new roads and parks are laid by government, etc. Spatial planning should thereby acknowledge that factors outside its authority play an important role in the impact on real estate values as well. In the long term it is the borrowing capacity of households that determines house prices. This borrowing capacity is explained by income evolutions, long-term interest rates, housing taxes, mortgage markets and tax legislations (Frank Vastmans, Buyst, Helgers, & Damen, 2014). The dynamics of the mortgage market and building land play thus an important role in the real estate market (Ryckewaert & Vastmans, 2011).

The moment of a property-transfer (whether between governments or between private persons) is the moment that the market determines a price, based on known data, flexibility, risks and (un)certainties. Decisions with impact on the property value are often spread over a longer period, and are only sporadically – and either simultaneously or otherwise – explicit via transfer of property. Often added value or reduction remain invisible until they are nailed down at transfer of property or change of use. A distinction can be made between the momentum of a decision that causes a change in value, and the moment at which there is actual effectuation (and possible compensation) of added or reduced value. This momentum cannot really be situated in the spatial policy, but largely in the implementation of this policy or the transfer of property of land and buildings.It could be interesting for a private owner to consciously not place land on the market, speculating on a further increase of its value in the future. This is why in practice there is often a discrepancy between the potential use value (i.e. building land) on the one hand, and the factual current use value on the other (i.e. plot in agricultural use).

The dispersion of compensation instruments through time is today not balanced. There are only a number of clear compensation mechanisms for changes in value linked to reallocation and area-driven policy, while there are none for generic policy. It is also striking that the available instruments for compensating value reductions – certainly from the sectoral policy – far outnumber those for taxating added value. Furthermore, spatial instruments, sectoral instruments and financial policies are only partly integrated, which makes it very difficult to evaluate whether reallocation mechanisms are effective or not.

6 CONCLUSIONS AND RECOMMENDATIONS

A large number of spatial decisions have an impact on property value and thus on assets of individuals, companies and public authorities. Examples are situated in different stages of the property chain: Changes in generic legislation, area-driven policy and reallocations, issuing of building permits, effective realisation of real estate projects, actual use and transfer of property etc.

Cases illustrate (the evolution of) the property value of certain projects. The Flemish government has a number of mechanisms to compensate value reduction for private persons, but mechanisms for taxating added values are rare. Existing mechanisms do not, however, capture the complete value addition or reduction and are not always linked to the moment of value creation or reduction. They are mainly based on changes in the zonation. Changes in general legislation or in the finalised project proposal are at least equally important and also generate an added or reduced value at a certain moment in time but are not now understood. Case studies indicate that it is in fact this time aspect that has an important impact on total property value. The taxating mechanisms should therefore be aligned to the moments of decisions resulting in an added or reduced value (i.e. when the actual programme is known, whether or not the number of storeys has been changed, etc.) and not so much to the moment of the change in zonation.

A central recommendation is that policy makers within spatial planning and outside it must at least try to be aware of the possible financial consequences of their choices. Data are not always available or can only be estimated, but comparison of various alternatives or proposals should at least include some financial consequences of spatial planning decisions. Governments should enlarge their knowledge of project development and real estate valuation, in order to create more negotiating power and better policy making.

Property valuation and uniform estimation methods are not easy to implement by public authorities, despite the large demand for standardization. Case studies show that the influence of policy decisions on property value is complex and that the government has limited means to budget these elements. A plea for the development of calculation instruments that take into account this complexity is appropriate. Important parameters are: the exact moment of value creation, the geographic dispersion of property values in Flanders and the net present value of future cash flows from a property. A systematic monitoring of changes in property values is needed and is only possible with an update of current land registry incomes and by using the area-covering database with building permits.

The Flemish government is working on a harmonisation of its compensation mechanisms: both the Flemish government (Vlaamse Regering, 2014) and the authorised minister (Vlaams minister van Omgeving Natuur en Landbouw - Schauvliege, 2014) (Policy paper Minister of Environment 2014-2019) have the intention to issue a global instrument decree which will include an evaluation of the existing mechanisms. The development and evaluation of compensation mechanisms forces spatial planners to look beyond their own area of expertise. Spatial planners should expand their financial and real estate knowledge in order to estimate the consequences of spatial planning more accurately. The research presented in this paper supplies crucial insights.

In addition to optimisation of instruments, a general and more fundamental renewal of spatial policy in Flanders is on its way. On 4 May 2012, the Flemish government approved the Green Paper of the Spatial Policy Plan (Vlaamse Overheid, 2012). Its key ambition is to realise the necessary spatial developments for our social needs in a sustainable way. Future developments respect the limits of growth and contribute to the liveability of society and find the right balance between economic, sociocultural and ecological aspects with respect for the capacity of the space. Negative aspects of further asphalting (more traffic congestion, flooding, heat stress, drying out, loss of productive open space and a less healthy living environment, etc.) will be addressed in an innovative and participative spatial policy. Insights from this study will be considered in the operationalization process.

The Spatial Development Department (Ruimte Vlaanderen) is, at the moment, carrying out follow-up research into the ‘development of financial arguments for intensification of the built area and protection of the open space and into financial redistribution mechanisms for spatial planning (between towns, cities and governemental partners).

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Augmented Reality im öffentlichen Raum

Wolfgang Höhl, Daniel Broschart

(Dr.-Ing. Wolfgang Höhl, Ludwig-Maximilians-Universität München (LMU), Lehrstuhl für Medieninformatik, D-80333 München, mailto: wolfgang.hoehl@lmu.de)

(M.Sc. Daniel Broschart, Technische Universität Kaiserslautern (TU KL), Computergestützte Planungs- und Entwurfsmethoden (CPE), D-67663 Kaiserslautern, mailto: daniel.broschart@ru.uni-kl.de)

1 ABSTRACT

Diese Arbeit beschäftigt sich mit aktuellen Einsatzgebieten von Augmented Reality-Anwendungen im öffentlichen Raum. Dazu gehören nicht nur Entscheidungsinstrumente für Planer, Politik und Öffentlichkeit, sondern auch eine breite Palette an Anwendungen für Tourismus, Bildung und Entertainment.

Augmented Reality oder Erweiterte Realität mag zunächst nach Science Fiction klingen. Die rasante Entwicklung von Smartphones und Tablets ermöglicht aber viele neue und interessante Anwendungen im öffentlichen Raum – und das nicht nur für wenige Fachleute, sondern für die breite Öffentlichkeit. Dieser Beitrag gibt einen Überblick über aktuelle Augmented Reality-Anwendungen die sich im öffentlichen Raum einsetzen lassen.

Das sind einerseits sogenannte Augmented City Guides, Augmented Reality Games, Urban Story Telling und historische Stadt- und Architekturführer, wie zum Beispiel die Anwendungen „Chronovizor“, „Landauer Walk“, „Time Traveller“ oder „Zeitfenster“. Andererseits gibt es aber auch neue Werkzeuge zur Beurteilung von Planungen und Neubauten im öffentlichen Raum, sogenannte Design Review Systems und Collaborative Virtual Environments (CVE´s). Dazu gehören die Projekte „Talking Places“, „Location-Based-Audio“, „Baukultur mit allen Sinnen entdecken und erleben“, „Variantendiskussion im Entwurfsprozeß“, „Augmented Collaborative Architectural Visualization“ und der „AR-Bebauungsplan“. Diese Projekte unterstützen die Beteiligung von Bürgern und Politik in frühen Phasen einer Projektentwicklung.

Diskutiert werden unter anderem die technischen Voraussetzungen und Komponenten eines AR-Systems, Content und umsetzbarer Detaillierungsgrad, Servermanagement und Cloudlösungen, Geolokalisierung und Trackingverfahren, sowie die markerbasierte und die markerlose Umgebungserkennung. Es wird gezeigt, dass sowohl die eingesetzte Technologie als auch deren Komponenten stark vom Content, dessen Detaillierungsgrad und vom beabsichtigten Nutzerkreis abhängig sind. Gespannt warten darf man heute auf den Einsatz weiterer Kamerasensorik (Oculus Rift, Samsung Gear VR, Intel Real Sense Camera) in Hinblick auf zukünftige Anwendungen und deren Rezeption durch den Nutzer.

2 ANWENDUNGSBEREICHE UND PROBLEMKREISE VON AR IM ÖFFENTLICHEN RAUM

2.1 Anwendungsbereiche nach Branchen

Aktuell gibt es fünf wesentliche Anwendungsbereiche von AR-Anwendungen im öffentlichen Raum: (1) Entertainment, (2) Tourismus, (3) Engineering, (4) Architecture and Design und (5) Life Sciences. Diese Anwendungsbereiche haben unterschiedliche Inhalte und Nutzergruppen. Innerhalb dieser Anwendungsbereiche haben wir eine große Auswahl an unterschiedlichen Softwareanwendungen (Wikitude, Layar, AR Media, AR Works, Sightspace 3D, Metaio, Junaio, AR Studio, ARTag, ARToolKit, DART [Designers Augmented Reality Toolkit], APRIL, Studierstube, AMIRE [Authoring Mixed Reality], CATOMIRE oder Tinmith). Wie wir noch später sehen werden, ist die Auswahl der Software, der Technologie und des Darstellungsverfahrens stark abhängig von der Komplexität des Inhalts, der beabsichtigten Nutzergruppe, vom Anwendungsbereich und der Phase in der Wertschöpfungskette. Handelt es sich um eine Entwicklung für den fachlich wenig versierten Endnutzer, sprechen wir bei Anwendungen von Augmented City Guides, Augmented Reality Games oder Urban Story Telling. Wenn wir über Anwendungen für Fachleute in der Produktentwicklung reden, dann finden wir hier Design Review Systems oder sogenannte Collaborative Virtual Environments (CVE´s).

2.2 Problemkreise von AR im öffentlichen Raum

Welche aktuellen technischen Probleme stellen sich nun bei Augmented Reality Anwendungen im öffentlichen Raum? Wo liegt der weitere Forschungsbedarf? Wie wir gesehen haben, gibt es zur Zeit drei aktuelle Problemkreise für neue Lösungen bei AR-Anwendungen im öffentlichen Raum:

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- Umgebungserkennung, Lichtverhältnisse und Verdeckung
- Darstellungsmethode, Inhalt und Anwendungsbereich
- Nutzerkreis, Technologien und Anwendungen

2.2.1 Umgebungserkennung, Lichtverhältnisse und Verdeckung

Zur Zeit gibt es folgende technische Probleme von Augmented-Reality-Anwendungen im Aussenraum: (A) die performante, markerlose und exakte dreidimensionale Umgebungserkennung (B) Geeignete Trackingsysteme für Vor-Ort-Visualisierungen (C) die Berücksichtigung wechselnder Lichtverhältnisse zu unterschiedlichen Tages- und Jahreszeiten im Aussenraum und (D) das genaue dreidimensionale Einpassen virtueller Geometrie in eine vorhandene städtebauliche Situation, sowie (E) die Berücksichtigung von Verdeckung von Objekten (Occlusion) und Transparenz.

Bei einer Fokussierung auf die eingesetzte Trackingtechnik aktueller AR-Techniken fällt auf, dass sich diese wiederum in drei grundsätzliche Verfahrensarten unterscheiden lassen: GPS-Tracking, markerloses und markerbasiertes Tracking. Beim GPS-Tracking wird auf das integrierte GPS-Modul zurückgegriffen. Markerbasierte Systeme beruhen auf einem Bilderkennungsverfahren und setzen sogenannte optische Marker ein. Markerlose Trackingsysteme arbeiten mit einer Kanten- und Flächenerkennung im aktuellen Kamerabild und gleichen die Abbildung der erkannten Kanten und Flächen mit der Lage der entsprechenden Geometrie in einem vorher angefertigten 3D-Modell ab. Dies erfordert eine vorhergehende genaue Kalibrierung und Skalierung von 3D-Modell und Bild (vgl. Schattel et. al. 2014).

2.2.2 Darstellungsmethode, Inhalt und Anwendungsbereich

Der Performanz der vorgenannten Technologien ist abhängig von der gewählten Objektgröße und dem Detaillierungsgrad. Auch die Darstellungsmethode (Real / Mixed Reality / Augmented Reality / Augmented Virtuality / Virtual Reality) ist in hohem Grad abhängig von der Komplexität des gewählten Inhalts und dem Detaillierungsgrad der virtuellen Objekte. Diese Faktoren bestimmen im Wesentlichen über die performante Echtzeitverarbeitung großer Datenmengen.

Beide oben beschriebenen Verfahren – egal ob es sich um die Variante der Geolokalisierung oder Marker-basierten AR von Layar oder Junaio handelt – benötigen einen Server von dem die hinterlegten Inhalte auf das Smartphone des Nutzers gestreamt werden. Um eine angenehme Visualisierung zu ermöglichen, wird damit gleichzeitig eine jederzeit entsprechend gute mobile Internetverbindung vorausgesetzt. Die Abhängigkeit von der mobilen Internetverbindung stellt im gleichen Zug den „Flaschenhals" beim umsetzbaren Detaillierungsgrad dieser Variante dar: Große oder komplizierte Modelle können nicht ohne längere Wartezeiten in den AR-Browser gestreamt werden.

AR-Anwendungen, bei denen der zu überlagernde Inhalt lokal auf dem Endgerät gespeichert werden kann, rücken an dieser Stelle in den Vordergrund der Betrachtung. 3D-Modelle können bei dieser Art Applikation direkt auf das Endgerät synchronisiert werden und in einer Bibliothek innerhalb der Anwendung gespeichert werden. Der Vorteil solcher Apps liegt auf der Hand: Es können auch solche Inhalte auf dem Smartphone visualisiert werden, die für das Verfahren des Streamings zu große Datenmengen aufweisen. Die Limitierung stellt theoretisch nur noch die Hardware-Konfiguration des Endgeräts dar. Gleichzeitig bedeutet die Ablage der Inhalte im internen Speicher des Smartphones eines Nutzers auch eine Beschränkung hinsichtlich der Nutzerzahlen: Es können nur die Betrachter erreicht werden, die sich den 3D-Inhalt auf ihr Endgerät laden.

2.2.3 Nutzerkreis, Technologien und Anwendungen

Wichtig für die Akzeptanz einer AR-Anwendung ist beim Endnutzer die Bedienbarkeit ohne Fach- oder Programmierkenntnisse. Entscheidend für zukünftige Endanwenderentwicklungen wird auch die Nutzerakzeptanz neuer Sensorik (HMD´s | Magic Leap | MS HoloLens). Spannend bleibt dabei auch das Feld der Entwicklung von Collaborative Virtual Environments (CVE´s) für Fachleute und Laien in der Produktentwicklung und der Präsentation städtebaulicher Projekte.

3 AKTUELLE ANWENDUNGEN, TECHNOLOGIEN UND EINSATZFELDER

Welche Möglichkeiten bieten AR-Techniken der Architektur und Stadtplanung? Die Auswahl der Technik soll später zielgerichtet auf das spezifische Einsatzfeld erfolgen. Um diese Zuordnung vorab zu testen, müssen die einzelnen aktuellen AR-Techniken auf ihre jeweiligen Eigenschaften geprüft werden, da sich aufgrund dieser unterschiedlich hohe Detaillierungsgrade umsetzen lassen. Die Wahl auf eine Streaming-Variante oder ein Verfahren, bei dem die Inhalte lokal gespeichert werden, stellt hinsichtlich der erreichbaren Nutzerzahlen ebenso einen wesentlichen Aspekt dar. Um die aktuellen AR-Techniken und deren Potenziale aufzuzeigen, werden in diesem Kapitel eine Reihe von Projekten vorgestellt, bei denen die erwähnten Techniken zum Einsatz kamen.

3.1 Augmented City Guides | Augmented Reality Games | Urban Story Telling

3.1.1 Chronovizor (Gontz et. al. 2013)

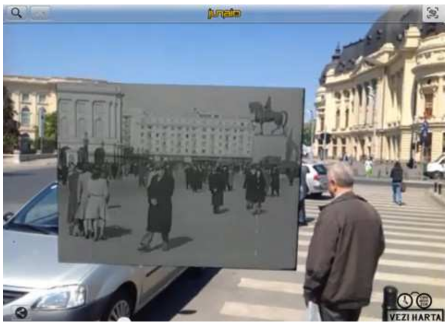

Abbildung 1: Chronovizor (Gontz et. al. 2013)

Chronovizor nutzt ein kombiniertes Verfahren aus ortsbezogenen GPS-Daten und einem vor Ort vorhandenen optischen Marker. Angeboten werden historische Stadtansichten in 2D-Standbildern und in bewegten 2D-Videoformaten, die Sie individuell mit ihrem Live-Kamerabild direkt vor Ort überlagern können. Eingebettet ist diese Anwendung in einen herkömmlichen Channel der Anwendung junaio der Firma Metaio. Über diesen channel wird die Orientierung gewährleistet und es können ortsbezogene Daten über eine Landkarte und interaktive Texte abgefragt werden. Lichtverhältnisse sind noch nicht und die Verdeckung ist bedingt steuerbar. Es handelt sich um einen einfachen Augmented City Guide für Endanwender.

3.1.2 Landauer Walk (Bayerischer Rundfunk 2014)

Abbildung 2: Landauer Walk (Bayerischer Rundfunk 2014)

Mit dieser App erleben Sie wichtige Stationen im Leben des ehemaligen FC Bayern Präsidenten Kurt Landauer. Es ist ein interaktiver Augmented City Guide für den normalen Endnutzer, mit dem Sie fünf historische Orte in München besuchen und erkunden können. Über die Plattform Wikitude, eine HTML5 und JavaScript-Lösung ist diese App plattformübergreifend nutzbar. Es gibt einen GPS-basierten interaktive Modus (Vor-Ort-Tour) und einen rein virtuellen Modus (Couch-Tour). Neben ortsbezogener Audio-, Video- und Textinformation werden auch interaktive AR-Bilder angeboten. In den interaktiven Modi können Sie direkt vor Ort historische Bilder mit dem Echtzeitbild der Kamera überblenden, im virtuellen Modus können Sie sich auch von zu Hause im historischen Panorama bewegen.

Im interaktiven Modus wird die Performanz direkt von der GPS-Ortung und den gestreamten Datenmengen wesentlich beeinflusst. Der Couch-Modus erlaubt durch das vorherige Laden die performantere Anzeige von speicherintensiven Datenmengen.

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3.1.3 Time Traveller (Metaio GmbH. 2014)

Abbildung 3: Time Traveller (Metaio GmbH. 2014)

TimeTraveller bietet Berlins Besuchern augmentierte Information zu bestimmten historischen Orten. Es ist ein kombiniertes Verfahren aus GPS-Tracking und ortsbezogenen optischen Markern aus großformatigen Bildern. An den früheren Standorten der Berliner Mauer an der Bernauer Strasse können Sie Videos von Fluchtszenen oder von historischen Gebäuden und Situationen direkt in Ihrem Live-Kamerabild beobachten. Begleitend dazu werden Navigationsfunktionen und textbasierte Informationen angeboten. Es handelt sich um einen Augmented City Guide für den normalen Endnutzer und ist durch die junaio-Browserlösung plattformübergreifend nutzbar.

3.1.4 Zeitfenster (Burkert et al. 2013)

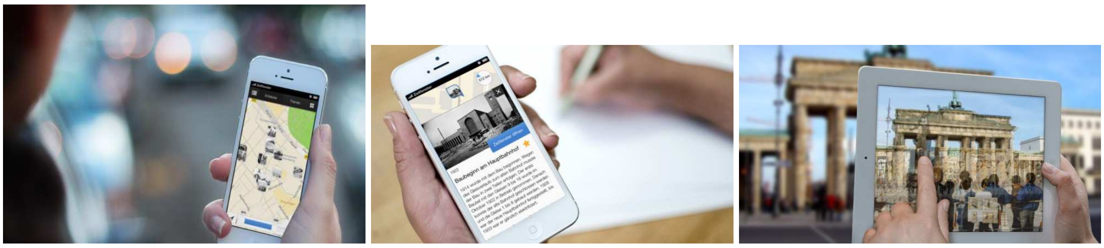

Abbildung 4: Zeitfenster (Burkert et al. 2013)

Zeitfenster bietet Navigation und ortsbezogene Text- und 2D-Bilddaten an. Verfügbar ist dieser historische Stadtführer für die Städte Berlin und Stuttgart und wird nur für die Plattform iOS angeboten. Die Technologie verwendet eine Serverlösung mit GPS-Tracking und einfacher Bildüberlagerung mit dem Live-Kamerabild. Es handelt sich ebenfalls um einen einfachen Augmented City Guide für den normalen Endnutzer.

3.1.5 Talking Places (Hesch 2011, Memmel und Groß 2011)

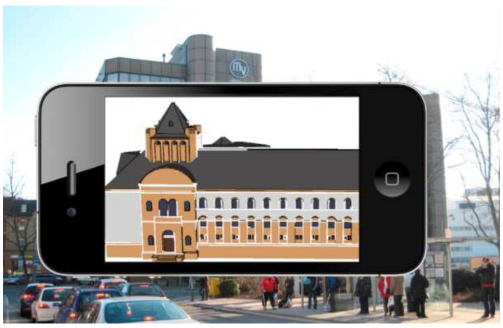

Abbildung 5: Talking Places (Hesch 2011)

Die Geschichte einer Stadt im Alltag wiedererleben, diesen Ansatz verfolgt das Projekt "Talking Places" das aus einer Kooperation zwischen der Technischen Universität und des DFKIs in Kaiserslautern entstanden ist. Gebäude die eine historische Bedeutung in der Geschichte Kaiserslauterns haben, allerdings aufgrund von Kriegszerstörungen oder zwischenzeitlichem Abriss nicht mehr im heutigen Stadtbild betrachtet werden können, wurden als virtuelle 3D-Modelle nachgebaut und mit der Geoposition des ursprünglichen Standortes versehen (Hesch 2011). Zusätzlich wurden diese Modelle über die vom DFKI entwickelte RADAR-Plattform (Resource Annotation and Delivery for Mobile Augmented Reality Services) in einen eigenen

Layer geladen, von dem aus sie in gängige AR-Browser wie Layar oder Junaio gestreamt werden können (Memmel, Groß 2011). Befindet sich der Betrachter an eben diesem Ort, so kann er die ehemaligen Gebäude aus allen Blickwinkeln betrachten und sich über deren Geschichte informieren.

3.1.6 Location-Based-Audio (Dörrzapf 2012)

Über mobile AR-Browser können nicht nur 3D-Informationen im öffentlichen Raum platziert werden, sondern eine Augmentierung um Audio- oder Video-Dateien ist ebenfalls möglich. In der Arbeit "Location-based Audio" wurden die Einsatzmöglichkeiten, Entwicklungstrends und konzeptionelle Ansätze durch die Erweiterung des öffentlichen Raumes durch die Platzierung von Audio-Dateien am Beispiel der Stadt Wien untersucht. Eine Verortung mehrerer solcher Dateien innerhalb einer AR-Umgebung ermöglichen so beispielsweise die Umsetzung einer neuen Art von Stadtspaziergang. Sobald der Nutzer die Geoposition, an der eine Information hinterlegt ist, erreicht wird deren Inhalt unverzüglich abgespielt. Eine Verknüpfung mehrerer solcher Stationen ist ebenso denkbar und eröffnet somit Potentiale zum Erzählen urbaner Geschichten (Dörrzapf 2012).

3.2 Design Review Systems | Collaborative Virtual Environments (CVE´s)

3.2.1 Augmented Collaborative Architectural Visualization (Schattel et. al 2014)

Abbildung 6: Augmented Collaborative Architectural Visualization (Schattel et. al. 2014), links: Collaborative Design Desktop (CDP) environment, rechts: On-site AR visualization

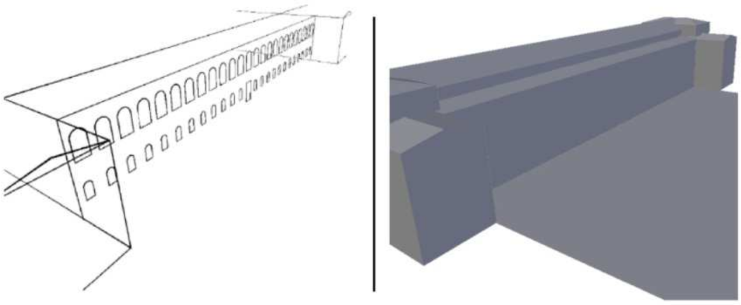

Abbildung 7: Augmented Collaborative Architectural Visualization (Schattel et. al. 2014). 3D-Modelle für Initialisierung (links) und Tracking (rechts)

Diese Arbeit beschäftigt sich mit der Entwicklung einer kollaborativen Designplattform für Laien und Fachleute. Es handelt sich dabei um ein kombiniertes virtuelles Environment mit einem interaktiven Tabletop und einer mobilen Endgerät zur Entwicklung von gestalterischen Varianten im Entwurfsprozess von Gebäuden. Änderungen am realen Modell am Tabletop können direkt vor Ort am mobilen Endgerät miterlebt werden. Das Tracking vor Ort ist eine kombinierte Technik mit GPS-Tracking und Erkennung eines virtuellen 3D-Kantenmodells. Zum Einsatz kommen hier 3D-Maps, der junaio-Browser und die junaio-Toolbox.

3.2.2 Baukultur mit allen Sinnen entdecken und erleben (Biwer et. al. 2013)

Abbildung 8: Baukultur in der Praxis trifft Technologie; Rundgang und Infostand am Tag des offenen Denkmals 2013 (Biwer et al., 2013)

Aufgrund einer gewissen Ungenauigkeit in der GPS-gestützten Positionsbestimmung kann es bei den in den Projekten "Talking Places" und "Location-based Audio" eingesetzten Trackingsystemen auf Geolokalisierungsbasis dazu kommen, dass Inhalte "zu springen" beginnen. Sollen dagegen gebäudebezogene Inhalte in einer AR-Umgebung visualisiert werden, stößt diese Art des Trackings schnell an ihre Grenzen, da die betrachterseitige Zuordnung von Information zu Gebäude erschwert wird. Tracking-Verfahren der Bilderkennung schaffen hier eine Alternative und erlauben eine genauere Überlagerung der gewünschten Inhalte. Das in Kooperation mit dem Stadtplanungsamt Saarbrücken entstandene Projekt "Baukultur mit allen Sinnen entdecken und erleben" beschäftigte sich inhaltlich mit der Sensibilisierung betroffener und interessierter Bürger für die Strukturen und Details der 1950er Jahre Architektur in der Eisenbahnstraße in Saarbrücken. Insbesondere aufgrund anstehender Modernisierungsarbeiten gilt das Bestreben dieses Projektes der Kommunikation der Bedeutung dieser Gebäude gegenüber den Bürgern. Neben einem auf Layar Vision basierten, geführten Rundgang durch das betroffene Gebiet, wurde bei der Eröffnungsveranstaltung des "Tag des offenen Denkmals 2013" zusätzlich mit virtuellen 3D-Modellen an einem Infostand über die Eisenbahnstraße informiert. Da die im Plangebiet eingesetzte Technik ein Streaming der Inhalte erfordert, wird der Detaillierungsgrad der Darstellung durch die Qualität der mobile Internetverbindung limitiert. Um diesem Punkt entgegenzuwirken, wurde das am Informationsstand platzierte virtuelle 3D-Modell mit einer AR-Anwendung umgesetzt, die eine lokale Speicherung auf dem Endgerät erlaubt. Die Limitierung des Darstellungsgrades wird somit theoretisch nur durch die Hardware-Konfiguration des Endgerätes bestimmt (Biwer et al. 2013).

3.2.3 AR-Bebauungsplan (Broschart, Zeile 2014)

Abbildung 9: AR-Bebauungsplan (Broschart, Zeile 2014)

Aufgrund ihrer Informationsdichte gelten Bebauungspläne als äußerst komplexe Planwerke. Da die darin geregelten Festsetzungen jedoch den Bürger in der Bebauubarkeit seines eigenen Grundstücks berühren können, muss diesem im Rahmen des gesetzlich vorgeschriebenen Beteiligungsverfahrens die Bildung einer eigenen Meinung und Einschätzung für etwaige Einsprüche gegeben werden. Wie soll aber ein Bürger eine eigene Meinung bilden, wenn er den veröffentlichten Plan nicht direkt erfassen und verstehen kann? Da die Vorkenntnisse beim Lesen von Plänen als unterschiedlich eingeschätzt werden, müssen bei der

Kommunikation dieser Inhalte solche Techniken herangezogen werden, die einen vielfältigen Einsatz erlauben. Eine direkte Augmentierung des “klassischen zweidimensionalen Planwerks” verspricht hierbei große Potentiale: Der Betrachter tritt in direkte Interaktion mit den vereinfacht dargestellten Informationen des Bebauungsplans, kann sich selbst auf spielerischem Wege eine eigene Meinung über die für ihn relevanten Inhalte bilden und diese im Beteiligungsprozess anzeigen (Broschart, Zeile 2014).

Zur Umsetzung eines augmentierten Bebauungsplans bieten sich Marker-basierte AR-Techniken wie Layar Vision oder Wikitude an. Der Plan selbst fungiert hierbei als Marker und wird um zwei- oder dreidimensionale Inhalte erweitert. Beim Einsatz als zusätzliches, informelles Beteiligungswerkzeug können die zweidimensionalen Festsetzungselemente der Planzeichenverordnung zum besseren Verständnis auch durch dreidimensionale Pendants ersetzt werden (Broschart 2013).

3.2.4 Variantendiskussion im Entwurfsprozess

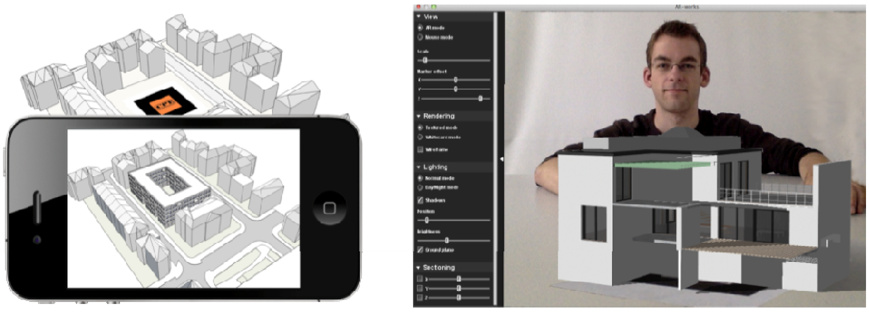

Abbildung 10: Variantendiskussion im Entwurfsprozess (Broschart 2013)

Anwendungen wie Sightspace 3D oder AR-Works setzen auf eine lokale Speicherung des virtuellen Inhalts. Dadurch lassen sich einerseits große Dateien visualisieren, aber aufgrund ihres User-Interfaces auch Varianten diskutieren. Sightspace 3D verwendet beispielsweise eine interne Bibliothek, in die eigene 3D-Modelle gespeichert werden können. Sind mehrere solcher Modelle auf einem Endgerät gespeichert, so lassen sich diese nacheinenander am Ort des Geschehens einblenden, anpassen und beurteilen.

Zur Diskussion von Varianten im Entwurfsprozess lässt sich auch die rein als Desktop-basierte Anwendung AR-Works heranziehen. Hierbei handelt es sich um ein Plugin für Vectorworks, welches dieses um eine AR-Exportfunktion erweitert. Das virtuelle Modell wird dabei mit einem speziellen Marker verknüpft und lässt sich im zugehörigen Viewer aus allen Perspektiven anzeigen. Angelegte Ebenen können dabei ebenfalls interpretiert werden und im Layermanager des Viewers ein- und ausgeblendet werden. So lassen sich beispielsweise unterschiedliche Entwürfe diskutieren. Zusätzlich ist eine Schattensimulation innerhalb des Viewers möglich.

4 CONCLUSION

4.1 Umgebungserkennung, Lichtverhältnisse und Verdeckung

Markerloses optisches Tracking mit Kantenerkennung bietet genauere Resultate im Aussenraum als das markerbasierte oder das GPS-Tracking. Forschungsbedarf besteht bei performanten Verfahren zur Schattendarstellung und Verdeckung von Objekten (Occlusion) bei wechselnden Lichtverhältnissen.

4.2 Darstellungsmethode, Inhalt und Anwendungsbereich

Der Anwendungsbereich und die Phase in der Wertschöpfungskette bestimmen wesentlich die Inhalte der AR-Anwendung (Datenmenge, Objektgröße und Detaillierungsgrad), die Darstellungsmethode und die gewählte Technologie (Streaming | Lokale Daten), sowie die konkrete Nutzergruppe. Nicht jede Darstellungsmethode (Realität, Augmented Reality, Mixed Reality, Augmented Virtuality oder Virtual Reality) eignet sich für jeden Inhalt. Die Auswahl des Werkzeugs richtet sich immer nach dem jeweiligen Anwendungsbereich und dem speziellen Inhalt. Der Anwendungsbereich definiert ebenfalls Objektgröße und Detaillierungsgrad in Inhalt und Darstellung.

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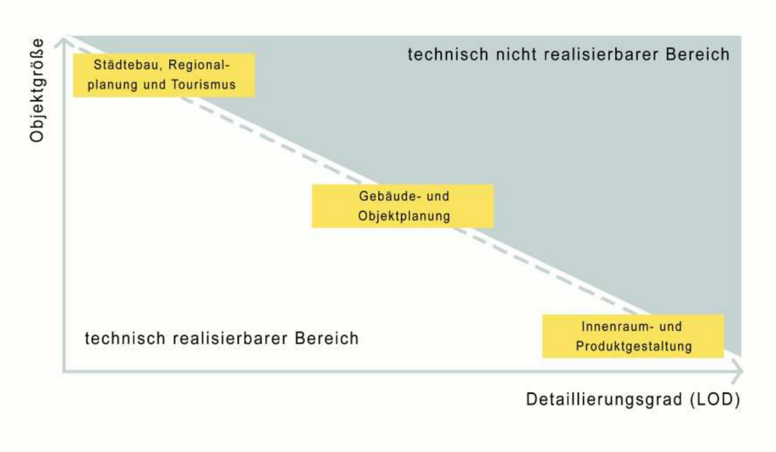

Abbildung 11: Objektgröße, Detaillierungsgrad (LOD) und Anwendungsbereiche

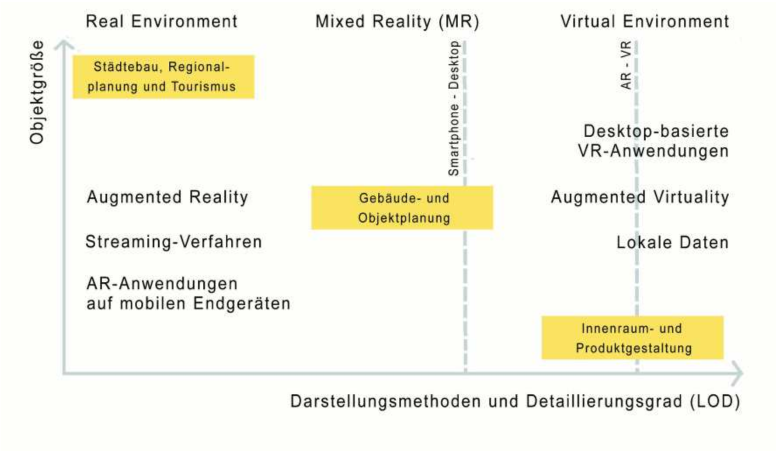

Abbildung 12: Darstellungsmethoden, Anwendungsbereiche und Technologien

Soll Information möglichst breit gestreut werden, bietet sich der Einsatz von Serverkonzepten mit Streaming-Varianten an. Dabei muss allerdings auch beachtet werden, dass der Inhalt nicht allzu detailliert ausfallen darf, weil große Datenmengen die mobile Internetverbindung schnell überfordern und die virtuelle Erfahrung einschränken können. Verfahren bei denen die Inhalte lokal auf dem Endgerät gespeichert werden bieten den Vorteil eines hohen Detaillierungsgrades, lassen dagegen nur einen kleinen Nutzerkreis zu, da hierbei zunächst mehrere Voreinstellungen getroffen werden müssen, bevor der virtuelle Inhalt bestaunt werden kann. In Bezug auf den umsetzbaren Detaillierungsgrad bildet die jeweilige Hardware-Konfiguration des Endgerätes dabei theoretisch die einzige Grenze. Reichen auch die Möglichkeiten einer mobilen AR-Visualisierung nicht mehr aus, um den gewünschten Detaillierungsgrad der virtuellen Information umzusetzen, können solche technische Varianten herangezogen werden, die sich über Notebooks oder Desktop-PCs realisieren lassen. Die Darstellung in einer rein virtuellen Umgebung lässt hinsichtlich des Detaillierungsgrades der eigentlichen Computergrafik einen noch höheren Detaillierungsgrad zu. Lassen sich mit den vorgestellten Streaming-Varianten beispielsweise einfache Textinformationen, aber auch Audio-, Video- oder kleine 3D-Modelldateien hinterlegen, bieten die Varianten einer lokalen Speicherung die Visualisierung hochdetaillierter 3D-Modelle bis hin zur Darstellung von Inneneinrichtungen in reinen VR-Umgebungen.

4.3 Nutzerkreis, Technologien und Anwendungen

Anzahl der Nutzer und die jeweilige Fachkenntnis bestimmen die Komplexität des Inhalts (Einfache Textinformation [POI´s], Location-based Audio, Videowalks, 2D-Daten, 3D-Grafik) die Art der Datenüberlagerung, die verwendete Technologie (Streaming | Lokale Daten | Sensorik) und Endgeräte Augmented Reality im öffentlichen Raum bedeutet, dass wir es mit großen Nutzergruppen zu tun haben. Nutzergruppen, die über weniger Fachkenntnis verfügen, aber oft einen hohen Anspruch an die Usability eines Augmented Reality Systems haben. Anzahl und Fachkenntnis der Nutzer entscheiden aber auch über die verwendete Sensorik und die Komplexität der Inhalte (Sensorial Engagement, Design Abstraction und

Data Engagement Overlay). Und diese Einbeziehung des Nutzers bestimmt maßgeblich die Darstellungsmethode (Reality, Mixed Reality oder Virtual Reality).

Während die vorgestellten Techniken aus dem Bereich der Augmented Reality versuchen virtuelle Informationen und reale Situationen in Bezug zu bringen, konzentrieren sich die aktuellen Entwicklungen aus dem Mixed Reality-Bereich auf die Verbesserung der Interaktion zwischen Mensch und Maschine. Parallele Entwicklungen gibt es im Bereich der Virtual Reality beim Einsatz von Datenbrillen wie der Oculus Rift. Ihr auf den ersten Blick als reine Visualisierungstechnik entwickeltes Einsatzgebiet wird durch die Anbindung weiterer Sensoren zunehmend erweitert. Durch den integrierten Lagesensor ermöglicht bereits die Basis-Version dieser VR-Brille dem Nutzer ein „natürliches“ Umsehen in der virtuellen Welt: Durch eine Bewegung des Kopfes kann der Betrachter den Blickwinkel anpassen. Bereits aufgrund dieser Eigenschaften entwickelt sich diese Technik in den Bereich der Mixed Reality, die Mensch-Maschine-Interaktion steht im Vordergrund der Visualisierungserfahrung. Während die Navigation innerhalb der virtuellen Welt nach wie vor per Tastatur oder Joystick erfolgt, gibt es über die Grundausstattung hinaus schon erste Entwicklungen, die eine natürliche Veränderung der Position zulassen. Durch die Anbindung eines Laufbandes bewegt sich der Nutzer zwar in der realen Welt auf der Stelle, kann aber die virtuelle Welt beliebig begehen.

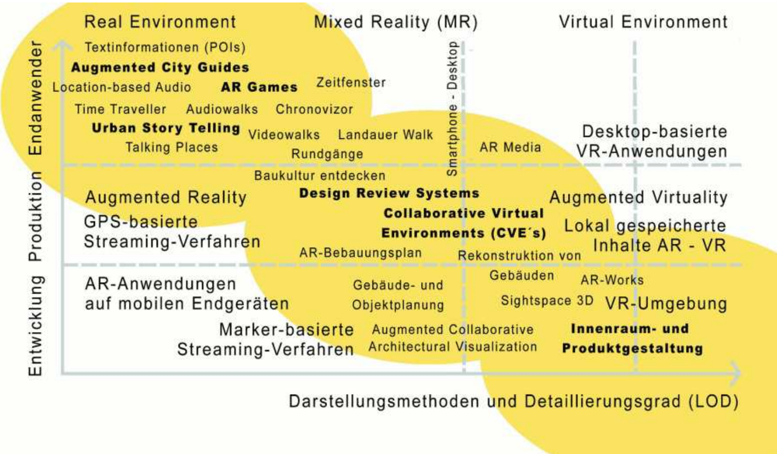

Abbildung 13: Nutzerkreis, Technologien und Anwendungen

Collaborative Virtual Environments (CVE´s) unterstützen die lokale und non-lokale Kommunikation zwischen Planern und Öffentlichkeit. Insbesondere beim Vorliegen einer persönlichen Betroffenheit durch eine Planung können die Visualisierungstechniken von Augmented Reality und Mixed Reality ihre Potenziale während der Kommunikation mit interessierten Laien zeigen. Bürger können auf diese Weise auf spielerische Weise für durchaus ernste Themen der Stadtplanung sensibilisiert werden und sich eine eigene Meinung bilden, die sie in weiteren Planungsphasen äußern können. Bei diesen Kommunikationsprozessen können die vorgestellten Techniken unterstützend eingesetzt werden, jedoch muss dabei beachtet werden dass soziale Gruppen, die (noch) nicht über das entsprechende Endgerät verfügen, aufgrund technischer Barrieren ausgegrenzt werden. Dieser Digital Divide kann durch geführte Touren, kommentierte Visualisierungen usw. umgangen werden, bei denen der Planer eine vermittelnde Anwaltsfunktion einnimmt, um dem interessierten Bürger diejenigen Inhalte zu erklären zu können, die er aufgrund reiner Plandarstellungen und Visualisierungen noch nicht verstanden hat. Erst durch diesen Austausch wird aus reiner Visualisierung ein Kommunikationsvorgang, zwar unterstützen die Darstellungstechniken Architekten und Planer bei der Plankommunikation, können aber das direkte Gespräch nicht ersetzen. Oder kurz: Das Online funktioniert nicht ohne das Offline!

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Augmented-Reality als Erweiterungs-Tool des partizipativen Austausches in Planungsprozessen zum Ziel einer integrativen städtebaulichen Entwicklung

Lisa Rockmann, Simon Adler

(Cand. B.Eng. Lisa Rockmann, HS Anhalt FB 1, Strenzfelder Allee 28, D- 06406 Bernburg, lisa.rockmann@student.loel.hs-anhalt.de)
(M.Eng. Susanne Raabe, HS Anhalt FB 1, Strenzfelder Allee 28 06406 Bernburg, s.raabe@loel.hs-anhalt.de)
(Dr.-Ing. Simon Adler, Fraunhofer IFF, Sandtorstraße 22, D-39106 Magdeburg, simon.adler@iff.fraunhofer.de)

1 ABSTRACT

Die von der EU ausgehende Nachhaltigkeitsstrategie (BMUB, 2013) sorgt für eine voranschreitende Innenentwicklung von Städten. Baulücken und ungenutzter städtischer Raum sollten vorzugsweise und gezielt entwickelt und bebaut werden, um die Inanspruchnahme von Flächen außerhalb und im Bereich des Stadtrandes zu reduzieren.

Die Nachverdichtung und somit Innenentwicklung von Städten ist häufig mit erheblichem Widerstand seitens der Bevölkerung verbunden, besonders wenn solche Baulücken als Freiflächen empfunden oder sogar als Erholungsraum genutzt werden. Eine Forsa-Umfrage im Auftrag der Bundestiftung Baukultur im Januar 2014 (BUNDESSTIFTUNG BAUKULTUR, 2014a) ergab, dass in der Bevölkerung eine generelle Protesthaltung gegen Bauprojekte zu erkennen ist. Es ist Aufgabe von Planern und Planungsträgern, das Projekt in die Bevölkerung zu kommunizieren. Doch steht die Kommunikation zwischen den beiden Parteien in der Regel vor großen Hürden.

In diesem Beitrag wird als Grundlage für das Themengebiet die Bedeutung der Bürgerbeteiligung in Planungsprozessen mit Blick auf die städtebauliche Entwicklung aufgezeigt und die aktuellen Möglichkeiten des Einsatzes von Augmented Reality Technologien anhand der bisherigen Forschungsergebnisse und -Ansätze des kooperativen Forschungs- und Entwicklungsprojektes Augmented-Reality als Werkzeug der Architekturkommunikation (ArchKM-AR) diskutiert. In Verbindung mit den Entwicklungen aus ArchKM-AR werden die zentralen Schwierigkeiten der Kommunikation zwischen Planungsverantwortlichen und der Bevölkerung beschrieben. Der Fokus liegt dabei auf der Effizienz der Beteiligung und der Etablierung von Akzeptanz für ein Bauprojekt in der Bevölkerung. Des Weiteren wird über Schwerpunkte der Forschungsarbeit wie die Einrichtung eines zuverlässigen Tracking-Verfahrens, die Ansprüche von Software und Nutzer an die 3D-Modelle im Sinne des Detailierungsgrades und die Integration der Anwendung in den Workflow eines Planers unter Betrachtung der Datenauf- und -verarbeitung berichtet.

Im Ergebnis des Forschungsprojektes steht der Prototyp einer App, die den Dialog und die Informationsvermittlung mithilfe von Augmented Reality mit Blick auf eine gesteigerte Produktivität und Effektivität modifizieren soll. Neben der Schilderung des aktuellen Entwicklungsstandes der Softwarekomponente mit dem Schwerpunkt auf den Kommunikations- und Beteiligungsprozess wird die vielversprechende Bedeutung dieser Innovation für die Praxis anhand zweier Szenarien verdeutlicht.

2 EINLEITUNG

Der Großteil der Bevölkerung lebt im städtischen Raum mit vielseitigen Nutzungsansprüchen, die neben Wohnen und Arbeit auch Naherholung, Versorgung und Teilhabe an kulturellen und gesellschaftlichen Aspekten umfassen. Die Stadtentwicklung ist bedingt durch viele Faktoren, die aufgrund der fortwährenden Entwicklung der Gesellschaft und ihrer Ansprüche in stetem Wandel begriffen sind. Eine Vielzahl dieser Faktoren wirkt sich auf den Städtebau aus. Das stete Veränderungs- und Entwicklungspotenzial verlangt eine entsprechende Anpassung der städtebaulichen Elemente mithilfe von Rückbau, Umbau und Neubau unter Beachtung der genannten Ansprüche und Faktoren. Vor dem Hintergrund der internationalen Nachhaltigkeitsstrategie mit der Verringerung der Flächeninanspruchnahme ist das Flächenrecycling / die Nachverdichtung ein wichtiges Mittel im Prozess der Stadtentwicklung. Damit rücken Veränderungen des Stadtbildes häufig auch in die Bereiche einer Siedlungsstruktur, die intensiv frequentiert sind. Da die städtebauliche Struktur einen wesentlichen Aspekt für die Bevölkerung darstellt, um sich mit ihrem Lebensumfeld zu identifizieren, werden Planungsprozesse und Bauvorhaben häufig kritisch oder skeptisch von der Öffentlichkeit beobachtet. Ähnlich wie bei politischen Beschlussfassungen, ist das Zustandekommen planerischer Entscheidungen für die Öffentlichkeit nur dann nachvollziehbar (vgl. WIENHÖFER et al. 2002), wenn sie zielgruppengerecht vermittelt werden können. Ist das nicht der Fall, resultiert ein

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Informationsmangel in Verständnislosigkeit und Unzufriedenheit – im ungünstigsten Fall in der Manifestierung von Gegeninitiativen der Zivilgesellschaft. Eine aktive, zielgerichtete Partizipation im Planungs- und Bauwesen besitzt jedoch das Potenzial einen erfolgreichen Planungsabschluss im Einklang mit der öffentlichen Meinung positiv zu unterstützen. Sie soll dazu beitragen, eine u.U. zwischen den Bürgern und den an der Planung beteiligten Experten bestehende Kommunikationsbarriere aufzubrechen sowie bestehendes Vertrauen zwischen beiden Parteien zu festigen und nachhaltig zu fördern.

Auswertungen einer Forsa-Umfrage im Auftrag der Bundestiftung für Baukultur im Januar 2014 zur Stadt- und Wohnumfeldentwicklung mit Blick auf die Ausprägung der Bürgerinformation und -beteiligung, beschreibt den Trend eines für Planungsträger bedeutenden Dilemmas. Reiner Nagel, Vorstandsvorsitzender der Bundesstiftung Baukultur, fasst die Ergebnisse zusammen: „Laut der Forsa-Umfrage haben wir bundesweit eine eher mäßige Beteiligung bei Planungsvorhaben, aber in der öffentlichen Wahrnehmung eine weit verbreitete Protesthaltung der Bundesbürger gegen große Planungsvorhaben oder Baumaßnahmen.“ (BUNDESSTIFTUNG BAUKULTUR, 2014b) Dem stünde jedoch ein wachsendes Interesse an Bauvorhaben gegenüber.

3 PLANUNGSVORHABEN IN DER STADT UND IHRE HÜRDEN DER BETEILIGUNG UND CHANCEN MIT DEM EINSATZ VON AUGMENTED REALITY

3.1 Experte und Laie – Kommunikationshürden

Bei der Kommunikation zwischen zwei Parteien kommt es nicht nur auf die Information und den Prozess der Informationsübertragung an, sondern vor allem auf deren Entschlüsselung. Kann der Empfänger die Informationen in ihrer Sinnhaftigkeit und Korrektheit nicht verstehen, ist die Kommunikation fehlgeschlagen. Dieser Umstand wird in den klassischen Kommunikationsmodellen nicht berücksichtigt. Es ist demnach erforderlich, dass Sender und Empfänger sich auf den jeweiligen Gesprächspartner einstellen. Die Vorkehrung beruht hierbei nicht auf der zwischenmenschlichen Beziehung, sondern vor allem auf dem vermuteten und häufig unterschiedlichen Wissensstand der Gesprächspartner.

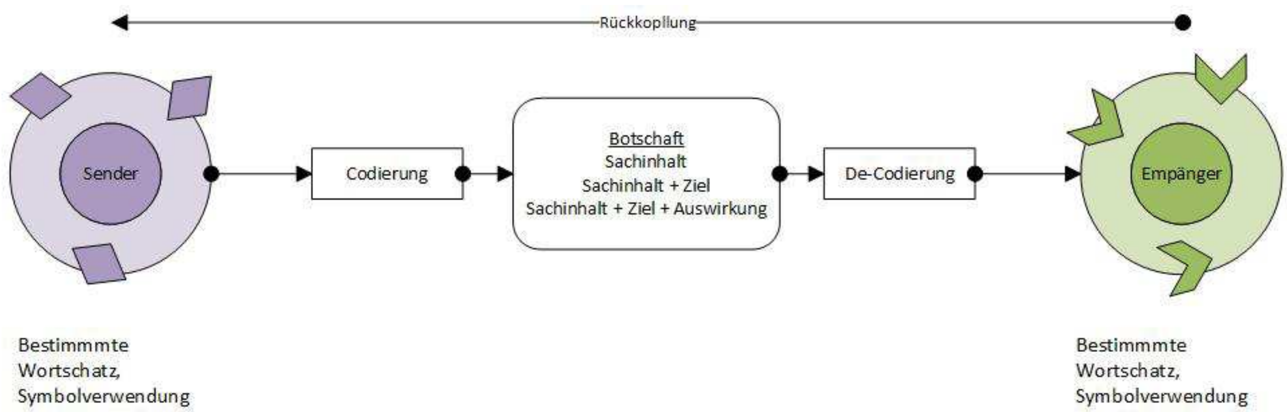

Abbildung 1: Prinzip der Planungskommunikation (Quelle: eigene erweiterte Darstellung basierend auf dem Sender - Empfängerprinzip nach FÜRST und SCHOLLES 2008; S. 198)

Darüber hinaus ist die auf der Wahrnehmung aufbauende Kommunikation zwischen Experten und Laien erheblich durch eine sich zwischen Alltags- und Fachsprache unterscheidende Verwendung von bestimmten Begrifflichkeiten erschwert. Die Fachsprache fordert eine sehr konkrete Verwendung von Begriffen, während im Alltag häufig Begriffe mit ähnlicher fachlicher Bedeutung als Synonym verstanden und akzeptiert werden. Bei der Kommunikation zwischen Experte und Laie kann eine solche unpräzise Verwendung von Worten aufgrund einer unterschiedlichen Begriffsdeutung zu Missverständnissen führen (vgl. BROMME & RAMBOW, 1998).

3.2 Weitere Hürden in der Bürgerbeteiligung

>> Aufwand vs. Betroffenheitsempfinden/Motivation

Eine Schwachstelle ist die fehlende Motivation, sich eigenständig umfangreich und mithilfe qualitativer Informationsquellen über ein Vorhaben zu informieren. Bezogen auf die erste Berührung mit einem Planungsvorhaben besteht an dieser Stelle schon eine Hürde. Die Forsa-Umfrage im Auftrag der

Bundesstiftung Baukultur im Januar 2014 ergab, dass die Hauptinformationsquellen der Bürger durch die lokale Tageszeitung und persönliche Gespräche mit Freunden, Bekannten, Nachbarn und Arbeitskollegen repräsentiert werden. Die Aussagekraft im Sinne der Neutralität und Informationstiefe sowie -korrektheit und somit ihre Eignung als Grundlage für eine dialogfähige und begründete persönliche Meinung, ist bei diesen Informationsquellen größtenteils in Frage zu stellen. Oberflächliche und möglicherweise fehlerhaft übermittelte und falsche Informationen können beim Empfänger schnell zu einer vorschnellen Meinungsbildung führen.

>> erschwerter Zugang zu Informationen und komplizierte Aufbereitung

Neben der wesentlichen Bedeutung einer emotionalen Bindung zum Planungsobjekt oder -ort spielen der Zugang zu den Informationen und ihre Aufbereitung eine bedeutende Rolle. Der Zugang und die Aufbereitung von Informationen zum Planungsobjekt und zum Planungsprozess sind für den Bürger oftmals undurchschaubar, zu komplex und unpraktisch. Selbst, wenn der Weg zur Information über ein Planungsvorhaben gefunden wird, können weitere Hürden auftauchen. Kommunikative Barrieren entstehen aufgrund unterschiedlicher Wissens- und Informationsbasen, und bedingen zugleich ein abweichendes Verständnis von Architektur und Baukultur.

Die Mitwirkung von Bürgern an Planungsvorhaben oder Maßnahmen gestaltet sich trotz wachsenden Interesses mit einer mäßigen Beteiligung und einer weit verbreiteten Protesthaltung. Laut der Forsa-Umfrage vom Januar 2014, die sich auf die vorangegangenen 12 Monate bezieht, hätten 29% der Bürger an Unterschriftenaktionen teilgenommen. 19% hätten an Versammlungen von Bürgervereinen oder Bürgerinitiativen teilgenommen und 16% hätten öffentliche Anhörungen besucht (vgl. BUNDESSTIFTUNG BAUKULTUR 2014a). Die Bereitschaft oder der Wunsch zur Mitwirkung eines Projektunbeteiligten an Planungsprozessen entwickelt sich basierend auf der Kenntnisnahme aus einer ersten, meist intuitiven und möglicherweise unbewussten Meinungsbildung. Unter Voraussetzung von bestehendem Interesse für das Projekt sollten Informationen gesammelt werden, die gemeinsam mit einer gefestigten Meinung als Grundlage für einen Austausch mit Projektbeteiligten und für eine qualitative Beteiligung fungieren. Diese ideale Abfolge ist in Abbildung 2 dargestellt.

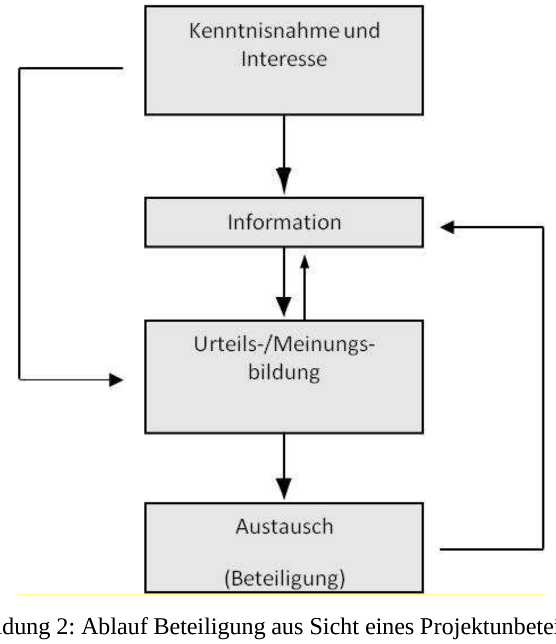

Abbildung 2: Ablauf Beteiligung aus Sicht eines Projektunbeteiligten

3.3 Augmented Reality im Kontext der Informationsvermittlung

Städte wandeln sich und städtebauliche Veränderungen können sowohl die unmittelbare Nachbarschaft als auch den Ablauf des Alltags (bspw. im Rahmen der Infrastruktur) beeinflussen und somit jeden Bürger einer Stadt betreffen. Die Beteiligungstendenzen zeigen jedoch, dass derzeit genutzte Verfahren der Bürgerbeteiligung (z.B. frühzeitige Bürgerbeteiligung und Planauslegungsverfahren §3 BauGB) häufig nicht den Ansprüchen der modernen Gesellschaft gerecht werden und an zeitgemäße Wege der Informationsbereitstellung sowie Informationsbeschaffung angeknüpft werden sollte. Eine geeignete Technologie für die Vermittlung von Planungsdaten vor Ort ist die Augmented Reality (AR, erweiterte

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Realität). Sie bietet dem Anwender zwei große Vorteile: Eine Sicht auf die Realität plus deren virtuelle Ergänzungen in Kombination mit Interaktivität. Mit deren Hilfe können öffentlich beteiligte/interessierte Laien, aber auch Projektpartner Fachinformationen abrufen und sich einen Überblick über Bauvorhaben resp. einen eigenen Raumeindruck von Bauwerken verschaffen. Die Präsentationen von Planungsinhalten mittels 3D Visualisierungen in der frühzeitigen Beteiligung sind sinnvoll und können zu einer Beschleunigung und Verifizierung von Planungsprozessen führen (ZEILE 2010). Zudem wird der Planer in die Lage versetzt, in einen kommunikativen Prozess mit sich selbst zu treten. Denn der eigene Architektur-/Planungsentwurf kann vor Ort kritisch geprüft und ggf. hinterfragt werden.

Realisiert werden kann dies über AR-Technologien, mit denen die direkte reale Umgebung mit 3-D-Modelldaten lagesynchron überblendet wird. Mittlerweile sind AR-Anwendungen nicht mehr nur stationären Rechnersystemen vorbehalten, sondern finden Einzug in mobile Endgeräte wie UMPCs, PDAs oder Mobiltelefone. Mobile Endgeräte mit ihrem hohen Verbreitungsgrad, relativ geringen (Unterhaltungs-) Kosten, einer sehr großen Standortunabhängigkeit sowie deren wachsende Bandbreite im kabellosen Telekommunikationsbereich weisen ein starkes Potenzial auf, die Entwicklung und Verbreitung von AR-Anwendungen zum Zwecke des Wissens- und Informationskonsums/-austausches oder zur Beförderung von Planungsprozessen voranzutreiben. Die rasante technische Entwicklung lässt ständig neue Anwendungsfälle zum Beispiel im Bereich des zielgruppenspezifischen Einsatzes von Augmented Reality und Web 2.0 in partizipativen Verkehrsplanungsprozessen (REINWALD et al. 2013) oder als Einsatz in Beteiligungsverfahren großräumiger Bauprojekte wie die Planung eines Hotel- und Tagungskomplexes auf einem bauhistorisch wertvollen Industriegelände in Finnland (OLSSEN et al. 2012) entstehen.

Im kooperativen Forschungs- und Entwicklungsprojekt ArchKM-AR der Hochschule Anhalt und dem Fraunhofer IFF Magdeburg steht vornehmlich die Architekturkommunikation im Fokus. Die Motivation ist die Schaffung eines Hilfsmittels, um Dialog und Information von Interessierten und Beteiligten in Planungsprozessen zu unterstützen und qualitativ aufzuwerten bzw. zu effektivieren. Ziel ist die Erzeugung einer weitreichenden Akzeptanz von Projekten und Maßnahmen unter Bürgern durch ein frühzeitiges Erkennen von Planungsfehlern und eine Stärkung der Beteiligungsmotivation von Bürgern. Zu diesem Zweck entwickelt die Forschungsgruppe den Prototyp einer Anwendung, die an mobilen Geräten genutzt wird und die die Potenziale der erweiterten Realität (Augmented Reality – AR) verwendet. Im Beitrag zur Real Corp 2012 „Innovative Informationstechnologien als Bausteine einer nachhaltigen Stadtentwicklungspolitik“ (KRUG et al. 2012) wurde das Forschungs- und Entwicklungsprojekt ArchKM-AR bereits mit seinem Hintergrund, den Forschungszielen und der Vorgehensweise vorgestellt.

4 SCHWERPUNKTE DER FORSCHUNG UND ENTWICKLUNG – AKTUELLER STAND IN ARCHKM-AR

Das Ziel einer transparenten Öffentlichkeitsbeteiligung besteht in der frühzeitigen und verständlichen Aufbereitung und Vermittlung relevanter [Fach-]Informationen, wofür die ePartizipation durch den Einsatz moderner IuK-Technologien eine sehr gute Möglichkeit bietet. Die Vorteile der digitalen, internetgebundenen Beteiligung liegen beispielsweise in der zielgruppengenauen Abfrage von Meinungsbildern, einem erleichterten, barrierearmen Zugang zum Verfahren (z.B. individuell zeitenunabhängige Beteiligungsmöglichkeit) und einer automatisierten Datenerfassung und -auswertung.

Eine Motivation des FuE-Projektes ArchKM-AR liegt in der Verwendung neuer Technologien und Medien, die die Neugier und das Interesse besonders der jüngeren Bürger anspricht. Mobile Applikationen befähigen den Nutzer, selbst zu entscheiden, wann und wie intensiv er sich mit dem entsprechenden Inhalt auseinandersetzen möchte. Dieser individuelle Anwendungscharakter kann die Eigeninitiative der Bürger unterstützen und die Informationsgewinnung effektiver gestalten. Der Anwendungsprototyp wird entwickelt für die Nutzung an Tablets. Mithilfe der Augmented Reality (AR-)Technologie werden dreidimensionale Modelle von Planungsobjekten in Bezug zur realen Umgebung beziehungsweise dem zu beplanenden Ort gebracht. Das wird ermöglicht durch Kopplung von verschiedenen Systemkomponenten, die skizzenhaft in Abbildung 3 dargestellt sind.

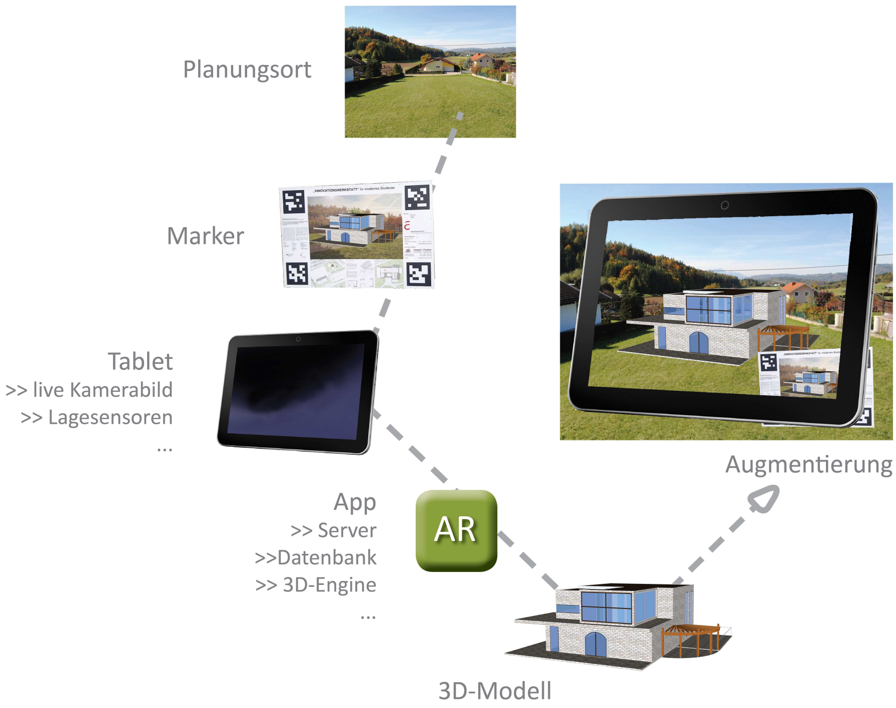

Abbildung 3: Systemelemente der markergebundenen Augmentierung

Etappenevaluationen mit den Praxispartnern im Rahmen des Projektes ergaben, dass die visuelle Darstellung eines Objektes als dreidimensionaler Körper gut geeignet ist, um als Kommunikationshilfsmittel zu dienen. Das Verstehen des Planungsobjektes ist nicht an das Fachwissen, die Interpretationsfähigkeit von Termini und das individuelle Vorstellungsvermögen der Person gebunden. Das Objekt wird intuitiv mit seiner Umgebung in Relation gesetzt und in seiner Gestalt erkannt. Die Anwendung bietet damit die Möglichkeit, einem Projektunbeteiligten erste Informationen zum Vorhaben zu vermitteln, wobei er sich zu beliebiger Zeit und für unbestimmte Dauer mit den Informationen auseinander setzen kann. Auf diese Weise ist die Grundlage für eine Beteiligung geschaffen.

Im Forschungs- und Entwicklungsprojektes ArchKM-AR liegt der Fokus zur Entwicklung der App einerseits in der Aufbereitung der Systemkomponten und andererseits in der Grundlagenermittlung verschiedener relevanter theoretischer Aspekte. Einige werden hier aufgeführt.

4.1 Tracking

Zu den Systemkomponenten gehört die Entwicklung eines geeigneten Trackings. Tracking ist die Bestimmung und Verfolgung der Position und Orientierung (Pose) eines Zielobjektes. Beim inside-out Tracking bestimmt das mobile Gerät seine Pose anhand von Merkmalen in der Umgebung. Dies ist erforderlich, um Planungsobjekte so im Kamerabild darzustellen, dass im Videobild eine Fusion von Planung und realer Umgebung erreicht wird. Beim bildbasierten Tracking erfolgt die Posebestimmung durch Analyse des Kamerabildes nach bekannten Merkmalen. Für eine Akzeptanz der Anwendung ist es unerlässlich, dass das Tracking robust ist, damit kleine Bewegungen nicht zu plötzlichen Sprüngen in der bestimmten Pose führen. Während markerlose Verfahren (Natural Feature Tracking, SLAM) sehr kontrollierte Umgebungsbedingungen (u.a. homogenes Licht, wenig Verschattung) benötigen, sind künstliche Marker (ähnlich QR-Codes) kontrastreich und robuster zu detektieren. Aufgrund der Ausmaße der Modelle muss der Anwender einen großen Abstand von dem Ort, an dem die Planungsdaten dargestellt werden, einnehmen. Durch einen speziellen Verbund zueinander kalibrierter Marker kann auch bei weniger kooperativen Umgebungsbedingungen ein robustes Tracking bei einer ausreichenden Bewegungsfreiheit des Anwenders gewährleistet werden.

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Abbildung 4: Augmentierung eines virtuellen Gebäudemodelles mit Hilfe eines Verbundmarkers am Gelände der Hochschule Anhalt, Foto: ©Fraunhofer IFF

Im Rahmen der Systementwicklung wurden für das Tracking ein aufwendiger Distanzversuch im Außenraum durchgeführt. Bei diesem Versuch sollte die Plausibilität durch Bewertung des Tracking, der Visualisierung und der Handhabung in ausgewählten Anwendungsszenarien untersucht wurden. Die Szenarien 'Studentenhaus-Innovationswerkstatt' der Hochschule - Anhalt, 'Windrad' und 'Baugrenze' waren angelehnt an unterschiedliche Planungsmaßstäbe von der Objektplanung bis zur Landschaftsplanung. Im Feldversuch wurden Entfernungen von 25 bis 200 m zum Marker getestet. Es wurden vier ID-Marker (30 cm) mit den Abständen von 2,5 m Breite und 1,5 m Höhe angebracht. Für die Szenarien Windrad und Baulinie, sind große Entfernungen zum Marker für die Begutachtung der Gesamtplanung zu erwarten. Die beiden Szenarien erwiesen sich als sehr problematisch. Je größer die Distanz zum Marker war, desto ungenauer war die Lage. Die genaue Positionierung mit Hilfe des Kamerabildes war aufgrund der Kameraauflösung auf weite Entfernungen nicht möglich. Wenige Pixel im Kamerabild waren in der Realität bereits mehrere Meter. Als Testobjekt im zweiten Feldversuch blieb somit das Anwendungsszenario Innovationswerkstatt bestehen. Bezugnehmend zum Distanzversuch konnte das zukünftige Anwendungsfeld der AR-App für den weiteren Projektverlauf mit resp. das Projektergebnis eingegrenzt werden: für großräumlichere Planungsebenen(bspw. Leistungsbild nach HOAI, Teil 2 - Abs. 2: Flächenplanung: Landschaftsplanung) soll die Software vorerst nicht eingesetzt werden, da die erzielbaren Darstellungen der 3D-Modelle nicht den gängigen Visualisierungsgrundsätzen nach Repräsentanz, Akkuratesse usw. genügen; demzufolge im weiteren Projekt- und Entwicklungsverlauf auf die Objektplanungsebene (bspw. Leistungsbild nach HOAI, Teil 3 - Abs. 1-4: Gebäude u. Innenräume/ Freianlagen/ Ingenieurbauwerke/ Verkehrsanlagen) zu fokussieren ist.

Abbildung 5: Distanzversuch zur Plausibilitätsprüfung der entwickelten Systemkomponenten in ArchKM-AR (Quelle: ©Fraunhofer IFF)

4.2 Workflow

Ein bedeutender Aspekt der Forschung ist die Integration des Tools in den Arbeitsablauf eines Planers beziehungsweise in das gesamte Planungssverfahren. Die Unterstützung durch die AR-Anwendung sollte dabei nach Möglichkeit nicht zu einem signifikanten Mehraufwand führen. Es wurde deshalb untersucht, welche Software häufig zur Objektplanung verwendet wird und welches Austauschformat einen einfachen Import für die AR-Visualisierung ermöglicht, was abhängig von der verwendeten 3D-Engine ist. Im beschriebenen Projekt wurde zunächst die Engine Ogre3D verwendet, für die Export-Plugins für alle gängigen Modellierungsprogramme (u.a. 3DSMax, Maya, Blender) verfügbar sind. Alternativen, mit entsprechenden Lizenskosten, bildet das FBX Format bei der Nutzung des Metaio-SDK oder spezielle Exporter für die UNITY3D-Engine.

4.3 Detaillierungsgrad

Der Erfolg der Beteiligung liegt neben dem Erzeugen eines Grundverständnisses in der Lenkung der Stellungnahmen und Diskussionen auf die je nach Projekt und Planungsphase relevanten Aspekte, was primär über den Detaillierungsgrad des visualisierten Planungsobjektes realisiert werden kann. Für die Erstellung einer zielgerichteten Detailtiefe empfiehlt sich die Orientierung an den Leistungsphasen der HOAI (Honorarordnung für Architekten und Ingenieure, 2013). Im Rahmen des Forschungsprojektes wurde ein beispielbezogener Katalog für die Einteilung des Level-of-Detail (LOD) verfasst. Als weiteres Hilfsmittel für die Ausmodellierung des Objektes kann die von WESTHEIMER, KOFFKA und KOHLER begründete Theorie der Gestaltpsychologie mit ihren fünf Gestaltgesetzen angewandt werden. Diese Theorie beschreibt die Mechanismen, durch die mehrere Einzelobjekte als Ganzheit wahrgenommen werden: mit dem Gesetz der Nähe, der Ähnlichkeit, der verbundenen Elemente, der Kontinuität und der Geschlossenheit (vgl. JÄNICKE, k.A.). Der Detailgrad der für die AR verwendeten 3D-Modelle wird durch die Leistungsfähigkeit (Prozessor) und den verfügbaren Speicher (Grafik- und Arbeitsspeicher) der Endgeräte limitiert. Für die AR ist, analog zur Bildwiederholrate der Kamera, eine Aktualisierungsrate von 25-60Hz für eine Echtzeitdarstellung erforderlich. Bei der Datenmodellierung ist auf die Anzahl der leistbaren Polygone (aktuell ca. 200.000) und die Vielfalt der verwendeten Bilder als Texturen zu achten, um keine Performoanceprobleme zu erhalten.

4.4 Variantendarstellung

Die HOAI beschreibt mit den Leistungsphasen den Ablauf in der Objektplanung. Eine intensive Beteiligung der Öffentlichkeit mit Potenzial und Gelegenheit zur Änderung und Anpassung von Planungsständen bieten die Phasen der Vor- und Entwurfsplanung. Hier kann eine Meinungsbildung am besten mit der Einbindung von Modellvarianten gefördert werden. Der Nutzer kann hierfür in der Augmentierung zwischen verschiedenen Varianten interaktiv wechseln und diese damit visuell vergleichen. Eine interaktive Modellierung oder detaillierte Anpassung des Planungsobjektes vor Ort ist nicht sinnvoll. Obwohl das Gewicht moderner Tablets unter 400g liegt, sind komplexe Interaktionen in einem Live-Videobild mit einer Hand nur bedingt möglich.

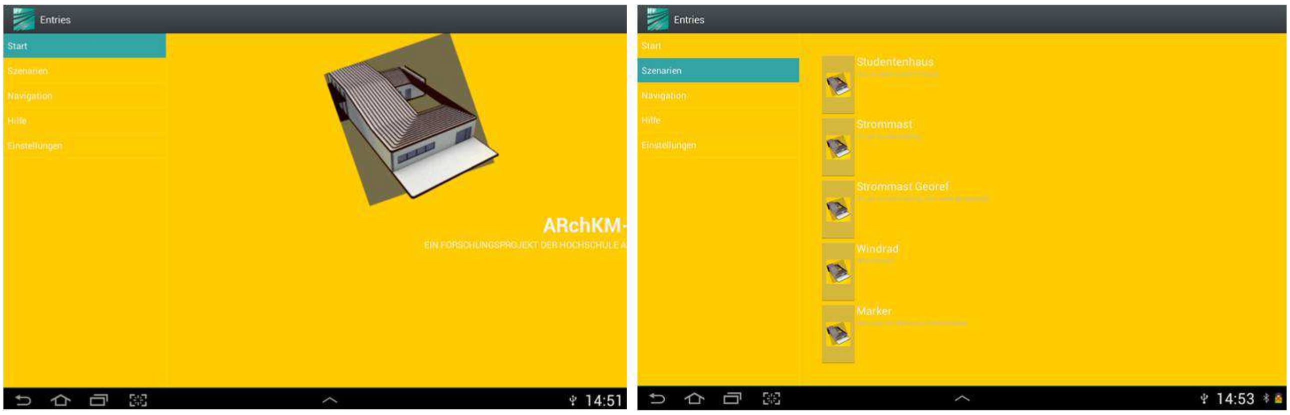

Abbildung 5: Screenshot der Startseite der App mit dem Menü auf der linken Seite. Hier können allgemeine Informationen zum Projekt bzw. zur App eingeblendet werden. Szenarienmodul – hier kann der Nutzer Varianten aufrufen und begutachten (Quelle: Hochschule Anhalt)

Die untersuchten theoretischen Grundlagen dienten vor allem der Funktions- und Aufgabenkonzeption der App. Diese Aspekte wurden intensiv mit den Experten der Praxis besprochen. Dazu gehört die Frage der Einsatzmöglichkeiten der App, die im Rahmen des Distansversuchs geklärt würde.

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4.5 Szenarien für den Einsatz der Anwendung

Der Nutzungsschwerpunkt der angestrebten App liegt vorrangig bei Planungen im städtischen Raum beziehungsweise in der Objektplanung. Hierbei werden Projekte, die in großem Maßstab, also einem verhältnismäßig engen räumlichen Bezug zum Betrachter stehen, adressiert. Dazu gehören beispielsweise der Bau oder die Sanierung eines Gebäudes oder einer Brücke im Siedlungsraum, die Überplanung eines Platzes mit Brunnen, Gehölzen und Bänken, die Planung von Spielplätzen, aber auch die Visualisierung von zerstörten Elementen eines historisch bedeutsamen Bauwerkes. Für vergleichbare Projekte kann mit der Entwicklung eine stabile und aussagekräftige Darstellung erzeugt werden. Der Einsatz dieser Software erfordert die Erstellung dreidimensionaler Modelle der zu diskutierenden Planungsphasen. Aus Sicht der Honorarordnung für Architekten und Ingenieure (HOAI) zählt diese Aufgabe zu den besonderen Leistungen des Architekten und ist entsprechend honorarwirksam. Das System ist deshalb vor allem bei Großprojekten von Vorteil. Darunter sind Projekte von bedeutendem öffentlichem Interesse zu verstehen.

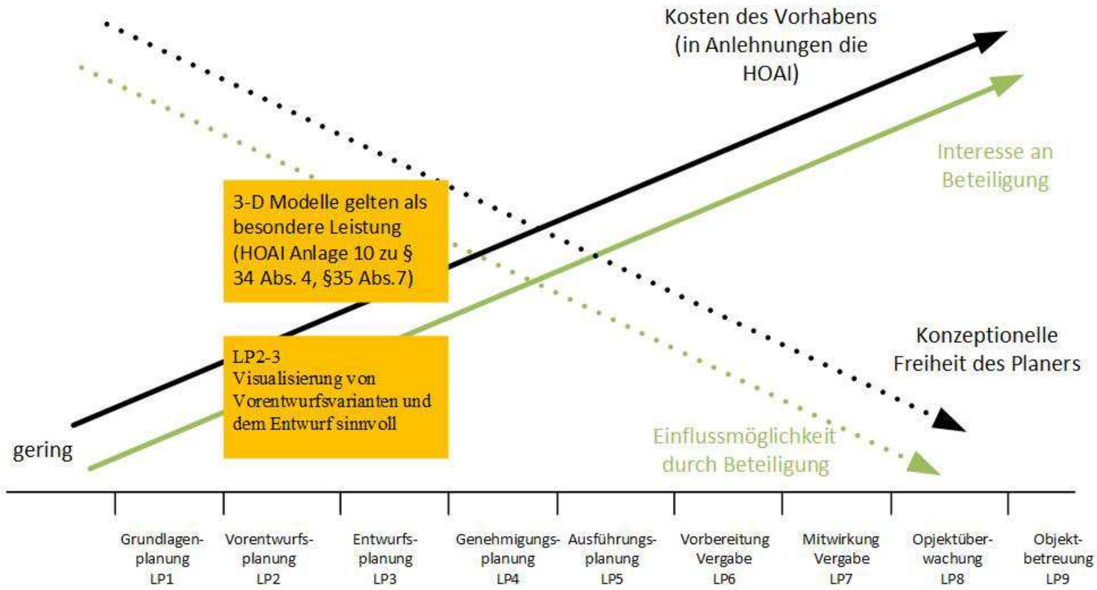

Abbildung 6: Entwicklung der Beteiligungsmöglichkeit und dem Beteiligungsinteresse im Planungsablauf sowie die Einordnung von Visualisierungsleistungen, nach den Leistungsphasen der HOAI (Quelle: eigene erweiterte Darstellung nach der Abbildung 'Das baukulturelle Dilemma' BUNDESSTIFTUNG BAUKULTUR 2014c: Baukulturbericht 2014/15, S.102)

5 ANWENDUNGSSZENARIEN

5.1 Komplexe Verkehrsplanungen im städtischen Raum

In den Medien wird häufig von städtebaulichen Projekten berichtet, die unter scharfer Kritik der Öffentlichkeit stehen und häufig von Gegeninitiativen begleitet werden. Ein solches Beispiel soll an dieser Stelle als potenzielles Anwendungsszenario für die AR-Entwicklung vorgestellt werden. Die Stadt Halle (Saale) in Sachsen-Anhalt plant den Umbau des prioritären innerstädtischen Verkehrsknotenpunktes ‚Am Steintor' für Straßenbahn-, PKW-, Fuß- und Radverkehr. Neben der sehr komplexen Verkehrssituation befindet sich zusätzlich an dieser Stelle eine städtische Grünanlagen mit altem Baumbestand, einem Kiosk und einem Brunnen aus DDR-Zeiten.

Im Rahmen einer Expertenbefragung im November 2012 von ArchKM-AR wurde beschrieben, dass bereits drei Jahre lang Bürgerbeteiligungsverfahren durchgeführt worden waren. Diskussionsgrundlage waren dabei drei Entwurfs-Varianten, die nach Aussage des Experten ungenügend visualisiert waren und zusätzlich eine schlechte Informationsvermittlung zu Verständnisproblemen führte. Die Beteiligung erfolgte mittels zweier Aushangverfahren und einem online verfügbaren Fragebogen mit der Möglichkeit zur Stellungnahme zu jeder Variante. Im Ergebnis wurden ca. 150 schriftliche Stellungnahmen gezählt und eine Bürgerinitiative mit etwa 3000 Unterschriften gegen das Projekt. Unter Beachtung der Informationen aus entsprechenden Presseartikeln zu diesem Fall ergeben sich aus Sicht der ArchKM-AR-Arbeitsgruppe folgende Einsatzmöglichkeiten für die Anwendung, die bei diesem Vorhaben möglicherweise hilfreich gewesen wären.

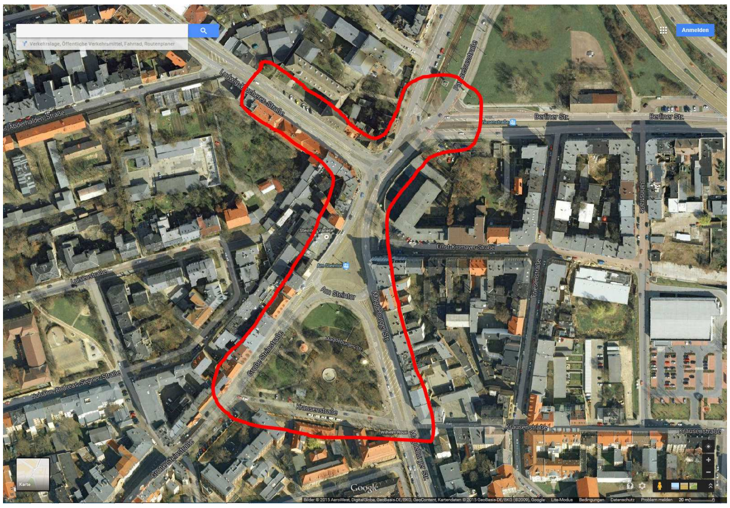

Abbildung 7: Luftbildausschnitt der Stadt Halle (Saale) mit grober Abgrenzung des Betrachtungsgebietes zum Planungsvorhaben am Verkehrsknotenpunkt Am Steintor; Quelle: Google Maps

In diesem Fall hätte die Anwendung nicht lediglich dazu genutzt werden müssen, die Planungsvarianten zu kommunizieren. Schon vor der Erstellung der Varianten hätte beispielsweise mit dem Aufzeigen der verkehrsbedingt gefährlichsten Stellen und Hindernissen der Barrierefreiheit eine Sensibilisierung der Bürger für die prekäre Lage stattfinden können. Sobald Entwürfe vorhanden sind, bietet die App die Möglichkeit, für einzelne Betrachtungsschwerpunkte wie zum Beispiel die Zugänge zu den drei Universitätsgebäuden, einzelne Augmentierungspunkte einzurichten, um eine gezielte Beteiligung und Diskussion zu implizieren. Diesbezüglich spielt auch der Detaillierungsgrad (siehe 4.3) eine wesentliche Rolle. Dieser eignet sich ebenso hervorragend, um auf die in Planung aktuell zu diskutierenden Elemente der Planung aufmerksam zu machen. Am Beispiel der Universitätszugänge würden diese Bereiche beispielsweise farbig und in einer stärkeren Detailtiefe modelliert, als andere Elemente der Planung in der näheren Umgebung. Die Augmentierungen können zur Vorinformation als Grundlage für eine öffentliche Informationsveranstaltung angeboten werden. Zum anderen kann auch die Beteiligung an sich dahingehend modifiziert werden, dass Planungsbeteiligte sich am Ort des Projektes aufhalten und mithilfe der Augmentierung mit Passanten ins Gespräch kommen.

5.2 Planung zur Schließung einer Baulücke

Ein weiteres naheliegendes Anwendungsszenario ist die Planung zur Schließung einer Baulücke. Bei diesem Fall wird sich die Öffentlichkeit vermutlich weniger mit der Frage beschäftigen, ob das Projekt durchgeführt werden soll, vorausgesetzt diese Flächen sind bislang nicht für die Erholung relevant. Dennoch kann eine Beteiligung für die spätere Akzeptanz des Bauwerkes sinnvoll sein.

Unter diesen Gesichtspunkten ist davon auszugehen, dass deutlich weniger Planungsansätze aus Gründen spezieller Fachplanungen wie beispielsweise der Verkehrsführung auftreten würden, die von der Öffentlichkeit kritisch in Frage gestellt werden würden. Die gestalterische Umsetzung des Gebäudes steht in solchen Fällen im Fokus der Öffentlichkeit. Die Gestaltungsfreiheit ist jedoch begrenzt – ferner durch die Vorgaben des Flächennutzungsplanes, konkreter durch die Regelungen der BauNVO bezüglich der Gestaltung im Einklang mit der Eigenart der näheren Umgebung (§34 BauGB) sowie durch die verfügbaren finanziellen Mittel des Vorhabenträgers. Es ist deshalb von Vorteil, der öffentlichen Meinungsbildung nicht die Illusion der unbegrenzten Gestaltungsfreiheit zu vermitteln und ihr damit eine freie Wunschäußerung zu eröffnen, sondern mithilfe vorkonstruierter Varianten einen Rahmen des Möglichen abzustecken. Damit ist den Bürgern eine Meinungsäußerung und außerdem die Möglichkeit des Mit-Entscheidens eröffnet.

6 FAZIT

In diesem Beitrag wurde dargestellt, welche AR-Technologien eine positive Umstrukturierung von öffentlichkeitsgebundenen Beteiligungsverfahren in Planungsprozessen bieten. Die technischen Entwicklungen nehmen dabei im FuE-Projekt eine prioritäre Bedeutung ein. Denn ein Mehrwert für die Beteiligung kann erst erzeugt werden, wenn die Anwendung eine entsprechend angemessene Funktionsweise mit Augmentierungsgenauigkeit und -stabilität aufweist.

Bislang unvollendete Aspekte der Entwicklung sind dabei beispielsweise die Layerstruktur für die Variantendarstellung und der intern als „Black-Box“ bezeichnete Arbeitsschritt der Verknüpfung des 3D-Modells mit dem Marker. Dieser Arbeitsschritt muss eine praxistaugliche Umsetzbarkeit erhalten.

Das FuE-Projekt findet seinen Abschluss in einer erneuten Evaluation, die den gesamten Anwendungsprozess auf seine Praxistauglichkeit prüfen soll. Auf Grundlage des bis zum Abschluss des Projektes entwickelten Prototypen bauen Impulse zur Weiterentwicklung auf, die im Rahmen eines Folgeprojektes in die App integriert werden könnten.

7 ERGÄNZENDE ANGABEN

Das vorgestellte Forschungsprojekt ArchKM-AR (FKZ: 17031X11) wurde durch das Bundesministerium für Bildung und Forschung im Rahmen des Förderprogrammes „Forschung an Fachhochschulen mit Unternehmen“ (FHprofUnt) gefördert.

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Bundesministerium für Bildung und Forschung

FORSCHUNG AN FACHHOCHSCHULEN

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Braving a New Life in the Old Dockyards – Towards an Integrated Approach

Agnieszka Zając

(Ir. Agnieszka Zając, project leader Old Dockyards, Autonomous Municipal Ghent Development Authority SOGENT, Voldersstraat 1, 9000 Gent, Belgium, agnieszka.zajac@sogent.be)

1 ABSTRACT

The city of Ghent is a very interesting example of a city with a double relationship with its own water infrastructure. There are three main reasons for this relationship. Firstly, the main historical ground for the existence of Ghent along the water was purely out of living conditions and economic reasons (textile industry, water for drinking and canalization support…). Later, however, the polluted water infrastructure had to be filled up to make place for another economic reason: free mobility access for cars, extra parking and open space. The third - and fairly recent - reason is that the city council together with urban planners discovered the water-backbone again, and gave it a third life as the new generator for the city, as a way of making the city "full of pleasure, with open perspectives and open sustainable public spaces" again. Ghent shows how the city can reuse its inner structure and how the water structure can change the future of the city. Sustainable water infrastructure can truly be the basis for city evolution and urban planning.

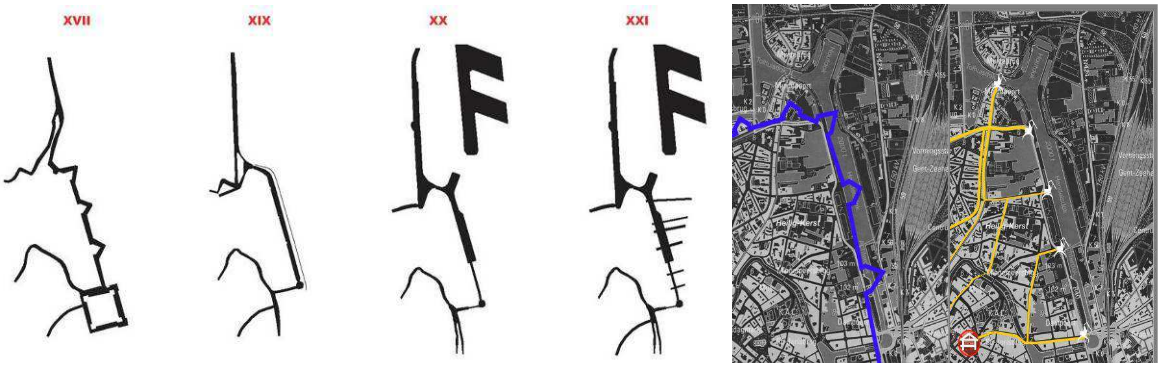
2 WATER IN THE CITY: A REDISCOVERY

2.1 From windmills

The town of Ghent and its waters are inseparably bound, one unable to exist without the other. Already in the Roman period, the town started to grow around the confluence of the rivers Lys (in Dutch: Leie) and Scheldt (in Dutch: Schelde). Because of that, the Flemish name 'Gent' was derived from the Celtic word 'Ganda', which means 'confluence'.

By the 12th century, Ghent was rapidly growing into a flourishing city. The cloth trade, based on the import of English wool, flourished like nowhere else, and within a century Ghent had become an important industrial city. Until the 13th century, Ghent was the second biggest city in Europe, north of the Alps, preceded only by Paris. By the late 15th century, the cloth trade had begun to decline, but Ghent remained prosperous by shifting its economy to the shipping trade along the rivers Lys and Scheldt. In the latter part of the 15th century, however, the closing of the Scheldt brought commercial decline, not to be reversed until the revival of cloth working(processing? production?) during the industrial boom of the 19th century.

From then on, the cotton industry flourished and Ghent turned into one of the most important industrial centres of the French Empire. The Ghent-Terneuzen canal was constructed and Ghent continued to grow as an industrial centre. As water-borne traffic and port activities increased, the sea canal was extended several times. Also at that time, as industrial activities developed in the city centre as well as in the docks, windmills gave way big industrial cranes…



Images 1 and 2: The evolution of water infrastructure in Ghent (sogent)

2.2 Through cranes

A century ago, filling in canals and bodies of water became an everyday affair – and there was every reason to do so. Cholera and tuberculosis were rife in deprived working class districts, diseases surely encouraged by the canals, which, in those days, functioned as open sewers. Water was a threat to public health. Besides,

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many canals and waterways had lost their function as supply routes. Trains (and later, trucks) became far more important means of transport than shipping.

The danger was not only pollution, but also its unpredictability. In the 19th and early 20th centuries, water was a regular menace to the city as a result of high water levels. Moreover, after the Second World War, the number of cars rose spectacularly. 'Abolished' watercourses were filled in or vaulted to make room for new roads or parking lots. By filling in the Lower Scheldt (in Dutch: Nederschelde) in 1960, the historical confluence of Scheldt and Lys disappeared.

2.3 To bridges

Already in the mid-1970s, attitudes were changing and respect for the role of water in the city was only growing. For example, in the last couple of decades, significant investments have been made in water treatment, with the construction of a comprehensive collector plan, which drains the sewage waters to a purification unit and no longer into the rivers. From the end of the 20th century on, lost canals and ports fallen into disuse were revalued. The city authorities started to realise that city watercourses had tourist and economic value, and might have a sustainable significance for the historical city, which could help improve the quality of life. In short: water could render the public space more attractive, thereby enhancing the city’s economic position.

3 URBAN TRANSFORMATION: WATER AS A SPATIAL BEAM

3.1 Spatial Structure Plan of Ghent

During recent years, Flanders has introduced structure planning as an important opponent to the functional zoning in the planning. This is an important tool for the city policy to provide strategic choices and actions in the planning. At the same time, the structure plan is very helpful for safeguarding and realising the long-term visions. Ghent had the same needs as elsewhere in Flanders, and they were very quickly translated into the Spatial Structure Plan of Ghent. The plan was published in 2003 and made legally binding by decree of the Flemish Government. It consists of balanced choices to ensure a sustainable and qualitative spatial development.

With a focus on spatial elements and key issues, the plan provides vision and certainty for all actors over the short- and (mid)long-term. It has no direct effect on citizens and is tuned to structural plans on other levels, such as Flanders and the province.

Obstacles (with which the plan had to deal included: a lack of green spaces on different levels, outflow of residents from the city, too densely built 19th century belt neighbourhoods, the majority of buildings in poor condition, a lack of zones for economic activities, underused train stations and the public transport network.

Despite the fact that long-term visions usually need a lot of time to be realised, the Spatial Structure Plan for the City of Ghent has certainly become a successful tool for accelerating the strategic policy decisions as well as the application of the visions. Several of the Structure Plan’s targets and ambitions became real priorities in the political planning and, thanks to that, the image of Ghent is now progressing day by day. Policy priorities (this is the strategic content of the plan) focus on developing green areas, re-developing the city and its districts, and developing a railway station site. But one of the main new visions was the way to transform water structure into the main spatial beam and leading factor. The city government describes its vision on water as follows: “The water and the confluence of the Lys and Scheldt rivers form the basis of the origin of Ghent. Still now, water remains an important structuring element for nature, economics (port, Ring Canal) and parts of the scenery in and around the city. Although it has been quite affected in the past (by filling in, vaulting, canalization, pollution) and though it may have become less functional, water in Ghent is still very present, compared to all other big Flemish cities (except Bruges).

These chances should be taken to their full extent, in order to strengthen the functioning of the city in several areas and to emphasize the typical character of Ghent as a 'city of water'”. Stad Gent, 2003, Ruimtelijk Structuurplan Gent.

3.2 Opening of the Lower Scheldt watercourse

The Lower Scheldt project is a perfect illustration of the renewed respect for the recreational, economic and historical value of water in the city.

Already in 1885, part of the waterway was covered, in order to secure a smooth link between the former South railway station and the city centre and to create a new town square. In the 1960s, because of city forming and water pollution, the remaining part was filled in up to the Lys estuary, except for a small section at the Castle of Gerard the Devil. As a consequence, it was no longer possible to take a full boat tour. In the southeast, boats sailing the Lys had to turn around at the point where the Lower Scheldt had been filled in.

At the beginning of this century, the city of Ghent set objectives to restore the broken connection between the Lys and Scheldt rivers, to provide pleasure craft passage through town, combining this with re-zoning the public space and building a marina. Already around the year 2000, Ghent started restructuring the Portus Ganda marina area to be situated at the historical cradle of Ghent, the Lys and Scheldt confluence and Saint Bavo's Abbey. The Rodetoren Quay would be stepped, making it an ideal spot to relax with a view across to the Veer Quay, which would be extended with wooden jetties and boardwalks, while the surrounding area was being enhanced with present-day street furniture. On 30 April 2005, Ghent’s fourth marina was officially opened. Meanwhile, an extensive part of the Lower Scheldt has already been uncovered. And more recently, on 18 February 2008, the Bavo, Nieuw and Wijdenaard Bridges were officially opened.

4 THE OLD DOCKYARDS PROJECT: TOWARDS AN INTEGRATED APPROACH

4.1 Introduction

Not only is the value of water being restored in the very centre of the city, the dockyards area to the north of the centre is also heading for a major transformation during the next 20 years. The Old Dockyards Project (in Dutch: Oude Dokken) will radically change the looks and the function of an entire area of the city. The aim of the Project is to re-develop the former harbour area called Old Dockyards and to enhance the liveability and employment in the neighbourhood.

4.2 Situation and history

The Old Dockyards area is situated around the city’s three oldest docks (the Achter, Handels and Hout docks), just outside the historical city centre, between the 19th century belt of the city and the railway station environment.

In the Middle Ages, this area already had a strategic position: for a long time, it was a wasteland that could be flooded very quickly to protect the city against enemies. In 1829, after the cranes replaced the forts and windmills, the first dock was built – the Handels Dock – parallel to the fortress and the moat. During recent years, because of expansion of the port, the harbour and its economic activities were moved to the north area of the city, around the Ghent-Terneuzen canal. As a consequence, the Old Dockyards area became neglected, harbouring outdated factory infrastructures with inadequate equipment, daily traffic jams, a scarcity of green areas and public spaces, etc.



Images 3, 4 and 5: Aerial view of the Old Dockyards (sogent) and the Handels and Hout Docks (City of Ghent archives)

This evolution was caused by two elements: the enlarged scale of the harbour activities (larger ships, more containers, etc.) and the transformation of the industry onto a more global level. While production was being moved away from Europe, the focus on high-tech production and various services grew. Moreover,

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waterways are no longer often used for production ends. As the area is situated near the historical city centre, it is easy to reach and full of potential for future developers. All this together – an empty area, without any function and pretty much futureless, but at the same time with an extraordinary character, soul and so much potential – convinced the city council to look for a sustainable evolution: the Old Dockyards Project was born.

4.3 Quality of urban planning and design

Years ago, the port of Ghent was located in the area of the Old Dockyards, located to the east of the historical city centre. However, the port activities gradually moved to the new municipal port, north of the city. Little by little, the grounds of the Old Dockyards (ca. 25 ha) were transformed into a real no-man's land, with a few scattered buildings, a couple of sheds and two industrial cranes.

From the remnants of a rich industrial past, a brand-new vivid quarter is now arising, a place where old and young inhabitants of Ghent will be able to live near the waterfront and in a green environment. The challenge for Ghent is to create this place based on sustainable and water-sensitive urban planning and re-using the numerous heritage elements.

Approximately 1500 housing units will be constructed, fulfilling the promise to deal with housing shortage. Modern houses will offer something to everybody's taste. Juniors and seniors, couples and large families, everyone will certainly find a place and be able to contribute to a cosy neighbourhood. There will also be enough room for offices, shops, recreation, culture and nature. The additional public services (elementary school, day care centre, neighbourhood sports hall), the extension of the public transport network, bicycle and pedestrian bridges, and high-quality public areas will also give the surrounding quarters, and the entire city, a strong impetus for renewal.

4.4 Main actors in the initiative

In 2003, the Ghent city council took decisive action by including a vision for the area in the Spatial Structure Plan for the city: "an approach of social, economic and physical rejuvenation of the Old Dockyards would lead to the development of an area of mixed use, a new, sustainable, mostly residential urban quarter."

The development of the Old Dockyards project is being supervised through a partnership between the City of Ghent and the Autonomous Municipal Ghent Development Authority (in Dutch: sogent), an operational agency owned by the City of Ghent.

Obviously, in a project of this complexity, a lot of other partners play important roles:

- Waterways and Sea canal (Flemish Government, construction of bridges for pedestrians and cyclists, and renovation of quay walls)
- AWV (Flemish Government, construction of motorways)
- Ovam (Flemish Government, mediation of soil)
- Private developers (Public Private Partnership to realize the project)
- A lot of corporations and links with universities and research institutes, collaborative networks and global relationships.

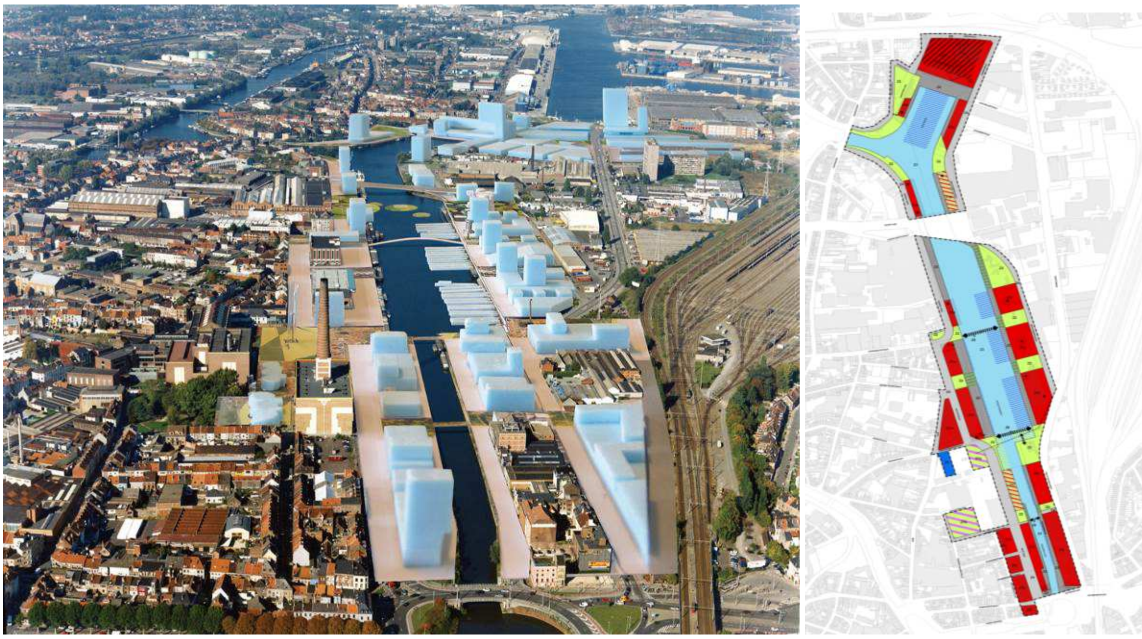
4.5 Financial aspects

Due to the complexity of the project, it is very hard to name an exact amount of money involved. The project is made possible thanks to numerous subsidies: the European Fund for Regional Development, the Flemish Fund for City Renewal, the Federal Urban Policy, and more. The City applies for different subsidies for all possible sub-projects and aims to break even. But the main opportunity is the fact that sogent owns more than 80% of the grounds, and thus can set high standards for the project development at all levels and demand creation of a highly sustainable environment.

For example: in the year 2008, eight cities in Flanders and the Netherlands, all of which planned to transform their former industry ports, joined forces. In the context of the European Interreg IV A-project 'Revitalization of Old Industry ports' (ROI), they all received a European fund for the realization of one part of their project (in Ghent, this was building the first bridge for cyclists and pedestrians). Besides that, they created a platform which made it possible to exchange knowledge about all aspects of city development in former industrial areas. The City of Ghent, in cooperation with Ghent University, was the leading partner of this project. More information: www.roi-project.be

4.6 Master planning by OMA

In 2004, the Ghent Development Authority organized a European urban design competition for the Old Dockyards Project – the Office for Metropolitan Architecture (OMA), from Rotterdam in the Netherlands, won. While historically the North-South alignment of the dockshad always been a dominant factor of the site, OMA proposed to rotate the structure into a transverse position, opening the views up to the waterfront and the city beyond, and adding new transverse canals. This initiated a new vision towards the evolution of waterfront areas. While in other cities the expansion line is actually visible and high buildings are erected along the waterline, OMA's master plan proposed a sustainable connection with the second plan – the 'B' and 'C' areas – situated further away from the docks – by transverse orientation. Making this opening inland re-started the discussion about the future of the whole area further away from the 'golden waterside'. This was an important moment: it became clear that extra studies about the entire area were necessary. OMA's master plan included three zones whose evolution could be proposed: the 'A', 'B' and 'C' areas. At present, sogent is developing the 'A' area; a new spatial structure plan is in preparation for the 'B' and 'C' areas.



Images 6 and 7: Aerial view of the Master Plan (OMA) and the Spatial Structure Plan (City of Ghent archives)

4.7 Waterfront: a dream for the developer or for the citizen?

Because of this new policy, the concept of the waterfront in Ghent will be different than in other cities. The focus is not on financial aspects, but on creating a liveable and vibrant new city district by fulfilling the needs of the city's inhabitants. This means that the green areas will support the needs of the new dwellings, but will also provide a solution to the lack of green in existing dwellings; and houses for families will be the first priority, which means fewer high-rise buildings and more one-family units. Also very important is the creation of a social network by providing playgrounds, a school and kindergarten, multi-functional halls for youngsters, a library for the quarter, and so on. For once, the sky is not the limit…

Every 19th century city should be grateful for such an evolution. The key success factor for the realization of the Old Dockyards Project is general water management, involving the reorientation of the boat moorings, the creation of a new yacht harbour for tourism, the innovative stabilisation of the quays (12 different types of embankments, with a total length of nearly 5 km), creating the new 'harbour' for houseboats and new parks on the water level.

Other important factors are the transformation of the accessibility of the Old Dockyards Project and the creation of sustainable new public spaces. Various transport solutions are required to transform the accessibility of the Old Dockyards Project. To increase liveability, the city ring road will be re-locatedand the new 'Verapaz' bridge will be constructed in 2018. The new walking and cycling bridge (Batavia bridge)

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is already constructed, and two more will follow in the next few years. Furthermore, plenty of new open spaces, parks, urban squares, playgrounds and sports areas, water promenades, etc. have to be modelled.

Our main aim is to create a successful waterfront project for the coming generations. This means that the issue of sustainability is very important in the Public Private Partnerships. All Public Private Partnerships are competitions – the project with the highest level of quality and long-term vision will win. It's not only a matter of building passive houses, we are asking for innovation in sustainability – for example, by capturing heat from dish- and clothes-washing water, by producing bio-gas based on faecal water, creations of the smart city grid, and so on. The first PPP for the development of 400 dwellings on the eastside of the Handels Dock subscribes to those ambitions. Another innovative idea was to choose the consortium of developers and architects by organising a "dialogue café" for more than 100 inhabitants of Ghent, who discussed the project together and listed their pro's and con's per project. For such an open "people referendum" to be held in Belgium was quite unusual.


Images 8 and 9: Aerial view of the first PPP project by cvba Schipperskaai, and a "dialogue café" (City of Ghent archives)

4.8 Innovation, creativity and uniqueness of the Batavia bridge

Considering the fact that the three bridges will be the focal point for all citizens entering the new district, an ambitious design, in close relation with the maritime history if the site, was needed. Apart from that, inland navigation has to remain possible with the bridges in place, without breaking the continuous connection with the inner city for bicycles and pedestrians.

Dietmar Feichtinger Architectes from Paris submitted the winning design for the three bridges. The design concept is based on the idea of a jetty in steel and wood that links both sides of the water and forms an extension of the public space. To allow vessels to pass underneath the bridge, the central part is raised, whilst still letting bicycles and pedestrians cross safely. This answered the city's request for an ambitious and appealing design that acts as a (tourist) attraction for the city. At the same time, by applying quite new techniques, this is innovative bridge design. The Batavia bridge opens very slowly, so that everyone can continue to use the bridge. Also, when it is in the open position, it is still accessible because the slope of the parts rising to the lifting table increases from 0% to 9%.



Images 10, 11 and 12: The opening of the Batavia bridge and the renovated quay wall at the Handels Dock (City of Ghent archives and sogent)

4.9 Innovation, creativity and uniqueness of the quays

The renovation of the unstable quay walls is a very difficult issue technically, in addition to being very expensive. In cooperation with the Flemish Waterway Manager, sogent decided on a design with high ambition: the new quay wall at the Handels Dock provides a new pedestrian promenade (more than 600 meters long) and provides the first inhabitants of the Old Dockyards with a modern mooring structure – the

34 houseboats have all necessary utility services; the new quay wall at the Hout Dock provides a new pedestrian promenade (more than 400 meters long) at the water level, and a slipway makes a new marina possible.



Images 13, 14 and 15: The construction of the quay wall at the Hout Dock, and two futuristic views (City of Ghent archives and sogent)

4.10 Innovation, creativity and uniqueness in re-use of heritage

Another interesting part of the plan is the commitment to maintain the historical character of the area by re-using elements of the architectural and industrial heritage. The strongly industrial scenery will evolve towards a new municipal scenery that owes its character to the port.

Four cranes, one yellow and three blue, will always be part of the skyline. A former concrete plant will be largely preserved and will receive a new function as part of the largest park in the area. The remaining typical tracks for the goods carriages and the ship bollards will be integrated as much as possible in the layout of the new public spaces. Furthermore, a range of additional maritime industrial elements – from anchors to old train wagons – will be re-introduced into the public spaces of the Old Dockyards. The intention is to create a touristic industrial route and, at the same time, provide some game incentives for children.

A very specific project, in terms of heritage and cohesion, is the renovation of a series of disused gravel tanks, formerly used for transferring gravel and sand between ships and trucks. By means of some limited interventions, a team of a young architect and an artist transformed this area into a unique multi-purpose public space. Today, the setting is a hotspot for youngsters, artists and people from the neighbourhood.

More information: http://www.wallpaper.com/architecture/rotor-installation-at-the-grindbakken-warehouse-in-ghent/6103.



Images 16, 17 and 18: The re-constructionof the gravel tanks and two futuristic views (City of Ghent archives and sogent)

4.11 Innovation, creativity and uniqueness – temporary uses

Between the making of the plans and the effective realization of the project, years are going by. The City of Ghent has given special attention to the temporary use of grounds and buildings during these periods. Certainly in the Old Dockyards, where a whole new living area is rising amidst existing surroundings, this aspect of the development is extremely important. By offering all kind of happenings for the neighbourhood and for Ghent's inhabitants – including films, exhibitions, theatre, sports, a city farm, urban agriculture, flea markets, handicrafts, and so on – the Old Dockyards has already become an integral part of the city. Today, the neglected dock area is alive and now on the mental map of the inhabitants. At the same time, it offers enormous opportunities in terms of communication. In a pleasant way, the City of Ghent can inform all visitors about future plans.

More information: www.oudedokken.be, www.dokgent.be, www.de-stadstuin.be and www.019-ghent.org.

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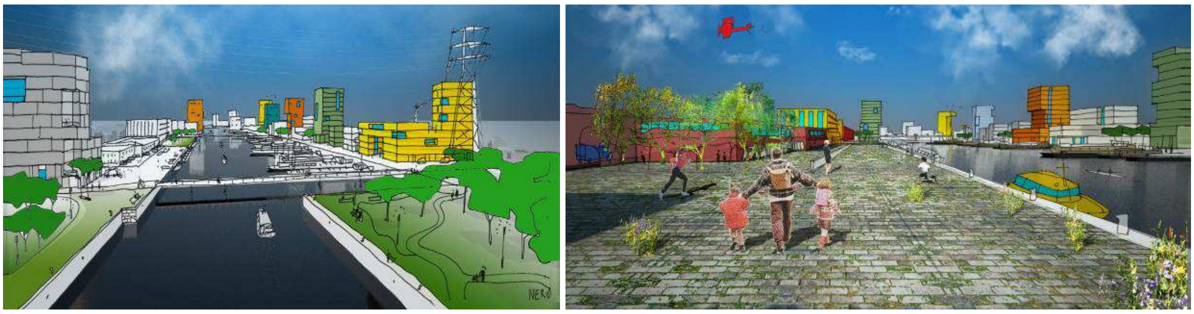
Images 19, 20, 21, 22, 23, 24 and 25: Some examples of the temporary use of the Old Dockyards area in 2013 (City of Ghent archives and sogent)

5 CONCLUSION



Images 26 and 27: Two futuristic views of the Old Dockyards (sogent)

Between the making of the plans and the effective realization of the project, years go by. The City of Ghent has special attention for the temporary use of grounds and buildings during these periods. By offering film, exhibitions, theatre, sports, meeting places… for the neighbourhood and for Ghent's inhabitants, the Old Dockyards already become a part of the city. At the same time, it offers enormous opportunities in terms of communication.

The Old Dockyards project is a fine example of a transformation of an abandoned brownfield area into a new living area for mixed use, all that with great respect for the maritime and industrial past of the location.

The results of the project will be miscellaneous. Current inhabitants of the city as well as possible new ones get the chance to live in a unique atmosphere: near the water, surrounded by green, and within walking distance of the old city centre. Smart interventions in terms of mobility and ecological sustainability will make the Old Dockyards a real part of the "smart-city" .

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reviewed paper

Bridging the Gap in E-Mobility: from Supranational Goals to Local Legal Barriers to New Market Opportunities

Heimo Aichmaier, Bertram Ludwig

(Graduate Engineer, Heimo Aichmaier, Austrian Mobile Power, heimo.aichmaier@austrian-mobile-power.at)
(Graduate Engineer, Bertram Ludwig, Austrian Mobile Power, bertram.ludwig@austrian-mobile-power.at)

1 ABSTRACT

Supranational, national and local goals clearly set the agenda for low-emission transport in urban and sub-urban areas. If no clear incentives are given on a nationwide or local scope, only "early adopters" implement e-mobility. Often it turns out that local authorities, respectively local regulations and laws are hindering e-mobility rather than technology itself. How the gap from supranational goals to urban barriers can be overcome and new market opportunities will be created is the core element of the following paper.

2 FROM SUPRANATIONAL GOALS TO LOCAL IMPLEMENTATION

2.1 Supranational and National Goals – Setting the Path for the Future and the Presence

A significant number of supranational goals are clearly setting the future agenda of motorized traffic, both passenger and freight traffic. In terms of e-mobility most notably the European White Paper on transport which aims to "halve the use of of 'conventionally-fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO2-free city logistics in major urban centres by 2030"(1) and marking therewith another important milestone to achieve the EU-2020 goals(2).

These general goals of reducing emissions in urban areas are backed up by different regulations of the European Union like 333/2014(3) targeting the reduction of CO2 emissions of new passenger vehicles, 540/2014(4) aiming at a reduction of motor vehicle noise emissions as well as directive 2014/94(5) on the deployment of alternative fuels and infrastructure. In the case of e-mobility these supranational goals are supported by a set of national as well as urban goals, like in the case of the city of Vienna (Austria) the "Urban Development Plan Vienna. STEP 2025"(6) aiming at a higher share of electric freight vehicles in the city of Vienna.

All do have in common the reduction of emissions from transport and consistently lead to a set of measurements which need to be implemented in urban and sub-urban areas. As e-mobility vehicles and e-mobility charging infrastructure have become suitable for everyday use as role models like Norway and the Netherlands have shown, often local barriers (e.g. building laws) are challenging the expansion of e-mobility as will be shown in this paper.

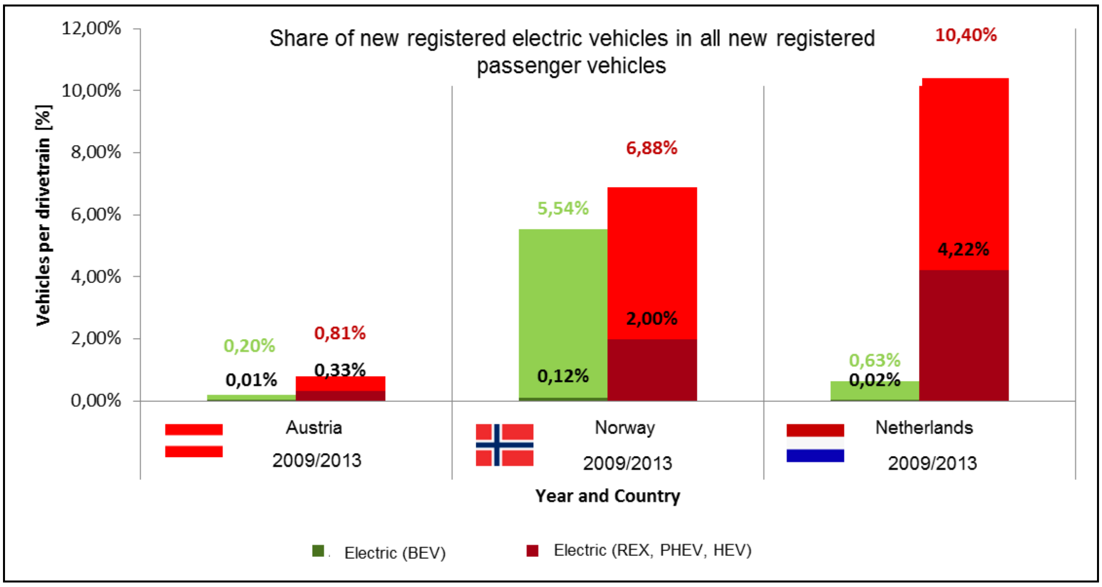

Fig. 1. Share of new registered electric vehicles.

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2.2 E-Mobility in urban and sub-urban areas

The daily average kilometres per private passenger vehicle in Austria are about 35 km(8) , vehicles used by the City of Vienna do have an average annual mileage of 7.000 km.

For different purposes the industry nowadays provides different low emission vehicles: Battery Electric Vehicles fully cover driving distances within urban and sub-urban areas; Fuell Cell Electric Vehicles, Plug-In Hybrid Electric Vehicles and Range Extender Vehicles are in other cases more suitable for daily commuters.

In addition to the developments in the field of automotive technologies also a broad selection of interoperable, intelligent charging infrastructure for different purposes already is available at the market: slow charging (>3,7 kW), accelerated charging (>20 kW) and fast charging (>43 kW) make charging easy and quick. The expected future distribution of e-charging stations is shown in figure 2.

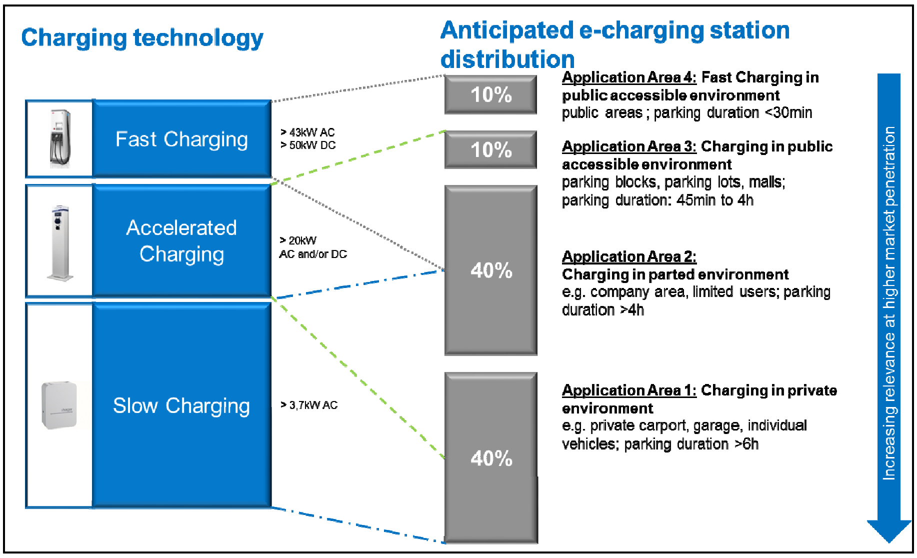

Fig. 2: Anticipated e-charging station distribution.

With such a broad offer of different vehicle and charging technologies available all types of user demands can already be fully covered. For example freight vehicles in urban areas can be fully recharged in public accessible areas within less then 30 minutes during a coffee break. In the case of daily commuting charging infrastructure at the workplace and at the place of residence allow users to fully recharge their electric vehicle within a maximum of 8 hours. Vehicles with full electric driving ranges from 50 km up to 500 km show that the supranational goal of urban emission free traffic can be achieved already today and electric vehicles could already today play a major role in urban traffic.

2.3 The presence for users

E-mobility is fully applicable for everyday use as the “virtual” example below shows:

Joe Early is mostly using public transport to commute to work, but due to some luggage he is carrying today he is opting for his private car. He has been using a Battery Electric Vehicle for more than 2 years already and enjoys the convenience of charging his car at his apartment home. He is sharing his charging station (“wallbox”) with Jane Now, his neighbour. For making sharing of infrastrucutre and accounting of consumption of electricity easier they use an “intelligence wallbox” which fulfils all technical requirements of the European Union Regulation 2014/94(5) . By fulfilling these standards their charging station could also be accessible for other users in their apartment home and even for users from “outside”.

Joe Early can also easily charge his car at his workplace; both charging stations at his workplace and at his residence place are for accelerated charging and therewith fully satisfy his needs: charging an electric vehicle within less than 4 hours. Joe Early´s employee (Green Vif Ltd.) describes himself as an urban pioneer company and is interested in new market opportunities for green technologies, hence Green Vif Ltd. applied for an ID for their charging infrastructure. Such an ID gives Green Vif Ltd. the opportunity to ensure

that all technical requirements are in line with supranational regulations and to become part of a Europe-wide charging network. Therewith Green Vif Ltd. also builds the base for roaming and the opportunity to sell the use of e-charging infrastructure to non-employees. Joe Early and Jane Now also thought about applying for an ID but both still think that there are too many barriers for electric vehicle users so they postponed their application.

2.4 Legislative barriers to overcome

As has been highlighted so far, technology for the use of electric vehicles in urban and suburban areas is ready but mainly used by "early adopters" rather than by "Joe Average". But what are the obstacles which hinder the market penetration of e-mobility in urban and sub-urban areas?

Beside fiscal incentives, which do have a strong influence on the share of electric vehicles (see also figure 1) potential users of e-mobility are often confronted with barriers hindering the implementation and operation of charging infrastructure. The implementation of new technologies, like charging infrastructure often contradicts existing regulations, e.g. building laws.

For example the ex post implementation of charging infrastructure in underground garages in apartment homes contradicts with old – but still existing – building laws not allowing the parking and charging of electric vehicles with lead-acid batteries (modern electric vehicles are run by Li-Ion batteries and do not emit any gas as do lead-acid battery run vehicles). Due to this and other outdated regulations it can take up to 12 months to implement charging infrastructure in apartment homes. Such time and "energy" consuming barriers make it difficult for "non-early adopters" to opt for electric vehicles.

Alongside the ex post implementation of charging infrastructure in real estates another important leverage for electro-mobility in urban areas are future real estate projects. Here building law play an important role for new technologies, e.g. e-mobility. For example compulsory conduits for later cabling as well as mandatory numbers of charging infrastructure per parking lot can have a major impact on the demand of e-vehicles and charging infrastructure. If such regulations are not compulsory, the circumstances for electric vehicles will remain hostile.

Beside the private use of electric vehicles the use of electric freight vehicles is often also hindered due to the same reason discussed above. In addition electric freight vehicles also lack fast charging infrastructure in urban public space due to high investement costs for construction works and connection for power supply as well as regulations which are not supporting the change towards eco-friendly technologies.

Due to these circumstances, e-mobility is mainly of interest for early adopters and still needs a lot of personal commitment. To overcome the gap between supranational goals and the local implementation more efforts are needed on an urban level. Efforts which should be reflected in building laws, operating charging infrastructure and other incentives (e.g. tax) to support new technologies.

3 CONCLUSION – WHAT CAN BE GAINED

What will be achieved if these barriers on a local level can be overcome?

- By easing the (ex post) implementation of charging infrastructure more charging infrastructure will be requested and subsequently the demand for electric vehicles will most likely increase.
- State-of-the art infrastructure already is interoperable and therewith (according to EU directive 2014/94(5)) accessible for different user groups. However, as users are facing legal barriers in terms of constructing charging infrastructure return of investment is difficult to achieve.
- If the legal framework would ease the implementation of charging infrastructure also new business opportunities for private and business operators of charging infrastructure could be expanded by giving them the opportunity to sell their services (charging, parking) to other electric vehicle users.
- Cities in Europe are implementing different strategies for reducing the number of on-street-parking. Still, the number of vacant parking lots in real estate in some cities is up to 70 %(9). By constructing a higher number of charging infrastructure in parking garages this number could be successfully reduced. Consequently there would be less on-street-parking giving the opportunity to re-use public space formerly used for on-street-parking.
- As was highlighted in 2.1. supranational and urban goals clearly describe the future path. The market is ready too and offering a diverse range of products, yet the quick amendment of legal framework on an urban scale is needed to allow new technologies to become profitable.

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What is clearly missing is the adoption of the legal framework to help implementing new technologies. Supranational and local goals can only be achieved if authorities in urban and sub-urban areas implement supporting legal framework to overcome out-dated regulations and smooth the way for e-mobility and consequently a better environment.

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Figure 1: Share of new registered electric vehicles. Source: RDC inMotiv Nederland B.V., Opplysningsrådet for Veitrafikken AS, Statistics Austria. Calculation by Austrian Mobile Power, 2013.

Figure 2: Anticipated e-charging station distribution. Source: Austrian Mobile Power, 2014.

reviewed paper

Building Inclusive Smart Sustainable Cities through Virtual Environment

Sandeep Kumar Raut, Papiya Bandyopadhyay Raut

(Dr. Sandeep Kumar Raut, Town and Country Planning Organisation, E – Block, Vikas Bhawan, I.P. Estate, New Delhi-110002, dr.sandeepraut@gmail.com)

(Papiya Bandyopadhyay Raut, School of Planning and Architecture, 4, Block-B, I.P. Estate, New Delhi-110002, papiyabraut@gmail.com)

1 ABSTRACT

During the last century Urban Population of India has increased from 27 million to 270 million (2001) and now it has reached to 410 million people. By 2050 it is estimated that 814 million person will be living in Indian cities, which will share about 50 percent of the total population of India. Moreover, the share of slum population living in cites is about 21 percent which in absolute term is 90 million persons. If urban population is compared with urban internet user's population, it is estimated to be about 160 million in June, 2014. Thus, only 39 percent of urban population has access to internet facilities; thought the users are growing at a rate of 47 percent in urban areas and more surprisingly 58 percent in rural areas. The present paper addresses the issue of access of internet or Web 2.0 technologies by economically weaker section of urban community for effective representation of public participation in the process of plan preparation and execution.

As now in India, with the taking over of BJP Government under the leadership of Honorable Prime Minister Shir Narendra Modi, planning for 100 smart cities by 2022 is the prime agenda for Urban Development. In this context the present paper examines the complexities of development and planning decision that are embedded in the process for establishing a smart city. No doubt Web 2.0 technologies in the cybernetic age is the fastest way to access, collect, analyze and transfer spatial information and providing innovative, sustainable, participatory solutions for effective government and community empowerment. However, due to the technological complexity, high cost, literacy levels, societal awareness and access to the technology create a social divide, more especially for low income group. Hence, the present paper answers the question that how society democratically and effectively access to Web 2.0 technologies for spatial information and translate the virtually tested, analyzed design in the real world. In overall, the paper tries to frame a concept in order to implement Web 2.0 technologies as a tool for building inclusive, smart and sustainable cites in India.

2 INTRODUCTION

The information and Web 2.0 technologies have revolutionalized the way we live today. Infact these technologies have changed human behavior and the way we live, work, play and travel. Twenty first century witnesses new life style and demand for more transparent world in terms of governance and decision making. Moreover rising complex urban problems have made urban and regional planners and urban managers to analysis or simulate real world into the virtual world. Complex urban realities in India now forced planner to transfer professional intelligent to find innovative solutions and developing new policies, strategies, participatory rapid appraisal for spatial data collection, analyzing, finding low cost traditional technologies for providing basic services, generation of spatial plan for sustainable and progressive society. Thus in order to have inclusive, smart, sustainable spatial planning, town planners in Indian need to adopt innovative ideas for public participation by taking the help of GIS and Web 2.0 technologies. Today whole world is also driven by fast changing information and digital technologies on the one hand and reducing cost on the other.

As far as urbanization is concerned, during the last century urban population of India has increased from 27 million to 270 million (2001) and now it has reached to 410 million people. By 2050 it is estimated that 814 million person will be living in Indian cities, which will share about 50 percent of the total population of India. Moreover, the share of slum population living in cites is about 21 percent which in absolute term is 90 million persons. If urban population is compared with urban internet user's population, it is estimated to be about 160 million in June, 2014. Thus, only 39 percent of urban population has access to internet facilities; though the users are growing at a rate of 47 percent in urban areas and more surprisingly 58 percent in rural areas. The present paper addresses the issue of access of internet or Web 2.0 technologies by economically weaker section of urban community for effective representation of public participation in the process of plan preparation and execution.

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As now in India, with the taking over of BJP Government under the leadership of Honorable Prime Minister Shir Narendra Modi, planning for 100 smart cities by 2022 is the prime agenda for Urban Development. In this context the present paper examines the complexities of development and planning decision that are embedded in the process for establishing a smart city. No doubt Web 2.0 technologies in the cybernetic age is the fastest way to access, collect, analyze and transfer spatial information and providing innovative, sustainable, participatory solutions for effective government and community empowerment. However, due to the technological complexity, high cost, literacy levels, societal awareness and access to the technology create a social divide, more especially for low income group. Hence, the present paper answers the question that how society democratically and effectively access to Web 2.0 technologies for spatial information and translate the virtually tested, analyzed design in the real world. In overall, the paper tries to frame a concept in order to implement Web 2.0 technologies as a tool for building inclusive, smart and sustainable cites in India.

3 NATIONAL URBAN INFORMATION SYSTEM

India due to its diversity in climate, culture, physiography and urban transition translates into different system, of urban settlement in different regions. Even cities and towns in the same region often show very dissimilar outcomes in the extent and nature of poverty; in the patterns and growth rate of investment and employment; in the spatial dispersion and sprawl of residential and commercial areas; and in environmental quality and cultural amenities. Opening up of the Indian Economy has made India cities more vibrant and progressive and act as a centers of employment. However, with increasing rate of slums, crime and converting green field into concrete jungle, Government of India launches NUIS Scheme for generation of digital base with the help of Remote Sensing, GPS, GPR and GIS technologies. Hence, infact JnNURM Scheme also has mandatory reform to convert all land record data into digital spatial data through GIS software.

In India gradually the professional demand is also rising to promote GIS or Web based master plane or zonal plan. National Urban Information System (NUIS) Scheme of Town and Country Planning Organization, Ministry of Urban Development during the last decade had paved the way to tread common ground for generation of digital spatial database. Moreover, under NUIS Scheme GIS applications are used to customize packages to generate outputs for urban planning and management. Capacity building has also been inbuilt in the NUIS Scheme with the view to expose decision makers, supervisory staff and operators to the whole range of issues dealing with spatial and attribute data. The underlying notion is that planning and decision support is required to be based on accurate database with provision for periodic updating and develop skills of town planners to tackle real world problems in virtual environment. As a result about 30 training programmes were organised and 600 town planners/ urban managers were trained and 141 towns digital data based were prepared which led to the foundation for building smart cities through virtual environment. In this context, information and Web 2.0 technologies will play an important role for analyzing complex spatial problems and taking appropriate decision for implementation of inclusive smart sustainable cities. Capacity Building programme for everchanging information and Web 2.0 technologies should be in-built in the NUIS scheme so that the local knowledge and experience will be transferred into an information base. Hence with the help of Web 2.0 technologies, like twitter and Mashup, local urban knowledge will act as a current infromation resource. This will enhance the vision of urban mangers and town planners and help to act innovatively, efficiently on higher capacity.

Implication for promotion of NUIS Scheme had resulted into change of strategies for development of spatial plan in GIS platform by Local Government and Development Authorities. In fact Jawaharlal Nehru Urban Renewal Mission (JnNURM) Scheme also has mandatory reform to convert all land record into digital format through GIS software. In order to have effective, smart and acceptable planning solution through public participation, Delhi Local Government floated a tender for preparation of Local Area Plan (LAP), with the help of modern state of art technologies. To it surprise Local Government has realizing that Web 2.0 technologies are much more effective and low cost or free, for gathering public information and suggestions for preparation of any spatial plan, right from Regional planning to Local Planning Area plans. However, due to caste, social taboo, illiteracy, non excess to the technology and low level of spatial/ map understanding, the public participation in planning process is low or negligible for low income group or lower class of urban community. Moreover, cost, complexity and limited access to GIS or Web 2.0

technologies, frequent transfer of skilled staff, lack of digital map and attribute data, absence of support for innovative practices have made even professional town planner limited in its approach to use Web 2.0 technologies.

4 WEB TECHNOLOGIES FOR URBAN AND REGIONAL PLANNING

In Urban and Regional Planning profession or during the preparation of Comprehensive Development Plan and Master/ Zonal Plan, community participation is an asset for preparing constraints and issues, mapping and also to identify what, in their opinion, are the special characteristics of their community. With the help of web technologies adding these comments directly onto a digital map makes it easier to share those ideas with others experts and import them into other programs for further analysis like GIS. Five years ago, this was a challenging task, since we had to spend a considerable amount of time customizing mapping programs to collect comments. Today, we use tools like Google's maps, Yahoo maps, Wikimaps etc, to quickly set up a map that everybody can access and add comments to.

With GPS enabled tablet PC's or phones, people may add comments, photos, and even video to a map or photo gallery with the geo-location embedded in the information. Using this all comments show up instantly in a common space for others to see and respond. Push technology, can be used to keep people constantly but unobtrusively aware and remain engaged in discussions. Thus, the new concept of 'Mashups' is emerging in Urban and Regional Planning through Virtual technology.

5 CONCEPT OF MASHUPS

Making Web as more interactive, user-friendly and which suits needs are actively emerging as Web 2.0, the new internet is increasingly dominated by the user. The concept of Web 2.0 allowing users to submit content, modify and add to open source software, and create new services and features using existing structures. One of the most common outcomes of the Web 2.0 philosophy and structure is a mashup. A mashup is a web application that combines data from more than one source into one integrated tool. These mashups are created by internet users, for internet users. GoogleMap's, Map my India and Wikimap are very popular sites that may be quickly incorporated into mashups. There are over 1500 Google Maps mashups in existence, allowing users to calculate electoral votes spatially, rate restaurants, map out their running routes, and even plot celebrities' homes on a map or share stories. The potential utility for Google Maps mashups in Urban and Regional Planning is enormous. User submitted information can make the job of planners much easier. In particular since communities are often competing for new residents based on the quality of life they offer, mashups are a very useful tool for both planning and economic development . Communities looking to support local businesses, highlight aspects of community character, or advertise local festivals all can find a Google Map's mashup to help them do so.

For example morning walk communities that are planning to find better place or route is a more advanced mashup for good health, better environment and sustainable city research, which helps a particular community to plan routes using a variety of criteria such as distance, elevation change, air quality, and amount of vegetation. This type of mashup, can also calculates calories burned and index of good health better working performance. This mashup could contribute to increasing morning walker safety. Planning offices could provide this service using base GIS data and let citizens add useful information, such as green areas needed for better health, the location of yoga centres, or particularly scenic or safe routes. As the internet moves ever more toward user generated content and functionality, planners have a tremendous opportunity to take advantage of community knowledge especially through spatially oriented mashups. Such Mashups can be used to maintain power and water supply, efficient traffic and transportation system, safer cycling route, safer school cab route, efficient management of other services for the community etc.

It is only evident that adoption of virtual technology will rapidly transform the Urban and Regional Planning education and profession and fundamentally change the way planners design for future smart and sustainable human habitat. Hence, smart way of planing sustainable cities is to use Mashups as one of the Web 2.0 technology option. However, how to make Web 2.0 technolgy inclusive is a big question?

6 ESTABLISH INCLUSIVE WEB 2.0 TECHNOLOGIES AT LOCAL LEVEL.

Proliferation in the use of the Internet in India is very much on cards. That means, global accessibility to the data stored on the website independent of physical location is possible. The planning process can, therefore,

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be made more participative and interactive in nature. Anyone can view the planning proposals and the maps when ported on the website of the planning authority and register suggestions and objections, even on-line. Downloading of permission forms can also be facilitated through the web site of a planning authority. Dissemination of information and delivery of certain services to the citizens can thus be simplified and expedited with the help of Web 2.0 technologies.

Other than traditional way of involving people by organizing ‘public participation workshop’ a community base local Neighborhood Digital Technology Center (NDTC) should be established for

(a) provide access to GIS and Web 2.0 technology;

(b) provide information for other related information generation agencies;

(c) Store public information and database.

(d) Analyze public information and feed to the main City Digital Technology Center (CDTC).

(e) May influence decision making and participatory planning processes.

These NDTC should be managed ‘by the people’; provide information to planning authorities ‘for the people’; and information generated ‘from the people’. NDTC should be accessed by any local community and thereby giving the people empowerment and direct accesse to digital spatial data system. Other than NDTC, ward wise community base local neighborhood group (NG) should be identified for provide training and access in GIS and Web 2.0 technologies especially in poor and slum areas for inclusive public participation. Thus this is the answer to digital divide and reducing the gap between planning professionals and local public.

Supportive infrastructure and services should be developed in a systematic manner so that GIS and Web 2.0 technology should be available in the remotest part of the country. The present level of IT services and facilities by (National Informatics Centre) NIC are inadequate to reach the digital technological services to the common man. Besides availability of digital technological services its affordability and access is also important. The communication and networking infrastructure need to be established, preferably introducing newer and low cost technologies for easy access to the remotest corner of the country.

Town and Country Planning Organization under the Ministry of Urban Development should identify certain smart citizen oriented services for use of digital information generation so that its benefit reaches to the lower section of the urban community. This would call for sustainability of good quality of Web 2.0 services to citizens for e-governance of the Town Planning organizations and departments which should be fully computerized for delivery of public services and internal functioning of the office. The planning and building permission, change of land-use cases, and implementation of Master Plans are some of the areas which need to be managed by GIS and Web 2.0 software for easy access to the masses.

GIS and Web 2.0 technologies education and training and its application for public awareness is another important issues which will act as a foundation for the growth/ success of Web 2.0 technologies. The School of Planning and Architecture (SPA) should take a lead role to facilitate IT and Web 2.0 technologies education to foster budding planner for smart understanding of Web 2.0 technologies. The existing planning professional should be given short training to become technology savvy. One of the most important area is software development, hence Entrepreneur GIS and customized Web 2.0 technologies for planning application and tools should be developed. These softwares need to be simple, user friendly and affordable. For Web 2.0 technologies Promotional Group professional organization (like TCPO) and educational institutions (like SPA) should be integrated to maximize the output and professional satisfactions.

An awareness programmes to make Web 2.0 technology based planning and public participation software, as a mass movement need to be worked out by encouraging value added network services in the form of ‘Telematic Kiosks/ window for ‘One window and Non Stop’ series for the urban community. These programme and training should be in local or regional languages in order to have easy understanding and social acceptability.

7 CONCLUSION

Biggest advantages of Web 2.0 technology is to have direct and immediate access to information by town Planning professional and urban manager to take sustainable decision base on opinion of all levels of urban community. Moreover establishment of NDTC will give local urban community free hand to tailored or customized Web 2.0 software as per their need and requirement and generate or manipulate their own information or spatial data rather than given answer or raised query to the predefined proposed land-use map. Hence, GIS and Web 2.0 technology is an inclusive, smart and sustainable way to build our cities. In short all those impediments in the way to establish Web 2.0 technologies application need to be removed so that it is available economically, interactively, in limitless capacity and round the clock. But success of implementation of Web 2.0 technologies will only depend how effectively capacity built within the urban communities. As Toppeta rightly said, 'smartness means a combination of ICT and Web 2.0 technology to find out innovative solutions and improve sustainability and livability'.

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This section (pp. 111-120) was removed due to cancellation of the author’s conference participation.

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reviewed paper

Can Planning Solutions be Evaluated without Insight into the Process of their Creation?

Marija Maruna

(Assistant Professor Marija Maruna, Faculty of Architecture University of Belgrade, Bul. Kralja Aleksandra 73/2, Belgrade, Serbia, m.ma@sezampro.rs)

1 ABSTRACT

The paper focuses on an analysis of the political project of Belgrade Waterfront as a drastic case of usurpation of formal planning procedures and the role of experts in the creation of planning solutions. As a campaign tool of the ruling political party, this project has evolved into an urban plan of national importance, and substantial modifications to the existing planning system in Serbia have been made to allow it to be achieved. In a completely non-transparent manner, and without professional involvement, changes have been made to the legal framework, system planning hierarchy, competences for planning decision-making, as well as to planning constraints for the site in question. Notwithstanding all these issues, there was no broad-based reaction by experts.

The primary objective of this study is to analyse the tone of day-to-day media reporting so as to determine the main stakeholders and how they speak about the project, and, having recognised these interests and power distribution, identify the real views of the profession about the project. Emphasis is placed on discovering the cause behind the lack of response by the profession, in particular in the context in which the planning system operates. Results of this research should indicate the main problems facing the system and, consequently, produce guidelines for its improvement.

2 INTRODUCTION

Serbia's political transition after 2000, development of democratic governance, shift to a market economy, and orientation towards moving the Serbian society into European and broader global integrations, have all transformed the framework within which planning and spatial development systems operate. The new social and economic order has altered both the concept of spatial intervention and professional approaches to spatial and urban planning. Yet there has been no fundamental change in the practice of planning and spatial development – because there has been no fundamental change towards either establishing a market economy or instituting democratic decision-making procedures that are of importance for spatial development. The differences between the state, power, society and the public sector in Serbia have been perceived but have not been defined in a corresponding manner in the sense of operationalisation in relation to the concrete issues and the tasks being of particular significance for planning (Lazarevic Bajec 2009, 86). The socialist-era comprehensive planning system that remains in effect in Serbia does not recognise the legitimacy of a plurality of interests and the open market.

Serbia's transition has left spatial development in a state of confusion with which the profession has been unable to cope, causing, in the end, a mismatch between spatial development documents and the needs of urban development. Many authors agree that the current planning practice in Serbia is obsolete and that planning documents are inflexible and inefficient with regard to current development needs (Lazarević Bajec, 2007; Lazarević Bajec, 2009; Vujošević & Nedović Budić, 2006; Vujošević, 2004). One of the reasons for this state of affairs is the lack of true communication between planners and decision-makers, manifested through the absence of a communications platform that would inform decision-making about spatial development as a framework for modern planning. Post-socialist transition countries are characterised by neglect of planning and ad hoc decisions at the local government level that reject long-term strategic visions of urban development. On the other hand, professionals do not co-operate with decision-makers at the strategic level. In practice, the traditional planning system has survived, and is dominated by a focus on narrowly technical matters and lack of integrity on the part of planning professionals with regard to demands posed by politicians and/or investors (Petrovic, 2009). On the other hand, the spatial development decision-making process is opaque and limited to a narrow circle of stakeholders. The problems that this state of affairs creates are made even more pronounced in times of economic crisis.

The problem is compounded by the traditional training of urban planners, which takes place within the framework of studies of architecture, formally a technical science, and where professional licences are acquired under the supervision of engineering associations. This means that urban planning practice is traditionally rooted in technical disciplines and oriented towards engineering skills, and does not recognise the need to incorporate knowledge from the humanities. Planners are consequently left unable to understand the complexity of the altered socio-economic framework, which requires democratic analysis and market-oriented action, as well as how these changes have affected the role of the planning profession. Although experts used to enjoy a monopoly on setting development priorities, their position is undermined as day-to-day development decisions are made elsewhere. The establishment of democratic planning in a post-socialist transition environment has radically changed views of justification for planning actions. Public interest, for decades the source of planning legitimacy, has lost its privileged position as the sole, indisputable, ‘higher’ reason that may not be brought into question (Vujoševic & Petovar, 2006). Trained as architects, spatial development experts are not able to cope with the issues and problems imposed by the new socio-economic environment.

This critical state of affairs within the profession and practice of spatial development in Serbia has culminated in the Belgrade Waterfront project, promoted by Serbia’s new governing parties after the 2012 general election. Belgrade Waterfront was first presented in parliament during the current ruling party’s election campaign as an effort that held the promise of a brighter future for the Serbian capital. Promotional materials presented a vision of the city that offered economic recovery through a form of public-private partnership where – according to this particular vision – the city and the state stood to benefit in multiple ways. No spatial development plans or projects, no economic or other expert studies were offered in support of this vision. There were no documents, just ideas and promises.

After its landslide victory, the ruling party set about putting into effect the ideas presented in the election campaign. This was the turning point in the usurpation of the planning system, where the strategic decision was taken at the political level, bypassing any discussions within a broader platform of relevant stakeholders. A number of steps were taken thereafter that dealt severe blows to the foundations of Serbia’s planning system and brought the existence of the planning profession into question.

This paper aims at illustrating the problems faced by spatial development in Serbia, where the planning system has been usurped by political stakeholders in public administration, and the public lacks competence to cope with the complex post-socialist context Serbia has found itself in. The Belgrade Waterfront project is an extreme case in which all of these problems are manifested to their fullest extent, and, as such, constitutes an important research arena.

3 CONCEPTUAL FRAMEWORK: DECISION-MAKING ABOUT SPATIAL DEVELOPMENT POLICIES

This paper studies how decisions are made about spatial development policies in Serbia, as well as the position of the profession in the decision-making system and its competence to take part in decision-making. The value framework in which Serbia’s spatial development operates is far removed from the principles of transparency, democracy, and institutional organisation that today’s planning paradigm relies upon. In the ideal situation, establishing the transparent process of decision making is requested, the process that incorporates all interests, those which are represented in the process and those that are not and, basing the process on the accurate information which everyone has the right to review (role of the planner, the experts) (Healley and Amdam in Lazarevic Bajec, 2009,90).

Decision-making and consensus-building with regard to development policies are of crucial importance for spatial development. The conditions for effective and legitimate policy processes in the national and international system have changed fundamentally. Governance, as the key concept, means the body of rules, enforcement mechanisms and corresponding interactive processes that coordinate and bring into line the activities of the involved persons with regard to a common outcome. Good governance implies effective political institutions and the responsible use of political power and management of public resources by the state. Good governance extends beyond the public sector to include all other actors from the private sector and society; it is guided by human rights and by the principles of the rule of law and democracy, such as equal political participation for all (ODCP).

The planning paradigm has shifted across the globe, and this shift has altered the planner’s role in the planning process. In contrast to his or her earlier role – that of an independent expert, acting either in opposition to or in concert with the authorities – the planner is now an active participant in the creation of spatial development policies. The role of the planner has become key in organising this process, bringing stakeholders together, distributing information, building trust amongst the actors, articulating interests, and facilitating stakeholder dialogue. This new role of the profession requires a different understanding of the planning process, and, as such, new skills and knowledge that go beyond engineering.

Planners are expected to take part in the entire spatial development policy-making process and work with a broad range of stakeholders. Given this decision-making framework, experts are the only persons able to take stock of development vision in a complex and holistic manner; support the collection and preparation of arguments and support for the development interests of participants in this process; and, finally, experts alone can view the different interests through the lens of spatial planning solutions and recognise likely outcomes (Healey, 1991; Alexander, 1992).

4 DESCRIPTION OF METHODOLOGY AND UNITS OF ANALYSIS

This paper focuses on uncovering the reasons behind the lack of an appropriate response by the professional public to the Belgrade Waterfront project. Although this project has quite evidently usurped the entire planning system, there has been no major resistance on the part of architects and planners. As reasons for the absence a professional reaction are not immediately obvious, the method of discourse analysis was chosen to investigate the background to this phenomenon. This approach allows hidden meanings of a particular phenomenon to be uncovered (Skillington, 1998).

Discourse analysis is a qualitative form of research that aims at explaining a particular form of behaviour in greater detail, and at answering the question of ‘why’. Discourse analysis assumes that a phenomenon/discourse can be understood only if the context in which it arises in clarified. There are no neutral discourses; every discourse entails a set of meanings and values. This means that the discourse concept carries a value component within itself. Discourse analysis attempts to unmask the power relationships in a society (Van Dijk, 1993), and its ultimate objective is social criticism.

The message that is relayed in a discourse is crucial to discourse analysis. This study therefore aims at studying the statements of various actors involved with the Belgrade Waterfront project and the reactions of the professional public. Their narratives – their versions of events – are self-serving, and as such reveal the respective value systems they support. The examination of actors’ statements was not restricted to commenting on the content, but also entailed analysing the structure, form, and organisation of the published texts.

This study analysed the key statements made by the relevant stakeholders – selected as units of analysis – between April 2012, when Belgrade Waterfront was first presented, and late 2014, which saw the adoption of the planning document formally allowing the project to go ahead. All actors who showed an interest in the project or readiness to talk about it were identified as relevant stakeholders. News items published in reputable media, such as Politika, Danas and Blic daily newspapers, the B92 broadcast and online media group, etc. were taken into consideration. The choice of media was seen as particularly important for research methodology, since there is broad consensus that media freedoms in Serbia are being restricted by the governing political party. The selection of media outlets reflects the value framework they promote, which is of exceptional importance for the application of the discourse analysis method.

5 PRESENTATION OF RESEARCH RESULTS

Research results are presented in the form of a table (Table 1). Statements – units of analysis – made by relevant actors (politicians, experts, investors, etc.) are shown in isolation. These statements are complemented by information about the interests each stakeholder stands for; key parts of statements that indicate each stakeholder’s value orientation are given emphasis in the text. The table also contains the date each statement was made, media outlet where it was published, and title of the news item in which the statement was carried, which also holds a value component. The statements were taken verbatim from the news items and are arranged in chronological order to ensure greater clarity.

DATE, MEDIA OUTLET, TITLE	BELGRADE WATERFRONT STAKEKOLDER STAKEHOLDER STATEMENT
12.04.2012, Vesti SNS [*SNS News Bulletin*] ***Beograd na vodi kao***	**Aleksandar Vučić, at the time standing for election as Mayor of Belgrade on behalf of the Serbian Progressive Party (SNS)** ‘The Belgrade Waterfront project will attract investors, generate employment, give

svetska metropola **['Belgrade Waterfront as global metropolis']**	Belgraders jobs, and reveal the fairer side of our city… The project was developed by a top-flight Swiss company, and today we will attempt to reveal something that has for decades been nothing but a dream for Belgrade, something no-one even had a concept for, let alone a project. We have developed a complete project and we will show it to you, we will show you a film of it… I think this is absolutely one of the largest projects that Belgrade and Serbia can have… we have secured investor support, I will of course tell you all about it, there will be tenders for everything, but what I can tell you in advance is that many people are interested in paying for this project to go ahead… We will do our part of the work in terms of providing land for construction and infrastructure, but everything else will be up to the investor. The investor will pay, because it will make money, and Belgrade will profit from what they have paid.'
12.04.2012, Vesti SNS [*SNS News Bulletin*] ***Beograd na vodi kao svetska metropola*** **['Belgrade Waterfront as global metropolis']**	**Jasmina Kojić, architect, at the project's presentation organised by the SNS** 'Let me underline that this entire project complies with amendments to the Master Urban Plan, which means that it also complies with the Master Zoning Plan.'
01.08.2013, Blic ***Đilas: „Beograd na vodi" i metro promeniće sliku grada*** **['Đilas: Belgrade Waterfront and metro to redefine city']**	**Dragan Đilas, Mayor of Belgrade** 'I believe that if national and city authorities co-operate on the metro project and this project we can do something that is truly good for all Belgraders.'
01.08.2013, Blic ***Vučić i Đilas do kraja nedelje o „Beogradu na vodi"*** **[Vučić and Đilas to talk Belgrade Waterfront by end of week]**	**Aleksandar Jovičić, head of SNS councillors' group in Belgrade's local parliament** 'What is important is that we, as the opposition party in the capital, will not give up on modernising Belgrade; rather, we would like to offer contacts with both United Arab Emirates and other global investors, since the Serbian Government – with the SNS at its centre – has opened the country up to all partners throughout the world, and we want to use this potential.'
13.08.2013, Blic ***Bijelić: „Beograd na vodi" ne može bez podrške države i evropskih fondova*** **[Bijelić: Belgrade Waterfront requires support from national government, EU funds]**	**Aleksandar Bijelić, head of the Democratic Party's Infrastructure Committee** 'Belgrade Waterfront is definitely one of the largest projects in the city, besides the metro, that cannot be completed without support from the national government and EU funds.'
20. 08. 2013, Blic ***Ljubitelji železnice protiv izmeštanja pruge uz Savu*** **[Railway enthusiasts protest removal of Sava railway tracks]**	**Karlo Polak, transportation engineer, head of the Railway Enthusiasts Association** 'At a time when Bratislava and London are investing vast sums in bringing railways closer to the centres of their cities, Belgrade is doing the opposite by planning to dismantle an existing railway line running through the very core of the city.'
20.10.2013, Belgrade Chamber of Commerce ***„Beograd na vodi" za 6 do 8 godina*** **[Belgrade Waterfront to be complete in six to eight years]**	**Srđan Rupar, enginner and planner, Belgrade Waterfront project manager** 'A team of some 20 people has been formed that has been working to develop the project, title issues have been cleared up, title deeds for more than 400 cadastral lots have been obtained, and approvals have been received from all 19 public enterprises at both national and city level for existing infrastructure to be relocated.'
25.12.2013, Blic **Čović: Tražimo investitora za Beograd na void** **[Čović: Investor sought for Belgrade**	**Nebojša Čović, member of Belgrade caretaker administration** 'You do not have to borrow to finance such investment, you can find an investor with an interest to embark on a major project such as Belgrade Waterfront. We have no intention of borrowing to build it, we are seeking partnerships for this investment cycle… As a project of national importance, Belgrade Waterfront will be prioritised and the time-consuming procedures we face in Belgrade can be shortened.'

Waterfront]	
24.12.2013, Politika **Emirati finansiraju tržni centar „Beograda na vodi“** **[UAE to fund Belgrade Waterfront shopping mall]**	**Aleksandar Karlovčan, Belgrade Waterfront project co-ordinator and member of SNS Governing Board** ‘The 66 million euros will come from the 2014 national budget through the Ministry of Transportation. We will attempt to get money from the United Arab Emirates not just for construction works in the Sava Amphitheatre, which have been valued at some 3.1 billion dollars, but also for clearing the site… We are certain we have an investor from the UAE for the shopping mall. We have been working with a team of their urban planners to develop the master plan for the area… There are two possible models of financing construction. Either the Emirates investor will buy up lot after lot and pay the required infrastructure development charges, or they will get the lots free of charge and build, whilst Serbia will receive one-third… There will be no public competition, but we will include all relevant institutions in the project, such as the Faculties of Architecture and Civil Engineering, the Chamber of Engineers, and other professional organisations.’
09.01.2014, Blic ***Vučić: Al Abar u Beograd na vodi ulaže 3,1 milijardu dolara*** **[Vučić: Alabbar to invest USD 3.1bn in Belgrade Waterfront]**	**Aleksandar Vučić, First Deputy Prime Minister** ‘[Alabbar’s] <u>concept</u> calls for <u>us to clear the site</u>: that should be the only requirement for Serbia. He will provide 3.1 billion dollars to build everything. Then we have to see how we will collect the proceeds from the sale once everything is complete. This will change everything.’
09.01.2014, Novosti ***„Beograd na vodi“:Za početak hotel i šoping mol*** **[Belgrade Waterfront to start with hotel and shopping mall]**	**Srđan Rupar, Belgrade Waterfront project manager** Serbian Railways <u>have been ordered</u> to start dismantling railway tracks along the Sava riverbank as early as June. Once this work is done, infrastructure construction will begin on part of the Phase One, which involves <u>building the largest shopping mall in this part of Europe</u> and a luxury hotel.’
09.01.2014, Novosti ***„Beograd na vodi“:Za početak hotel i šoping mol*** **[Belgrade Waterfront to start with hotel and shopping mall]**	**Aleksandar Karlovčan, Belgrade Waterfront project co-ordinator and member of SNS Governing Board** ‘The <u>planning documents will be flexible</u>… As <u>we in the SNS Governing Board have promised</u>, <u>draft planning documents</u> will be complete by late January and presented for public discussion in February.’
17.01.2014, Blic **Vučić: Uz „Beograd na vodi“ Srbija sigurno izlazi iz krize** **[Vučić claims Belgrade Waterfront is Serbia’s way out of crisis]**	**Aleksandar Vučić, First Deputy Prime Minister** ‘If we succeed, and we will do our best [to build Belgrade Waterfront], and we will succeed because we have raised the bar so high, I am absolutely certain this will mean the construction industry will recover from the crisis… <u>this means that our country is sure to recover from the crisis</u>.’
18.01.2014, Blic **Al Abar predstavio Vučiću projekat „Beograd na vodi“: Arapi grade apartmane, hotele, molove, operu** **[Alabbar presents Belgrade Waterfront project to Vučić: Arabs to build hotels, apartments, shopping malls, opera]**	**Eagle Hills, official press release** ‘The project will be built thanks to the <u>strong bilateral relations between the UAE and Serbia</u>, that have improved in particular following the recent visit to Belgrade of Crown Prince Sheikh Mohammed bin Zayed al Nahyan.’
19.01.2014, Blic **Stefanović: „Beograd na vodi“ budućnost za grad i Beograđane** **[Stefanović: Belgrade**	**Nebojša Stefanović, Speaker of the Serbian Parliament and SNS Vice-President** ‘We have shown that <u>we are able to think in strategic terms</u> and that we are able to attract investors who will bring in money, rather than waiting for some pittance to come from the national budget as a gift.’

Waterfront means future for city and residents of Belgrade]	
20.01.2014, Blic ***Predsednik Udruženja arhitekata: Raspisati konkurs za projekat „Beograd na vodi“*** **[Head of architects' association wants competition for Belgrade Waterfront]**	**Igor Marić, President of the Serbian Architects' Association** 'The design for developing the part of Belgrade along the Sava waterfront should be chosen in an international competition, rather than having this large-scale Belgrade Waterfront project built in an ad hoc manner… The Serbian Architects' Association welcomes any initiative to develop this neighbourhood, but a comprehensive, thorough plan needs to be prepared and the broader public and professionals should be involved in the development of this Belgrade on the Sava.'
20.01.2014, Blic **Vučić o „Beogradu na vodi“: Posao će biti završen [Vučić talks Belgrade Waterfront: Job will get done]**	**Aleksandar Vučić, First Deputy Prime Minister** 'We will abide by statutory procedures and adopt everything required by law, but one must respect other people's money. If you think we can join Europe and joke about other people's money in the process, that our cleverness is more important than someone's three billion dollars, I have got to ask you where do you think we are living.'
20.01.2014, Blic ***Transparentnost Srbija: Da li je za „Beograd na vodi“ isključena konkurencija?*** **[Transparency Serbia: Is competition excluded from Belrgrade Waterfront?]**	**Transparency Serbia, official press release** 'In the future, when a potential investor presents a project that calls for a joint venture where the state or city provides land, and the investor puts up the funding, will this offer be taken up, or will investors be treated selectively? What is the legal basis of this joint venture, is it a public-private partnership, and if so has the Public-Private Partnerships Commission reviewed it as envisaged under the 2011 law?'
20.01.2014, Blic ***Nikodijević: Prva faza projekta „Beograd na vodi“ u septembru*** **[Nikodijević claims first stage of Belgrade Waterfront project will start in September]**	**Nikola Nikodijević, member of Belgrade caretaker administration** 'When it comes to title issues, 95 percent of all of this land is completely clear in that regard because it is state-owned, or, rather, held by Serbian Railways, whilst compulsory purchase of the remaining land will be facilitated by the enactment of legislation to declare the project a matter of national importance.'
01.03.2014, Blic ***U Dubaiju predstavljanje, u Kanu premijera „Beograda na vodi“*** **[Belgrade Waterfront to be presented in Dubai, premiered at Cannes]**	**Siniša Mali, economy advisor to First Deputy Prime Minister** 'Tomorrow is the most important day in the development of Belgrade Waterfront to date. This is a key day because after that we can start preparing urban plans and all other planning documents needed to implement the project… The final presentation of the project's master plan will be made by Mohammad Alabbar, the author of the project.'
11.03.2014, Blic ***Počela obnova Beogradske zadruge*** **[Renovation works start on Belgrade Savings Bank building]**	**Goran Vesić, secretary of the Belgrade caretaker administration** 'This is a momentous day. We are beginning renovation work on the Belgrade Savings Bank building at a time when the Belgrade Waterfront project is having its premiere at Cannes, at the world's largest real estate fair.'
26.06.2014, Danas ***Čemu služi Beograd na vodi*** **[What is Belgrade Waterfront for]**	**Ivan Rašković, Belgrade Architects' Society** 'The aim of this project is fantastic, but the way it is being pursued is terrible… The whole affair is being handled without a public competition. All regulations enacted in recent months only serve to create a legal framework that will allow the investor to turn a profit.'
27.06.2014, Blic ***OTKRIVENA MAKETA Ovo je „Beograd na vodi“*** **[Belgrade Waterfront model presented]**	**Aleksandar Vučić, Prime Minister** 'This building is more than a model, take a look around, it looks like a museum piece. This building has changed the whole appearance of Karadjordjeva Street, and our plan is to change this part of the city and to make the face of Serbia as beautiful and as clean as this building.'

27.06.2014, Politika ***Mali: Beograd na vodi istorijska šansa i za celu Srbiju*** **[Mali calls Belgrade Waterfront historic chance for all of Serbia]**	**Siniša Mali, Mayor of Belgrade** ‘Each resident of Belgrade and every Serbian citizen will here be able to see what this project will look like and find any information they may be interested in… This is how we would like to show that the city’s authorities can quickly and efficiently issue all the approvals needed and work with the investor to solve problems… This primarily refers to completing the necessary paperwork, obtaining all documents required to allow a building permit to be issued for the project.’
05.10.2014, Politika ***„Beograd na vodi“ neće biti džungla oblakodera*** **[Belgrade Waterfront will be no skyscraper jungle]**	**Nebojša Stefanović, Director of Belgrade Urban Planning Agency** ‘Vistas of the old town from New Belgrade will be affected. But we have protected the vistas from the opposite side of the Sava Amphitheatre… Belgrade Waterfront will be no skyscraper jungle… The investor was surprised to learn everything had to be publicly owned… There was no competition because that was the agreement between the politicians and the investor. This is a project of national importance… We adjusted the investor’s concept in line with our professional views, legislation, and conditions imposed by 75 city and national authorities.’
06.11.2014, Politika ***SANU iznela 22 stranice primedaba na „Beograd na vodi“*** **[Serbian Academy presents 22 pages of objections against Belgrade Waterfront]**	**Members of the Serbian Academy of Sciences and Arts Architecture and Urban Planning Committee** ‘Unless the draft spatial plan is changed, Belgrade Waterfront will remain an isolated island at the centre of the capital, difficult to get to and move through, and will cause problems with traffic in other parts of the city as well.’
15.11.2014, Politika ***Šlaufima i pesmom protiv „Beograda na vodi“*** **[Activists deploy swim rings, songs against Belgrade Waterfront]**	**Activists of the *Ne da(vi)mo Beograd* group [** ‘We will not allow public funds to be spent on private projects that create nothing but spatial segregation and traffic jams. The development, functioning, and identity of a city cannot be dictated by investors’ wishes, but rather must be based on the needs of society.’

5.1 Vision of a better future (12 April 2012 – 24 March 2014)

The ideas that would later coalesce as the Belgrade Waterfront project first emerged on 12 April 2012, in the context of the election campaign waged by a leading Serbian political party that was at the time attempting to gain power. Presented to journalists during a river cruise, the project was billed as Serbia’s greatest development plan. In addition to a short film, which was shown only to the journalists present but whose content largely went unreported, the presentation included only a description of the intended uses of the various parts of the site and physical structures, as well as the approximate location where construction would take place. Brief information about the planned areas and profits was also presented, but no professional analyses or studies were cited in support of these estimates. Although a project developed by a ‘reputable foreign firm’ was mentioned, none was presented (nor was the firm named). To emphasise the originality of this idea, it was falsely claimed that no project had ever existed for this location.[1] (Figure 1.) The project was presented as a once-in-a-lifetime opportunity that would secure the future of both the capital and the country as a whole. Yet there was less clarity as to how investment was to be attracted for this project. It was hinted that investors had been selected in advance, although procedures required a public

[1] Belgrade’s ‘descent’ on the Sava River, to an area popularly known as the Sava Amphitheatre, is a very old concept that has been cropping up in public from time to time for decades. It first made an appearance in the 1923 Master Plan for Belgrade, authored by the architect Đorđe Kovaljevski. Some years later, in 1929, another architect, Nikola Dobrović, recognised the potential of the Sava Amphitheatre’s location in his design for the Terazije Terrace, developing these ideas further in his 1948 outline urban plan. The same ideas appear again in the 1972 Urban Master Plan for Belgrade, where they are part of a study for the development of Belgrade’s central core. The exclusive nature of the riverfront location was re-affirmed in the 1984 amendments to the urban plan, which made it possible to hold a major international competition, in 1986, where authors were invited to submit projects for this area of the city. In the early 1990s the Serbian Academy of Sciences and Arts also held an internal competition for designs for this location, under the motto ‘Third Millennium’. A concept entitled ‘Europolis’ was promoted during the 1995 election campaign. Finally, the 2003 Master Plan provided a platform for the development of commercial facilities and other amenities appropriate to the core of the city in the Sava Amphitheatre. In 2006, a concept was developed under the title of ‘Waterfront Town’, which one Belgrade municipality exhibited at the Venice Architecture Biennale.

competition for projects of such magnitude. Although this statement was later retracted, the contradiction was never fully cleared up. In addition, the role of the state in the project remained vague, in particular in terms of its financial commitments in constructing infrastructure at the site before construction could begin in earnest.

Figure 1. Site location of the project "Belgrade Waterfront"

Interestingly, when Belgrade Waterfront was first unveiled, an architect was on hand to claim, on behalf of the political party presenting the scheme, that the project was in compliance with existing planning documents. This statement showed a starting level of ignorance of the actual state of affairs and the content of planning documents.

Apart from the absence of basic planning documentation, many issues remained obscure after this first presentation, of which two were key: how would strategic documents pertaining to the spatial development of this major urban area be adopted – what would be the roles of the various stakeholders, in particular of planning experts; and, what expenses taxpayers would face.

After the election campaign ended, Belgrade Waterfront came to prominence again only in August 2013, when this issue was raised by the then-mayor of the city. The political party that had promoted Belgrade Waterfront had in the meantime come to power at the national level, whilst Belgrade was still controlled by the opposition. New coalitions were emerging and positions were being consolidated following dramatic changes to the political landscape that followed the 2012 general election. The governing party at the central level launched an all-out campaign to gain power in Belgrade, which the opposition countered by voicing doubts about the financial arrangements for Belgrade Waterfront. The project was becoming a key point of contention between the opposing political forces: the more acrimonious the conflict grew, the more criticism was levelled at the concept. When the party in government not long afterwards finally managed to appoint a caretaker administration to lead the city, it began a massive promotion effort for Belgrade Waterfront. As this political party consolidated its hold on the city, its officials started voicing clearer views about their party's intention to establish direct partnerships between the public sector and investors, as well as to amend planning and construction legislation. It was at this time that the United Arab Emirates investment was first mooted.

The profession's initial reaction came from experts in tangential areas who used non-governmental organisations as platforms to express their concerns about technical issues facing the project. However, the first major public appearance by experts tasked with implementing the project was made on behalf of an institution whose form was not entirely clear, a group of some twenty people headed by an individual hitherto unknown to any spatial development authority. The statements made on this occasion and actions undertaken by this group were directly opposed to formal planning and decision-making procedures. To this day it is not known who exactly established this institution that represented the project, what its competences were, and what its relationship was with the formal spatial development management system.

In early 2014 the investor for Belgrade Waterfront first became known. It was clearly stated that the government would partner directly with an investor, which the state believed – given the scale of the investment – was entitled to make demands and participate in the development of the project. Some experts from the informal project implementation team began providing more specific information as to the model of the economic relationship between the state and the investor, construction timeframe, and existing and possible professionals who could serve as future partners in the development of the project. However, no serious analysis of the financial commitments this type of agreement entailed were forthcoming; moreover, the actual form of the public-private partnership agreement remained unknown. From a procedural perspective, it was clear that strategic decision-making involved only the ruling political party and one investor. Two facts also became apparent: firstly, that the project was being managed informally by the governing party, bypassing official spatial development institutions and with disregard for statutory procedures; and, secondly, that the investor was making decisions about the spatial development of the site with no interference and according to its own interests. Project documents were drafted by a group established by the governing party without due consideration for procedures mandated by law. This caused the virtual abolishment of the planning function (in its capacity as manager and controller of spatial development), and defeated the purpose of public spatial intervention. This state of affairs was made particularly apparent when the foreign investor brought in a finished project – in the form of computer renderings – from abroad and presented it to the governing party's leadership.

In time, the idea of institutionalising the project gained traction. The first step in this direction was to formalise the project implementation team as a public enterprise of sorts. In parallel with this, it was also suggested that Belgrade Waterfront would be declared a project of national importance. This re-affirmed the relationship with the decision-making process, which was taking place inside a strictly controlled party political organisation and without any collaboration with government authorities. It was clear that options were being sought to bypass statutory procedures, which was initially achieved by co-ordination between bodies tasked with clearing the site in preparation for construction.

It was at this time that the profession's voice was first heard: the president of the national association of architects came forward to claim that Serbian professionals were being unfairly excluded from the project. However, these objections related only to the government's disregard for the profession's views about the project, and not the actual strategic decision-making procedure. The profession, as it transpired, failed to understand that strategic decision-making in spatial planning should be a collaborative process, as practised in democratic societies, but rather saw itself as the sole authority with competence for making such decisions.

In addition to the architects' association, a reputable non-governmental organisation that deals with transparency in decision-making spoke out against the legal basis for the project, citing multiple issues with its institutional arrangements that the public was not acquainted with. This NGO also underlined the importance of safeguarding public interest and compliance with planning and construction legislation. (Figure 2.)

It is important to note that the planning system in force at the time, made up as it was to a large extent of socialist-era procedures and deeply rooted in practice, was neither open to collaborative decision-making in the development of spatial plans, nor recognised investors as legitimate stakeholders. On the contrary: transition, and all of the practical problems associated with it, created a completely erroneous picture of how investors' interests should be treated.

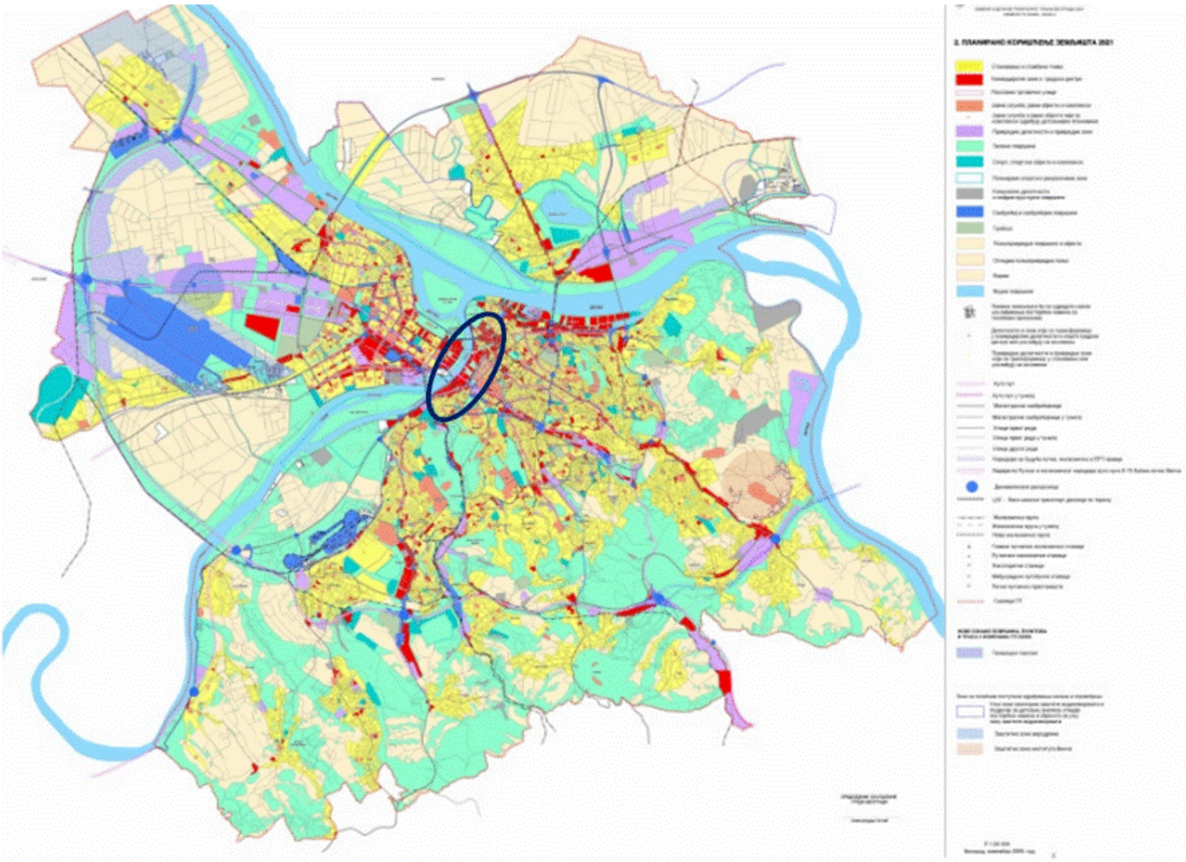

Figure 2. Official Belgrade plan wich shows that at the location are planned commercial facilities

5.2 Change at the top in the capital – Enter a new mayor (24 April – 31 December 2014)

The governing Progressive Party wished to capitalise on its meteoric rise in popularity following its landslide victory in the 2012 election, so preparations were being made to call a snap poll in the spring of 2014. In view of the major outreach effort involving the project during this period, Belgrade Waterfront was undoubtedly a cornerstone of the party's campaign aimed at gaining political power at all levels. The national authorities used the election campaign to commence preparatory work on the project, beginning with small-scale clearances on parts of the site to which the state held clear title, and renovate one building – but did not allow public scrutiny of the process.

Immediately after gaining power in the snap general and local election held on 16 March 2014, the ruling party began consolidating and institutionalising Belgrade Waterfront. The first step was to abolish city-level planning studies that posed constraints to the project's implementation[2], which was followed by amendments to the city's Master Plan. The governing party's majority in the local parliament allowed it to push these changes through. Nothing now stood in the way of the establishment of a Belgrade Waterfront Corporation to formally manage the project, adoption of required urban planning documents, or resolution of title issues. The party's victory in the snap poll enabled it to replace heads of all government institutions, giving it complete control over decision-making.

At the same time, a group of young professionals-activists, gathered around several non-governmental organisations, first began showing their interest in Belgrade Waterfront. Their engagement was manifested through public panel discussions that experts, mainly architects, were invited to attend. Although these panels proved popular, criticisms levelled at the project remained focused on the exclusion of practitioners from its development, and, in particular, on the disregard shown for public participation in decision-making procedures. Professionals still showed no sign of understanding how collaborative decision-making works

[2] The Belgrade caretaker administration met on 18 April 2014 to repeal the Tall Buildings Study.

and why all stakeholders must participate on equal terms. On the contrary, these comments revealed a great deal of ignorance of the investor's position in strategic decision-making, and were also directed against absolute power concentrated in the hands of a single political party.

On the other hand, Belgrade's new authorities continued making statements in support of the views and intentions they had previously hinted at – that decision-making about the project would involve only the state (or, in this case, the ruling political party) and one investor, to the exclusion of the planning profession and the public, as well as that the planning process was seen as an annoying procedural complication. This thinking showed a lack of understanding of planning as a public intervention and elementary ignorance of democratic decision-making.

Belgrade Waterfront was designated a project of national interest, and planning institutions were ordered to carry out this decision. Legal procedure was bypassed where necessary for the project to be legitimised and legalised. Planning was transformed into an instrument of the ruling party. Professionals with planning institutions attempted to incorporate a minimum of technical knowledge into the project, but there was no room for their involvement in strategic deliberations.

Groups of experts-activists attempted to utilise the modicum of room for civic participation allowed by statutory planning procedures by filing formal complaints against the plans, but their efforts met with crude disregard. The country's highest professional authority then waded into the fray by presenting the government body tasked with the project with an extensive list of objections against the planned design, which however mainly pertained to the technical issues that the project was believed incapable of solving, and the lack of a cost-effectiveness assessment for the project. Interestingly, the International Monetary Fund, in Serbia on a mission of controlling public spending, has also shown interest in the financial aspects of Belgrade Waterfront.

However, although it was officially announced that the planning document for Belgrade Waterfront, which would legally allow construction to begin, was adopted on 31 December 2014 at the highest government level, at the time of writing this paper is yet to be made public.

6 CONCLUSION

Serbia's formal planning system did not undergo any major changes in the wake of the country's democratic transition of 2000, which saw it embrace market economy and democracy. Socialist-era practices remained in force, with a centralised government system and spatial policy-making under direct state control, which was only logical since all land was owned by the state. And yet, in the absence of the most basic of preconditions for the new social and economic order – such as regulated private property, taxation policy, transparent procedures and information, legitimacy of multiple interests – the planning system metamorphosed into an arena open to unprincipled and corrupt practices; strategic decision-making became the preserve of powerful stakeholders and their opaque agreements.

Belgrade Waterfront revealed all the problems with the current planning system from the point of view of spatial development policy-making.

- Spatial development decisions were made at the very centre of political power. This became possible after one political party gained absolute power at all levels, which allowed it to control all state institutions, including those tasked with spatial development, which were transformed into instruments used to wield political power.
- The concentration of power in the hands of one party became an efficient means to alter the statutory and institutional framework to serve the party's own interests, and to allow agreements aimed at advertising the authorities' achievements. The absence or weakness of watchdog institutions that could prevent abuse of power also became apparent.
- Underdeveloped democratic consciousness and mechanisms of democratic action allowed decisions about public affairs to be made opaquely by a narrow circle of stakeholders not subject to public scrutiny, and created room for speculation in urban planning procedures.
- The planning profession was caught off guard, unable to pose pertinent questions and understand the situation. It became apparent that planners could not accept all interests as equally legitimate and adjust their behaviour to the realities of the new social and economic order. The profession's lack of

knowledge and capacity to act in a modern context rendered it unable to debate issues outside of a narrowly technical remit. Planners concerned themselves with issues of spatial functionality, technical problems of building the project, construction phases, and costs of developing the site in preparation for such an extensive construction effort. In short, the comments focused on the planned design, rather than on how that design was arrived at.

Belgrade Waterfront has stripped Serbia's planning system and profession of any purpose. In a sense, this project has only revealed the true extent of problems that have been present for decades. Planning professionals are in essence excluded from making strategic or indeed any other decisions, and are reduced to technical executors of decisions reached by the authorities and investors. Planning has become a mere formality, as the planning profession has remained cocooned in an obsolete social and economic environment and unable to learn new strategies that could allow it to consider issues thoroughly and react to them appropriately.

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reviewed paper

Chancen und Grenzen des energetischen Stadt- und Landschaftsumbaus – wieviel Steuerung ist nötig und möglich?

Ariane Ruff

(Ariane Ruff, Universität Liechtenstein, Fürst-Franz-Josef-Strasse, 9490 Vaduz, ariane.ruff@uni.li)

1 ABSTRACT

Der Klimawandel und die umzusetzende Energiewende stellen die Gesellschaft vor große Herausforderungen. Insbesondere der Ausbau der erneuerbaren Energien hat einen enormen räumlichen Impact und prägt schon heute das Stadt- und Landschaftsbild in großem Maße. Umfassende Literaturrecherchen sowie Analysen der ambitionierten Ausbauziele zeigen, dass große Konfliktpotenziale in der Konkurrenz zu anderen Raumnutzungen sowie in der Akzeptanz durch die Bevölkerung bestehen. Die Gestaltung des raumverträglichen Ausbaus der erneuerbaren Energien ist somit von zentraler Bedeutung. Es besteht Forschungsbedarf zur Entwicklung und Implementierung von standardisierten Bewertungskriterien und -methoden zur Abschätzung der Raumwirksamkeit und Raumverträglichkeit des Ausbaus der erneuerbaren Energien. Ziel des vorgestellten Promotionsvorhabens ist es, ein GIS-gestütztes integriertes Raumbewertungssystem zu entwickeln, das alle raumrelevanten Informationen zum Ausbau der erneuerbaren Energien zusammenfasst und aufbereitet, so dass Handlungsempfehlungen zur nachhaltigen energetischen Raumplanung abgeleitet werden können. Im Ergebnis soll das entwickelte Raumbewertungssystem auf der Basis von qualitativen und quantitativen Bewertungskriterien die Raumansprüche des energetischen Umbaus aufzeigen und damit einen Beitrag zum Verständnis und zur Akzeptanz notwendiger Raumveränderungen leisten.

2 ENERGETISCHER STADT- UND LANDSCHAFTSUMBAU AM BEISPIEL DES MODELLRAUMES NORDTHÜRINGEN

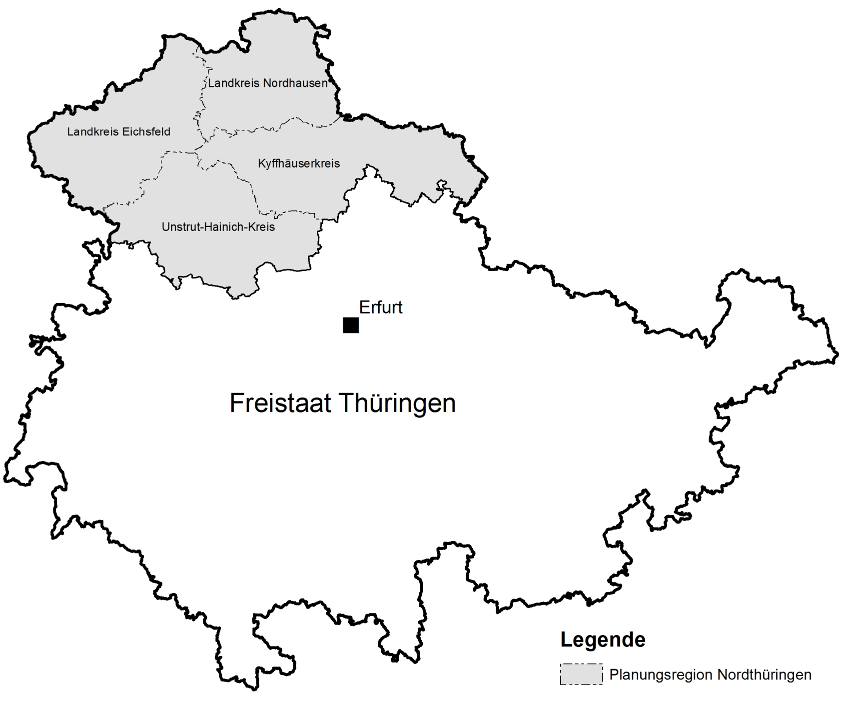
2.1 Nachhaltige Energielandschaften

Mit dem Fortschreiten der Energiewende hat sich der Begriff Energielandschaft in den letzten Jahren etabliert, wenngleich er unterschiedlich definiert und interpretiert wird. Aktuell werden mit diesem Begriff Landschaftsveränderungen beschrieben, die durch den Ausbau der erneuerbaren Energien entstehen (vgl. JOHANN 2010, S. 54). Historisch gesehen hat jedes „Energiezeitalter" zu mehr oder weniger starken Veränderungen der Landschaftsräume beigetragen. Bereits im Mittelalter führte die intensive Brennholznutzung zur Devastierung der Wälder und zur Entstehung von Heidelandschaften. Fossile und nukleare Energielandschaften sind vor allem durch große Kraftwerke mit ihren riesigen Kühltürmen, Erdöl- oder Erdgasbohrtürmen, Tanklager sowie Gas-, Öl- und Stromleitungen geprägt. Insbesondere der Abbau fossiler Brennstoffe hat seit dem 20. Jahrhundert zum Totalverlust von ganzen (Kultur)Landschaftsräumen geführt (vgl. PETERS 2013, S. 150 f). Beispiele dafür sind die ausgeräumten Bergbaufolgelandschaften in der Lausitz und im Ruhrgebiet. STREMKE definiert nachhaltige Energielandschaften als „Teil der physischen Umgebung, in welcher der Energiebedarf durch lokal verfügbare erneuerbare Quellen gedeckt werden kann", ohne negative Folgen für die Bevölkerung, die Biodiversität und die Landschaftsqualität (STREMKE 2010, 193). Er plädiert für die Entwicklung von langfristigen, regionalen Visionen und die schrittweise, planerische Umsetzung auf der Basis von allgemeingültigen, energiebewussten Entwurfsprinzipien (ebenda, S. 194 ff). Der Ausbau der erneuerbaren Energien ist sehr raumextensiv und deshalb stark landschaftsprägend und für die Bevölkerung sichtbar (GAILING 2013, S. 209). Die Wahrnehmung der Landschaft durch die Menschen beruht auf den reflektierten Erfahrungen. Veränderungen müssen sich erst im Bewusstsein verankern. Wichtig ist die Entwicklung neuer Raumbilder, die die regionalen Identitäten aufgreifen und helfen, die Chancen der Veränderungen zu kommunizieren (KOST 2013, S. 133-135).

Modellraum für die im Rahmen der Promotion durchzuführenden Untersuchungen ist die Planungsregion Nordthüringen (siehe Karte 1). Die Planungsregion Nordthüringen ist im Wesentlichen durch ländliche, dezentrale Siedlungsstrukturen und wenige Räume mit Verdichtungsansätzen sowie eine geringe Bevölkerungsdichte gekennzeichnet. Sie gehört im Freistaat Thüringen zu den strukturschwachen Regionen mit einem sehr geringen Anteil an Industriebeschäftigten, jedoch gibt es beträchtliche regionale Unterschiede in der wirtschaftlichen Entwicklung. Die nördlichen und westlichen Regionsteile sind nach dem

Landesentwicklungsplan (LEP) 2015 „Räume mit günstigen Entwicklungsvoraussetzungen“ mit einer demographisch und wirtschaftlich weitgehend stabilen Entwicklung. Der mittlere und östliche Teil der Region wird der Kategorie „Räume mit besonderen Entwicklungsaufgaben“ mit besonderen wirtschaftlichen und demographischen Anpassungsbedarfen zugeordnet. Der südliche Teil der Region gehört zu den „Räumen mit ausgeglichenen Entwicklungspotenzialen“ und ist durch eine weitgehend stabile demographische Entwicklung mit wirtschaftlichen Handlungsbedarfen gekennzeichnet. Nordthüringen verfügt über eine sehr vielfältige Naturausstattung mit einer Vielzahl von sensiblen, ökologisch und touristisch sehr wertvollen Landschaftsbereichen. Im Gegensatz dazu sind weite Landschaftsteile aufgrund der intensiv betriebenen Land-, Forst- und Wasserwirtschaft sowie der Rohstoffgewinnung durch einen starken Rückgang der Struktur- und Artenvielfalt gekennzeichnet. Zentrale Aufgaben für die Zukunft liegen

- im weiteren Aufbau wettbewerbsfähiger Wirtschaftsstrukturen unter Nutzung der verbesserten Standortfaktoren und der Schaffung von weiteren Industriearbeitsplätzen,
- in der Sicherung und dem funktionsgerechten Ausbau der Verkehrsinfrastruktur zur Sicherstellung der Erreichbarkeit der zentralen Orte,
- dem Ausbau und der Modernisierung des Stromnetzes zur Gewährleistung der Versorgungssicherheit und des Ausbaus der Nutzung regenerativer Energieträger,
- in der verträglichen Gestaltung der infrastrukturellen Ausdünnung im ländlichen Raum,
- in der generationenübergreifenden Vernetzung der familiennahen Sozial- und Dienstleistungen zur Abfederung der Folgen des demographischen Wandels,
- in der Bewahrung der unterschiedlichen Natur- und Kulturlandschaftsräume Nordthüringens sowie einer stärkeren touristischen Entwicklung und Vermarktung der vorhandenen Kultur- und Baudenkmale sowie wertvollen Naturräume,
- in der Verbesserung des vorsorgenden Hochwasserschutzes in überschwemmungsgefährdeten Gebieten,
- in der Erhaltung und Stabilisierung der Landwirtschaft als tragende Säule für die Stabilität der Ländlichen Räume,
- im Erhalt und der Entwicklung nachhaltiger Waldbestände im (im Vergleich zum Landesdurchschnitt) insgesamt waldarmen Nordthüringen,
- der Sicherstellung einer räumlich ausgewogenen Rohstoffgewinnung. (Regionale Planungsgemeinschaft Nordthüringen 2008)



Karte 1: Modellraum Planungsregion Nordthüringen.

Auch in Nordthüringen beruhte bis zum Beginn des fossilen Energiezeitalters die Energieversorgung auf den Energieträgern Wind, Wasser und Biomasse in Form von Holz. Davon zeugen heute noch erhaltene Wassermühlen entlang der Flussläufe Helme, Zorge, Wipper und Unstrut sowie historische Windmühlen auf exponierten Standorten der Nordthüringer Höhenzüge. Ab Mitte des 19. Jahrhunderts hat sich in der Region auch der Bergbau stärker entwickelt. Der Eisenerz-, Kupferschiefer- und Kohlebergbau hatte immer nur eine lokale Bedeutung, hingegen erlebte der Kalibergbau im 20. Jahrhundert in Nordthüringen eine Blütezeit mit überregionaler Bedeutung, die abrupt mit der Vereinigung Deutschlands und dem Eintritt in den internationalen Wettbewerb endete. Im Ergebnis ist das Landschaftsbild heute durch große Abraumhalden geprägt, deren Sicherung und Rekultivierung ein langfristiger Prozess ist, der auch noch die kommenden Generationen beschäftigen wird. Angestoßen durch ein studentisches Projekt der Hochschule Nordhausen wurde das Thema Rekultivierung mit der Aufgabe der Erneuerbaren Energiegewinnung kombiniert, das im Ergebnis zur Installation einer 1 MWp-PV-Freiflächenanlage auf der Kalihalde Bleicherode führte.

PV-Freiflächenanlage auf der Kalihalde Bleicherode (Foto: Steffi Gross, 2011).

Seit Ende der 90er Jahre wurden in der Planungsregion Nordthüringen eine Vielzahl von erneuerbaren Energieanlagen errichtet, im Wesentlichen Windkraftanlagen, Biogasanlagen und PV-Anlagen. Da die Region stark ländlich strukturiert ist, hat auch der Energiepflanzenanbau stark zugenommen. Bereits mit der Novellierung des EEG 2012 ist der Neubau von Biogasanlagen in Thüringen jedoch stark eingebrochen. 2012 wurden lediglich 12 Anlagen neu errichtet, 2013 nur noch 8 Anlagen (im Vergleich 2009-2012 im Durchschnitt 32 Anlagen) (Reinhold 2014). Ein spezielles Phänomen, das insbesondere in den neuen Bundesländern zu verzeichnen ist, ist der starke Zubau von PV-Freiflächenanlagen in Gewerbegebieten. Diese wurden zahlreich nach 1990 entwickelt, stehen jedoch oft leer oder sind unterbelegt. Diese Entwicklung wird inzwischen überwiegend sehr kritisch gesehen und kann durch die Planungsträger nur durch eine Änderung der Bebauungspläne, die den Bau von Photovoltaik-Anlagen explizit ausschließen, verhindert werden.

2.2 Ausbauziele der Erneuerbaren Energien

Die Energiewende basiert auf einem veränderten Umweltbewusstsein und der Umsetzung des gesellschaftlichen und politischen Willens in Form von Strategiepapieren, Richtlinien, Energiekonzepten und Gesetzen (z.B. EEG) auf nahezu allen politischen und planerischen Ebenen. In Tabelle 1 sind die Ausbauziele der Erneuerbaren Energien für die EU, Deutschland, das Bundesland Thüringen sowie die Planungsregion Nordthüringen, die als Modellregion für die Entwicklung des Bewertungsverfahrens gewählt wurde, zusammenfassend dargestellt.

Tabelle 1 zeigt, dass die Ausbauziele der erneuerbaren Energien auf allen politischen und räumlichen Ebenen ambitioniert sind und nur mit auch zukünftig hohen Ausbauraten insbesondere im Bereich der Windkraftnutzung zu erreichen sind. Zugleich nimmt die Akzeptanz durch die Bevölkerung in vielen Kommunen ab, was zahlreiche Bürgerinitiativen gegen den Neubau von Windparks und Biomasseanlagen deutlich zeigen. Es wird sich zeigen, wie sich die Neuausrichtung des EEG auswirkt und ob der Zubau wie beabsichtigt harmonisiert bzw. optimiert wird. Insbesondere für den Ausbau der Biomasse und die Errichtung von PV-Freiflächenanlagen haben sich die finanziellen Rahmenbedingungen durch das novellierte EEG deutlich verschlechtert.

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	Grundlagen	Ziel-jahr	Ausbauziele Erneuerbare Energien (EE)
EU	EU-Richtlinie 2009/28/EG v. 23.04.2009	2020	Gesamtziel Anteil von 20% EE am Brutto-Endenergieverbrauch Nationales Ziel Deutschland Anteil von 18% EE am Brutto-Endenergieverbrauch
Deutsch-land	Erneuerbare-Energie-Gesetz (EEG), letzte Änderung vom 01.08.2014 Erneuerbare Energien-Wärmegesetz (EEWärmeG) v. 07.08.2008	2025 2035 2050 2020	Anteil von 40 - 45% EE am Brutto-Stromverbrauch Anteil von 55 - 65% EE am Brutto-Stromverbrauch Anteil von mindestens 80% EE am Brutto-Stromverbrauch Anteil von 14% EE am Endenergieverbrauch für Wärme
Thüringen	Eckpunktepapier "Neue Energie für Thüringen" 2011 Positionspapier zum 2. Thüringer Energiegipfel 2013 Koalitionsvertrag zwischen den Parteien DIE LINKE, SPD und BÜNDNIS 90/DIE GRÜNEN v. 4.12.2014	2020 2020 2040	Anteil von 45% EE am Nettostromverbrauch Anteil von 33% EE an der Wärmebereitstellung Anteil von 30 % EE am Endenergieverbrauch Anteil von 10% EE am Treibstoffbedarf Anteil von 35% EE am Endenergieverbrauch Anteil von 100% EE am Endenergieverbrauch
Nord-thüringen	Regionales Energie- und Klima-schutzkonzept Nordthüringen (2011) Landesentwicklungsprogramm Thüringen 2025 „Thüringen im Wandel“ Thüringer Bestands- und Potenzialatlas (2011)	2050 2020 2020	Anteil von 100% EE am Endenergieverbrauch Gesamtziel Nordthüringen Anteil von 1.800 GWh Strom aus EE an der Thüringer Stromproduktion Der Anteil der EE an der Wärmebereitstellung ist im LEP Thüringen 2025 nicht auf Planungsregionsebene dargestellt. Ausbaupfad Nordthüringen (Strom - Referenzszenario) Photovoltaik: 195 GWh/a (2010: 57 GWh/a) Windkraft: 1.162 GWh (2010: 488 GWh/a) Wasserkraft: 2 GWh (2010: 2 GWh/a) Biomasse: 369 GWh (2010: 255 GWh/a) Deponiegas: 28 GWh (2010: 4 GWh/a) Gesamt: 1.755 GWh (2010: 806 GWh/a) Ausbaupfad Nordthüringen (Wärme - Referenzszenario) Solarthermie: 55 GWh (2010: 17 GWh/a) Erdwärme: 56 GWh (2010: 12 GWh/a) Biomasse: 1.037 GWh (2010: 936 GWh/a) Deponiegas: 16 GWh (2010: 4 GWh/a) Gesamt: 1.164 GWh (2010: 969 GWh/a)

Tabelle 1: Übersicht über die Ausbauziele der Erneuerbaren Energien in der EU, Deutschland, Thüringen und Nordthüringen.

Die im LEP Thüringen 2025 festgelegten Ausbauziele für erneuerbare Energien bedeuten für die Planungsregion Nordthüringen bis 2020 eine Verdopplung der regenerativen Stromerzeugung und eine Steigerung der regenerativen Wärmeerzeugung um 20%. Das größte Ausbaupotenzial im Strombereich hat die Windkraft mit dem Ausbau auf des 2,5-fache gegenüber 2010 (entspricht ca. 140 3-MW-Windkraftanlagen [Bestand 2010: 194 Windkraftanlagen]), gefolgt von der Photovoltaik mit einer Verdreifachung der Erträge bis 2020 (Ausbau nur auf Dächern und Fassaden und auf baulich bzw. durch Infrastrukturanlagen vorbelasteten Flächen) und einer Erhöhung der Stromerzeugung aus Biomasse um ca. 45% (Anm. d. Verf.: auf eine Flächenbedarfsangabe/-berechnung wird aufgrund der Komplexität der Berechnungen im Bereich Biomasse hier verzichtet). Neben dem Zu- bzw. Neubau von Windkraftanlagen wird das Repowering in den nächsten Jahren eine zunehmende Bedeutung haben. Aufgrund der Steigerung der Anlagenhöhe und der Rotordurchmesser bei neuen Anlagen können ggf. vorhandene Höhenbeschränkungen und Abstandsregelungen nicht eingehalten werden. Zur Lösung dieser Problemstellungen müssen planerische Lösungen erarbeitet werden. Im Bereich der regenerativen Wärmebereitstellung liegen die größten Ausbaupotenziale in einer Verdreifachung der Solarthermienutzung und einer Verfünffachung der Nutzung von Erd- und Umweltwärme, die im We-sentlichen im Gebäudebestand erfolgen werden und damit nur in geringem Maße raumwirksam bzw. im planerischen Sinn raumbedeutsam sind. Der Ausbau der Wärmebereitstellung aus Biomasse beträgt aufgrund der bereits sehr hohen Ausbaugrade lediglich ca. 10%. Mit dem Ausbau der erneuerbaren Energieerzeugung ist eine Anpassung, ggf. auch eine Erweiterung der bestehenden Leistungsnetze notwendig, der ebenfalls Flächen beansprucht und Nutzungskonflikte verursacht.

2.3 Raumwirksamkeit und Raumverträglichkeit des Ausbaus der Erneuerbaren Energien

Mit den wachsenden Nutzungsansprüchen an den Raum steigt einerseits die Belastung der natürlichen Ressourcen, andererseits wachsen die Nutzungskonflikte. Der Paragraph 15 des deutschen Raumordnungsgesetzes regelt die Prüfung der Raumverträglichkeit von raumbedeutsamen Maßnahmen im Rahmen der Durchführung von Raumordnungsverfahren. Gemeint ist die Prüfung von „raumbedeutsamen Auswirkungen der Planung oder Maßnahme unter überörtlichen Gesichtspunkten … insbesondere … die Übereinstimmung mit den Erfordernissen der Raumordnung und die Abstimmung mit anderen raumbedeutsamen Planungen und Maßnahmen“ (D ROG, Stand: 31.7.2009, § 15, Absatz 1). Die Begriffe Raumverträglichkeit und Raumwirkung sind also eng miteinander verbunden, wobei die Beurteilung der Raumverträglichkeit immer in Abhängigkeit von den Raumordnungszielen erfolgt. SCHOLLES versteht unter dem Begriff Raumwirkung bzw. Raumwirksamkeit die Beurteilung von gesellschaftlichen Aktivitäten und Verhaltensweisen, die raumprägend oder raumverändernd wirken. Er ist aufgrund der notwendigen Beurteilung der Auswirkungen auf Natur, Mensch und Landschaft eng mit dem Begriff der Umweltverträglichkeitsprüfung (UVP) verknüpft, der Anfang der 70er Jahre Einzug in die deutsche Planungspraxis gehalten hat. Die UVP „ist ein Prüfinstrument zur systematisch-analytischen Ermittlung, Beschreibung und Bewertung von Auswirkungen von Maßnahmen auf die Umwelt im Hinblick auf eine wirksame Umweltvorsorge“ (SCHOLLES 2008, S. 110). Somit beinhaltet die Raumverträglichkeitsprüfung immer auch eine Prüfung auf Umweltverträglichkeit, untersucht jedoch auch darüber hinaus gehende Aspekte, wie z.B. wirtschaftliche und soziale Auswirkungen.

Ein immer wichtiger werdender Aspekt im Rahmen der Bewertung der Raum- und Umweltverträglichkeit von Vorhaben ist die Berücksichtigung von Nachhaltigkeitsaspekten. Die Operationalisierung der Nachhaltigkeitsziele sowie die praktische Umsetzung dieser auf allen Entscheidungsebenen in der Raumplanung ist aufgrund der Komplexität und Interdisziplinarität eine äußerst anspruchsvolle Aufgabe. Zur Reduzierung dieser Komplexität werden häufig Indikatoren eingesetzt. Richtungweisend ist die vom Schweizer Bundesamt für Umwelt, Wald und Landschaft (BUWAL) entwickelte Methodik zur Integration von Zielen der nachhaltigen Entwicklung in die Landschaftsbewertung und -entwicklung. Das entwickelte Indikatorenset ermöglicht eine räumlich-quantitative Analyse und Bewertung des aktuellen Zustands und der Entwicklungstendenzen der Landschaft insbesondere unter Berücksichtigung von Nachhaltigkeitsaspekten (STREMLOW et al. 2003). Auch STREMKE und VAN DOBBELSTEEN weisen darauf hin, dass zur Entwicklung von nachhaltigen Energielandschaften verstärkt Nachhaltigkeitskriterien und -indikatoren entwickelt werden müssen, erste Ansätze und Methoden werden in ihrem Buch „Sustainable Energy Landscapes: Designing, Planning, and Development“ vorgestellt (STREMKE & VAN DOBBELSTEEN 2013, S. 494-495).

3 CHANCEN UND GRENZEN DER RÄUMLICHEN STEUERUNG

Die durch den Ausbau der Erneuerbaren Energien verursachten räumlichen Nutzungsansprüche und Nutzungskonkurrenzen müssen im Rahmen der räumlichen Planung koordiniert und gesteuert werden. Dazu gehören die Analyse und Bewertung der aktuellen Nutzungen, von bestehenden Nutzungskonkurrenzen und Nutzungspotenzialen sowie die Festlegung von Zielvorgaben (vgl. BMVBS 2011a; ÖROK 2009; SARTORIS et al. 2012).

3.1 Konfliktpotenziale des Ausbaus der Erneuerbaren Energien in der Konkurrenz zu anderen Raumnutzungen

Beim Ausbau der erneuerbaren Energien können vielfältige Raumnutzungskonflikte auftreten, die in Tabelle 2 zusammenfassend dargestellt sind. Es werden nur die raumplanerisch bedeutsamen Erneuerbaren Energieoptionen Wind (nur onshore), Photovoltaik-Freiflächenanlagen und Biomasse näher betrachtet und bewertet. Auf der Basis der zusammengestellten Wirkfaktoren wurde eine Beurteilung des Konfliktpotenzials in 5 Stufen vorgenommen. Es wird deutlich, dass insbesondere der Ausbau der Windkraft aufgrund der starken Beeinflussung bzw. Beeinträchtigung des Landschaftsbildes und der erheblichen Wirkungen insbesondere auf die Avifauna die größten Konfliktpotenziale in Bezug auf die anderen Raumnutzungen hat. Der Ausbau von Photovoltaik- und Solarthermie-Freianlagen erzeugt vor allem in der Nähe Wohn- und Naherholungsgebieten Konflikte, die jedoch durch Abpflanzungen etc. minimiert werden können und insgesamt auf einem mittleren Niveau einzustufen sind. Problematisch sind die Einzäunungen

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der Freiflächenanlagen, die Barrieren für Mensch und Tier darstellen. Bei der Nutzung von Biomasse müssen einerseits die Anlagen zur Ver-wertung bzw. Umwandlung der Biomasse in Energie als auch die Auswirkungen des Biomasseanbaus betrachtet werden. Die Biomasseanlagen erzeugen im Siedlungs- und Landschaftsraum nur geringe Nutzungskonflikte mit anderen Nutzungsansprüchen. Weitaus problematischer ist der Energiepflanzenanbau zu bewerten, der insbesondere zur Homogenisierung des Landschaftsbildes beiträgt und damit das Bild historisch gewachsener Kulturlandschaften tiefgreifend verändert und beeinträchtigt. Aus Naturschutzsicht ist insbesondere das Umbrechen von Grünlandbereichen als besonders problematisch zu bewerten. Generell ist anzumerken, dass viele der potenziellen Beeinträchtigungen durch den Energiepflanzenanbau nicht nur für diesen spezifisch sind, sondern generell den Folgen einer intensiven Landwirtschaft entsprechen (vgl. MENGEL et al. 2010, S. 40).

	Wirkfaktoren[1] / Konfliktpotenzial (5-sehr hoch, 4-hoch, 3-mittel, 2-niedrig, 1-sehr niedrig, 0-kein Konflikt)[2]			
	Windkraftanlagen	**PV/ST-Freianlagen**	**Biomasse-Anlagen**	**Energiepflanzenanbau**
Wohnen und Naherholung	visuelle Beeinträchtigungen durch die Anlagen und zusätzliche Stromleitungen, Schattenwurf, Reflexionen, Befeuerung); Schallemissionen, Eiswurf	visuelle Beeinträchtigungen durch die Anlagen und zusätzliche Stromleitungen; Verlust von Naherholungsräumen inklusiver möglicher Zerschneidungswirkungen	Geruchsbelästigungen; Beeinflussung des Landschaftsbildes (Fermenter, Silos); zusätzliche Verkehrsbelastungen durch An- und Ablieferung (Inputstoffe, Gär-reste)	Geruchsbelästigungen (Gärrestaufbringung); visuelle Beeinträchtigungen aufgrund optischer Barrierewirkungen durch hochwüchsige Energiepflanzen, Homogenisierung von Landschaften
	5	**3**	**2**	**2**
Land- und Forstwirtschaft	Bodenverdichtung bzw. -versiegelung durch Zuwegungen und Stellflächen (Verlust an landwirtschaftlicher Fläche und von Waldflächen)	Bodenverdichtung bzw. -versiegelung durch Zuwegungen und Fundamente (Verlust an landwirtschaftlicher Fläche)	Schließung von Stoffkreisläufen durch die Nutzung von biogenen Reststoffen	hoher Flächenbedarf; erhöhter Düngemittel-und Pestizideinsatz, erhöhte Erosion u. Bodenverdichtung beim Anbau von einjährigen Monokulturen; Nährstoffanreicherung durch Rückführung der Gärreste
	2	**2**	**0**	**2**
Natur- und Landschafts-schutz	Verlust und Beeinträchtigung von Lebensräumen (Scheu- bzw. Verdrängungswirkung, Barrierewirkungen, Gefahr von Kollisionen, Lärm- und Licht-emissionen, Erschütterungen); Erhöhung der Windwurfdisposition und des lokalen Waldklimas	Verminderung der Grundwasserneubildung durch erhöhten Abfluss; lokalklimatische Veränderungen und Verschattungswirkungen; Erhöhung von Barrierewirkungen (durch Einzäunungen); Scheuchwirkungen auf Vogelarten des Offenlandes; z.T. Aufwertung der Lebensraumfunktionen für Flora und Fauna (Umwandlung von Ackerland in Grünland)	Beeinträchtigung des Landschaftsbildes in dörflich geprägten Landschaften (technische Überprägungswirkung insbesondere bei größeren Anlagen)	Umbruch von Grün-land; Intensivierung der Grünlandbewirtschaftung; Zunahme von Schlaggrößen, Verlust an landschaftsstrukturierenden Elementen und Lebensräumen; Auswaschung von Nährstoffen und Pestiziden ins Grund- und Oberflächenwasser; Erhöhung des Anteils invasiver Arten (Topinambur); Verringerung der Artenvielfalt; Chancen zur Offenhaltung von Landschaften (Nutzung Landschaftspflegematerial)
	5	**3**	**1**	**4**
Kulturerbe Tourismus	visuelle Beeinträchtigungen durch die Anlagen und zusätzliche Stromleitungen, (Schattenwurf, Reflexionen, Befeuerung); Schallemissionen, Eiswurf	visuelle Beeinträchtigungen durch die Anlagen und zusätzliche Stromleitungen insbesondere in sichtexponierten Lagen und in qualitativ hochwertigen Landschaftsräumen	Geruchsbelästigungen; Beeinflussung des Landschaftsbildes (Fermenter, Silos); zusätzliche Verkehrs-belastungen durch An- und Ablieferung (Inputstoffe, Gär-reste)	visuelle Beeinträchtigungen aufgrund der Homogenisierung von Landschaften durch die großflächigen Monokulturen im Energiepflanzenanbau
	4	**2**	**2**	**3**
[1] nach (ARGE MONITORING VON PV-ANLAGEN 2007, BMU 2007, HILDEBRANDT 2009, MENGEL et al. 2010, REINHARDT & SCHEURLEN 2004, SRU 2007, RODE et al. 2005); [2] eigene Einschätzung.				

Tabelle 2: Übersicht über Wirkfaktoren und Konfliktpotenziale des Ausbaus der Erneuerbaren Energien in der Konkurrenz zu anderen Raumnutzungen.

Im Modellraum Nordthüringen sind die räumlichen Voraussetzungen zur Nutzung der Windkraft, der Solarenergie und der Biomasse aufgrund der naturräumlichen und siedlungsstrukturellen Voraussetzungen sehr gut. Dementsprechend hoch ist der bereits heute aus Wind und Biomasse bereitgestellte Strom pro Einwohner im Vergleich zum Landes- und Bundesdurchschnitt (vgl. GENSKE et al. 2011). Die in Abschnitt

2.2 dargestellten Ausbauziele fokussieren insbesondere auf den Ausbau der Windkraft und der Biomassenutzung, so dass speziell in diesen Bereichen sowie im Bereich des Ausbaus der benötigten Leitungsinfrastruktur zukünftig größere Konfliktpotenziale mit den anderen Raumnutzungen zu erwarten sind. In Anbetracht der in den letzten Jahren umgesetzten größeren Infrastrukturmaßnahmen (z.B. Autobahnbau A 38 und A 71), der vor allem mit einen Verlust von landwirtschaftlichen Flächen verbunden war, ist der weitere Ausbau des Energiepflanzenanbaus im Konflikt mit der Erzeugung von Nahrungsmitteln problematisch. Der Ausbau von Photovoltaik- und Solarthermieanlagen soll aufgrund der Vorgaben im Landesentwicklungsprogramm 2025 hauptsächlich auf Dach- und Fassaden sowie auf baulich bzw. durch Infrastrukturanlagen vorbelasteten Flächen erfolgen, so dass keine größeren Konflikte beim Ausbau der Potenziale in diesem Bereich zu erwarten sind. Anzumerken ist, dass keine zusätzlichen Konflikte in Bezug auf die Siedlungsentwicklung zu erwarten sind, da aufgrund der demographischen Entwicklung nur ein geringer Bedarf für weitere Flächenausweisungen besteht.

3.2 Chancen

Die Entwicklung der erneuerbaren Energien bietet auch Chancen. Insbesondere in ländlichen Regionen kann mit einem Ausbau der erneuerbaren Energien negativen Entwicklungen, z.B. dem demographischen Wandel und Schrumpfungsprozessen, entgegengewirkt werden. In Abhängigkeit von lokalen Spezifika können durch die Etablierung integrierter Energieanlagen neue Kulturlandschaften entwickelt werden. Die Treiberfunktion der erneuerbaren Energien kann in strukturschwachen Regionen genutzt werden, um langfristig und nachhaltig einen Strukturwandel zu initiieren und neuartige Kulturlandschaften zu entwickeln (Johann 2010, S. 55-56). Gute Beispiele sind u.a. die inzwischen zahlreich entwickelten Bioenergiedörfer, die in der Regel neben der Bioenergie weitere Erneuerbare Energien nutzen. Die Nutzung regionaler Energiepotenziale führt zu lokalen Wertschöpfungseffekten in Form von zusätzlicher Beschäftigung und erhöhter Kaufkraft und trägt insbesondere zur Steigerung der Ortsidentität der Dorfbewohner sowie zur Stärkung der Dorfgemeinschaften bei.

3.3 Instrumente zur planerischen Steuerung des Ausbaus der EE

Generell lassen sich verschiedene Instrumente zur Steuerung des Ausbaus der Erneuerbaren Energien unterscheiden in Instrumente, die sich aus dem jeweilig betroffenen Fachrecht, z.B. dem Forst- und Naturschutzrecht, dem Bodenschutzrecht, dem Bauleitplanungs- und Raumordnungsrecht und dem Immissionsschutzrecht, ergeben und Instrumente, die sich aus dem Förderungsrecht, z.B. dem EEG oder Regelungen des Cross Compliance, ergeben. Zusätzlich lassen sich formelle und informelle Instrumente unterscheiden.

Im Folgenden wird auf die Steuerungsmöglichkeiten im Bereich der Räumlichen Planung näher eingegangen.

3.3.1 Planungsinstrumente zur Steuerung der Windkraftnutzung

Zentrale Steuerungselemente im Bereich der Errichtung von Windkraftanlagen sind das Raumordnungs- und Bauleitplanungsrecht sowie das Naturschutzrecht. Der Bau von Windkraftanlagen unterliegt der Genehmigungspflicht nach Bundes-Immissionsschutzgesetz. Im Genehmigungsverfahren werden immissionsschutzrechtliche, bauleitplanungs- und raumordnungsrechtliche sowie naturschutzrechtliche Anforderungen geprüft. Windkraftanlagen sind vom Gesetzgeber durch Privilegierung explizit in den Außenbereich verwiesen worden, aber nicht an jeder beliebigen Stelle im Landschaftsraum zulässig. Auch für sie gilt der Grundsatz der größtmöglichen Schonung des Außenbereiches und es ist eine Abwägung mit anderen öffentlichen Belangen notwendig. Die Träger der Bauleit- und Regionalplanung haben zudem das Recht durch die Ausweisung von Vorrang-, Eignungs- oder Vorbehaltsgebieten Windenergie in bestimmten Bereichen zu konzentrieren oder auszuschließen und damit den Ausbau räumlich zu steuern. In Form von Windenergieerlassen oder Handlungsempfehlungen zur Ausweisung von Konzentrationszonen werden den Planungsträgern me-thodische Empfehlungen und Konzepte zur Ermittlung und Ausweisung von geeigneten Windeignungs- bzw. Vorranggebieten an die Hand gegeben. Nach aktueller Rechtsprechung ist die Unterscheidung von sogenannten harten und weichen Tabuzonen inklusive der Dokumentation der Überlegungen zur Auswahl der weichen Tabukriterien zwingend erforderlich. Anschließend hat im Rahmen von Einzelfallprüfungen auf den verbleibenden Potenzialflächen die Prüfung und Abwägung der Eignung als Windvorranggebiet zu erfolgen. Der Artenschutz und das Landschaftsbild spielen im Rahmen der Planungs-

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und Genehmigungsverfahren eine besondere Rolle, da sie die wichtigsten Konfliktfelder abbilden. Generell kann man feststellen, dass oft unzureichende Daten zu den Artenvorkommen und Populationsgrößen sowie unzureichende Erkenntnisse zu den Wirkungen der Windkraftanlagen auf die Avifauna vorliegen und somit die Vorgaben des Artenschutzrechtes nur schwer in die konzeptionelle Ermittlung von geeigneten Vorrangflächen einbezogen werden können. Liegen avifaunistische Daten flächendeckend in ausreichender Qualität vor können artenschutzrecht-liche Belange über die Erstellung von Konzentrationsflächenkarten bereits frühzeitig in den Planungen berücksichtigt werden. Eine weitere schwierige Aufgabe ist die Berücksichtigung der Auswirkungen auf das Landschaftsbild. Hierzu gibt es eine Vielzahl von interessanten, kontrovers diskutierten methodischen Ansätzen, auf die an dieser Stelle nicht näher eingegangen wird (siehe ROTH 2012).

3.3.2 Planungsinstrumente zur Steuerung der Biomassenutzung

Im Bereich der Steuerung der Biomassenutzung ist generell zwischen der Steuerung des Biomasseanbaus und der Steuerung der Biomasseanlagen zu unterscheiden. Der Anbau von Biomasse unterliegt allein der Verantwortung der Landwirte, die entsprechend der Guten fachlichen Praxis wirtschaften und keinen Unterschied zwischen Nahrungsmittel,- Futtermittel- oder Energiepflanzenanbau machen. Somit gibt es keine Steuerungsmöglichkeit in Bezug auf den mengenmäßigen Anteil der Anbauflächen für den Energiepflanzenanbau und die Art der Energiepflanzen über die landwirtschaftliche Bodennutzung. Eine formelle räumliche Steuerung des Biomasseanbaus ist mit dem vorhandenen Instrumentarium nicht möglich. Einen raumplanerischen Steuerungsbeitrag können Regionale Energiekonzepte (REK), die sich explizit mit dem Thema Bio-massenutzung auseinandersetzen, als informelle Planungsinstrumente leisten.

Auch Biomasseanlagen bedürfen einer Baugenehmigung nach den jeweiligen Landesbauordnungen, wobei kleine Anlagen bis 500 kW im Außenbereich privilegiert sind. Diese Anlagen sind über die Regelungen der Privilegierung direkt an den landwirtschaftlichen Betriebsstandort gekoppelt, so dass eine zusätzliche Zersiedelung des ländlichen Raumes als auch eine räumliche Konzentration von Anlagen verhindert wird. In Abhängigkeit von der Anlagengröße bzw. Leistungsklasse ist zusätzlich eine immissionsschutzrechtliche Genehmigung notwendig. Zur Errichtung von nicht privilegierten Anlagen im Außenbereich sind die Aufstellung eines Bebauungsplans und die Änderung des Flächennutzungsplanes notwendig (Darstellung als Sondergebiet Biomasseanlage). Auf der Ebene der Regionalplanung ist eine angebotsorientierte Steuerung in Form der Ausweisung von Vorrang- oder Vorbehaltsgebieten „Bioenergienutzung“ möglich.

3.3.3 Planungsinstrumente zur Steuerung von PV-Freiflächenanlagen

Photovoltaik-Freianlagen sind nach den Vorgaben des Baugesetzbuches im Außenbereich nicht privilegiert und bedürfen einer Baugenehmigung nach den jeweiligen Landesbauordnungen. Ist eine Errichtung im Außenbereich beabsichtigt muss ein Bebauungsplan aufgestellt werden. Parallel ist die Änderung des Flächennutzungsplanes (Darstellung als Sondergebiet Solaranlage) notwendig. Ein wichtiges Instrument zur Ermittlung von geeigneten Flächen mit möglichst geringem Konfliktpotenzial ist der Landschaftsrahmenplan. Die direkte Steuerung kann über die Bauleitplanung erfolgen, z.B. über restriktive Festlegungen in Form von Vorrang- und Vorbehaltsgebieten. Rückbauverpflichtungen sollten über städtebauliche Verträge rechtssicher verankert werden. Auf der Ebene der Regionalplanung ist eine angebotsorientierte Steuerung in Form der Ausweisung von Vorrang- oder Vorbehaltsgebieten „großflächige Solaranlagen“ möglich.

3.3.4 Übergeordnete Planungsinstrumente zur Steuerung des Ausbau der Erneuerbaren Energien

Die Ebene der Regionalplanung ist als Umsetzungsebene für die Steuerung des Ausbaus der Erneuerbaren Energien als Bindeglied zwischen Landes- und Kommunalebene besonders geeignet. Es stehen informelle (strategische Energie- und Klimaschutzkonzepte) und formelle Instrumente (Ausweisung von Vorrang-, Vorbehalts- und Eignungsgebieten sowie Vorgaben für die Leitungsnetzplanung in den Regionalplänen, siehe Abschnitte 3.3.2 und 3.3.3) zur Verfügung.

Regionale Energiekonzepte können in die Abwägung zwischen regionalen Ausbauzielen zum Ausbau der erneuerbaren Energien und konkurrierenden Raumnutzungsansprüchen einbezogen werden. Sie dienen der Ermittlung raumverträglicher EE-Potenzialflächen und dem Aufzeigen von möglichen Ausbauszenarien unter Beachtung demographischer, wirtschaftlicher und raumstruktureller Entwicklungen und sind somit eine wichtige Basis für die planerische Steuerung des Ausbaus der Erneuerbaren Energien auf regionaler Ebene, wenn gleich sie keine rechtlich bindende Steuerungswirkung haben (siehe Abb. 1) (BAUMGART & KÖTTER 2013, S. 59-61).

Das Bundesministerium für Verkehr, Bau und Stadtentwicklung (BMVBS) empfiehlt in seiner Studie „Strategische Einbindung Regenerativer Energien in Regionale Energiekonzepte“ die Entwicklung von standardisierten Kriterienkatalogen zur Beurteilung der Raumverträglichkeit als planerische Grundlage auf regionaler Ebene sowie die Entwicklung von Standards für Art und Umfang der Datengrundlagen in Abhängigkeit der jeweiligen erneuerbaren Energieoptionen. Die Studie hat gezeigt, dass Bewertungsgrundlagen und -verfahren zur Beurteilung von:

- Flächennutzungsstrukturen unter dem Aspekt der Flächenverfügbarkeit und tatsächlichen quantitativen Flächeninanspruchnahme durch Erneuerbare Energieanlagen,
- potenziellen Flächennutzungskonkurrenzen,
- räumlichen Auswirkungen auf andere Landschaftsfunktionen und
- Immissionen und Infrastrukturveränderungen

erarbeitet werden müssen (BMVBS 2011b, S. 177 f.).

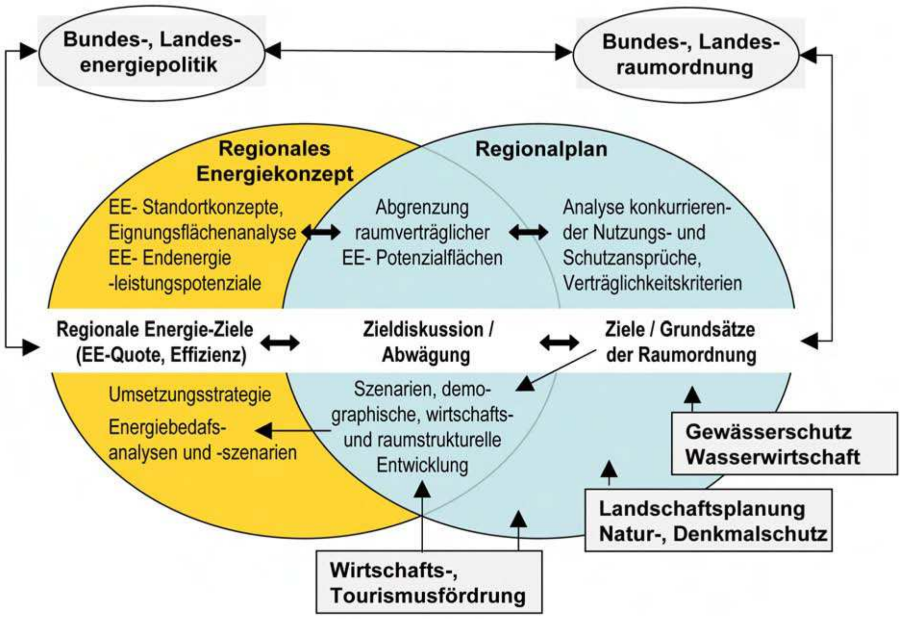

Abb. 1: Schematische Darstellung der Schnittmengen zwischen Regionalem Energiekonzept und Regionalplan (BMVBS 2011b, S. 141).

Aufbauend auf diese Studie hat das Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) das Forschungsvorhaben „Räumlich differenzierte Flächenpotenziale für erneuerbare Energien in Deutschland“ in Auftrag gegeben. Ziel des Projektes war die Entwicklung eines Berechnungsmodells zur Ermittlung regionaler, raum- und umweltverträglicher erneuerbarer Energiepotenziale in Abhängigkeit von naturräumlichen, politischen, rechtlichen, planerischen, technischen und wirtschaftlichen Rahmenbedingungen. Das entwickelte Modell gestattet die Verschneidung der grundlegenden Raumansprüche und Raumwirkungen der einzelnen erneuerbaren Energieoptionen mit den realen Voraussetzungen und planerischen Zielen im Untersuchungsraum. Auf der Basis der Zuordnung von Konfliktrisiken und Nutzungsrestriktionen zu den Einzelflächen können optimierte Flächenpotenziale ermittelt werden, die konkurrierende Nutzungs- und Schutzaspekte in die Flächenermittlung einfließen lassen. Im Ergebnis wurde festgestellt, dass die Methoden und Werk-zeuge zur Ermittlung von Nutzungsrestriktionen für Flächen bzw. Flächenkategorien sowie zur Beurteilung der Raumverträglichkeit des Netzausbaus insbesondere auf der Ebene der Regionalplanung weiterentwickelt und verbessert werden müssen (BBSR 2015; Anm. d. Verf.: Die Veröffentlichung des ausführlichen Abschlussberichtes ist nach Auskunft des BBSR derzeit in Bearbeitung und steht zeitnah zur Verfügung.).

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3.4 Hemmnisse

Die Steuerungsmöglichkeiten des Ausbaus der Erneuerbaren Energien sind auf der Ebene der Regionalplanung an die Raumbedeutsamkeit des jeweiligen Vorhabens gebunden. Dazu gehören der Bau von Windkraftanlagen, die Nutzung von Solarenergie auf Freiflächen, nicht privilegierte Vorhaben zur Biomassenutzung, ggf. auch größere Vorhaben zur Wasserkraft- und Geothermienutzung sowie der Energiepflanzenanbau. Weiterhin müssen die Zulässigkeit und die Erforderlichkeit einer raumordnerischen Steuerung gegeben sein. Dies trifft uneingeschränkt nur auf die Windkraft zu. Zur Steuerung der Photovoltaik-Freiflächen¬nutzungen können im Regionalplan Vorbehalts- oder Vorranggebiete ausgewiesen werden, Ausschlussregelungen sind aufgrund der fehlenden Privilegierung umstritten. Eine positiv-planerische Steuerung ist der kommunalen Bauleitplanung vorbehalten. Besonders problematisch ist die Steuerung der Bioenergienutzung. Weder der Energiepflanzenanbau noch die Anzahl der Biomasseanlagen sind formell durch die Regionalpla-nung steuerbar. Für die Umsetzung regionaler Ausbauziele der erneuerbaren Energien müssen weitere Instrumentarien entwickelt und eingesetzt werden (BMVBS 2011b, S. 5- 6).

Ein Hindernis bei der Erarbeitung und Umsetzung von Regionalen Energiekonzepten ist die Datenverfügbarkeit und -aktualität. In der Regel ist es sehr schwierig, aktuelle regionalisierte Energiebilanzen, Zahlen zum Stand der Nutzung erneuerbarer Energien sowie geeignete Datengrundlagen für Potenzialstudien (z.B. zur Windhöffigkeit in Narbenhöhen moderner Windkraftanlagen etc.) zu erhalten. Diese sind jedoch wichtig, um räumlich differenzierte Ausbauziele abzuleiten. Das gleiche gilt für die Abschätzung der Auslastung bzw. Leistungsfähigkeit der vorhandenen Leitungsnetze. Ein weiteres Problem sind Unsicherheiten für die Planungsträger bei der Ausweisung von Windvorranggebieten, die sich aus der aktuellen Rechtsprechung ergeben. In der jüngeren Vergangenheit wurden viele Regionalpläne zumindest für den Teilbereich Windenergie für rechtsunwirksam erklärt. Auch die schnelle Weiterentwicklung der EE-Technologien und die damit verbundenen veränderten Standortanforderungen, z.B. im Bereich der Windkraft, bedingen eine stetige Anpassung der verbindlichen Raumordnungspläne, die manchmal schneller erfolgen müsste als die „normalen“ Fortschreibungszyklen leisten. In diesem Zusammenhang spielen ebenfalls die finanziellen Rahmenbedingungen eine wichtige Rolle. Durch die in relativ kurzen Zeitabständen durchgeführten Novellierungen des EEG verändern sich auch planerische Rahmenbedingungen und Standortkriterien, die einen wesentlichen Einfluss auf die Ausbauraten in den einzelnen erneuerbaren Energiesparten haben. Nicht zuletzt sei auf die knappen Personalressourcen in den Planungs- und Genehmigungsbehörden hingewiesen, die aufgrund der schnellen wissenschaftlich-technischen Entwicklungen, der veränderten Rechtsprechung, neuen Gesetzen, Verordnungen und Richtlinien auf Bundes- und EU-Ebene einen hohen Weiterbildungsbedarf haben, der jedoch oftmals aufgrund von Zeit- und Finanzknappheit nicht gedeckt wird.

3.5 Anpassung und Weiterentwicklung von Planungsinstrumenten

Es steht ein umfangreiches Planungsinstrumentarium zum Ausbau der erneuerbaren Energien zur Verfügung, das generell gut geeignet ist, den Ausbau der erneuerbaren Energien raumverträglich zu steuern. Für die näher betrachteten raumbedeutsamen Energieoptionen ist die Steuerungswirkung unterschiedlich stark ausgeprägt (vgl. Abschnitt 3.2).

Im Windenergiebereich ist eine räumliche und mengenmäßige Steuerung des Ausbaus mit den vor-handenen Instrumenten möglich. Eine große Herausforderung ist die Ermittlung von geeigneten, möglichst konfliktfreien Standorten für die Windenergienutzung. Aktuell arbeiten die zuständigen Planungsbehörden in den einzelnen Bundesländern mit unterschiedlichen Kriterien und Katalogen, die einerseits die aktuelle Rechtsprechung andererseits die jeweiligen landespolitischen Vorgaben berücksichtigen müssen. Die vom Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (BMUB) durchgeführte Begleitforschung zum EEG empfiehlt die Erarbeitung von bundesweit einheitlichen, flexibel gestalteten Kriterien und Standards zur Ermittlung von geeigneten Standorten der Windenergienutzung sowie die Berücksichtigung relevanter artenschutzrechtlicher Vorgaben bereits in der Phase der Ausweisung geeigneter Vorranggebiete. Zu besseren Vergleichbarkeit sollten standardisierte, avifaunistische Datenerfassungsmethoden entwickelt und eingesetzt werden, zugleich muss das Wirkungswissen durch die Auswertung von Monitoringergebnis-sen verbessert werden (vgl. PETERS & DIJKS 2013, S. 8-9). Ein wichtiger, erster Schritt wäre die flächendeckende Analyse, Bewertung und Fortschreibung von verfügbaren planungsrelevanten Daten, die sich z.B. aus der Auswertung von Gutachten aus Zulassungsverfahren sowie aus Monitoring-Maßnahmen ergeben.

Die räumliche Steuerung insbesondere des Biomasseanbaus gestaltet sich wesentlich schwieriger als bei der Windkraft. Der größte Steuerungsspielraum besteht im EEG und im Fachrecht. Eine zusätzliche, planerische Steuerungsmöglichkeit besteht in der Erarbeitung von regionalen Konzepten zur naturverträglichen Biomassenutzung. Diese können als Basis für das Gesamtenergiekonzept und zur koordinierten Standortsuche dienen. Zudem bilden sie eine gute Grundlage für Beratungsangebote zur nachhaltigen Biomassenutzung und zur Eruierung von alternativen Substraten und verfügbaren Reststoffen (PETERS & DIJKS 2013, S. 7-8).

Die planerische Steuerung von Photovoltaik-Freiflächenanlagen erfolgt über die Bauleitplanung oder die informelle Angebotsplanung auf regionaler Ebene. Aufgrund des wachsenden Einvernehmens darüber, dass die Nutzung der Solarenergie prioritär gebäudegestützt oder auf baulich oder infrastrukturell vorbelasteten Flächen erfolgen soll, wird der Umfang des Ausbaus von Photovoltaik-Freianlagen in Zukunft wahrscheinlich abnehmen. Generell ist bei Bedarf über die Entwicklung und Umsetzung von Ausschlusskriterien die Schaffung einer Grundlage zur formalen Steuerung auf regionaler Ebene möglich. Eine Weiterentwicklung der planerischen Steuerungsinstrumente hat derzeit eine untergeordnete Bedeutung.

Den Regionalen Energiekonzepten kommt aufgrund der dynamischen Entwicklungen und der verlangsamten Reaktionsmöglichkeit formeller Instrumente eine wachsende Bedeutung zu. Besondere Vorteile liegen in der gesamtheitlichen Betrachtung aller relevanten Energieoptionen. Der auch in diesem Bereich erforderliche Anpassungs- bzw. Weiterentwicklungsbedarf wird im Folgenden zusammenfassend dargestellt:

(1) Die Regionalen Energiekonzepte müssen aufgrund der relativ schnellen Änderungen der Rahmenbedingungen vor allem im technischen und finanziellen Bereich ständig aktualisiert und fortgeschrieben werden. Zudem ist es wichtig, dass alle Akteure einen Zugriff auf die Datenbasis haben, um eine größtmögliche Transparenz insbesondere zur Verbesserung der Akzeptanz herzustellen.

(2) Die Datenbasis muss ständig erweitert und verbessert werden. Dazu ist es notwendig, Daten aus den Genehmigungsverfahren der EE-Anlagen, aus den laufenden Monitoringmaßnahmen sowie aus sonstigen relevanten Planungsverfahren zu erfassen und aufzubereiten, so dass sie für die Fortschreibung der Regionalen Energiekonzepte genutzt werden können.

(3) Die Regionalen Energiekonzepte als informelle Planungsinstrumente müssen weiter qualifiziert werden, so dass die Ergebnisse möglichst einfach in die vorhandenen formalen Planungen einfließen und die Steuerung des Ausbaus der erneuerbaren Energie insgesamt optimiert werden kann. Eine Möglichkeit ist die Entwicklung und der Einsatz von multikriteriellen, GIS-gestützten Bewertungsverfahren, die Nachhaltigkeitsaspekte einbeziehen und Wege zum raumverträglichen Ausbau der Erneuerbaren Energien aufzeigen.

(4) Die Entwicklung und Anwendung von (bundes)einheitlichen Kriterien und Standards zur Erstellung von Regionalen Energiekonzepten insbesondere bei der Ermittlung von räumlich differenzierten erneuerbaren Energiepotenzialen ist eine zwingende Voraussetzung zur Verbesserung der Vergleichbarkeit der ermittelten Potenziale und zum Abgleich von überregionalen bzw. landesweiten Differenzen auf Energieerzeugungs- und Verbraucherebene. Darauf aufbauend könnten zur länderübergreifenden Synchronisation von Erzeugung und Nutzung der Erneuerbaren Energien Netzausbaubedarfe als Basis für die Erarbeitung von Netzausbauplänen ermittelt werden.

4 ENTWICKLUNG EINES GIS-GESTÜTZTEN INTEGRIERTEN RAUMBEWERTUNGS-SYSTEMS

4.1 Vorarbeiten

Das Energiemodell STEM (Space Type Energy Model) ist ein GIS-gestütztes Expertensystem, das auf der Basis von Siedlungs- und Landschaftsraumtypen den aktuellen und zukünftigen Energiebedarf und die erneuerbaren Energiepotenziale ermittelt. Die Grundidee zur Methodik bzw. zum Modell entstand im Rahmen des Forschungsprojektes "Nutzung städtischer Freiflächen für erneuerbare Energien" für das Bundesamt für Bauwesen und Raumordnung, Bonn (BBR/BBSR & BMVBS 2009). STEM wurde in zahlreichen Modellräumen, u.a. Hamburg (GENSKE et al. 2010), Basel (BERGER et al. 2011),

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Villach/Kärnten (GENSKE et al. 2012), Freistaat Thüringen (TMWAT 2011), Fürstentum Liechtenstein (DROEGE et al. 2012) sowie der Planungsregion Nordthüringen (GENSKE et al. 201) angewendet und wird ständig weiter entwickelt. Das Modell verfolgt einen gesamtheitlichen räumlichen Ansatz, in dem alle (zurzeit bereits marktfähigen) erneuerbaren Energieoptionen, alle Energieparteien und alle nachgefragten Energieformen (Strom, Wärme, Treibstoffe) berücksichtigt werden. Die Projektion des zukünftigen Energiebedarfs im Strom- und Wärmebereich sowie dessen Deckung mittels erneuerbarer Energien erfolgt szenarienbasiert. Die Szenarien bilden mögliche gesellschaftliche, politische und technologische Entwicklungen ab, die als quantifizierbare Größen in die Berechnungen Eingang finden.

Die mit dem Ausbau der erneuerbaren Energien verbundenen Raumansprüche und die daraus resultierenden Raumnutzungskonkurrenzen wurden im STEM-Modell bislang nicht explizit betrachtet.

4.2 Zielstellung

Ziel der Arbeit ist es, ein GIS-gestütztes integriertes Raumbewertungssystem zu entwickeln, das alle raumrelevanten Informationen zum Ausbau der erneuerbaren Energien zusammenfasst und aufbereitet, so dass Handlungsempfehlungen zur nachhaltigen energetischen Raumplanung abgeleitet werden können.

Im Rahmen des Promotionsvorhabens soll untersucht werden:

- wie sich der Ausbau erneuerbarer Energiepotenziale räumlich auswirkt,
- welche Synergien, aber auch Konflikte mit anderen Raumnutzungen bestehen,
- welche standardisierten Parameter und Bewertungskriterien als Basis eines integrierten Raumbewertungssystems eingesetzt werden können und
- wie der Ausbau der Erneuerbaren Energien raumverträglich gesteuert werden kann.

4.3 Methoden

Es steht ein umfangreiches Repertoire an Methoden zur Verfügung, die zur Durchführung des Vorhabens eingesetzt werden. Dieses umfasst klassische Literaturrecherche- und Auswertungsmethoden, spezielle Raumanalyse und -bewertungsverfahren sowie qualitative Methoden der empirischen Sozialforschung (Experteninterviews). Das im Rahmen der Promotion zu entwickelnde Modell der energetischen Raumbewertung ist als Raumbewertungs- und Simulationsmodell angelegt, das zur Beschreibung bzw. Darstellung der bestehenden Raumwirksamkeit bzw. Raumbelastung durch den Ausbau der erneuerbaren Energien sowie zur Simulation alternativer Ausbaupfade eingesetzt werden soll. Der Schwerpunkt der Arbeit liegt in der Analyse und Bewertung von Raumwirkungen des Ausbaus der Erneuerbaren Energien. Dazu ist der Einsatz eines Methodenmixes notwendig, der Analyse,- Prognose- und Bewertungsverfahren umfasst. Zu den Analysemethoden zählen u.a. Verfahren zur Definition von Indikatoren, Verfahren der Kartenüberlagerung sowie ökologische Wirkungsanalysen. Klassische Bewertungsverfahren sind die Raumempfindlichkeitsuntersuchung und die ökologische Risikoanalyse, die insbesondere im Bereich der Umweltverträglichkeitsprüfung eingesetzt wird. Prognoseverfahren dienen der Simulation von möglichen Raumwirkungen und zukünftiger Strukturen und Prozesse und können im Rahmen von Leitbilddiskussionen eingesetzt werden. Die Auswahl geeigneter Methoden und Verfahren hängt von verschiedenen Faktoren ab, insbesondere jedoch von der Datenverfügbarkeit und -qualität, den gewählten Zielstellungen und den angestrebten Ergebnissen.

4.4 Forschungsplan

Im Folgenden wird der geplante Forschungsablauf (siehe Abbildung 1) vorgestellt. Die Untersuchungen gliedern sich in die im Folgenden beschriebenen Hauptabschnitte.

4.4.1 Grundlagenstudien

Zunächst erfolgt eine detaillierte Analyse der Raumansprüche bzw. der Raumwirkungen der betrachteten erneuerbaren Energieoptionen (Arbeitsschritt 1). Ein weiterer wichtiger Grundlagenbaustein ist die Ermittlung und Beschreibung von Indikatoren der nachhaltigen Raumnutzung, die bei der Ermittlung von Raumbelastungsgraden beim Ausbau der erneuerbaren Energien Berücksichtigung finden sollen. Ein Schlüsselindikator zur Beurteilung der nachhaltigen Raumnutzung in Bezug auf das Handlungsziel Ausbau der erneuerbaren Energieerzeugung ist z.B. die Zunahme der Flächeninanspruchnahme durch den Bau von

Anlagen zur erneuerbaren Energieerzeugung bzw. der dazugehörigen Infrastruktur. (Arbeitsschritt 2). Weitere Indikatoren sind z.B. Freiflächenanteil und -qualität, Zerschneidungsgrad und Nutzungspotenzial. Basierend auf den Ergebnissen aus Arbeitsschritt 1 und 2 werden geeignete Bewertungskriterien bzw. Indikatoren ausgewählt. Auswahlkriterien sind z.B. die Verständlichkeit, Objektivität, die Datenverfügbarkeit sowie die Eignung zur Analyse von Wechselwirkungen mit anderen Nutzungen (Arbeitsschritt 3).

Meilenstein 1: Darstellung der Raumwirkungen / Indikatoren nachhaltiger Landnutzung

Im Mittelpunkt des nächsten Arbeitspaketes steht die Analyse, Beschreibung und Bewertung von Wechselwirkungen des Ausbaus der Erneuerbaren Energien mit anderen Raumnutzungen, mit dem Ziel, bestehende Synergien sowie Nutzungskonkurrenzen bzw. -konflikte mit Hilfe von zuvor definierten Bewertungskriterien und Indikatoren zu beschreiben. Im Ergebnis sollen Raumverträglichkeits- bzw. Raumbelastungsgrade für die untersuchten erneuerbaren Energieoptionen in Abhängigkeit von definierten Nachhaltigkeitsaspekten abgeleitet und in Abhängigkeit von den regionalen Rahmenbedingungen für den Modellraum dargestellt werden (Arbeitsschritt 4).

Meilenstein 2: Bestimmung von Raumverträglichkeits- bzw. Raumbelastungsgraden

4.4.2 Entwicklungsphase

Aufbauend auf den Ergebnissen aus den Grundlagenstudien wird für jede untersuchte Erneuerbare Energieoption eine Raumbewertungsmatrix abgeleitet, die den Grad der Raumverträglichkeit in Abhängigkeit von den bestehenden Potenzialen, dem aktuellen Ausbaugrad und Nachhaltigkeitsaspekten darstellt (Arbeitsschritt 5).

Voraussetzung für die Integration der Bewertungskriterien in ein Raumbewertungssystem ist die Operationalisierung. Diese beinhaltet Festlegungen, mit welchen Indikatoren die Gesamtraumbelastung- bzw. Raumverträglichkeit gemessen bzw. abgebildet werden soll und mit welchen GIS-basierten Erhebungs- und Analyseverfahren diese ermittelt werden können. Aufbauend auf der Analyse von Wechselwirkungen und Zielkonflikten zwischen den einzelnen Indikatoren erfolgt eine Kategorisierung der Bewertungskriterien in indifferent (im Sinne von unabhängig, beziehungslos), komplementär (sich ergänzend) und konfliktär. Zunächst werden konfliktäre Bewertungsaspekte betrachtet, um sogenannte KO-Kriterien zu bestimmen, die bestimmte Nutzungen (hier Erzeugung Erneuerbarer Energie) ausschließen. Alle anderen Kriterien werden priorisiert oder gewichtet in die Gesamtbewertung einbezogen. Diese so kategorisierten, priorisierten und gewichteten Bewertungskriterien werden schließlich in einem integrierten Raumbewertungssystem zusammengefasst (Arbeitsschritt 6).

Mit Hilfe von leitfadengestützten Experteninterviews wird das entwickelte Indikatorenset sowie das Bewertungssystem verifiziert und angepasst. (Arbeitsschritt 7)

Meilenstein 3: Entwicklung und Verifizierung des integrierten Raumbewertungssystems

4.4.3 Erprobung/Auswertung

Das Raumbewertungssystem wird im Modellraum getestet. Es werden raumverträglich nutzbare Flächenpotenziale ermittelt und regionale Ausbauziele definiert. Es können verschiedene Ausbauszenarien analysiert und ausgewertet werden. (Arbeitsschritt 8).

In der letzten Phase des Vorhabens erfolgt eine beispielhafte Erprobung bzw. Anwendung des entwickelten Raumbewertungssystems in der Praxis im Rahmen eines Planspiels. Ziel ist es, die Eignung als informelles Planungsinstrument zu testen. (Arbeitsschritt 9)

Meilenstein 4: Beispielhafte Erprobung des Raumbewertungssystems im Modellraum

Aufbauend auf einer Analyse bestehender Planungsinstrumente sollen Empfehlungen für die Anpassung bestehender bzw. Entwicklung neuer Instrumente zur Steuerung des raumverträglichen Ausbaus der erneuerbaren Energie abgeleitet werden (Arbeitsschritt 10).

Meilenstein 5: Ableitung von Empfehlungen für den praktischen Einsatz

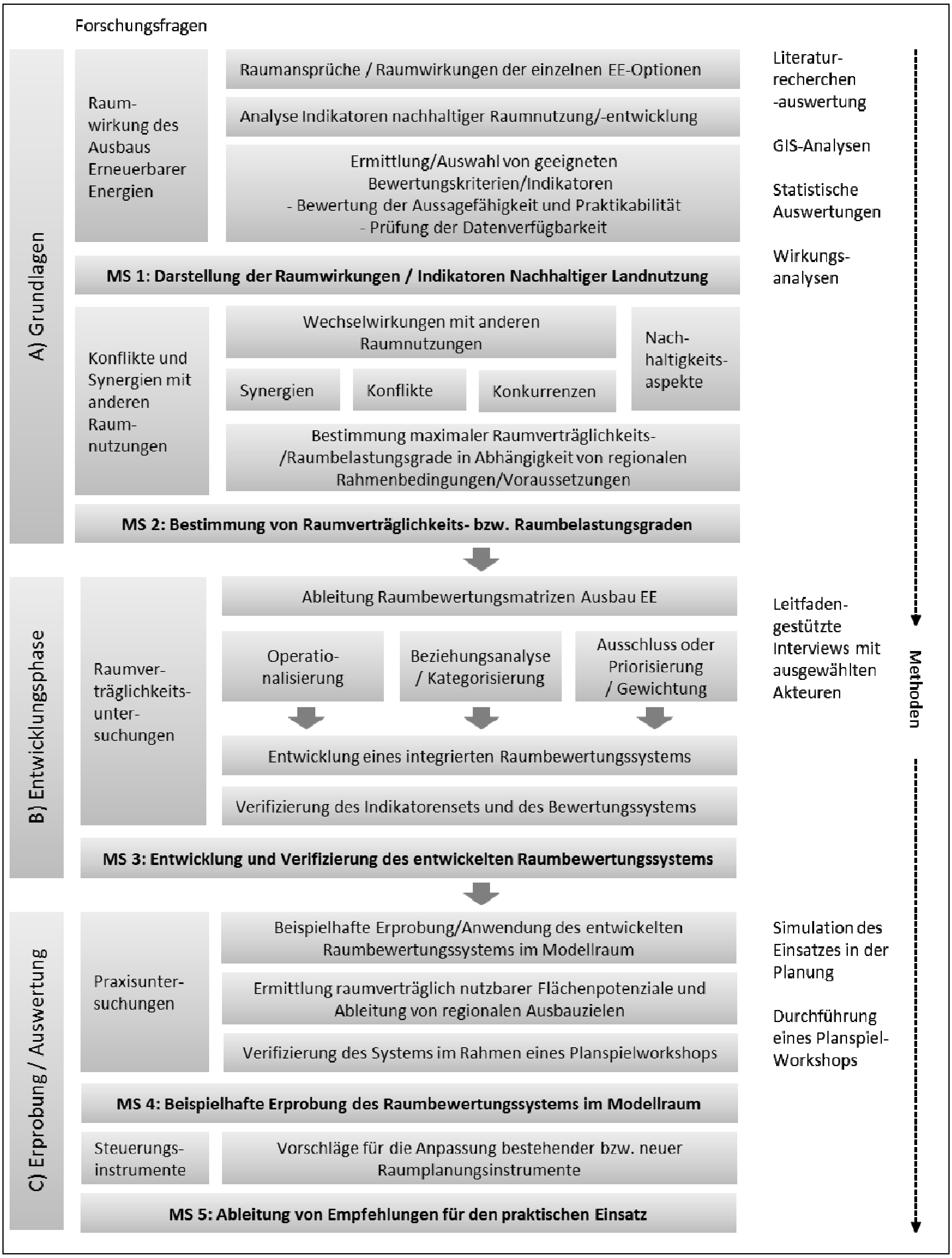

Abb. 2: Forschungsprozess und eingesetzte Methoden.

5 ZUSAMMENFASSUNG UND AUSBLICK

Die in den vorausgegangenen Abschnitten durchgeführten Betrachtungen als auch die Diskussionen in der Öffentlichkeit und der Fachwelt verdeutlichen die Komplexität der Energiewende, die Fragen einer stabilen, bezahlbaren, regenerativen Energieversorgung vor dem Hintergrund des Klimawandels und anderer konkurrierende Raumnutzungen mit der überordneten Frage nach der Gesamtnachhaltigkeit der Landschaftsraumnutzung durch den Menschen verbindet. Die Entwicklung von nachhaltigen Energielandschaften basiert auf dem schrittweisen, raumverträglichen Ausbau dezentraler erneuerbarer Energieanlagen. Die anvisierten Ausbauziele sind ambitioniert und erzeugen eine Reihe von

Nutzungskonflikten mit konkurrierenden Raumnutzungen. Es ist Aufgabe der Raumplanung, die durch den Ausbau der Erneuerbaren Energien verursachten räumlichen Nutzungsansprüche und Nutzungskonkurrenzen im Rahmen der räumlichen Planung zu koordinieren und zu steuern. Dazu steht ein umfangreiches Repertoire an Planungsinstrumenten zur Verfügung, das kurz vorgestellt und bezüglich seiner Steuerungswirkung und bestehender Hemmnisse bewertet wurde. Die vorhandenen Planungsinstrumente müssen aufgrund der dynamischen Entwicklungen im technischen Anla-genbereich als auch der finanziellen Rahmenbedingungen stetig angepasst und weiterentwickelt werden. Eine wachsende Bedeutung als informelle Planungsinstrumente zur Steuerung des raumverträglichen Ausbaus der erneuerbaren Energien haben die Regionalen Energiekonzepte. Es ist notwendig, für die Erstellung dieser Konzepte einheitliche Kriterien und Methoden zur Ermittlung von raumverträglichen erneuerbaren Energiepotenzialen zu entwickeln, die auch in anderen Modellräumen angewendet werden können. Somit könnten die Ergebnisse der Potenzialanalysen in den Regionen einerseits verglichen werden, viel wichtiger jedoch, auch miteinander verschnitten werden. Anhand einer überregionalen, auf der gleichen methodischen Basis ermittelten Übersicht über räumlich differenzierte Erzeugungspotenziale und Verbrauchsschwerpunkte könnten Netzausbaubedarfe abgeschätzt und Netzausbaupläne entwickelt werden. Dieser Aufgabe stellt sich das vorgestellte Promotionsvorhaben. Anhand von standardisierten Bewertungskriterien und -methoden sollen die Raumansprüche und vorhandenen Nutzungskonflikte des energetischen Umbaus aufzeigt und auf der Basis eines GIS-gestützten Bewertungssystems raumverträgliche Flächen- bzw. Energiepotenziale zum Ausbau der erneuerbaren Energien für den Modellraum Nordthüringen ermittelt werden. Ein weiterer Schwerpunkt der Arbeit, auf den im Rahmen dieses Beitrags nicht näher eingegangen wurde, liegt in der Entwicklung von Nachhaltigkeitskriterien, die in die Ermittlung der raumverträglichen Ausbaupotenziale der erneuerbaren Energien einbezogen werden sollen.

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reviewed paper

Chancengleichheit und Gender Mainstreaming im regionalen Diskurs – Beteiligung und Kooperation in regionalen Planungsprozessen

Mechtild Stiewe

(Dipl.-Ing. Mechtild Stiewe, Institut für Landes- und Stadtentwicklungsforschung, Brüderweg 22-24, 44135 Dortmund, Germany, mechtild.stiewe@ils-forschung.de)

1 ABSTRACT

EQUAL OPPORTUNITIES AND GENDER MAINSTREAMING IN THE „REGIONAL DISCOURSE" PARTICIPATION AND COOPERATION IN REGIONAL PLANNING PROCESSES

After 40 years the Regionalverband Ruhr (RVR) is again in charge and responsible for the Regional Planning in the Metropole Ruhr (Germany) since 2009. At the moment, based on 5 existing Regional Plans, the Regionalplan Ruhr is drawn up. For that reason the so called Regional Discourse was initiated along the lines of "Heading for the Future of Metropole Ruhr" implementing a multitude of participation. Equal opportunities and gender mainstreaming – not simply based on legal requirements – provide substantial elements and cross-cutting issues, which should (hopefully) be considered in all topics of spatial planning. Their implementation takes place on three different levels: Level of structure, level of processing and level of content.

The <level of structure> intends the establishment in the law of the Regionalverband Ruhr (RVRG), especially concerning the aspects of organisation and personnel development. Concerning the <level of processing> the aspects of equal opportunities and gender mainstreaming are integrated in all forms of operations and participation from the very beginning.

Mainly this success is based on intensive and critical support of the "Women´s network Ruhr-area" (founded in 2009) and their qualified comments and statements. Special events and (Future)panels provided intensive discussions on challenges, needs and expectations from the standpoint of the gender perspective. The competition "1000 Ruhr-ideas" was realized including the local press thus including a wide range of the area´s population.

On the <level of content> insights and concrete results of the above described forms of participation should be included in the Regionalplan Ruhr (as formal result of the Regional Discourse) and a strategic volume (as informal result of the Regional Discourse).

2 KURZFASSUNG

Der Regionalverband Ruhr (RVR) ist seit 2009 nach ca. 40 Jahren wieder für die Regionalplanung der Metropole Ruhr (Deutschland) verantwortlich. Aus bestehenden fünf Regionalplänen wird derzeit ein Regionalplan Ruhr aufgestellt. Aus diesem Anlass wurde der sogenannte Regionale Diskurs unter dem Motto „Auf dem Weg in die Zukunft der Metropole Ruhr" initiiert, der eine breite Beteiligung beinhaltet. Dabei sind auch Chancengleichheit und Gender Mainstreaming - nicht nur vor dem Hintergrund der gesetzlichen Vorgaben - wesentliche Bestandteile und Querschnittsthemen, welche in allen Themenfeldern der räumlichen Planung Berücksichtigung finden (sollen). Die Implementierung erfolgt dabei auf drei unterschiedlichen Ebenen: auf der Strukturebene, der Prozessebene und der inhaltlichen Ebene.

Die Strukturebene meint die Verankerung im Gesetz über den Regionalverband Ruhr (RVRG), insbesondere im Bereich der Organisations- und Personalentwicklung. Auf der Prozessebene werden im Regionalen Diskurs die Belange im Hinblick der Chancengleichheit und des Gender Mainstreaming in allen Verfahrens- und Beteiligungsformaten von Beginn an integriert.

Dies geschieht vor allem durch die intensive und kritische Begleitung durch das im Jahr 2002 gegründete Frauennetzwerk Ruhrgebiet insbesondere in Form von Fachbeiträgen und Stellungnahmen. In Fachveranstaltungen und (Zukunfts)Foren wurde intensiv über Anforderungen, Bedürfnisse und Erwartungen aus Sicht der Gender Perspektive diskutiert. Über den Ideenwettbewerb „1.000 Ruhrideen" wurden in Kooperation mit der örtlichen Presse (WAZ) auch Bürgerinnen und Bürger einbezogen.

Inhaltlich sollen die Erkenntnisse sowie die konkreten Ergebnisse aus den verschiedenen Beteiligungsformaten in den Regionalplan Ruhr (als formales Ergebnis des Regionalen Diskurses) und in einen (sogenannten) Strategieband (als informelles Ergebnis des Regionalen Diskurses) einfließen.

3 GENDER MAINSTREAMING ALS STRATEGISCHER ANSATZ IN DER RÄUMLICHEN PLANUNG

Die Lebensrealitäten von Männern und Frauen, jungen und älteren Menschen, Familien und Singles sind vielschichtig und dementsprechend die Anforderungen an die Stadt- und Regionalplanung. Die Berücksichtigung der Genderperspektive bedeutet auf der einen Seite die Geschlechterverhältnisse zu thematisieren (geschlechtsspezifische Datenerhebungen und -auswertungen) und andererseits zu einer Veränderung hin zu mehr Geschlechterge¬rechtig¬keit beizutragen.

Dabei bezeichnet der englische Ausdruck Gender das soziale und psychologische Geschlecht einer Person im Unterschied zu ihrem biologischen Geschlecht. Gender wird mithin als soziale Realität gesehen und nicht als natürlich gegebenes Faktum. Diese Form der Geschlechtlichkeit entsteht und verändert sich gesellschaftlich, also in der Interaktion zwischen Individuum, Gruppe und Gesellschaft.

Die Gender-Perspektive besagt: Frauen und Männer, aber auch Kinder/Jugendliche, Mobilitätseingeschränkte, Ältere, Menschen mit Migrationshintergrund finden in der Gesellschaft unterschiedliche Lebensbedingungen und Chancen vor. Sie entwickeln aufgrund geschlechtsspezifischer, sozialer bzw. ethnischer Sozialisation unterschiedliche Interessen und Bedürfnisse. Sie sind von gesellschaftlichen Prozessen und deren Auswirkungen unterschiedlich betroffen.

Was die Unterschiede in der Lebenssituation der Geschlechter angeht, so sind in vielen Bereichen Veränderungen in Richtung Angleichung zu bemerken. In der Schulbildung beispielsweise haben sich die Verhältnisse inzwischen umgekehrt, hier bedeutet Gender Mainstreaming nun, dass die Jungen besonders gefördert werden müssen. Frauen sind dennoch nach wie vor in vielen gesellschaftlichen Feldern benachteiligt:

- Erwerbs- und Transfereinkommen
- Vermögen, Wohneigentum
- Arbeitsbedingungen (prekäre Beschäftigungsverhältnisse, Teilzeit, Minijobs)
- Beruflicher Status/Stellung (Führungspositionen)
- Macht und Einfluss (Politik, Wirtschaft, Medien)
- Anteil an der unbezahlten Familienarbeit

Nach wie vor sind es auch in erster Linie Frauen, die für die Versorgung der Familie und für die Hausarbeit zuständig sind, unabhängig davon, ob sie erwerbstätig sind oder nicht. Eine Zunahme der Berufstätigkeit von Frauen – insbesondere von Müttern – führt jedoch nicht zu einer Gleichheit, sondern i.d.R. zur Doppelbelastung der Frauen bei gleichbleibenden Verhältnissen der Männer.

Es sind also immer noch Maßnahmen notwendig, um die Gerechtigkeit zwischen den Geschlechtern herzustellen. Dabei wird mit Gender Mainstreaming der Blick einerseits auf diese strukturellen Unterschiede gelenkt, andererseits aber auch für die unterschiedlichen Bedürfnisse, Interessen und Anforderungen innerhalb der Gruppen der Männer und Frauen geschärft. Und damit geraten eben auch z. B. der sozialen Lage, dem Alter oder dem ethnischen Hintergrund ins Blickfeld.

Der Begriff Gender ...

... verweist auf die ökonomischen, sozialen und kulturellen Zuschreibungen und Chancen die damit

verbunden sind, männlich oder weiblich zu sein. In fast allen Gesellschaften unterscheiden sich Männer und Frauen im Hinblick auf ihre Aktivitäten, im Zugang zu und Kontrolle über Ressourcen und auf die Teilhabe an Entscheidungsprozessen. Die Geschlechterdefinition – was es heißt, männlich oder weiblich zu sein – variiert zwischen den Kulturen und ändert sich mit der Zeit.

(Quelle: Leitfaden EU Gender Mainstreaming 2005 / EQUAL Program)

Der Begriff Gender Mainstreaming wurde erstmals im Jahr 1985 auf der 3. UN-Weltfrauenkonferenz in Nairobi diskutiert und zehn Jahre später auf der 4. UN-Weltfrauenkonferenz in Peking weiterentwickelt. Seit den Amsterdamer Verträgen von 1997/1998 ist Gender-Mainstreaming auch das erklärte Ziel der Europäischen Union.

Auch die Bundesregierung erkennt durch einen Kabinettsbeschluss aus dem Jahr 1999 Gender Mainstreaming als durchgängiges Leitprinzip ihres Handelns an und implementiert die Strategie seit dem Jahr 2000 durch eine interministerielle Arbeitsgruppe. Nach § 1 Absatz 6 Satz 3 Baugesetzbuch (BauGB) 2004 sind bei der Aufstellung von Bauleitplänen „die sozialen und kulturellen Bedürfnisse der Bevölkerung, insbesondere die Bedürfnisse der Familien, der jungen, alten und behinderten Menschen, unterschiedliche Auswirkungen auf Frauen und Männer sowie die Belange des Bildungswesens und von Sport, Freizeit und Erholung" zu berücksichtigen.

Für die Regionalentwicklung und Regionalplanung erfordert dies eine erweiterte „Zielperspektive" zu mehr Transparenz über Chancen bzw. Defizite und zu mehr Qualität und Effizienz in der räumlichen Planung. Zudem können dadurch die Beteiligungsmöglichkeiten insbesondere für Frauen und die Bedeutung von Partizipation für die Region gestärkt werden. Als Herausforderung auf der Bearbeitungsebene ist die Genderperspektive auch in der Regionalplanung durchaus im Bewusstsein, es gibt jedoch bislang erst wenige Ansätze und Praxiserfahrungen und erst recht keine Planungsroutinen.

4 DER REGIONALVERBAND RUHR

Der Regionalverband Ruhr (RVR) ist ein kommunaler Zweckverband und setzt sich aus den elf kreisfreien Städten (Bochum, Bottrop, Dortmund, Duisburg, Essen, Gelsenkirchen, Hagen, Hamm, Herne, Mülheim a. d. Ruhr und Oberhausen) sowie den vier Kreisen (Ennepe-Ruhr-Kreis, Kreise Recklinghausen, Wesel und Unna) der Metropole Ruhr zusammen.

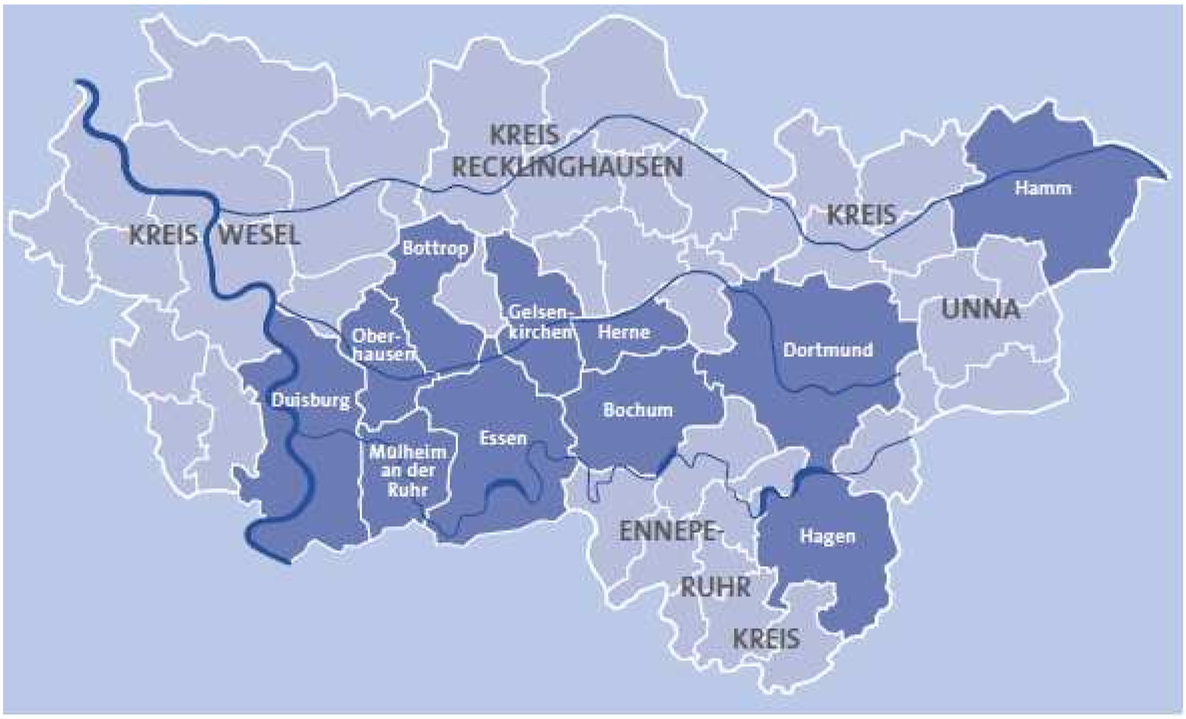

Abb. 1: Verbandsgebiet des RVR, Quelle: RVR 2012

In der Metropole Ruhr leben rund 5,1 Mio. Einwohnerinnen und Einwohner auf einer Fläche von mehr als 4.400 Quadratkilometern, die sich auf insgesamt 53 Städte und Gemeinden verteilen. Damit steht die Metropole Ruhr neben Greater London, Île-de-France, Istanbul und Moskau für eine der fünf größten Agglomerationen in Europa.

Regionalplanung in Nordrhein Westfalen ist eine "hoheitliche Aufgabe", die das Land dem Regionalverband Ruhr als "Staatliche Regionalplanung" zugewiesen hat. Mit den gesetzlichen Reformen in den Jahren 2004 - 2007 hat der Landtag des Landes Nordrhein-Westfalen dem Regionalverband Ruhr weitreichende Planungskompetenzen für die Metropole Ruhr (zurück)gegeben: Mit der Übernahme der staatlichen Regionalplanung am 31. Oktober 2009 steht die Metropole Ruhr nun vor der Chance, nach mehr als 40 Jahren wieder einen einheitlichen Regionalplan für die Gesamtregion aufzustellen, der für die nächsten 15 Jahre die Rahmenbedingungen für die räumliche Entwicklung festlegen wird.

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Das "Ruhrparlament", die Verbandsversammlung des RVR, entscheidet in seiner neuen, zusätzlichen Funktion als Regionalrat Ruhr über den Regionalplan. Im Ruhrparlament vertreten die Repräsentantinnen und Repräsentanten der kreisfreien Städte und Kreise die Interessen der Metropole Ruhr. Sie werden bislang nicht direkt sondern von den Räten bzw. Kreistagen der Mitgliedskörperschaften gewählt. Außerdem sind die 15 Oberbürgermeisterinnen und Oberbürgermeister sowie die Landräte stimmberechtigte Mitglieder.[1]

4.1 Gender Mainstreaming – Ziel und Querschnittsaufgabe für die regionale Planung im Regionalverband Ruhr

Gender Mainstreaming verfolgt das Ziel der Geschlechtergerechtigkeit und bedeutet, bei allen Planungen und Entscheidungen, Verordnungen oder Gesetzen von Anfang an daran zu denken, dass sie sich unterschiedlich auf Frauen und Männer auswirken könnten, da es keine geschlechts¬neutrale Wirklichkeit gibt. Gender Mainstreaming zur Umsetzung von Chancengleichheit wird durch den Gesetzgeber auf den verschiedenen Ebenen der Planung – und damit auch für die Regionalplanung – vorgegeben; die Berücksichtigung von Gender Mainstreaming hat im Regionalverband Ruhr Tradition. So ist Gender Mainstreaming im § 13, Absatz 1 Punkt 4 und in § 17 (Aufgaben der Gleichstellungsbeauftragten), Abs. 1 im Gesetz über den Regionalverband Ruhr (RVRG) verankert. Die Berücksichtigung der Genderperspektive wird zudem explizit von der Verwaltungsspitze eingefordert.

So weist die Organisations- und Personalentwicklung des Regionalverband Ruhr folgende Strukturen auf, um Gender Mainstreaming nachhaltig in das ‚Tagesgeschäft' zu integrieren: Der Verband hat eine Gleichstellungsbeauftragte, einen Frauenförderplan, eine Sachbearbeiterin mit expliziter Gender-Aufgabenstellung für die räumliche Planung sowie eine interne referatsübergreifende Arbeitsgruppe, die sich intensiv mit den Planungsthemen des Verbandes auseinandersetzt und prüft, wie und wo Aspekte des Gender Mainstreamings integriert werden können. Des Weiteren gibt es eine intensive Kooperation mit dem Frauennetzwerk Ruhrgebiet.

5 DAS FRAUENNETZWERK RUHRGEBIET - PLATTFORM FÜR EINE AKTIVE BETEILIGUNG

Die Zusammenarbeit des Frauennetzwerkes Ruhrgebiet mit dem Regionalverband Ruhr bzw. seinem Vorgänger dem Kommunalverband Ruhr (KVR) hat inzwischen eine dreizehnjährige Tradition. Im Sommer des Jahres 2002 gründetet sich das Frauennetzwerk im Nachgang der Veranstaltung „Frauen entwerfen ein Leitbild für die Region" um das Leitbild des Gender Mainstreaming in der Region zu verankern. Dabei ging und geht es um eine strategische und methodische Neuorientierung.

Als ein informelles, unabhängiges Netzwerk von Planerinnen, Gleichstellungsbeauftragten sowie Frauen, die an Genderthemen, Stadt- und Regionalentwicklung interessiert sind liegen Koordination und Organisation bei der Gleichstellungsbeauftragten des RVR und einem gewählten Sprecherinnengremium.

Das Frauennetzwerk verfolgt die Umsetzung des Gender Mainstreaming in der Region und trifft sich zu regelmäßigen Sitzungen. Es setzt sich kritisch mit planungsrelevanten Fragestellungen aus der Genderperspektive auseinander, die die Region betreffen. In diesem Zusammenhang werden Stellungnahmen zu Gesetzesentwürfen, Flächennutzungsplänen etc. verfasst und „Genderprojekte" bearbeitet, deren Ergebnisse in kommunale und regionale Prozesse eingespeist werden.

Die Intention der Frauen des Netzwerks liegt in der Umsetzung von Gender Mainstreaming in den Planungsalltag und das Verwaltungshandeln in der Region. Dabei wirkt das Netzwerk durch Initiativen und Impulse von von „außen" sowie in der Regel von „unten" (bottom up) und ist bei der Umsetzung von Projekten auf die Kooperation und das Zusammenwirken mit Projektträgern, Verwaltungsspitzen bzw. den Führungsebenen angewiesen (top down) im Sinne der Doppelstrategie des Gender Mainstreaming.

Das Frauennetzwerk Ruhrgebiet hat sich inzwischen als ein qualifiziertes Gremium von Expertinnen sowohl für die Implementierung von Gender Mainstreaming in der Planung beim RVR als auch in der Region etabliert. Neben regelmäßigen Stellungnahmen, gemeinsamen Veröffentlichungen („Frauenatlas Ruhrgebiet" (2000), „Frauen entwerfen ein Leitbild für die Region" (2002), „Perspektivwechsel" (2007) und

[1] vgl. http://www.metropoleruhr.de/regionalverband-ruhr/ruhrparlament.html.

„FrauRuhrMann“ (2011) begleitet das Frauennetzwerk derzeit intensiv den „Regionalen Diskurs“ zum Regionalplan Ruhr des RVR.

6 DER REGIONALE DISKURS – AUF DEM WEG IN DIE ZUKUNFT DER METROPOLE RUHR

Das Ruhrgebiet ist wie kaum eine andere westdeutsche Region vom Strukturwandel betroffen. Weitreichende Transformationsprozesse sind die Folge. Sie stellen nicht nur eine Herausforderung für die Identität ihrer Bewohnerinnen und Bewohner dar, sondern prägen auch die Suche nach einem Leitbild für die Region.

Der Regionalverband Ruhr hat die Reform der Übernahme der staatlichen Regionalplanung zum Anlass genommen, die gesamte Metropole Ruhr wieder als planerische Einheit in den Blick zu nehmen. Dabei werden die strategisch-konzeptionellen Gesichtspunkte der Regionalentwicklung und die raumordnerische Umsetzung der Regionalplanung gemeinsam bedacht.

Die Übertragung der Planungskompetenz auf den Regionalverband Ruhr im Jahr 2009 bietet die einmalige Chance nach mehr als 30 Jahren wieder eine gesamträumliche Planung anzugehen. Aus den bestehenden fünf Regionalplänen wird derzeit ein Regionalplan Ruhr aufgestellt. Dafür entwickelte der RVR einen innovativen, diskursiven Planungsprozess: den sogenannten „Regionalen Diskurs“ auf dem Weg zur Erarbeitung des Regionalplans Ruhr. (vgl. http://www.metropoleruhr.de/regionalverband-ruhr/regionaler-diskurs.html)

In einem umfassenden und in großen Teilen auch kooperativem Verfahren wurden und werden Lösungen gesucht, die herkömmliche Erwartungen durchbrechen und auch ganz bewusst Anreize zu Diskussionen geben. Dieser, auf breite Beteiligung ganz unterschiedlicher regionaler Akteure (Kommunen, Politik, Wissenschaft, Bürgerinnen und Bürger) angelegte Prozess beinhaltete verschiedene Beteiligungs- und Veranstaltungsformate. Wichtige Bausteine waren dabei die drei großen Regionalforen, und die Auslobung des Ideenwettbewerbs „Zukunft Metropole Ruhr“.

Der „Regionale Diskurs“ ist ein auf Transparenz und Kommunikation angelegter Prozess, der eine neue Form einer „strategischen Regionalplanung“ erprobt, bei der insbesondere auch informelle Planungselemente (wie verschiedene Veranstaltungs- und Beteiligungsformate) integraler Bestandteil sind (vgl. Abb. 2).

Hierzu zählt eine intensive Beteiligung der (Fach-)Öffentlichkeit. Eingebunden wurden seit dem Jahr 2011 verschiedenste Verbände, Fachinstitutionen, die Wirtschaft, die Landwirtschaft, die Politik, die Zivilgesellschaft sowie die Kommunen und Kreise der Metropole Ruhr. Der Austausch in einem strukturierten und innovativen Prozess und die Zusammenarbeit mit den unterschiedlichen Akteurinnen und Akteuren aus der Region sowie mit den Expertinnen und Experten aus Wissenschaft/Forschung und Praxis sind dabei von zentraler Bedeutung. Erklärtes Ziel ist es, einen Plan von der Region für die Region zu erstellen. Gemeinsam sollen die Entwicklungspotenziale der Region und ihre aktuellen Herausforderungen identifiziert und Ziele formuliert werden. Daran schließt sich dann die Ableitung von konkreten Handlungsempfehlungen und letztendlich auch eine planerische Umsetzung an.

Dies betrifft alle planungsrelevanten Themenfelder wie Siedlungsentwicklung, Industrie, Handel, Land- und Forstwirtschaft, Verkehr und Mobilität, Energieversorgung, Freiraum, Freizeit und Tourismus, Kulturlandschaften, das Thema Wasser sowie den Bereich Bildung. Chancengleichheit/Gender Mainstreaming sowie Anpassungen an den Klimawandel und den Demographischen Wandel sind Querschnittsziele und werden in allen o.g. Themenbereichen berücksichtigt.

Der Ideenwettbewerb (vgl. http://ideenwettbewerb.metropoleruhr.de/) als ein wichtiger Baustein im Gesamtprozess (vgl. Abb. 2) ermöglichte auf der einen Seite durch die Beteiligung fünf international und interdisziplinär zusammengesetzter Planungsbüros einen Blick von außen auf die Region und zum anderen den Akteuren der Zivilgesellschaft und nicht zuletzt den Bürgerinnen und Bürgern der Region eine frühzeitige und intensive Einbindung in den Planungsprozess. Gegenseitige Impulse und Diskussionen waren ausdrücklich gewünscht und können rückblickend als positiver Teilhabeaspekt herausgehoben werden. Positiv zu bewerten ist auch die durch die Planungsbüros eingenommene Nutzer- und Nutzerinnenperspektive – ihre Ideen zur aktiven Beteiligung der Menschen an der Zukunftsgestaltung. Dies ist ganz im Sinne einer Genderstrategie und der Umsetzung von Chancengleichheit, also der Ziele, die sich das Frauennetzwerk Ruhrgebiet für die Region gesetzt hat.

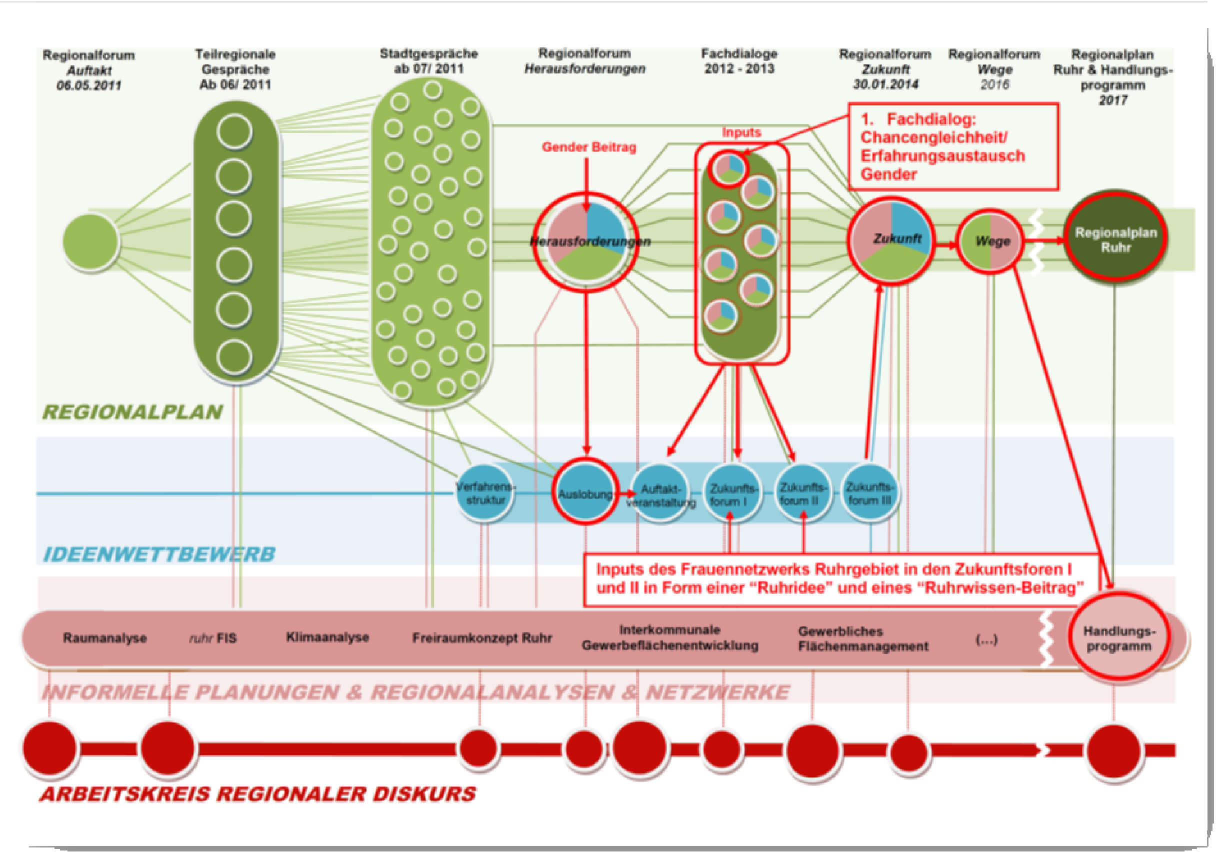

Abb. 2: Beteiligungsverfahren im Regionalen Diskurs, Quelle RVR 2014

6.1 Gender Mainstreaming im Regionalen Diskurs

Bereits zur Beginn des Regionalen Diskurses stand fest, dass „Chancengleichheit/Gender Mainstreaming“ von Anfang an integriert werden muss, was nicht zu letzt darauf zurückzu führen ist, dass das Thema Gender Mainstreaming bereits seit einigen Jahren als handlungsleitendes Prinzip Eingang auf verschiedenen Ebenen des Regionalverbandes Ruhr findet. So ist die Implementierung von Gender Mainstreaming auch im Rahmen des Regionalen Diskurses breit angelegt: auf der strukturellen, der inhaltlichen sowie auf der Prozess-Ebene.

6.1.1 <u>Implementierung auf der strukturellen Ebene</u>

Die strukturelle Ebene meint die Verankerung im Gesetz über den Regionalverband Ruhr (RVRG), insbesondere im Bereich der Organisations- und Personalentwicklung. Eine erfolgreiche Implementierung von Gender Mainstreaming hängt davon ab, ob und wie dieser Leitgedanke von den verantwortlichen Entscheidungsträgern vollends unterstützt wird – als Top-down-Strategie. Sowohl Verwaltungsspitze des RVR, wie auch die Politik haben sich für die Berücksichtigung der Genderbelange im Regionalen Diskurs für den Regionalplan Ruhr und die künftige Regionalentwicklung des RVR entschieden.

Bereits beim Erfahrungsaustausch Gender/Chancengleichheit im Jahr 2012 machte Martin Tönnes, Bereichsleiter Planung beim RVR dies deutlich:“Ich stehe dafür, dass Chancengleichheit als wichtiges Zielin das Verfahren der Regionalplanung eingebracht und auch im weiteren Erarbeitungsprozess berücksichtigt wird. (…) Die Metropole Ruhr braucht gendergerechte (Leit-)Bilder über das Leben und Arbeiten sowie eine daran orientierte Planung; denn die Region hat sich deutlich gewandelt. In der Außenwelt wird sie vielfach noch als männerdominierte Arbeitswelt wahrgenommen.“ (RVR 2012a)

Die Gleichstellungsbeauftragte des RVR hat von Beginn aktiv am Prozess mitgearbeitet und dabei auch als Multiplikatorin zum Frauennetzwerk Ruhrgebiet gewirkt. Erleichert wird diese Ebenso hat die hausinterne, referatsübergreifenden Arbeitsgruppe Gender die einzelnen Etappen des Regionalen Diskurses intensiv begleitet.

6.1.2 Implementierung auf der Prozess-Ebene

In den Verfahrens- und Beteiligungsformaten des Regionalen Diskurses wurden die Belange des Gender Mainstreaming – nicht zuletzt auch durch eine starke Beteiligung des Frauennetzwerkes – von Beginn an integriert (Abb. 2).

Im ersten Regionalforum Herausforderungen im Jahr 2011 wurde explizit eine externe Expertin zum Thema Gender Mainstreaming eingeladen, um die räumlichen Ansprüche und Kriterien aus der Gender Perspektive darzustellen.

Die Fachdialoge zu allen für den Regionalplan relevanten Themenfeldern , die im Zeitraum Frühjahr 2012 bis Sommer 2013 stattfanden, dienten dem Austausch über sektorale und fachbezogene Handlungsfelder der Raumentwicklung. Der Erfahrungsaustausch Chancengleichheit/Gender wurde gezielt vor den zehn thematischen Fachdialogen (und auch nicht als solcher bezeichnet) durchgeführt, um die Akteure frühzeitig für das Thema zu sensibilisieren. Die Fachdialoge fanden zu folgenden Themenfeldern statt:

- Erfahrungsaustausch Chancengleichheit/Gender
- Regionale Grünzüge
- Großflächiger Einzelhandel
- Land- und Forstwirtschaft
- Verkehr und Mobilität
- Energie und Klima
- Freizeit und Tourismus
- Kulturlandschaften
- Freiraum
- Wasser
- Siedlung

Grundlage waren die Fachbeiträge, Gutachten und fachlichen Stellungnahmen, die insbesondere von den Trägern öffentlicher Belange im Rahmen der Erarbeitung des Regionalplan erstellt wurden. Ziel dieser Fachdialoge war es, unterschiedliche Perspektiven und räumliche Steuerungsmöglichkeiten auf regionaler Ebene mit einer Vielzahl von Akteuren zu diskutieren und die weitere Vorgehensweise konkreter Inhalte, der Methodik und der Festlegungserfordernisse abzustimmen. Die Ergebnisse dienen jedoch (ganz bewusst) nicht der planerischen Abwägung.

An allen Fachdialogen haben Expertinnen aus dem Frauennetzwerk teilgenommen und jeweils „Genderbeiträge“ eingebracht: Hier wurde den Fragen nachgegangen, wie beispielsweise Frauen und Männer von der jeweiligen Thematik betroffen sind; welche Auswirkungen die Planungen auf den Alltag von Frauen und Männern hat, usw.

Der Ideenwettbewerb Zukunft Metropole Ruhr, bei dem fünf international und interdisziplinär zusammengesetzten besetzte Planungsteams Visionen für die Metropole Ruhr entwickelten, forderte bei der Auslobung explizit auf, die vielfältigen Lebensentwürfe von Frauen und Männern sowie unterschiedlichen Kulturen in den Planungen zu berücksichtigten. Chancengleichheit und Gender Mainstreaming wurden in den verschiedenen Zukunftsforen der Ideenwettbewerbs thematiesiert sowie Genderprojekte im Rahmen der Beteiligungsformate „Ruhrideen“ (durch die Zivilgesellschaft eingebrachten Vorschläge) und „Ruhrwissen“ eingebracht.

Der Ideenwettbewerb hatte zum Ziel, den Blickwinkel durch Impulse von außen zu weiten sowie unkonventionelle Raumanalysen, Lösungsstrategien und frische Gestaltungsideen - auch mal das vermeintlich Unmögliche denken - in den weiteren Prozess mit aufzunehmen. Dabei standen die Menschen der Region als Zukunftsgestalterinnen und Zukunftsgestalter und Imbulsgebende im Mittelpunkt, z. B. als agierende „Neuländerinnen und Neuländer“ in den Quartieren.

Das Verfahren des Ideenwettbewerbs wurde von drei Zukunftsforen begleitet, in denen sich Fachpublikum, Politik, Zivilgesellschaft sowie Netzwerkerinnen und Netzwerker, beispielsweise auch das Frauennetzwerk Ruhrgebiet, mit den Herausforderungen der Region, Fragen der Zukunftsgestaltung und den Sichtweisen und

Lösungen der Büros sehr intensiv – oftmals auch kontrovers - auseinander gesetzt haben. Gegenseitige Impulse waren gewünscht und sie waren bereichernd für alle.

Der gesamte Regionale Diskurs wurde und wird zudem intensiv mit dem zuständigen Planungsausschuss erörtert und von der Verbandsversammlung, dem Ruhrparlament beschlossen.

6.1.3 Implementierung auf der inhaltlichen Ebene

Inhaltlich fließen die Erkenntnisse sowie die konkreten Ergebnisse aus den o.g. Beteiligungsformaten in den Regionalplan Ruhr (als formales Ergebnis des Regionalen Diskurses) und in ein Strategieband (als informelles Ergebnis des Regionalen Diskurses) ein. Wie dies in der Praxis konkret aussehen wird, bleibt abzuwarten.

Alle zehn Fachdialoge, der Erfahrungsaustausch Chancengleichheit/Gender, die Regionalforen und der Ideenwettbewerb wurden unfassend dokumentiert; die Erkenntnisse sowie die Ergebnisse auch der Genderbeiträge und -kriterien wurden in die jeweiligen Publikationen eingearbeitet.

Der Ideenwettbewerb als ein wichtiger Baustein im Gesamtprozess ermöglichte auf der einen Seite durch die Beteiligung fünf international und interdisziplinär zusammengesetzter Planungsbüros einen Blick von außen auf die Region und zum anderen den Akteuren der Zivilgesellschaft und nicht zuletzt den Bürgerinnen und Bürgern der Region eine frühzeitige und intensive Einbindung in den Planungsprozess. Gegenseitige Impulse und Diskussionen waren ausdrücklich gewünscht und können rückblickend als positiver Teilhabeaspekt herausgehoben werden.

Positiv zu bewerten ist auch die durch die Planungsbüros eingenommene Nutzer- und Nutzerinnenperspektive – ihre Ideen zur aktiven Beteiligung der Menschen an der Zukunftsgestaltung. Dies ist ganz im Sinne einer Genderstrategie und der Umsetzung von Chancengleichheit, also der Ziele, die sich das Frauennetzwerk Ruhrgebiet für die Region gesetzt hat. Dazu gehören auch eine Stärkung der Region durch regional governance, intensivere und bessere Zusammenarbeit der formellen und informellen Akteure für den Ausbau der verkehrlichen und sozialen Infrastruktur zugunsten der Lebensqualitäten, verbesserter Erreichbarkeiten sowie bessere Arbeitsmarktchancen für Frauen und Männer gleichermaßen.

Die wesentlichen Erkenntnisse aus dem Regionalen Diskurs, künftige Ziele und Anforderungen – Gender Mainstreaming impliziert - wurden in das Positionspapier „Perspektiven zur räumlichen Entwicklung der Metropole Ruhr“ eingebunden, welches von allen beteiligten Akteuren der Region befürwortet sowie inzwischen auchvon der Politik beschlossen wurde.

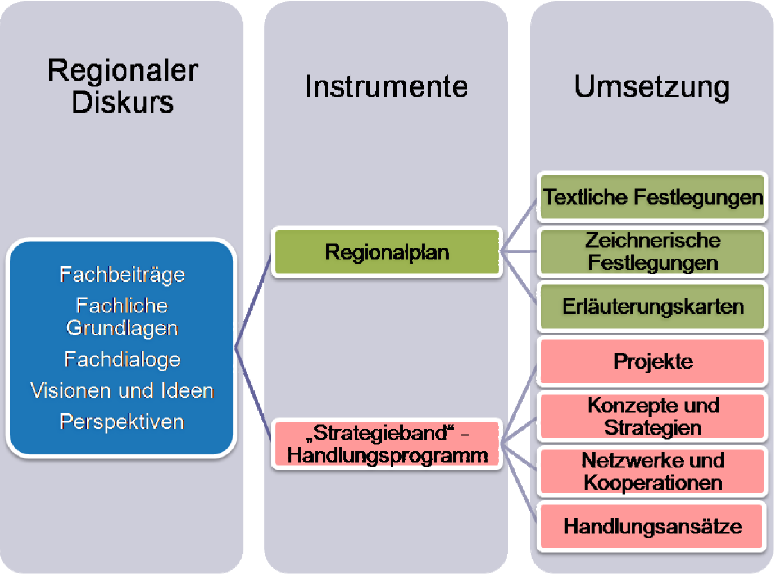

Abb. 3: Regionaler Diskurs: Handlungsprogramm und Regionalplan, Quelle RVR 2014

Es dient als regional abgestimmte Grundlage sowohl zur Erarbeitung des Regionalplans Ruhr als formelles Planungsinstrument[2] als auch für die Erarbeitung des Handlungsprogramms „Zukunft Metropole Ruhr“ als

[2] Formelle Planungsinstrumente hingegen sind gesetzlich festgeschriebene Planungsinstrumente; die Festlegungen und Ziele sind bindend. Der Regionalplan hat eine Bindungswirkung für die nachgeordneten Behörden.

informelles Planungsinstrument[3] - als Vorgabe für die künftige Regionalentwicklung durch den Regionalverband Ruhr.

Gerade auf der regionalen Ebene ist insbesondere hinsichtlich der Siedlungsstruktur, der Infrastruktur, der Mobilität und Nahversorgung eine geschlechterdifferenzierte Betrachtung notwendig.

Gender Planning ist eine Planung, die das soziale und kulturell geformte Geschlecht der Person bzw. Geschlechterverhältnisse, -beziehungen und -differenzen in allen Phasen der räumlichen Planung berücksichtigt und diese zum selbstverständlichen Denk- und Handlungsmuster macht. Planning steht für eine räumliche Planung, für einen zielorientierten Prozess, bei dem eine Vielzahl von Teilaspekten berücksichtigt wird, um konkrete Vorhaben zu realisieren

Aus aktueller Sicht lässt sich ableiten, dass die Gender Perspektive nicht zuletzt auch durch die breit angelegten Beteiligungsverfahren, die Begründungszusammenhänge verstärkt und damit auch für die Abwägung eine hohe Relevanz hat, z. B.:

- Stärkere Konzentration auf Innenentwicklung
- Ausrichtung der Siedlungsentwicklung an vorhandener Infrastruktur
- Wohnortnahe Freiraumversorgung
- Sicherstellung einer qualitativ hochwertigen ÖV-Anbindung

7 FAZIT

Mit der Implementierung von Gender Mainstreaming in den dialogorientierten, regionalen Planungsprozess und breite große Themenpalette (von Siedlungsentwicklung über Mobilität etc. bis zu technisch bis sozialorientierten Fachthemen) beschreitet der Regionalverband Ruhr einen beispielhaften Prozess mit Pilotcharakter. Aufgrund der hohen Abstraktion von (Gender-)Zielen und Inhalten auf der regionalen Ebene der Planung stellt dieser hohe Anforderungen an alle Prozessbeteiligten – intern (RVR) und extern (Akteure, Kommunen, Politik). Meinungsbildung und Akzeptanz werden daher im Rahmen der vielen Diskussionen – unterstützt durch Expertise – immer wieder eingefordert. Den dargestellten Implementierungsprozess zeichnen insbesondere folgende Merkmale aus:

- Berücksichtigung von Gender Mainstreaming/Geschlechtergerechtigkeit und Chancengleichheit von Beginn an
- Unterstützung durch externe Fachkompetenz aus der Region (Frauennetzwerk Ruhrgebiet, Fachplanerinnen, Gleichstellungsbeauftragte …)
- Miteinander- und Voneinander Lernen als dauerhafter Prozess

Die Implementierung von Gender Mainstreaming ist als permanenter Prozess angelegt; er wird aber weiter konkretisiert werden müssen auf der Basis bereits erarbeiteter Genderziele, -kriterien und -inhalte und weitere konkrete Projekte des RVR.

Wichtig ist die Beteiligung von Stakeholdern wie hier dem Frauennetzwerk. Es braucht aber auch motivierte Führungskräfte und Mitarbeiterinnen und Mitarbeitern in der der Planungsverwaltung sowie engagierte regionale Akteure, die das Thema voranbringen. Nur so können sich Routinen und Selbstverständlichkeiten in der planerischen Herangehensweise im Sinne der Strategie des Gender Mainstreaming entwickeln und etablieren. Die Entwicklung von gegenseitigem Vertrauen sind für die Überführung des Wissens und der Erfahrung in den planerischen Alltag sehr wichtige Komponenten um Gender Mainstreaming nachhaltig in Verwaltungs- und Planungshandeln zu implementieren.

Die bisherigen Ergebnisse des Regionalen Diskurses und insbesondere auch des Ideenwettbewerbs liefern wertvolle, zukunftsweisende Strategien, die reich sind an Denkanstößen sowohl für die strategische Regionalplanung, die der RVR anstrebt, als auch für die nachfolgenden kommunalen Planungsebenen bis hin

[3] Informelle Planungsinstrumente bezeichnen Formen verschiedener freiwilliger Zusammenarbeit wie Kooperationen, Arbeitskreise als auch konkrete konzeptionelle Planungen, die nicht formalisiert sind. Die Planungen sind nicht bindend für den Bürger oder andere Behörden und Institutionen, erwirken jedoch auf Grund der freiwilligen Mitarbeit eine selbstauferlegte Verpflichtung.

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zur Quartiersentwicklung. Es bleibt also spannend! Wie wird der angestoßene Prozess weitergehen und wie finden die vielfältigen Ideen Eingang in die weitere Planung und nicht zuletzt auch in die Umsetzung.

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🏆 *reviewed paper*

Changing Cities – Changing Minds

Judith Ryser

(Judith Ryser, DiplArchEPFL/SIA, MSc (UCL); MCIOJ; Isocarp (General Rapporteur Isocarp congress 2015); CityScope Europe London; Senior Advisor FM Madrid; judith@urbanthinker.com, jryser@dircon.co.uk, www.urbanthinker.com)

1 INTRODUCTION

Long established planning practices are hard to overcome. Top down control mechanisms remain in place with little devolution and self-determination.[1] In many countries ministers can overrule elected regions and municipalities and governments continue to hold the purse strings, invoking national interest to legitimise their reserve powers. Although conventional wisdom claims that cities are the drivers of future prosperity, many city dwellers undergo precarious employment, expensive commuting, overpriced housing, congestion, pollution and erosion of the public realm, undermining their quality of life. Disillusioned by party politics, some are turning to alternatives. Out of necessity, a parallel universe is emerging in urban areas, also in the developed world, relying on own resources and contributing creatively to a 'vibrant city'. Yet, activists may become the victims of their own success when the developing industry reaps the benefits of their efforts, not seldom acquiesced by planning. The motivation of this paper is not just a 'vibrant city' but a more equitable and inclusive city. It draws on twelve cities in north-west Europe where dynamic stakeholders are realising their aspirations by reinventing planning in cooperation with bottom-up forces.

2 THE CHANGING ROLE OF PLANNING

A long standing obstacle of planning is its limited powers over implementation. In market economies statutory plans may prescribe who should have the right to use land and how. Such plans may prevent development from happening, but they cannot make it happen. With the advent of neo-liberalism and the gradual erosion of the welfare state the role of planning became contested in many countries by the development industry and, albeit marginally, by direct action from below. Conversely, some academics argued that cities are generated from the bottom-up.[2]

During periods of recession, the nation state devised new ways of shifting the balance between the public interest and private property rights in favour of the latter to stimulate development. In the UK, for example, development corporations substituted traditional local planning, acquired compulsory purchase powers also for municipally owned land and had access to enormous amounts of public money for infrastructure provision to attract private development. Enterprise zones offered further advantages to the development industry to accelerate this process.[3] Gradually, local planning powers were eroded, and municipalities lacking control over their own finances and undergoing continuous cuts were unable to trigger development. Planning by plans became planning by negotiation but this did not mean that development became speedier. It took several business cycles and bankruptcies to build the second financial city in London's Docklands which is still under construction more than thirty years after the setting up of the London Docklands Development Corporation.[4]

Presumption in favour of development[5] often led to greater spatial polarisation and social segregation. This became visible mainly in cities where related unrest was acted out. Occupy is just one example of such

[1] The International Manual of Planning Practice gives a good overview of planning laws and their implementation in countries in five continents. The new and expanded edition containing information on some 120 countries worldwide will be published in 2015. Judith Ryser & Teresa Franchini (eds). 2015 International Manual of Planning Practice. Isocarp (forthcoming).

[2] for an academic approach cf for example: Michael Batty, Generating Cities from the Bottom-Up, using complexity theory for effective design. In: Cluster. http://www.cluster.eu/generating-cities-from-the-bottom-upcreare-la-citta-dal-basso-in-alto/

[3] These powers were provided by the Local Government, Planning and Land Act 1980. Development corporations replaced de facto local authority planning powers for a limited period of time, akin to the 1946 Now Towns Act.

[4] The London Dockland Development Corporation was instituted in 1981 and wound up in 1998. http://www.lddc-history.org.uk/lddcachieve/index.html

[5] cf for example National Planning Policy Framework in the UK consolidating planning guidance and adding presumption in favour of sustainable development without defining 'sustainable' operationally.

protests,[6] the temporary informal use of indeterminate spaces is another. Many more grievances were emanating from the increasing gap between rich and poor: student marches against higher fees, resistance against evictions and displacements from gentrifying areas, a swell of squatters. Cities are the stage of such manifestations, regardless whether they relate directly to the management of space.

Aware of their eroding powers some cities perceived the need to change their minds in the light of these urban transformations.[7] Some cities were reconsidering their role in spatial management including planning in this process.[8] No longer endowed with the same external resources, some cities were exploring alternative approaches by mobilising hitherto untapped internal resources to maintain quality of life in cities. Among them are the twelve cities which have become self-selected partners in the experiment of the International Society of City and Regional Planners (Isocarp) during its 50th anniversary congress in autumn 2015.[9]

The twelve cities which form the experimental part of the 2015 Isocarp congress. Source Isocarp

3 EXPERIMENTS OF PLANNING TOGETHER, BUT DIFFERENTLY

Created in the 1960s at the height of self-assured planning powers the International Society of City and Regional Planners (Isocarp) has evolved over time.[10] This year a few of its members have decided to test the current planning discourse about genuine participation, devolution, redistribution and shared responsibility

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[6] For a critical account of Occupy and its relation to space, cf Sam Halvorsen. 2015. Subverting Space in Occupy London: Rethinking Territoriality and the Geography of Social Movements. PhD Thesis, UCL.

[7] cf for example the initiative of the Association of Greater Manchester Authorities (AGMA) to devise a spatial development plan to manage land supply across the city region. http://www.planningresource.co.uk/article/1314449/10-manchester-authorities-start-consultation-joint-spatial-development-plan

[8] One of the pioneer cities changing its approach to planning and sustainable development using indigenous resources innovatively was Curitiba in Brazil when Jaime Lerner was mayor and later regional governor. http://newint.org/books/reference/world-development/case-studies/sustainable-urban-development-curitiba/

[9] The 2015 congress of Isocarp takes place in 12 cities in the Netherlands, Belgium and Germany with a subsequent plenary in Rotterdam, 19-23 October 2015. www.isocarp.org www.isocarp2015.org

[10] Judith Ryser (ed). 2015. Isocarp, Fifty Years of Knowledge Creation and Sharing. Isocarp (forthcoming).

for the planet. They subscribed to the premise that cities were best placed to contribute to changing the minds of the actors directly involved in, and affected by changing cities. Although the twelve cities share a geography and a long term history, the planning deficiencies they identified and the innovative approaches they initiated are expected to have resonance beyond their region and relevance to structural changes in planning worldwide, owing to globalisation which has created unprecedented interdependence between world regions, regardless of their relative stage of development. The twelve cities will share their experiences with planners from all continents in a genuinely devolved setting where they will contribute actively to 'rethinking planning' and the role and responsibility of planners at the 2015 Isocarp congress.

The assumption of the paper is that the transformation of mentalities and broader power sharing are the prerequisite of a more equitable urban development process than hitherto. The paper identifies what these cities have in common in their alternative approaches, what distinguishes them and what lessons can be learnt from these inside-out initiatives across cultures and levels of economic development. It focuses on how these twelve cities are changing existing practices and, in particular, circumventing the inertias of the existing planning system to transform their visions into reality. What they appear to have in common is to take on board the aspirations of the beneficiaries of collectively reached objectives and to engage their sustained active participation in a continuous process of change. Critical observations may provide some insights into this process and point to practical changes toward more equitable, wider ranging, truly interactive and accountable urban governance.

4 TWELVE PLANNING ISSUES, TWELVE APPROACHES, TWELVE CHALLENGES TO MIND-SETS

In the global context the twelve cities are small and medium sized. However, in European terms they and their specificities form part of dense polycentric city networks.[11] The Ruhr which used to be Germany's mighty power-house groups ten former industrial towns in a region of 8.5 million population, now declining and in need of economic restructuring. Dortmund is the largest city of the Ruhr region with a large technical university which cooperates actively with businesses with the aim to make the economy of the region internationally competitive. The Randstad in western Netherlands to which Amsterdam, Rotterdam and Delft belong encompasses 7 million people. Amsterdam, the largest city in the Randstad is not the administrative but the financial capital. Brussels with its 1.1 million population is a national and EU capital, as well as a semi-autonomous 'city-state'. Rotterdam is the largest European port, Schiphol is the fourth busiest European airport, Groningen is an important European energy generator and trade node, Delft houses the largest technical university of the Netherlands, Maastricht is one of the earliest cross border EU regions, the Meuse-Rhine 'euregio' with Aachen in Germany and Liege in Belgium cooperating across three different languages, cultures and nationalities. Eindhoven was the seat of Philips and continues to accommodate the R&D activities of the global Philips company reoriented to medical imaging and nano-technology. Wageningen accommodates an internationally renowned university focusing on food, healthy environment and agricultural research. Deventer is a small historic town which is losing its industrial base and turning its historic core into a regional destination for shopping and specialised services, such as publishing. The latter assumes a special role as a pilot city to test the implementation capacity of Dutch cities of new national planning legislation.

These cities are participating in the Isocarp experiment because they are aware of their exposure to global competition and the need to mobilise their own human capital to innovate and valorise their assets in pursuit of a sustainable position in the globalising world. By selecting planning problems of international relevance which they aim to turn into opportunities they are expecting to gain from sharing knowledge with planners engaged in similar endeavours in cities from other parts of the world. The question is whether planning issues have generic characteristics which are relevant to other places under different conditions. This experiment should show whether approaches, better still solutions can be shared across different cultures and stages of economic development for planning issues identified as critical at a given local level and in a specific context.

[11] cf for example: Peter Hall and Kathy Pain. 2006. The PPolycentric Metropolis, learning fro mega-city regions in Europe. Earthscan

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4.1 Communalities and divergences

The twelve cities share some common ground which guided the selection of their twelve specific and complementary planning questions. Most importantly, they all rest on the sustainability principle, a balance between economic, social and environmental objectives. Secondly, the focus is on implementation and deliverability of the proposed interventions, taking advantage of cities as locus of realisation rather than abstract visions and strategies. Thirdly, European cities share history. They have been long in the making, growing erratically over centuries, affected by colonialism and undergoing dramatic change with industrialisation and urbanisation before the world wars. Most of the twelve cities had to cope with devastating war damage, initially through ad hoc refurbishment due to lack of labour and material, later through demolition and reconstruction following modernist principles. With increasing affluence and popularisation of the motorcar cities tended to lose population to the outskirts, smaller market towns and the wider hinterland.[12] However, business cycles and deindustrialisation are affecting these cities unevenly to this day, some growing, some declining. Fourthly, they are all undergoing impacts of globalisation and have to face the austerity regimes following the latest financial crisis. Fifthly, most of the twelve cities are very cosmopolitan, as population, immigration and asylum seeking are increasing, mainly in the larger cities.[13] In some of them half the population is of foreign origin which brings them closer in minds to cities in the developing world.

source: http://en.wikipedia.org/wiki/Demographics_of_the_Netherlands#mediaviewer/File:COB_data_Netherlands.PNG

Against this common backcloth, individual cities selected diverse approaches to their experimental workshops. Most of them resorted to local authorities, cities and regions as hosts, some chose universities, and others social entrepreneurs. Some decided to involve several groups of stakeholders while others went ahead with a single host. The issues they selected were at different stages of the planning process. Some focused on implementation, others were at the negotiation or planning stage, others involved in evaluation. However, all had selected concrete places of intervention, sometimes several, some small, some at regional scale.

City	population	% foreign population*	planning issue
Amsterdam	813,562 (2014) municipality 1,575,263 (2014) metro 2,332,773 metro region 6,979,500 Randstad growing	50,5% foreign (2012) 30% non western origin	How to build the city in a cooperative way?
Rotterdam	619,879 (2014) municipality 1,181,284 metro 2,261,844 metro region growing	45% foreign 70% singles in city centre	How to develop unprecedented port city synergy?

[12] For a recent discussion about the effects on restrictive planning of urban sprawl on house prices, cf Wendell Cox, 2011. The cost of smart growth revisited: a 40 year perspective. http://www.newgeography.com/content/002324-the-costs-smart-growth-revisited-a-40-year-perspective
[13] http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLEN&PA=37943eng&LA=EN

Schiphol Haarlemmeer Amstelveen	144,226 (2014) 85,749 (2014) growing	[4th European airport, 65,00 staff]	How to connect a globalising world?
Eindhoven	216,036 (2011) growing	4.5% foreign students from 150 countries	How to react when traditional industries move away?
Groningen	197,823 (2014) growing	25% = students	How to sustain energy resources?
Maastricht	119,664 (2011) steady	4.5% foreign	How to build a trans-border urban system?
Delft	99,737 (2014) growing	19,500 students (2012) 2236 foreign 11% 3375 academic staff, 2280 admin staff	How to create a sustainable knowledge region?
Deventer	98,510 (2014) steady	1.2% foreign	How to implement a national legal framework for local integrated planning and implementation?
Wageningen	37,434 (2014) steady	7400 uni staff 7933 students from 106 countries 25% foreign	How to feed the world's metropolises?
Brussels capital region	1,139,000 (2012) growing	27% foreign	How to build an international capital with active local participation?
Antwerp	480,721 (2009) growing	17% foreign	How to rework the productive city?
Dortmund	580,956 (2012) declining Ruhr metro: 8,572,745	~ 30% foreign 24,000 students 3200 foreign students from 100 countries	How to leverage economic growth from spatial projects?
* these figures are only order of magnitudes, from diverse web sources, unchecked/ uncheckable and uncoordinated.			

Table: Twelve participant cities, planning issues, population

4.2 Planning for and by people

The economic dimension of sustainability tends to dominate periods of recession. Nevertheless, a number of cities deliberately focused their approach on the premise that planning was for and by people. They attempt to move away from prescriptive planning to soften the chasm between the aspirations of the many and the interests of the few. Both Brussels and Antwerp chose a very pragmatic approach to implementing concrete development objectives deliverable step by step, within a broader and longer term spatial policy frameworks. Struck by the demise of its main employer Philips, activists in Eindhoven responded by bottom-up initiatives to assist the large redundant workforce to survive by building on indigenous resources and energies while aiming to turn the city into a 'brainfield' which would offer opportunities to the whole population. Led by social entrepreneurs, the Amsterdam Pakhuis de Zwijger initiatives were closest to direct bottom-up action, while Maastricht wanted to illustrate cross-border, cross cultural cooperation focused on sharing localised experiences of punctual interventions with cultural diversity in mind within its broad context of international cross border cooperation. Even Schiphol, a de facto airport city, was sensitive to local requirements and aspirations and the need to create closer connections between the function of the airport as a global hub and its need to connect to the locality, not only Amsterdam and the Randstad but also its immediate neighbourhoods, and thus to turn a mono-functional airport city into an urban environment which contributes to local identity and pride.

4.3 Taking care of the environment

Environmental concerns motivated Wageningen which introduced food supply as a planning issue, not usually prominent in mainstream planning. Groningen also attached importance to the environmental dimension in its strategy to transform the Energy Valley into green and decentralised energy production while retaining its energy trade hub position. The prime objective of the IBA, the international garden exhibition was to regenerate the degraded environment of the Emscher Park in the Ruhr for leisure, culture and recreation while experimenting with renewable energy generation on sites of past coal extraction and fossil fuel energy generation. This intervention accompanied by considerable state subsidies took place during a period of growth from 1989-1999 when there was faith in the European Spatial Development Perspective adopted in 1999 and the ability of the EU to create greater social cohesion and territorially balanced sustainable development across the EU space as a whole which was expected to generate economic growth. The financial crisis of the mid-noughties decried that and pushed economic concerns into the forefront of national as well as planning policies. This was also the case of the Ruhr and Dortmund is now focusing on opportunities for job creation.

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4.4 Economic motivation

Unemployment is an issue in all twelve cities. Faced with rising unemployment (13.9% in 2013) Rotterdam decided to create greater synergy between the city and the port. Conventional wisdom postulates that high income countries cannot produce goods competitively in the globalising world. Rotterdam contested this premise by 'making things again' with the contribution of its large number of SMEs (small and medium size firms) producing high value added goods locally. In Rotterdam's view, high quality, high end goods such as cruise ships can be produced competitively in the developed world because of the innovative capacity of its SMEs and its universities which build on past excellence and pioneering R&D. Delft is counting on its technical university as its local and regional economic driver. It seeks greater integration between the internationally renowned campus to exploit the quality of life of the city to attract and retain students and business start-ups.

Increasing affluence in developing countries is putting pressure on wages, reducing profitability and thus directing surplus capital in pursuit of better returns elsewhere. Witness speculative investment from developing countries into real estate in developed countries, leading to ubiquitous CBDs worldwide, designed by the same starchitects and realised by the same international developers, thereby putting similar demands on planning systems globally. Globalisation is also contributing to greater global mobility and movements of people, as well as goods and capital. All these factors confirm the pertinence of sharing contemporary urban planning issues internationally as contribution to a mutual learning process.

4.5 Institutional hurdles

Planning tends to be constrained by both economic pressures and political processes expressed in statutory top down objectives. Although planning has to navigate between these constraints, it has to identify its room for manoeuvre, even in terms of non action if need be. Cities throughout the world face contradictions between objectives at different levels of decision making: international, national, regional and local. There is constant tension between forces from above and those from below. Deventer, together with some other small cities in the Netherlands, has been designated to test the implementability at local level of new national legislation integrating spatial planning, environmental protection, water management and infrastructure. Deventer has chosen this opportunity to revisit its own local governance with a broader range of stakeholders and more active citizen participation. Although the test focuses on plan making, implementation encompasses a far broader set of stakeholders to get national policies translated into local spatial intervention. Sharing international experiences on the discrepancy between planning processes and governance is expected to make a concrete contribution to new approaches.

Institutional issues may be more difficult to resolve at a larger regional scale, such as the Meuse-Rhine Euregio which has been in existence since 1976 but has acquired judicial status only in 1991. It includes three main cities in three countries, Aachen in Germany, Liege in Belgium and Maastricht in the Netherlands and other smaller cities, and encompasses five provinces with 3.9 million inhabitants. It straddles three national and one regional language and diverse economic activities, ranging from heavy industry to European services, culture and tourism. From Maastricht's point of view,[14] cross-border cooperation focuses on knowledge and innovation (a start has been made in the health care sector), relation between culture and the economy (with a bid for 2018 European city of culture), and a place for cosmopolitan gathering. EMR 2020, strategy for the Euregio Meuse-Rhine[15] focuses on similar sectors: economy and innovation, culture and tourism, besides labour market, education and training, health care and public safety. This example shows the inertia embedded in cross-cultural communication, even more so cross-border cooperation, let alone international interaction. This leads to methodological issues of comparative studies.

5 MATTERS OF METHOD

Methodological aspects are important in academic comparative research, in particular in studies which reach across cultures, different contexts, and data from different sources previously collected for different purposes than the objective of the study in hand. Such studies can be confined to a preselected set of criteria, a limited

[14] Memorandum on the internationalisation strategy of the Municipal Council of Maastricht. EN_Samenvatting MaastrichtIntlPolicy.pdf

[15] EMR 2020, a future strategy for the Euregio Meuse-Rhine. Stichting Euregio Meuse-Rhine, 2013. (with assistance of Interreg IV-A EMR, in collaboration with the participant regions, provinces and cities).

number of quantitative or quantifiable factors, few expected outcomes. Comparisons like the ones proposed in the twelve cities during exchanges between planners with knowledge on the topic but from different backgrounds, places and cultures which deal with real life experiences are fraught with complexities, contradictions, unruly qualitative aspects and culture-bound interpretations. They do not lend themselves to reductionist modes of establishing correlations, which are just that and not explanatory causalities. In such a complicated environment, what is the purpose of comparisons and what can they usefully achieve?

5.1 Transferability

Both academic and real-life comparisons raise a fundamental methodological issue. Are findings from a particular situation directly transferable to another one, can they give rise to a generalised model of thinking, analysis, problem solving, or is there a need for transposition, 'translation' from one situation to another? Or are the only lessons applicable elsewhere of a generic nature? Are outcomes at best producing general principles, and do they need adjustment to different contexts?

5.2 Justification of international comparisons

It could be argued that although academic comparative studies are often expected to produce transferable findings such transfers do not necessarily take place, not least because they would have to happen after the contractual research period. Conversely, the twelve city experiment could be used as a test of this question. The exchanges between international planning professionals on twelve specific planning issues in which they have expertise are rooted in concrete cases in the twelve cities and those linked to the international participants. However, the twelve cities have a lot of contextual communalities while the contexts of experiences from other continents vary widely. For this reason, planning issues, especially in the developing world might be considered too divergent for planning solutions generated in the developed world to be relevant. From a different standpoint, a case could be made for the usefulness of such comparisons due to correspondences and interdependencies of planning methods and processes worldwide. For example, some ex-colonies have planning laws which are still modelled on post war UK planning legislation. Many western planning firms have carried out work in the developing world, devising masterplans for cities like New Delhi or Chandighar, designing plans for international developers and investors, or more recently for governments, land owners and decision makers of emerging countries, like the United Arab Emirates or China. With decreasing planning work in developed countries this trend is on the increase. There is great mobility of planning students, not only across Europe stimulated by EU programmes, but a growing number of students from the developing world are studying in the developed world who continue to work there and eventually repatriate that type of knowledge for home use or to assist their investors abroad.

All these actions amount to a long standing transfer of planning culture, regardless of whether the approach was appropriate to different situations, levels of development, cultures and lifestyles. While such transfers tended to take place from the developed to the developing world, globalisation is changing these relations. It could be argued that foreign investment from emerging countries into cities in the developed world affect the planning system there by attaching extraneous conditions to investment and obtaining long term concessions.

At a more structural level, situations which were attributed to conditions of the developing world, such as self-build housing and informal economy have become more widespread in cities of the developed world and are addressed by Amsterdam and Antwerp respectively. The populations involved in these processes tend to be immigrants from developing countries who bring with them not only skills of informal action but also different mind sets towards city living which, in turn, affect expectations and demands of urban spaces and their uses in their recipient countries. These processes can be seen as a basis for a reverse transfer of planning practices and implementation. The 'twelve city experiment' could operate as a laboratory to identify such movements of planning cultures and explore their mutual impacts.

Polarisation and greater disparity between 'haves' and 'have nots' takes place worldwide and provokes movements of discontent. The twelve cities share the objective to become more inclusive and equitable which means that planning is less about development than redistribution. Comparing approaches and findings at an international event like the Isocarp congress may be justified as potential contribution to the creation of vibrant cities worldwide. Isocarp invites the CORP constituents to participate in this experiment.

reviewed paper

City in Transition: How to Plan Riga in 21st Century

Sarmite Barvika, Sandra Treija, Egons Berzins

(MBA Sarmite Barvika, Riga Technical University, The Faculty of Architecture and Urban Planning, 18 Azenes street, Riga, LV-1048, Latvia, sarmite.barvika@rtu.lv)

(Dr. arch. Sandra Treija, Riga Technical University, The Faculty of Architecture and Urban Planning, 18 Azenes street, Riga, LV-1048, Latvia, sandra.treija@rtu.lv)

(Associate professor Egons Berzins, Riga Technical University, The Faculty of Architecture and Urban Planning, 18 Azenes street, Riga, LV-1048, Latvia, egons.berzins@rtu.lv)

1 ABSTRACT

It is clear that the social-economic and political reality of the 21st century has undermined most of all the expectations from the current (2006-2018) planning vision of the city of Riga, the capital city of Latvia and the largest historical and economic canter of the Baltic States. It is time to restart the necessary instruments (evaluating the current state, defining goals and needs of interested parties, developing planning tools and supplementary documents – like visions, normative acts, data bases, etc.) in order to be "well-prepared" in planning, as well as in preserving the most important values of Riga (such as the number of residents, infrastructure, cultural sites and buildings) for the next 12 years (2018-2030).[9] [10]

The modern thinking for spatial planning strategies is based on principles of urban intelligence and on the development of the new concept of smart cities, in which the integration between contemporary reality and the historical city becomes an important factor and were urban "smartness" has been also reached through historic (cultural) elements within "the virtual world" of ICTs.[19]

This paper will discuss the most important aspects (problems and possible solutions) in the planning of the most internationally well-known part of Riga - Riga's Historical Center and its protective zone (HCR and its PZ), which is also a UNESCO World Heritage Site [11], noted for its architectural qualities – outstanding urban space, Art Nouveau and 19th century wooden architecture. [15] [20]

The paper will also note what kind of modern instruments would be necessary (still not efficiently used) for the planning process of the most internationally well-known part of Riga (Riga's Historical Centre and its protective zone) smart (more and more uses of ICT tools for creation, updating and publication of spatial planning related information).

2 ACTUALITY AND METHODOLOGY OF THE STYDY

The capital city of Latvia, Riga, currently is facing a new challenge - how to develop a new city development plan in a sustainable (smart) manner, which would satisfy all of the "in-planning" interested parties (entrepreneurs, international investors, tourist, institutions and citizens) and would solve the most urgent , typical for most European metropolises and addressed to urban design problems (like de-urbanization, polarized economic growth, increased pollution, transferring brownfields into greenfields, maintenance of historical sites and buildings, insufficient funding for fulfillment of public needs etc.).

One of the major challenges for contemporary urban planning is the growing complexity and holism of planning function. In planning practice the broadly used pragmatic approach has been examined to adapt traditional planning instruments to new requirements - smart planning (the use of the ICT progress in the planning process and discussion). ICT progress has changed the manner of planning, involving more and more technologies (particularly geographic information systems (GIS) solutions) for the maintenance, publishing and updating of environmental spatial and descriptive data, as well as social-economic data. [8] [19]

Many cities world-wide are searching for a way to turn their planning strategies into reality and want to know how suggested smart solutions for planning can help to fulfill their expectations for transforming their cities into „smart cities". "smart sustainable cities" or „smart historical cities". [1] [19]

Riga is amongst those metropolises that would comply with the criteria to be „a smart historical city" in the future due to outstanding historical values and current GIS developments. It has been emphasized by international organizations (e.g. the UN, the European Commission) that cultural heritage is the fundamental aspect of people's identity in modern society and must be transferred to the next generations in the best possible condition and way.

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Also the land administration paradigm, to which urban design is addressed, has changed: alongside the three classical dimensions (economic, environmental, and social), it nowadays also includes “good governance” and “the culture”, requiring a systemic approach, a balancing of interests, more public involvement (bottom-up planning) and classified environment related data. [31]

Therefore one of the most unique sites of urban design in Latvia and in North-Eastern Europe - the RHC and its PZ have been selected as the object of this study, answering the following questions:

- What makes an historical city „smart” and what kind of recommendations exist for planning an historical city in a smart manner?
- What kind of problems does the HCR and its PZ particularly face that must be solved using spatial planning instruments?
- What kind of solutions would be developed (introduced) for the planning of historical part of Riga in sustainable (smart) manner?

The theoretical framework of study is based on an analysis of earlier international and local research of theoretical principles of smart cities, modern spatial planning methods and cultural heritage protection. Analysis of Latvian spatial planning regulation, freely available data from public registers and open source platforms, as well as the surveys of resident’s satisfaction has been used. This analysis is a part of initial results of the on-going study „Prospective for Maintenance of Residential Function in the HCR and its PZ” (2014-2015).

The following research methods (approaches) will be applied: the empirical approach (for the analysis of theoretical sources of the concept of values, property valuation and spatial planning); quantitative research (for studying and the processing of social-economic statistics, property market data, surveys of satisfaction of residents and spatial planning information). Spatial analysis using Arc Map 9.3 will be applied for depicting the physical location (e.g. borders) of the HCR, its PZ and Old Riga (downtown) on the cadastral map (background material), permitted land use (residential buildings) and the distribution of residents by building in the HCR and its PZ.

3 WHAT MAKE CITY SUSTAINABLE AND SMART?

The term “smart city” is still quite „a fuzzy concept” and has been applied in ways that are not always consistent. [1] There are numerous definitions and criteria exist world-wide for the characterizing of smart cities. In most of the cases, one important “umbrella” element has been dominant: the efficient use of ICT progress (particularly in running traditional spatial planning GIS solutions) as a key instrument to enhance numerous functions of cities and their well-being (high quality of life by excelling in multiple key areas: economy, mobility, environment, people, living, and government) with the purpose of reducing resource consumption and effectively and actively engage with their citizens. [1] [15]

However there are also other definitions (or criteria) for smart cities that exist globally, putting ahead other aspects or national priorities instead of the dominant use of technologies in the functioning of the cities (e.g. social and cultural elements, wise management of natural resources, “life-knowledge” based development, safety and prosperity, development of traditional communication infrastructure, involvement of citizens in city governance, increasing the of quality of life, employment, education opportunities, occupational skills and income level). [12] [30]

The term „sustainable city” (or “eco-city”) considers the environmental impact of human activities and is dedicated to minimizing required inputs of resources (energy, water, food and raw-materials; pollution) []

There is no complete consensus for a paradigm for what components should be included in „sustainable city”. [21] Generally, planning experts agree that a sustainable city should meet the needs of the present without sacrificing the ability of future generations to meet their own needs. [15] [30] [31]

It is estimated that over 50% of the world’s population now lives in urban areas. The mobility of people is high world-wide. Because of this, a shift to more dense, urban living would provide more opportunities for social interaction and material prosperity.[12]

Contrary to common stereotypes, urban systems very often can be more environmentally sustainable than rural or suburban territories due to more control and interest in regional and local planning. [14] [21]

During the past decade international organizations (e.g. the UN and the European Union (EU)) have devoted constant efforts to developing strategies and criteria for achieving “smart' urban growth for metropolitan city regions. The European Commission (EC) in particular in its spatial development and environment protection related documents describing “smart urban growth” uses such terms like “an information society”, “digital content”, “semantic information”, “smart infrastructure”, encouraging and promoting the use of ICT solutions in the governance of cities. [13] [19]

The EU defined the basic framework of smart cities for the European Community that consists of six basic elements where ICT plays an important role in data sharing, support for decision making support, producing big data and developing stakeholder platforms and tools for better promoting public policies and better funding of the development needs of cities (e.g. EU funding). (See Fig 1)

Fig. 1: The framework of a smart city (EU requirements) [19]

The EC Smart Cities Stakeholders Platform (2013) emphasizes the need for implementation of the Integrated Action Plans (IAP) for smart cities based on common principles for setting the baseline for benchmarking studies, standardized information for assessment of indexes (internally and externally available) and common standards (particularly use of ISO standards) for granting of the status and monitoring the functioning of sustainable smart cities. IAP for sustainable smar cities consists of a long term vision (which would be clarified by short term objectives) and long and short term strategies. [19]

The governance of the cities is very complex. Cities in their daily life face the challenge of simultaneously combining competitiveness and sustainable urban development [8]. Success depends on their capacity in decision making, as well as solving local conflicts linked to a wide variety of actors and the implementation of modern knowledge (ICT and e-services).[8]

Smart spatial planning provides a vision for successful urban operation and ensures that people and territories can connect in the present and future.

Five key success principles have been identified for sustainable smart cities: 1) Sharing the vision; 2) Effective governance; 3) Long-term political commitment; 4) Strong links with land-use planning and economic development; 5) Long-term funding commitment.[19]

The development of IAP should be based on a clear structured process that takes into consideration multiple factors and regular studies: 1) Studies of best practices and policy examples of the cities; 2) Analysis of cities components (including utilities, real estate, transportation, city services); 3) Estimation of the indexes of cities; 4) Setting of cities objectives (social, economic, environmental). [19] [26]

Digital technologies can collect and process sufficiently large amounts of actual and historical data that are used in the operation of cities (particularly in spatial planning). The new ICT potential from sensors on buildings, roads and other components of urban space and the sharing and integration of this data between service delivery channels will enable the improvement of data services, monitor and control resource usage and react to real-time information. This data has also been used for public discussions (involving society in development of spatial vision and local territorial planning [8].

In practice the level of implementation of the governance of smart cities varies between countries. For example, Great Britain has developed a national strategy for smart cities with the specific recommendations for different planning levels and states. Among the most „smart” cities are Barcelona, Stockholm, Chicago and Boston. However the levels of „smartness” of those cities vary and depend on common level of ICT

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development, policies for public registers, and the level of access and use of Internet and development priorities. Many of them (e.g. U.S. and Canadian cities) are developing their own „smart action plans" (e.g. San Francisco and New York setting their transportation and environmental policies within their jurisdiction) or the use of technical tools for the making of cities „smarter" (e.g. the increasing dominant habit of people to use smart phones for local communication and using numerous public services – public parking, paying bills, use of infrastructure, etc.).

4 WHAT DOES IT MEAN TO BE A SMART SUSTAINABLE CULTURAL CITY?

The culture of sustainability is a new inter-disciplinary approach, whose purpose is to increase the significance of culture and cultural space in sustainable development planning. Sustainably shall be measured through both cultural policy setting and science. [12]

Culture as an element is also integrated into the modern land administration paradigm.[31] However more initiatives from national countries are still necessary to transform these recommendations, knowledge and information into practical, well-operating heritage protection systems.[8]

Culture probably is the most important and complex aspect for promoting the sustainable development of cities and refers to ethics - how people understand and appreciate nature, resources, common values (also planning culture) and each other. [12] [29] Ignoring ethical aspects can have a profound impact on long-term development. Intangible or invisible (e.g. identity, local and international recognition, aesthetic, values, beliefs) and tangible or visible (social groups, institutional framework, corporate, technologies, tangible culture, e.g. inherited built environment) elements of culture create cultural space. [12]

The most representative reference document that guides local governments in how to elaborate on their cultural policies is "Agenda 21 for culture". Agenda is based on traditional principles of cultural diversity, human rights, as well as on intercultural dialogue, participatory democracy, sustainability and peace. [1]

5 INITIATIVES FOR CULTURAL HERITAGE SPHERE

The use of the ICT progress also helps us to innovate architectural heritage conservation strategies to allow safe, sustainable and effective action in the context of the smart management of a city and common context of planning methodology.[1] [8] [15]

European cultural heritage also has a high economic potential. [27] The EU represents a significant demand for culture: 39% of respondents (from EU 27) have indicated that culture is very important in their lives, associating it with the performance and visual arts and architectural heritage.[13]

In the EU direct and indirect activities with cultural heritage produced an income of almost 350 billion euros and ensured 9 million work places (2013). Turnover of conservation activities is about 5 billion euros yearly. The potential of conservation activities remains high: more than 25% of all buildings in Europe were built prior to 1940 and need care. Another challenge (also chance for many industries) for ensuring sustainability is the adjustment of heritage buildings to the requirements of energy efficiency and environmental accessibility.

The ongoing COST Action initiative "Investigating Cultural Sustainability" (2011-2015, http://www.culturalsustainability.eu/DuxburyCOST14.11.2013.pdf) is aiming to increase understanding of the place of culture in people's lives and sustainable development via multidisciplinary approaches [1], but ethical living, education and innovation shall be considered to be the essential means for the required common cultural environmental change.

The advancements of ICT lead to more and more use of Linked Open Data (OLD) providing for innovation also in the heritage sphere and its related services. It has been estimated that nowadays over 80% of all data has a spatial component or dimension, but people worldwide prefer to use spatial (image) data instead of texts and figures. The number of smart phones users is growing and people use apps. [2] [7]

Particulary interest in architecture promotes international tourism and this data can promote developmet of new e-services, data application for education, tourism and businesses for SME. [2]

EU project SDI4Apps (2014-2016; http://sdi4apps.eu/) focuses on the use of geographic information in education and supports creativity, technical capabilities, skills, knowledge and relations, through online sharing of spatial based content for the environment, history and culture of different local and European regions beyond linguistic barriers (which are one of the most significant constraints for the communication between different regions). [13]

Other example is Arches (Heritage Inventory & Management System) project (http://archesproject.org/). Arches is an innovative open source software system that incorporates international standards and is built to inventory and help manage all types of immovable cultural heritage. This initiative brings together a growing worldwide community of heritage professionals and ICT specialists. This portal offers freely available information to download, customize, and independently implement.

Information on cultural heritage becomes more and more accessible due to culture and environment related data digitization and integration initiatives.

UNESCO (the most recognizable authority in heritage protection) lunched its World Heritage Site (website: http://whc.unesco.org/en/list), which is an interactive website addressing places that are listed by UNESCO as of special cultural or physical significance and having digital content and cultural monuments in danger.

UNESCO contributes to projects and places of culture and scientific significance, such as: Masterpieces of the Oral and Intangible Heritage of Humanity; Memory of the World International Register and World Heritage Sites. These activities have aggregated the world's best knowledge, practices and recommendations from 196 member countries. [24] [29]

Despite information digitization and integration initiatives, large amounts of cultural heritage related information (especially regarding architectural heritage) are still not digitized, classified (standardized), summarized (estimated common stock) and integrated in open access information systems..

6 EUROPEAN CONTEXT FOR SPATIAL PLANNING

In 2009 Latvia has started the development of it SDI with the purpose to implement requirements of the INSPIRE directive and its implementation rules in numerous areas: metadata, data specifications, network services and technologies; licenses on data sharing, access and use; and coordination and monitoring mechanisms, processes and procedures established, operated or made available in accordance with the INSPIRE requirements.[2]

The concept included geodesy and cartography at its essence its development. [3]

The INSPIRE Directive has been adapted in Latvia’s legislation by the adoption of the Spatial Planning System Development Concept (2009) and the passage of the Geospatial Information Act in 2009. [8]

Simultaneously several Latvia’s public authorities had started to develop their mutually integrated, important for spatial planning, GIS systems (e.g. “Development of the State Land Service’s Geospatial Data Geospatial Information System” (SLS GIS), "Information System for Administration and Supervision of Territorial Development Planning of Local Governments, Infrastructure and Immovable Properties” (TDPIS), Building Data Information System (BIS)) using funding from the European Regional Development Fund for the purpose of complying with the European environmental policies (e.g. requirements of the INSPIRE directive) and promote the use and sharing of spatial data. [2]

The most important system for spatial planning is the TDPIS (https://ivis.eps.gov.lv/IVISPortal/files/folders/tapis/default.aspx), which aims to create a modern, GIS based system for transparent spatial planning information storage, processing and sharing, territorial development and real estate and infrastructure management for the entire territory of Latvia in lieu of the current, autonomous, unconnected with actual property information planning systems of local municipalities. [14] TDPIS will contain all of Latvia’s planning systems: national, regional, municipal plans, detail plans, local plans, functional zonings, and all documentation on planning initiatives, activities and normative regulation.

It is estimated that TDPIS will be fully introduced into practical operation in 2015-2016. However, one module of the TDPIS infrastructure - “The Regional Development Indicator Module” (RAIM) (http://raim.gov.lv/pub/#/) was launched in 2014. The initial purpose of RAIM is the provision of social-economic data and statistics accessibility and processing for local territorial plans.

Other projects – The SLS GIS (cadastre, addresses, property values) and the BIS (building data and documentation) is also needed for spatial planning and will be integrated into TDPIS.

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Within the implementation of INSPIRE, numerous European and local public and private initiatives developed open standards based spatial data sets. “Big data” owners (mostly state agencies) very slowly open their data bases for free [are very slowly making their data bases available for free???]. It makes planning activities difficult (particularly efficient public involvement) and the development of new data platforms and e-services. However new e-services (also royalty free) have been introduced into property data registration and use (e.g. Cadastre, Land Register, Enterprise Register, and Municipality of Riga). The best examples of open data platforms are Zemgales Region Geoportal (geoportal of Zemgales planning region authority), Koceni Municipality, topografija.lv (topographic data), e-skola (education), grausti.lv (deserted buildings of Riga’s municipality).

The Riga City Council operates its GIS system “RIGIS”, which helps support the planning and function of the city. “RIGIS” is publicly available and as background materials uses an unupdated (year old) cadastral map [vai maps] and available ortho-photo maps. RIGIS it is not fully integrated with other planning related databases and does not ensure efficient support and monitor of such complex (holistic) function as is the case for planning. [20]

7 LATVIAN NATIONAL VISION FOR SPATIAL PLANNING

The Concept of Territorial Development Planning (2009) identified that the most important problems of the current planning system are a lack of common data standards, a lack of a classification system for depicting current land use in territorial planning cartography and uniform planning principles, poor digital content for spatial information and non-integrated and out-of-date spatial planning related data systems. It has emerged that the identified problems must be solved prior to the introduction of the national SDI. Several planning documents, laws, by-laws were adapted: e.g. “Sustainable Development Strategy of Latvia until 2030” (Latvia2030), Spatial Development Planning Law (common spatial planning process); Construction Law (new building regulation), General Regulations for the Planning, Use and Building of the Territory (land use standardization). [26]

Strategy Latvia2030 in principle differed from earlier ones. It was developed using the EU requirements for sustainable development and for the first time in Latvia promotion of the use of Internet as the most important skill for any person for realization such strategic principles as creativity, tolerance, cooperation and participation (involvement in bottom-up governance) was made a priority. [26]

Latvia2030 shall be implemented through seven interactive actions: 1) Investment in human capital; 2) Change in paradigm of education; 3) Innovative and eco-efficient economy; 4) Nature as a Future Capital; 5) Perspective of Spatial Development; 6) Innovative Governance and Participation of Society; 7) Development of Cultural Space. The main policy areas will be: accessibility and mobility, the polycentric structure of settlement and the development of spaces of national interest (e.g. Riga agglomeration, Baltic Sea coastal area and Eastern border area). [26]

Latvia2030 also required development of long term spatial visions for five planning regions and established as the priority the promotion of development of open data sets also in the public sector, public e-services and the improvement of geomatic skills of civil society and small and medium sice enterprises (SME).

8 THE BUILDING OF THE NEW CONCEPT FOR A PLANNING VISION FOR RIGA

In 2014 the Riga City Council adopted the new Sustainable Development Strategy for Riga until 2030 and the Development Program of Riga (2014-2020). [9] [26]

The development of the “next generation” spatial plan for Riga (2018-2030) shall be based on a completely new approach for planning (defining the baseline for future monitoring of the planning process, performing benchmarking and preliminary comprehensive research, ensuring a continuous cooperative planning method and use more transparent, “image-based”, planning manner), taking into account the new spatial development strategy and legislation (e.g. new land use classification), as well as use of required standardized GIS tools in the planning process, data publishing and sharing (compliance with the criteria to be a “smart” city).

The planning process of the new spatial plan for Riga will be introduced in four phases: research and development of the methodology for planning, benchmarking and development of 11 thematic plans (2013-

2014), development of the 1st draft (2015), the approval process for the original document (the decision of the Riga City Council), (2016-2017) and implementation and use (from 2018 to 2030), (see Fig. 2).

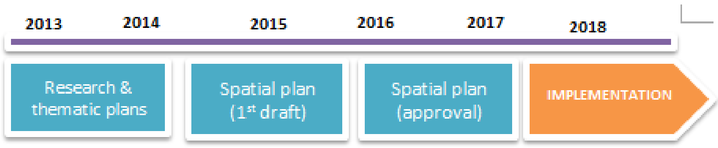

Fig. 2: The planning process of the new spatial plan for Riga [9] [26]

The new main goals for the spatial planning of Riga will be:

- To provide solid regulatory and proactive function of land use planning to ensure proper legal ground for the regulation of land use and construction processes, as well as for use in application of cooperative planning method in the process of planning;

- To establish a system for the Riga municipality that provides a continuous “multi-stage” planning process and monitoring (holistic cooperation, cooperative planning, digital, semantic content, integration spatial data with statistical module, as well as to ensure future integration of planning documentation in the TDPIS);
- To ensure “bottom-up planning” - maximum transparency of planning, explaining planning objectives, tasks and processes by which they are achieved to the civil society: the private and public sector (e.g. maintenance of website and interactive communication);
- To build a compromise between the various parties involved in the development of the city (e.g. to advocate the interests of those who are not able to participate in discussion);
- To move the process of spatial planning closer to the general public of Riga (e.g. transparent monitoring of urban land use changes);
- To develop a program for thematic planning (for 11 thematic plans, e.g. for cultural monuments and housing);
- To create “a strong and well-founded” planning concept for Riga (provide sufficient information for setting a baseline and for development of a 1st draft for functional zoning);
- To create knowledge about planning and scenarios as to how urban sustainability can be reached (to research the best practices and model it on the case of Riga), (See Fig. 3). [9] [26]

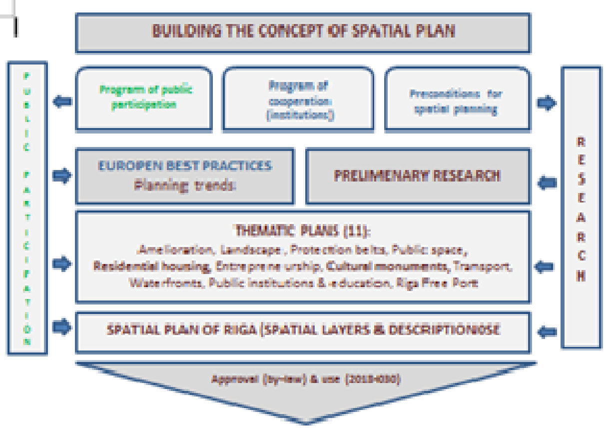

Fig. 3: The framework of building of the spatial plan for Riga (2018-2030) [9] [26]

A cooperative planning method will be used during all of the planning process until the approval:

- Input of “in planning interested persons” into establishing a correct vision and planning details and input of research tools (e.g. living labs);
- Data collection (e.g. from open data sources) for the support of planning with cartographic and descriptive information. [9]

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9 METHODOLOGY FOR STUDY

The theme of “cultural monuments” is one of the eleven important elements which will be integrated into the new digital content functional zoning for Riga and has been researched within the study „Prospective for Maintenance of Residential Function in the HCR and its PZ” (2014-2015). Criticisms to the current plan for Riga are mostly addressed to functional zoning, however international planning examples have shown that the scope of problem can be more complex and that the best solutions in comprehensive planning can be reached using a cooperative planning method.

The evaluation of prospective for maintaining residential function within the HCR and its PZ was performed using the following methodology:

- A survey of the requirements (regulation, trends, ICT trends and standards for information, demands for cultural monument protection, construction, environment impact evaluation, living standards, taxation, occupancy, etc.) for the modeling of culture dementia in a sustainable urban environment;
- Collection of data and the building of a semantic data base for performing comprehensive spatial and statistical analysis and for the setting of the baseline:
  - available data sets, background materials and data layers, e.g. Open Street map, RIGIS cadastral map and address points of the State Address Register (for the purpose of identifying the location of buildings in the cadastral map), ortho-photo map, spatial data from open source platforms, e.g. skolas.lv (education establishments), grausti.lv (location and addresses of deserted buildings and slams), etc.;
  - available socio-economic, demographic, cadastral, ownership and building permits statistics, classifications of land use, buildings, groups of premises and encumbrances (e.g. the status of a “cultural monument”), addresses, distribution of residents (Population Register), distribution of enterprises (Enterprise Register), building data, property market data, Census 2000 and 2011 data (from the data base of the Central Statistical Bureau), general social-economic trends (RAIM data), data from the surveys of citizens (2011, 2014, publicly available), etc. The initially built structure of the data base and required parameters in vector format are depicted in Fig. 4;
- Diagnosis of the state of implementation of current functional zoning (elaboration of data layers with current (2014) and permitted (2006) land use, identification of the changes and its impact characteristics (breakdown and volume of land use and ownership, volume of issued building permits, size of free area, portion of residential use, public space, etc.);
- Diagnosis of the socio-economic impact and demographic changes (2006-2014);
- Diagnosis of the satisfaction of residents (surveys from 2014 - this tools is being used for the first time for local planning needs);
- Diagnosis of property market trends (supply against demand) – the impact on residential function and scenarios for development (the use of statistics form Land Registry ans The State Land Service);
- Diagnosis of other factors (global, environmental, cultural, technological, political, etc.) that may be affecting residential function and the common development of the HCR and its PZ;
- Mapping of socio-economic and structural changes (the use of Arc Map 9.3 tools)
- Summarizing of the results of spatial and descriptive data analysis and the setting of the baseline parameters for future comprehensive planning (residential function);
- Identification and the grouping (classification) of the most important problems (its impact and importance on the common development of territory and possible solutions);
- The Drafting of the final report and the preparation of supplementary information ([a vai the] spatial and descriptive data base for the HCR and its PZ) for future integration into the common data base of spatial plan of Riga.

Fig. 4: The Initial structure of the data base and the required data

10 THE HISTORIC CENTER OF RIGA AND ITS PROTECTIVE ZONE

The city of Riga encomposses the HCR (mostly identified as a compact territory of Old Riga) and its PZ adjacent vicinities (mostly built prior 1940). The HCR is the unique World Heritage Site, listed in UNESCO’s World Heritage List due to its outstanding composition of urban space, Art Nuveau and 19th century wooden architecture. HCR and its PZ occupy only 1.4% of 307 sq.km. of territory of Riga, encompassing in total about 62 000 (in 2011) inhabitants and 4000 buildings of various age, style and use (e.g. residential and commercial functions). [20] [22] [23]

More than 200 cultural monuments (forming a total of 8584 registered units in the entire country) of State and local significance (mostly buildings) are concentrated within the HCR, however other urban fabrics located in this area and its PZ also have outstanding architectural qualities and contribute to common design. More than 80% of buildings were built prior 1940; have depreciation in average 60%; 62 buildings have been recognized as “a degraded object of public space” (slam status). [16] Today large numbers of privately owned historical buildings (e.g. multi stores Art Nuveau buildings) are refurbished, well maintained and occupied (e.g. rented out for wide range tenants: local and international business, foreigners, etc.). These buildings represent the most prestique sector of real estate market, mostly are too expensive for local clients and sold out for foreigners from East Europe and Asia. Realtors do not prefer to invest in wooden (low-story) heritage buildings: they are difficult to maintain, expensive to remodel and have no option of demolishing the building or changing its physical size. [6] [18] Almost 50% from current residents live within the HCR less than 10 years; average size of household is less than 2 people. Almost 60% of respondents would move to suburb due to environmental reasons (e.g. air pollution, noise, unsafe place for children, lack of green areas, high crime, and poor parking abilities). [17]

Functional zoning (permitted land use plan) represents economic, potential (use) of land and structures located therein. Land use planning for the HCR and its PZ is well supported by solid normative regulation due to its status: the Master Plan of Riga (2006-2018), the Master Plan of HCR and Its PZ and supplementary by-law of Riga City Council. [4] The Master Plan of Riga and its supplementary documents contain a general framework (new construction, restoration, remodeling), allowed parameters for plots and buildings (size, volume, number of floors, height, sub-division, minimum plot, free area, proportions of public space and street, etc.), plans for permitted land use and protective zones and by-law regulation. The Master Plan of HCR and Its PZ, and the by-law of the Riga City Council has been applied alongside with general regulation of the Master Plan of Riga for the development of new plots, reconstruction and remodeling of current structures (e.g. size, parameters, distribution and use of area, used interior and exterior materials, interior and exterior architectural features), planning and organizing of public space (to ensure its historical qualities and promote its use). [4] [22]

Functional zoning (permitted land use plan) allows mixed land use in the entire HCR and its PZ to promote the diversity of perspective land use and in the remodeling of current structures, sets provisions (proportions in %) for public space, parking lots and street area. In mixed territories land and buildings (mainly multi stores) can be used for apartments, business, services, dwellings (in several territories low-stores buildings), allowing business and service spaces on the lower stores. The proportions of the various types of use vary in different locations and can be irregular for residential function: Central building territories with small

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proportions for dwellings (40% and less – it can vanish) and Central building territories with big proportions for dwellings (40% and more – will provide also high living standard), see Fig. 5. [4] [22] [23]

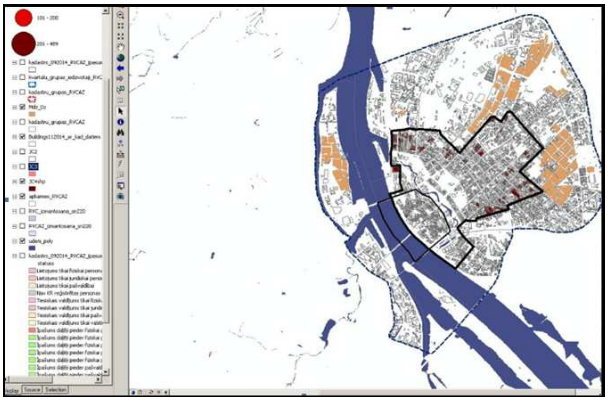

Fig. 5: Distribution of current use of land for residential purpose in the HCR. Background material – cadastral map (year 2014).

The breakdown of permitted use of territories (2006) has shown that approximately 20% from all building space can be used as residential; 2% of entire territory is used for green areas (probably contain existing parks and squares); 4% of territory is free (probably un-built plots or plots with poor construction), making difficult to develop new green areas and new construction (probably also rising demand and prices in vacant land. [22]

According to the Census, since 1989 the number of residents in the HCR has decreased by almost 40% (11790 in 1989; 70192 in 2000; 62 000 in 2012). However, the current distribution of residents in the HCR is regular in all locations, see Fig.6. [22] [25]

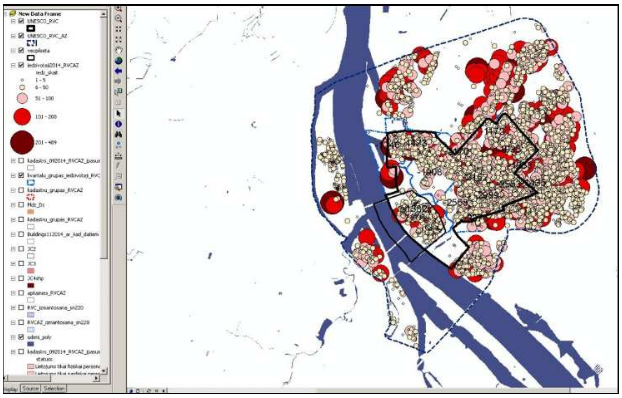

Fig. 6: Distribution of residents and its changes (2006 against 2011) in the HCR and its PZ. Statistical data source: The Office of Citizenship and Migration Affairs, Population Register (year 2014);Census 2011. Background material – cadastral map (year 2014).

11 IDENTIFIED PROBLEMS

All within stydy "Prospective for Maintenance of Residential Function in the HCR and its PZ" identified problems can be divided into the following five groups: global (common, social economic), technological, spatial planning (problems addressed urban design, public space and its infrastructure), political (institutional and systemic problems) and cultural (institutional and political (corporate) culture), see Table 1).

Depopulation, which has been emphasized as the most important problem addressed in the spatial design of the HCR and its PZ, has causes that are global and social economic - that cannot be addressed as a problem only particular to one area and cannot be solved by zoning regulation, the building code and the promotion of property market. It requires deeper analysis in regards to how it can be stopped and how planning function can promote it.

Current zoning documentation of the HCR and its PZ and its supplementary documentation contain all the required spatial and descriptive documentation in relation to the development of historical properties. Unfortunately this information is not well structured and integrated. Registers are no integrated making difficult this information use, understand, compare and publish.

Typical problems addressed in the planning and remodeling of historical buildings mostly relate to administrative burden (e.g. numerous procedures in the planning process, property data registration, etc.) and complicate the decision making process involving shared ownership rights, week financial aid and instruments for owners in renovating historical properties, etc. [8] [26]

Group	Specification of the problem	Couse	Solution/impact
Global (common, social economic)	Depopulation; Global (local) political and economic instability; Cultural differences (e.g. corporative culture and planning culture); Mobility of work and people; Change of living standards; [27] Change in personal values and preferences (technological impact); Unbalanced development of property markets (insufficient, adequate, residential market supply for local purchasers); [5] Insufficient purchasing power of residents; Limited alternative work options (e.g distance work); Internationalization of local market.	Global and national (local) social economic and political impact, its trends.	Global and national (local) social economic recovery, Common geopolitical stability.
Technological	CT impact on common (people and institution) manner use, consume, collect, update, exchange information; Change in manned of planning (application of GIS solutions).	Global ICT development trends, its implementation state in national (local) land administration.	Adaption of global ICT trends in national property data maintenance, exchange, update and publishing; The use of GIS solutions in planning.
Spatial planning problems (addressed urban design, public space and its infrastructure)	Unbalanced developments of territories (contrasts, empty buildings, irregularly developed infrastructure); Unbalanced supply and demand of residential space (e.g. in size, financially available for local clients); [27] Deserted buildings (high administrative burden in planning, construction, remodeling and removal); Insufficient social infrastructure (lack of places for kindergartens, parking options, playgrounds, parks); Insufficient “family friendly” open space (risk for children safety; lack of children’s playgrounds); Pollution (poor air quality, noise); Unsafe public space (high crime risks, low trust in police).	Functional zoning in connection with local property market trends (demand/supply) and common (national) housing policy.	Monitoring of implementation of spatial regulation (GIS based solutions); Public involvements (the use of cooperative, bottom-up planning manner). The improvement of uses cartography materials.
Political (institutional and systemic problems)	Complicate (non-transparent) building condition (long planning phase, construction process, complicate building demolishing involving property data updating); Non-integrated, property data system (e.g. separate Land Register and Cadastre, limited amount of information about architectural heritage are available on-line (e.g. archive)); Complicate property rights (separate rights in land and buildings make difficult property transaction, investments, remodeling, etc.); Insufficient policies in support or the owner in cultural monuments maintenance and renovation (only 8% received state financial aid for renovation. Regulation of public procurement (lower price) limits attracting of ES funds for ensuring of energy efficiency of residential real estate in HCR); No tax reliefs exist for owners, who maintain, occupy, and invest in cultural residential property (less income tax, discounts for loans). Slowing housing policy (e.g. first residence for young families).	Current state of national land administration and real property policy.	Adjustment of land administration instruments (legislations) and its supportive system (institutions, registers and services) to current internal demand, as well as international trends.
Cultural (institutional and political (corporate) culture).	Low common public trust in institutions, politicians, as well as in spatial planning and construction process, property market activities , efficient use of public resources (collected taxes); Unfair social policy (access to social residence and distribution of financial support).	Common social economic environment regarding publicly, supported and shared values.	Changes in common value system (from political to individual).

Table 1: identified groups of problems affecting spatial planning in the HCR and its PZ (research of residential function and protection of heritage).

12 CONCLUSION

The culture, elements of cultural space, as well as considerations regarding its value positive social-economic impact are fully integrated into the modern framework (from the international level to the local) of strategies, concepts, policies and normative regulation (responsibilities) with the purpose of preserving cultural heritage (e.g. a limited number of unique historical sites and structures) in urban structures.

However, its practical implementation has faced such problems as: insufficient administration capacity and financial basis; incomplete information on cultural objects; occurrence of unforeseen global risks (common social economic decline, political instability, shifts in priorities and preferences, etc.) and technological impact (e.g. use of technologies for heritage data collection, process and use). In near future exactly implementation of common framework of national digitized spatial data infrastructure (compliance with requirements of INSPIRE directive and implementation of GIS solutions particularly in spatial planning) will be challengeable also for heritage protection sphere due to large number collected, but not standardized and published yet information, which is important and widely used in spatial planning, construction process, estimation of property value, arts industry and science, general education, property management, avoiding of failure of property markets, etc.

The planning is holistic activity of the public sector and requires daily cooperation with numerous institutions and other stakeholders, appropriate data bases, resources and skills, implementation of technologies, following global social political trends, public involvement and continuous monitoring of the balance of planning related interests (e.g. private, entrepreneurship, institutions, environment, heritage protection, realtors).

All problems in support of residential function (e.g. survival of cultural heritage buildings) in the HCR and its PZ can be divided into two basic groups: spatial planning related problems (addressing the design of urban space and its infrastructure and other (social economic, systemic and institutional culture) problems. Depopulation is a complex (common or global) problem whose solutions are more complex than functional zoning can provide.

Its consequences in areas such as HCR are low demand of residential space (low market and construction activity), necessity to attract international capital (investments) to support local property market, increase of quality of building stock (unpopulated buildings), increase of quality of architecture and public space (loss of cultural values); heterogeneous development of public infrastructure, growing pollution, less security (rising crime and violence).

Current planning documentation of HCR provides sufficient information and available on-line regime, but information is not “GIS based” and integrated with other state registers and social-economic information. Today spatial planning requires more smart ICT solutions (particular GIS) involvement in spatial planning data development, publishing, updating and exchange.

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EIROPAS SOCIĀLAIS FONDS
EIROPAS SAVIENĪBA

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reviewed paper

Coupling of CityGML-based Semantic City Models with Energy Simulation Tools: some Experiences

Giorgio Agugiaro, Stefan Hauer, Florian Nadler

(Dr. Giorgio Agugiaro, AIT – Austrian Institute of Technology, Giefinggasse 2, 1210 Vienna, Austria, giorgio.agugiaro@ait.ac.at)
(MSc Stefan Hauer, AIT – Austrian Institute of Technology, Giefinggasse 2, 1210 Vienna, Austria, stefan.hauer@ait.ac.at)
(DI (FH) Florian Nadler, AIT – Austrian Institute of Technology, Giefinggasse 2, 1210 Vienna, Austria, florian.nadler@ait.ac.at)

1 ABSTRACT

More and more cities are creating and adopting three-dimensional virtual city models as a means for data integration, harmonisation and storage, often based on CityGML, which is an international standard conceived specifically as information and data model for semantic city models at urban and territorial scale. A centralised database can thus foster the development of new integrated applications profiting from such an harmonised data source, in that detailed information is retrieved about building characteristics or any other relevant entities needed for urban planning (infrastructures, hydrography and terrain models, etc.).

This paper focuses on the adoption of a CityGML-based semantic 3D virtual city model to perform energy simulations. It deals primarily with the demand side, and concentrated particularly on the spatial and temporal evaluation of the net energy demand for space heating of buildings in a city.

Two approaches are presented: the first one deals with the estimation of the heating energy demand of buildings adopting a standard-based approach, which allow obtaining monthly values of heating energy demand. The second approach describes the first results as how a dynamic simulation tool can be connected to a CityGML-based city model in order to benefit from the amount of harmonised data stored therein and further refine the results, e.g. in terms of time resolution.

As test area, a part of the city of Trento (Italy) was chosen.

2 INTRODUCTION AND RELATED WORK

City-wide energy-planning requires a precise understanding of the complex system interdependencies at urban level with regards to demand and supply of energy resources, including their spatial distribution. The identification of energetically inefficient buildings and the evaluation of potential retrofitting measures to increase their energy efficiency plays therefore an important role in all strategies aiming at reducing the overall energy consumption and CO2 emissions, as buildings make up to 40% of global the urban energy consumption. The European Union, for example, is aiming for a 27% cut in Europe's annual primary energy consumption by 2030.

Nowadays, precise information about a limited number of “modern” buildings, including their physical and functional characteristic, can be organised in a Building Information Model (BIM), for which a number of simulation tools already exist in order to estimate the global energy demand and to raise the building energy efficiency. For this purpose, two modelling languages are already available: the well-known Industry Foundation Classes (IFC), for which however energy-related applications in the construction industry are limited to a small number of buildings (generally up to some dozens), and the Green Building XML schema (gbXML), which has been developed ad hoc to facilitate transfer of data stored in a BIM to engineering analysis tools (e.g. for performance analysis of buildings), and whose area of application focuses – so far – on one or very few buildings (Casper et al., 2014). At the same time, several energy simulation tools for buildings have been developed and are based often on one of the former modelling languages, or own formats (e.g. EnergyPlus).

However, moving from the single building approach to a city-wide one, but still having the buildings as smallest reference unit (and not a larger, aggregated area like a neighbourhood or a district), can represent a big challenge for several reasons. First, obtaining such city-wide information can be difficult because accurate data are missing or not properly integrated, in that they might be spread out over different heterogeneous data sources. Secondly, a city is a more complex system than a single building, as it is not just a “simple” aggregation of buildings, as many more entities and their mutual relations must be considered.

To this extent, CityGML is a comprehensive data model for modelling, storing and exchanging virtual 3D semantic city models. All objects contained in it (buildings, transportation and utility networks, water bodies, etc.) are described not only in terms of geometry, but also by semantics (e.g. building type, usage, construction date) and topology (e.g. adjacency to other buildings, shared walls).

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One of its peculiarity is the possibility to offer multiple levels of detail (LoD), in which the geometrical and semantical level of information increases from the simplest LoD0 to the richest LoD4 (Gröger and Plüner, 2012). Although even the highest level of detail for the buildings does not reach the richness and completeness of IFC or gbXML, CityGML is being used more and more as integrated and coherent information hub for simulations in different scientific fields, e.g. the energy-related ones. When it comes to buildings, for example, CityGML can already store attributes with regards to the year of construction, the building class and use, however not all energy-related attributes and features can be stored natively in a systematic and standard way.

At this point, the possibility to extend it by means of so-called Application Domain Extensions (ADE) represents therefore a useful characteristic of CityGML: depending on the specific needs, new features or properties can be simply added, hence augmenting the facto the modelling capabilities offered by CityGML. When it comes to energy simulations, some detailed information about an on-going project to define an Energy ADE will be given in the last section.

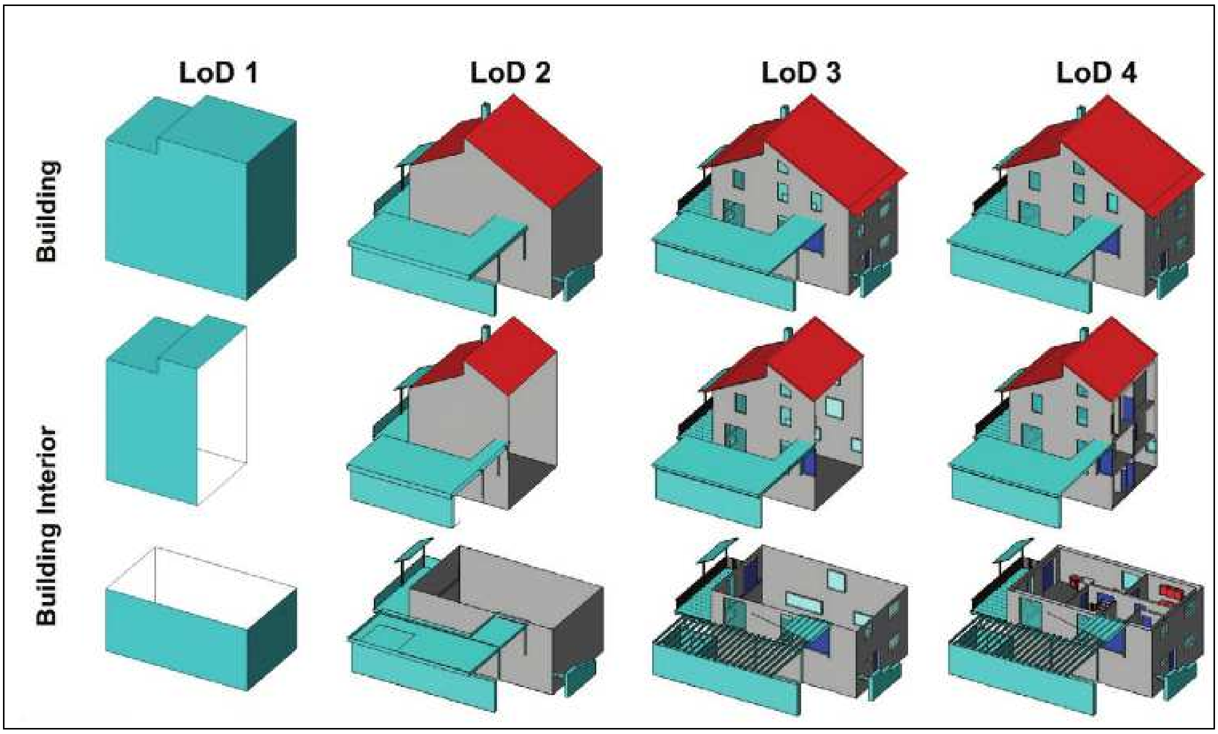

Fig. 1: Different levels of detail (LoD) for buildings according to CityGML. Source: Karlsruhe Institute of Technology (KIT), CityGML 2.0 Encoding standard.

This paper deals with energy simulation of buildings up to the urban scale starting from a semantic virtual 3D city model based upon the CityGML international standard. It deals primarily with the demand side, and focuses in particular on the spatial and temporal evaluation of the net energy demand for space heating of buildings in a city.

First, a semantic 3D virtual city model is adopted. The first part of the article describes the main characteristics of the 3D model, in which 3D geometries, cadastral data, statistical data and physical properties are associated to each building. The 3D city model acts therefore as the information hub to be successively coupled with different energy simulation tools, in order to estimate the energy demand of buildings.

In the second part of the paper, two approaches are described: the first one deals with the estimation of the heating energy demand of buildings adopting a standard-based approach (namely: the Italian Technical Specifications UNI/TS 11300), which allow obtaining monthly values of heating energy demand. The second approach describes the first results as how a dynamic simulation tool (namely: EnergyPlus) can be connected to a CityGML-based city model in order to benefit from the amount of harmonised data stored therein and further refine the results, e.g. in terms of time resolution.

The developed tools allow furthermore evaluating the impact of different refurbishment scenarios, both at single building level, and at city-scale.

A test area in the Italian city of Trento was used, given the availability of a great quantity of data required for this work.

The use of semantic 3D city models for energy simulation has been investigated by Carrión et al. (2010) and Strzalka et al. (2011). The project "Energy Atlas Berlin" (Krüger and Kolbe, 2012) created a city-wide energy atlas, focussing on space heating energy demand for residential buildings. The project was later extended to estimate total energy demand (e.g. domestic hot water and electricity) and production (e.g. solar potential of the roofs, geothermal heat potential) (Kaden and Kolbe, 2013). Similar examples are found in Nouvel et al. (2013) and Bahu et al. (2013) for the cities of Stuttgart, Hamburg, Karlsruhe, Ludwigsburg and Lyon.

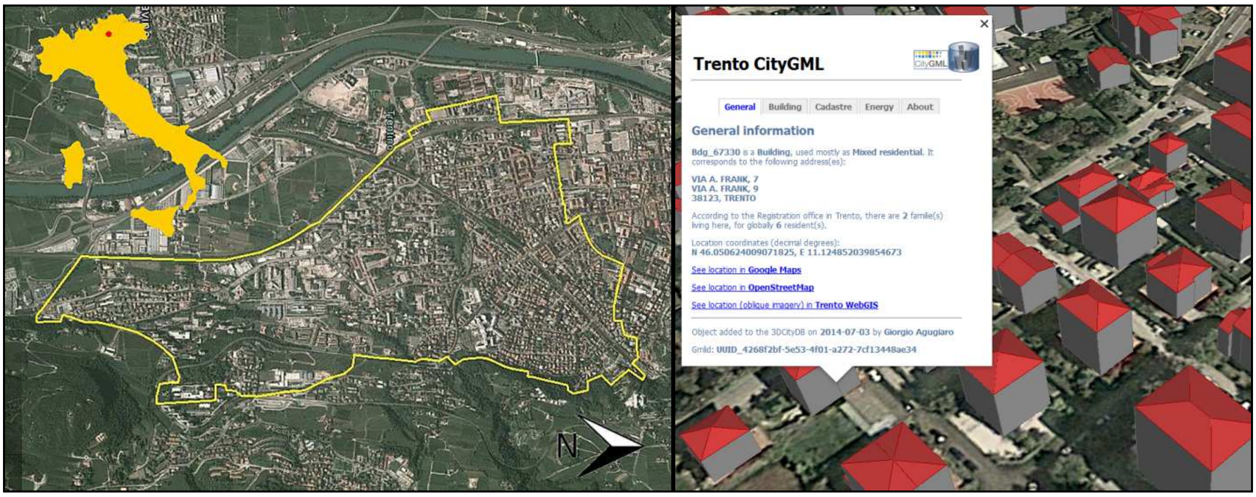

Fig. 2: On the left, the position of Trento in Italy and the extents of the study area. On the right, an excerpt of the 3D city model, visualised in Google Earth. For each building a balloon shows the most relevant data.

3 THE 3D CITY MODEL

This section describes the CityGML-compliant 3D model of the test area, which is located in Trento, a city of about 115.000 inhabitants in the North-east of Italy, as shown in Figure 2 (left). In the test area, about 3.5×1.5 km wide, there are approximately 2300 heterogeneous buildings in terms of use, size and geometry complexity. The test area spreads from the older central and densely built-up area southwards to the immediate outskirts, more recent and less densely built-up. This allows therefore a better distribution of building typologies and age classes.

The virtual 3D city model was obtained by integrating different data sources. In terms of geometry, all buildings are modelled in LoD2, i.e. not as "simple" blocks obtained by extrusion from the footprints, but instead as geometries whose boundary surfaces are represented and semantically differentiated according to CityGML (GroundSurfaces, WallSurfaces, and RoofSurfaces).

Once the geometric modelling was completed, more datasets (spatial and non-spatial) were harmonised and integrated. A more detailed description concerning the overall process of the 3D city model generation and the data integration issues is given in Agugiaro (2014a).

Finally, for each building the following data were integrated:

(1) Ground surface area, volume, number of storeys (above and underground), number of full storeys above ground;

(2) Address(es);

(3) Number of residents, number of families;

(4) Cadastral code, number of property units, number of flats, number of rooms, main use;

(5) Year of construction;

(6)List of updates/refurbishments since building completion, as well as list of EPCs (Energy Performance Certificates).

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The 3D city model was finally imported into a PostgreSQL 9.3/PostGIS 2.1 database by means of the 3DcityDB tools, which also allow exporting it as kmz file for visualisation in Google Earth (Figure 2, right).

All residential buildings were further characterised, in order to enrich the number of attributes and provide as many parameters as possible in order to carry out the energy simulations. Using the available data in the database and by means of the "Tabula" criteria for Italy (Corrado et al. 2012), all residential buildings were classified automatically into 8 construction periods (before 1900, 1901-1920, 1921-1945, 1946-1960, 1961-1975, 1976-1990, 1991-2005, 2006-today) and 4 building sizes (Single family house, Terraced house, Multi-family house, Apartment block), totalling 32 building typologies.

Successively, a number of further attributes were computed or derived. They can be grouped approximately as follows.

From the 3D city model:

(7) For all surfaces (walls, ground and roof surfaces), area, azimuth and pitch angles were computed;

(8) For each shared wall between adjacent buildings, the area was computed, and a classification into adiabatic and non-adiabatic surfaces was carried out (The former separate two adjacent buildings with no heat exchange, while the latter are characterised by heat transmission);

(9) The volume of each building.

From "Tabula", depending on the building typology:

(10) U-values for all thermal envelope surfaces (external walls, roof, upper and cellar ceilings, floor and windows), g-values for window glass, average thickness of the exterior walls, heat capacity per square meter.

From the UNI/TS 11300 Technical Specifications:

(11) Coefficients to estimate the net floor area of each building, as well as the heated volume for each building.

From the Italian standard UNI 10349:

(12) Monthly average daily global solar irradiation values on horizontal and vertical surfaces in the 8 cardinal and ordinal directions;

(13) Monthly values for temperatures (min, max and average) for the city of Trento.

4 ESTIMATION OF ENERGY DEMAND

The semantic 3D model of Trento was the starting point for the development or coupling of tools for the estimation of the energy demand of each residential building in the study area.

In this section, two approaches are described. For each one, the working assumption and simplifications are first presented, followed by a description of the adopted estimation methodology.

In both cases, the LoD2 geometries and all relevant information were used to compute the thermal envelope in terms of opaque and glazed surfaces. Given the lack of detailed information about openings (windows and doors), a unique, constant ratio between windows and external walls was used (0.28), while door openings were not considered. Moreover, the study area falls within the moderate climate zone E, for which a heating period from mid-October to mid-April is assumed. Cooling energy demand for the summer months was neglected.

Given the availability of information about the history of each building in terms of past refurbishments, different scenarios could be computed, because the characterising energy-related values (U-values, g-values, etc.) were changed depending on the type and year of refurbishment. In other words different tuples of characterising parameters could be set for the same building to describe different physical conditions over time. Therefore, not only the original state (i.e. "as built") could be obtained, but also a current state (i.e. "after updates") was computed, thus reaching a characterisation of the buildings closer to reality. One (near) future refurbishment scenario was also computed, in that every building was assigned the current best achievable U- and g-values, corresponding to those of the newest building age class (2006-today). In the following, results will be shown with regards to multiple scenarios at the same time.

4.1 Simplified approach

The goal of this approach was to obtain annual and monthly energy demand values for space heating in a reasonably quick way (if compared to standard energy simulation tools who can take longer computation times for detailed analyses).

Algorithms were implemented on the basis of the national calculation procedure, as described by the Technical Specification UNI/TS 11300-National annex to CEN standards, which were adopted and implemented as far as possible with regards to the required simplifications and the available data. The UNI/TS 11300 (part 1) deals with the "evaluation of energy demand for space heating and cooling". Although in October 2014 updated versions were published, the work presented in this paper is based on the 2008 edition.

For space heating, the energy demand values $Q_{H,nd}$ in kWh were obtained in standard conditions (*asset rating*) by means of the well-known total energy exchange equation

$$Q_{H,nd} = (Q_{H,tr} + Q_{H,ve}) - \eta_{H,g}(Q_{int} + Q_{sol})$$

with:

$Q_{H,tr}$ heat losses through transmission,

$Q_{H,ve}$ heat losses through ventilation,

Q_{int} internal heat gains,

Q_{sol} solar heat gains,

$\eta_{H,g}$ utilisation factor for heat gains.

However, some simplifications had to be made. For every building, a unique thermal zone was used, given the lack of precise information about the internal structure. A constant value of 5% of the transmission losses through opaque wall surfaces was used for thermal bridging losses, as well as other constant values for the internal room temperature, the correction factor due to shadowing, etc. Nevertheless, whenever adopting a simplified, constant value, the UNI/TS 11300 were taken as reference. A comprehensive list with all parameters used and their values can be found in Agugiaro (2014b).

All monthly values were finally summed and divided by the net floor area of the building, in order to obtain normalised values in kWh/(m^{2}a).

As most of the required parameters had already been pre-processed during the previous step (characterisation of the building model, see section 2), the computational time yielded globally approximately 130 seconds for circa 1900 residential buildings and three scenarios on a normal laptop with a 2 GHz quad core processor.

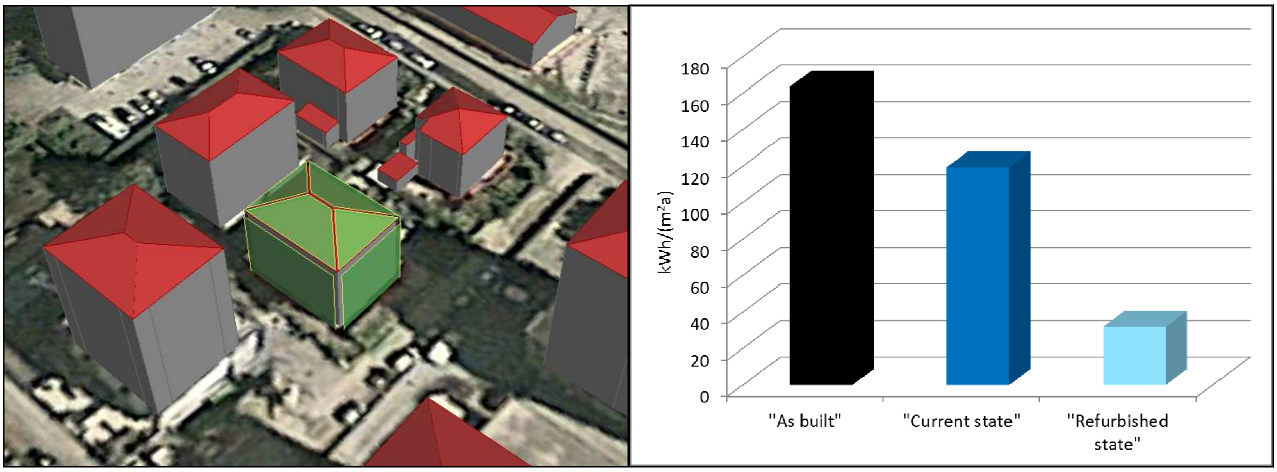

Fig. 3: On the left, the building for which the results in term of net energy demand for space heating are shown in the chart on the right side. The colour coding for the three scenarios (black, blue, azure) remains the same all over this paper.

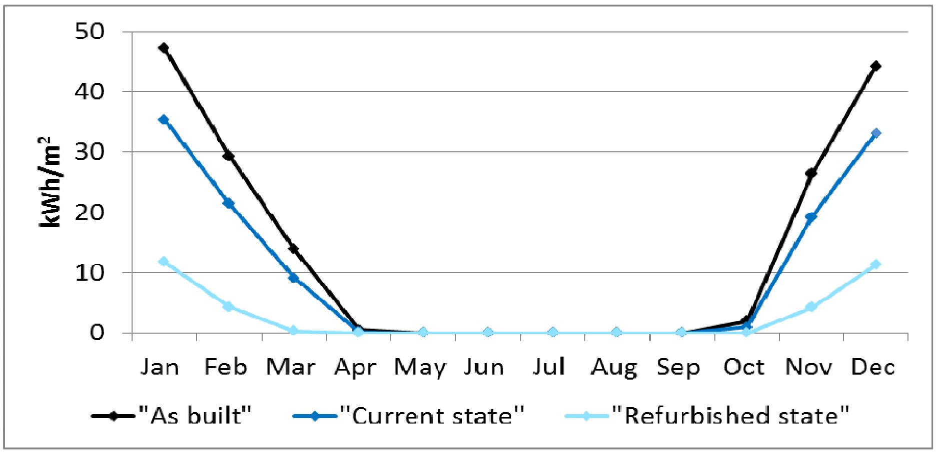

Fig. 4: Plot of the monthly net energy demand values for space heating for the building depicted in Figure 3 (left) are presented. As elsewhere in this paper, three different scenarios were computed.

4.2 Dynamic simulations

The goal of this approach was to exploit the benefits of dynamic energy simulation at urban scale. By coupling the CityGML-compliant database with the dynamic simulation environment EnergyPlus, the following improvements were aimed for:

- Detailed time-dependent analyses are possible using results with a higher time resolution, e.g. hourly values of energy demand, room temperatures etc.;
- The simulation results are based on more detailed interior building models, thanks to a finer thermal zoning instead of the simplified approach presented before (one building, one zone). The generation of the multiple thermal zone is carried out automatically;
- Using multiple zones, different load profiles can be used, thus further refining the model;
- Using real weather data instead of statistical typical data further increases the quality of the simulation results.

Although dynamic energy simulation tools for building generally require high quantities of input parameters, the basic idea of this approach was to perform simulations keeping the number of required input data as little as possible, which nevertheless represents “real-word” conditions when working at city scale. Therefore, some simplifications and assumptions had to be made, similarly to the previous approach. They can be summarised as follow:

(a) All meaningful parameters (e.g. U- and g-values, infiltration ratio, window-to-wall ratio) were extracted from the 3D city model, therefore reusing as many parameters as possible as in the previous approach;

(b) Only the full-storey volume was considered as heated, and the volume was automatically partitioned into floors. For each floor, a core internal thermal zone and several outer thermal zones were created. Windows corresponding to 28% of the respective outer wall surface were generated automatically. This is exemplified in Figure 5 (left). Based on best practices, this kind of space partitioning allows a better simulation of the building behaviour. More detailed information about the modelling process can be found in Leal et al. (2012) and Leal et al. (2013);

(c) The weather data from the nearby city of Bolzano/Bozen was used in order to approximate the regional weather of Trento as good as possible (such data can be freely downloaded from the EnergyPlus site);

(d) Wherever further energy-relevant parameters were not available or unknown (e.g. internal gains caused by occupancy), values were derived either from the norms (UNI/TS 11300) or from established best practices;

(e) No shadowing of neighbouring buildings was taken into account at this stage. However, some results from a parallel work adopting a similar workflow can be read in Bres et al. (2015).

Once the relevant CityGML properties and features where selected, they were exported to the pre-processing tool and mapped to the corresponding EnergyPlus objects, in order to take care of the automatic space partitioning and of the generation of the EnergyPlus peculiar idf file format.

The automatic generation of the thermal zones is a complex problem, as several geometric constraints need to be considered (e.g. only convex zones are permitted). Eventually, the complete building model (including material properties for each wall, windows, internal gain profiles) is imported into EnergyPlus and the actual energy simulation started. Analogously to the previous approach, three scenarios were computed, corresponding to the same configurations ("as built", "current state", "refurbished state").

The hourly results of net energy for space demand for each thermal zone (exemplary presented in Figure 6 for one zone) were aggregated and normalised in order to finally obtain a global annual value for the whole building in kWh/(m2a), as shown in Figure 5 (right). Other output values were not considered, as they are not yet relevant at this stage of development.

In terms of computation time, some tests were carried out on a limited number of buildings on the same machine as described before (laptop with a 2 GHz quad core processor). Taking the building shown in Figure 5 as example, the pre-processing time took about 47 s, while the simulation time approximately 45 s. More detailed analyses concerning the dependency of simulation time depending on the size of the building are described in Leal et al. (2014), where it is shown that time increases linearly with the numbers of floors.

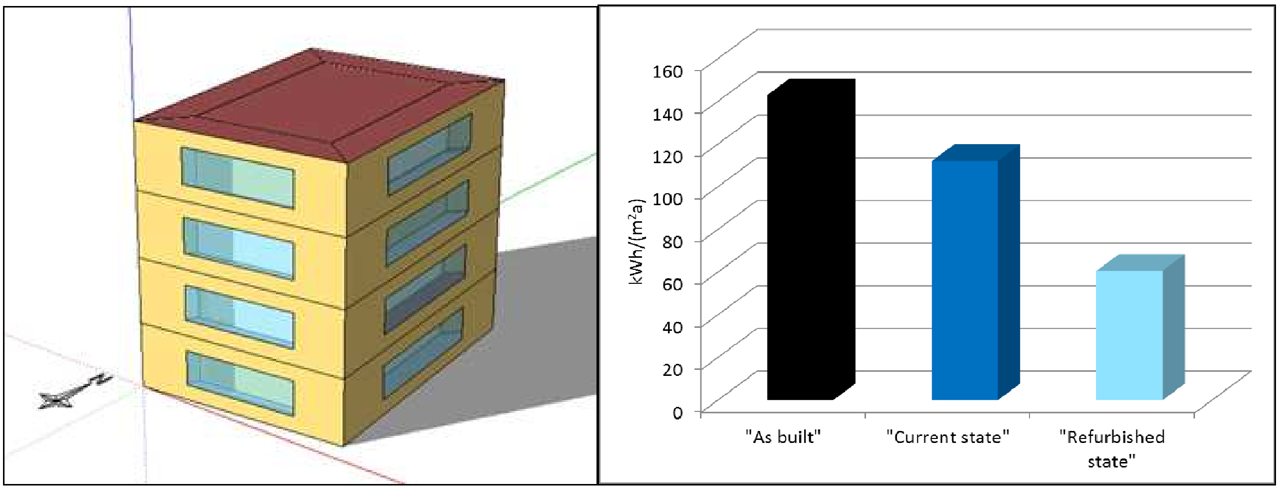

Fig 5: On the left, an example of an automatically generated building model is shown. The different inner and outer thermal zones can be seen. The represented building is the same as in Figure 3 (left).On the right, the annual net energy demand for space heating for each refurbishment scenario.

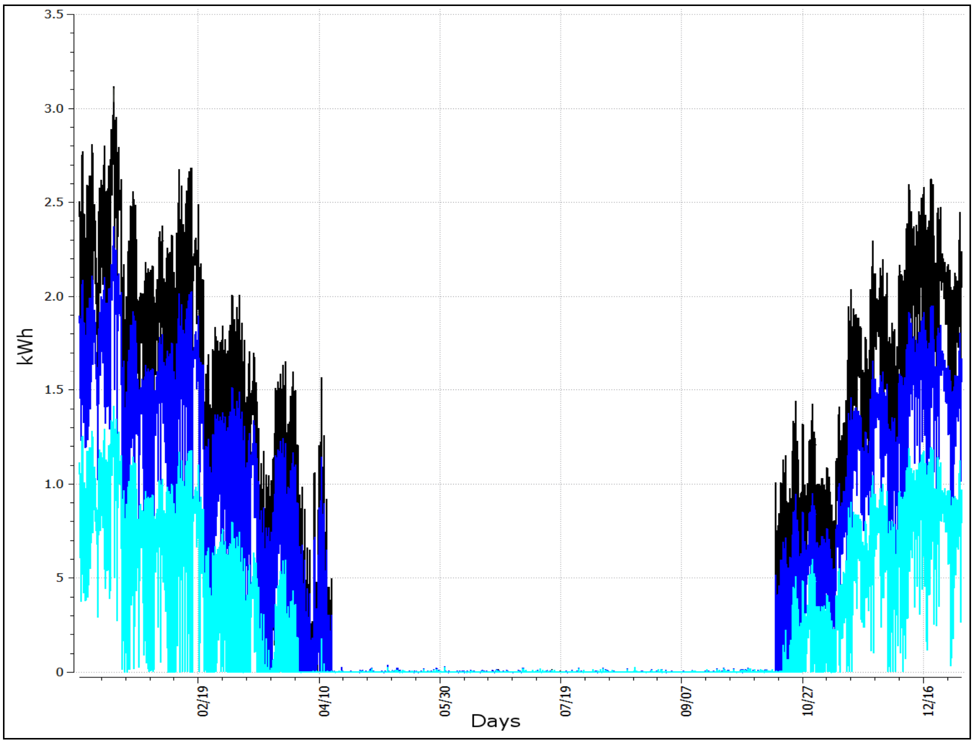

Fig 6: Plot of the hourly energy demand values for one zone. As elsewhere in this paper, the different colours correspond to the three different scenarios: black "as built", blue "current state", azure "refurbished state".

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5 CONCLUSIONS

In this paper some experiences with regards to the coupling of a CityGML-based semantic city model with energy simulation applications were presented and described.

The goal was the estimation of the net energy demand for space heating of all buildings in order to obtain a city-wide energy mapping of the built environment. In this work, only residential and mixed residential buildings were analysed. A part of the Italian city of Trento was chosen as study area.

Two approaches were presented: the first is a simplified one which allows estimating the energy demand with a monthly time resolution and is based on the Italian Technical Specifications UNI/TS 11300; in the second one the well-known EnergyPlus simulation software has been coupled in order to perform dynamic simulations with hourly time resolution.

The first approach allowed computing monthly and annual energy demand values for all buildings in the study area within few minutes, thus enabling a theoretical upscaling beyond the study area to the whole city. Different refurbishment scenarios were computed at the same time. Moreover, the implemented tools are conceptually similar to those developed in analogous experiences from other international cities (London, Berlin, Lyon, Zurich, etc.), which proves that the methodology is replicable without major efforts in other urban contexts of different countries, thanks to the adoption of a standardised data model.

For the second approach, the initial results for the coupling of CityGML with EnergyPlus were presented. Energy-relevant properties and entities were extracted from the common database and pre-processed in order to prepare an EnergyPlus-compliant, multi thermal zone model to be fed to the energy simulation software. Hourly results for space heating were obtained and further aggregated up to annual values. Like in the previous approach, three different refurbishment scenarios were computed. Given its development status and the currently required processing times, this approach has not been applied to the whole study area (yet), as the focus is currently on stability and fault-tolerance. Nevertheless, some improvements are already planned and will be shorty presented in the next section.

Although attention was paid to using as many common input parameters as possible, the lack of proper weather data for Trento can surely contribute to some discrepancies in the results. Therefore, a meaningful comparison between the numeric results is not yet applicable at this stage of development, nevertheless both approaches delivered comparable results in the test cases which were analysed.

The advantage of both approaches resides in the ability to conduct energy demand estimations based on a very limited number of parameters, which is indeed close to reality when working at city scale, as detailed knowledge about every building is extremely unlikely to be available.

Although dealing with the same problem and delivering conceptually the same kind of results, the two approaches can be considered more complementary than alternative to each other. Depending on the needs and constrains of a specific task (e.g. computation time, time resolution of results), one approach could be better suitable than the other.

Nevertheless, both approaches retrieve the required energy-related parameters and features from a CityGML-compliant semantic 3D city model, in which for each building several characteristics and physical properties are stored in a homogeneous way. The data integration and harmonisation lead in fact to mutual benefits for each newly added dataset, reducing redundancy and inconsistencies and adding more check controls for data quality. Furthermore, such a centralised data source could be easily exploited in other simulation applications.

5.1 Further improvements

Although the methodology and the implemented tools already deliver good results, several improvements are already planned in order to overcome current limitations and enhance the overall performance and extend the number of capabilities. In the following, some open issues and possible further improvements will be discussed.

As mentioned before, CityGML currently allows storage of some building-specific and generic attributes, however not all energy-related attributes and features can be stored natively. The possibility to extend CityGML by means of Application Domain Extensions (ADE) is therefore a useful characteristic: new features or properties can be added, augmenting the modelling capabilities offered by CityGML. When it comes to energy simulations, an Energy ADE is currently being developed and tested, and the first version should be published during Spring/Summer 2015. Several international institutions (Open Geospatial Consortium, Sig3D, HFT Stuttgart, TU München, Karlsruhe Institute of Technology, just to name some) are involved and the goal is to define a harmonised version of a CityGML Energy ADE and other development tools like libraries for wide spread use in the development of applications in the energy sector. Further details can be obtained from the CityGML Energy ADE wiki page (Energy ADE).

One of the immediate advantages tied to the adoption of the Energy ADE will be the possibility generate and store only once some features that are now generated every time during pre-processing (e.g. all the thermal zones geometries) and to retrieve them in successive simulations. Taking for example the computation times described in section 3.2, this would reduce the pre-processing effort considerably, from 92 s (47 s pre-processing, 45 s simulation time), to 45 s for one scenario, with even more time gains when dealing with multiple scenarios for the same building. It must be noted that simulation time for multiple buildings could greatly profit from parallelisation over multiple nodes, as each simulation can be carried out autonomously (adjacent buildings are considered adiabatic).

A second planned improvement consists in making the pre-processing tools more flexible and robust, in order to better deal with potentially sub-optimal geometries coming from GIS-based data. Given the somehow strict requirements of EnergyPlus, where for example the envelope surfaces must be sealed and watertight (a maximum tolerance of 1 mm is mandatory), this may not always be the case with “real-world” geometries coming from surveyed data, where several types of problems might arise (overlapping polygons, multiple vertex points, incoherent surface orientations, etc.).

One further improvement will consist in the extension of the toolchain to perform estimation also of the primary energy demands, although this will require more data with regards to installed technologies in buildings (and/or other meaningful assumptions and simplifications).

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🏆 *reviewed paper*

Cross-Border WebGIS Database CURe MODERN

Jan-Philipp Exner, Timo Wundsam, Rüdiger Noll, Guido Kebbedies

(Dr.-Ing. M.Sc. Jan-Philipp Exner, University of Kaiserslautern – Department of CAD & Planning Methods in Urban Planning and Architecture - CPE, Pfaffenbergstraße 95, 67663 Kaiserslautern, exner@rhrk.uni-kl.de)

(Dipl.-Ing.Timo Wundsam, University of Kaiserslautern – Department of CAD & Planning Methods in Urban Planning and Architecture - CPE, Pfaffenbergstraße 95, 67663 Kaiserslautern, wundsam@rhrk.uni-kl.de)

(M.Sc. Rüdiger Noll, University of Kaiserslautern – Department of CAD & Planning Methods in Urban Planning and Architecture - CPE, Pfaffenbergstraße 95, 67663 Kaiserslautern, rnoll@rhrk.uni-kl.de)

(Dipl.-Ing. Guido Kebbedies, ETH Zürich – Raumentwicklung, Stefano-Franscini-Platz 5, 8093 Zürich, kebbe@ethz.ch)

1 ABSTRACT

As part of the INTERREG IVa-research project CURe MODERN, a WebGIS-platform was developed, which enables a visual comprehension of studies done within the project. This project was realized in cooperation with the university of Kaiserslautern (TU Kaiserslautern), the Department of Computer Aided Design (CAD) & planning methods in urban planning and architecture, the Fraunhofer Institute for Nondestructive Testing (IZFP), the State Office for road construction in Saarland (LFS), the french associate CEREMA (Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement) as well as the Eurodistrict SaarMoselle and the company of Rogmann engineers from 2012 – 2014. Aim of the project was to use non-destructive testing methods for infrastructural and cultural buildings and to make these results available for stakeholders of the german and french side. As a kind of an infrastructural and cultural database, this platform aims to communicate results and experiences within the project as well as between the members of the project and also to politicians and citizens. It can offer policymakers a tool to quantify problems and to clarify where possible weak spots could be present for various buildings. With the integration of three dimensional models inside the platform, details such as the need to repair certain parts of the buildings can easily be shown to any interested citizen. This easy understandable platform was developed without the use of special expensive GIS-software. It was created as a browser based system and so it works with any common computer and helps with the communication between different disciplines.

2 INTRODUCTION

The problems of an aging infrastructure and the decline of cultural and historical monuments is not only a European problem, but even a global one. However, a cross-boarder region with various countries and planning mentalities offer a wide variety of solutions. This includes different legal regulations or interpretations of EU directives in combination with historically developed and matured approaches or solutions. The INTERREG IVa-research project CURe MODERN is targetting to use non-destructive testing methods for researching the structure of infrastructural and cultural buildings. In order to be able to show up the visual results of all researches, a special WebGIS based platform was developed for use within this research project. In order to reach this goal, four mayor goals are on the agenda (Kurz et al. 2014):

(1) The creation of a transnational network of specialized partners from the Saarland, Lorraine and Rhineland-Palatinate

(2) Implementation and application of new automated non-destructive testing methods, which were transferred in the corresponding services for monitoring of infrastructure works and cultural monuments in the region of Saarland-Lorraine-West Palatinate

(3) Use of methods and procedures for constructing 3D-models of selected objects in cooperation with local companies in the regional industry

(4) To give public authorities and municipal councils a tool for monitoring the state of their infrastructure, cultural and historical monuments with the construction of a cross-border database

3 THEORETICAL FRAMEWORK

For the implementation of cross-border monitoring of infrastructures and cultural buildings, various objects were analyzed with specific investigations for every object. The methods to visualize the gathered results need a scientific basis in the areas of WebGIS-development, 3D-visualization and the construction of geodatabases.

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3.1 WebGIS-platforms as communication tools

In the light of technological developments, it is obvious that dynamic changes for spatial plannings are to be expected and planners can use ICT technologies for new ways of the planning process. Ubiquitous and pervasive sensors are omnipresent in the urban space and various sources of data could be used on the internet, from every place of the world. The diffusion of physical and real world will go on and a variety of planning tools will evolve (visualization tools, WebGIS etc.) which help planners with the communication process (Exner 2013). In the context, theory of Geoweb which shows the importance of the geospatial location of data (Herring 1994) will be crucial for the use in GIS for example (Crooks, Hudson-Smtih et al. 2014). GI-System are also seen as integral part of Planning Support Systems (PSS) (Geertman 2002). This is especially relevant, when content needs to be transported and communicated, for instance on complex planning issues such as with cross-border context, as it is part of the research project (Wundsam 2012). One approach are 3D visualizations, which put actors with different professional backgrounds target-oriented and effective in knowledge. To organize the relating content in terms of spatial data, the use of a Geographical Information System (GIS) is essential. Thus it was one aim of the project to create a tool, which combines the functionalities of a (Web-) GIS together with an easy accessible information platform on the internet. To build such a platform, on the one hand the complex requirements due to the heterogeneous databases have to be fullfilled and at the same time it must be easily accessible by policy makers.

3.2 Geodatabase

In order to be able to illustrate objects and informations on a WebGIS platform, all the data needs to be stored in a geodatabase. Therefore, the Open Source Database PostreSQL is used in combination with the Open Source Servertool Geoserver. By following a description of Streich, a database persists of three main parts of a geoinformationsystem. Further parts are the cartographic presentation and the geospatial analysis (Streich 2011 p.288)

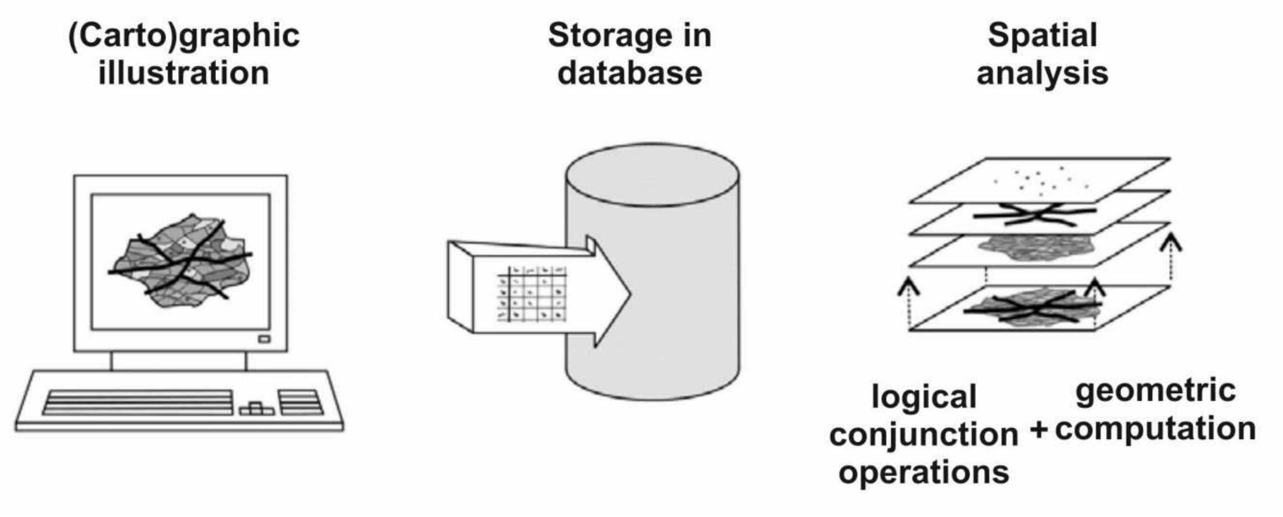

Figure 1: Components of a GI-System analysis (own graphic, based on: Streich 2011 p.288)

Due to PostgreSQL databases are not able to process spatial data to realize the database's georeference, an additional PostGIS-Extension will be required. While combining PostgreSQL with the PostGIS Extension, a spatial database can be defined, in which geometries and other data can be stored in tables (Mitchell, Emde et al. 2008 p.40). While using a geodatabase, collected informations and results of realized researches can be saved and afterwards get connected between themselves. The results can also be located on the deposited map, in order to achieve a clear allocation of the data. Therefore, threedimensional visualizations as well as detailed views of parts of the buildings can be displayed.

3.3 3D-Visualizations in WebGIS-platforms

In order to be able to present the results of the research project, all the buildings that were observed by non-destructive testing methods during the project were modelled in 3D true to scale. Especially in the content of urban and special planning, 3D-visualizations were seen as integral part of an embracing communication element within the planning process (Zeile 2010). This allows the users of the platform to localize the researched spots and to show up the intensity of the damages at buildings. Software like Navisworks enables project review, integration and communication and has functionalities for the export of specific data, which can be visualized in WebGIS-platforms.

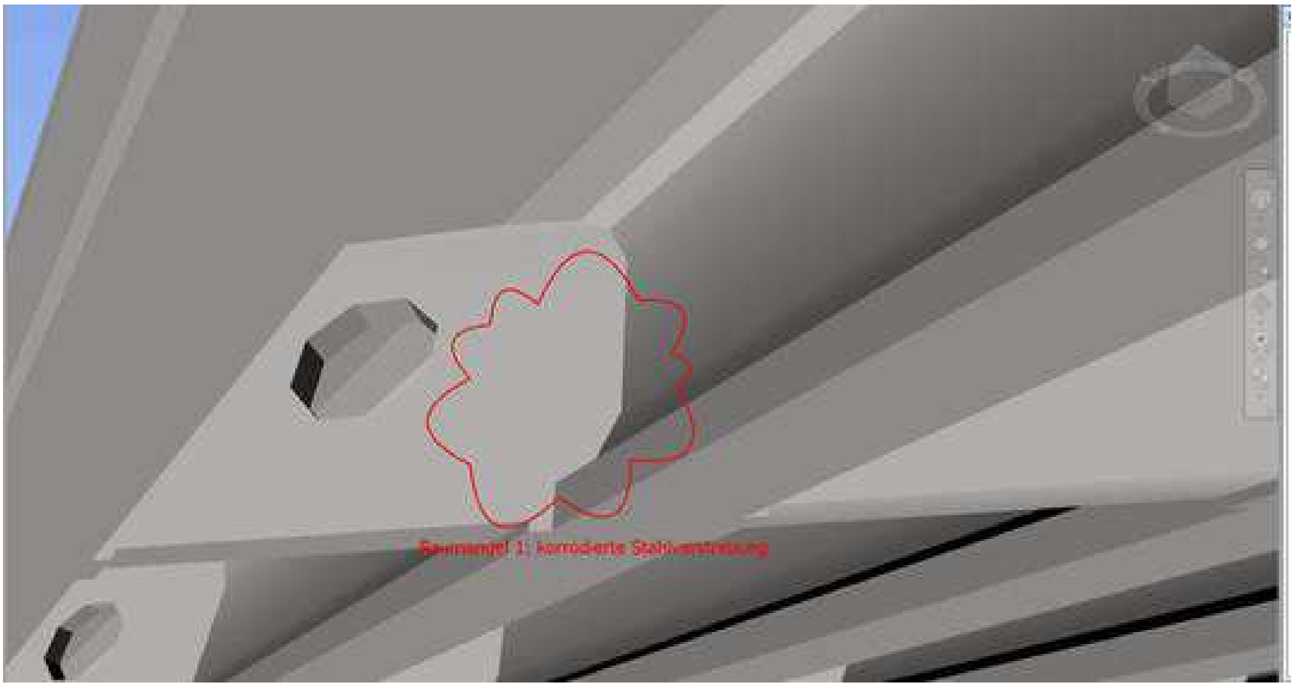

Figure 2: Screenshot from Autodesk Navisworks for vizualizing construction damages (Own source)

Usually 3D visualizations are used to transform complex issues to visual tangible 3D-models to be able to ease spatial comprehension of the circumstances. Especially for policymakers with a restricted expert knowledge of cross-border stakeholder constellations, this platform offers a simplification of the complex issues. As a consequence, the risk of a false localization of the structural damages will be possible to avoid. Therefore, it was part of the project, to build adequate exact threedimensional models of the object of investigation, which will be able to ensure engineering accuracy. But it also needs to stay manageable to be able to graphically complement object damages, as shown in figure 2.

Figure 3: 3D-model of the Mettnich bridge near Nonnweiler/Germany

4 IMPLEMENTATION OF THE WEBGIS-PLATFORM

In the context of the EU funded project CURe MODERN, it was a matter from the beginning, to develop a common database, which contains detailed informations of several infrastructural and cultural buildings. This database was supposed to allow all participants and even in a second stage the public, to recognize, what is the current state of each building and where researches are currently done. It also helps to get deeper insights to specific damages, while certain details of the buildings are threedimensional visualized. During the time of the project, it has been obvious, that the consumption of informations raised immediately. Therefore, the service was configured in the way, that a lot of information about buildings could be implemented with a very user-friendly user-interface. This also includes three-dimensional models, measurement results, pictures and construction maps.

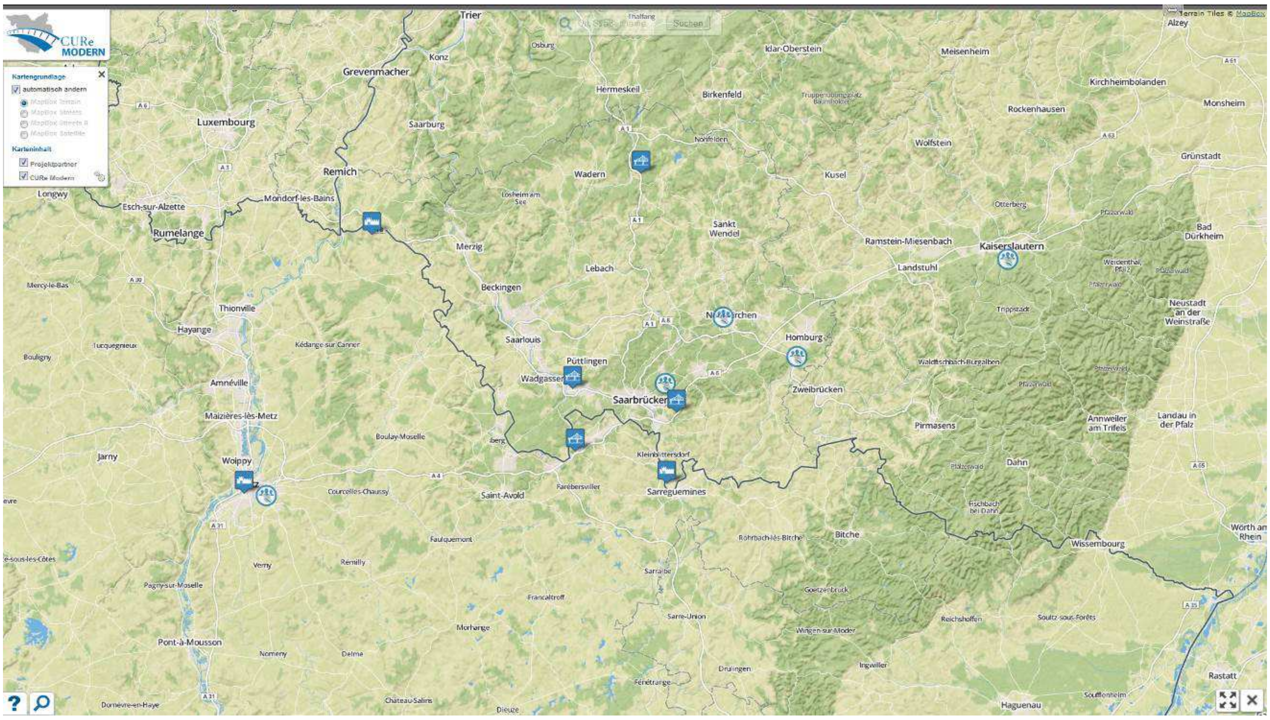

Figure 4: User interface of the WebGIS platform CURe MODERN (Own source)

4.1 Data gathering of non-destructive methods

The investigations were used in combination with specific non-destructive object testing methods. In addition to investigations conducted destructive threedimensional geo-referenced models were created of all researched objects. Then, both were implemented into the developed database. Within the geodatabase, it is required to store plenty of data. Simultaneously, the risk of redundancies needs to be avoided. Therefore, a dedicated structure is required and will be described following.

- All informations, which are directly related to the research object, just like a consistent object-ID
- A table, in which all relevant attachments will be collected, which relate to the research object
- A list in which all research results, that are connected with the test object, are saved. Thereby informations like name, status, costs, priority, damage classification, time period and arrangements will be stored
- A table, which is related to the attachement of the researches. These are able to be get filled up with multiple data formats to reach extended informations

The information range of the tables is modular expendable and it’s possible to add more required attributes. In this context, it’s important to be able to add new attributes into the user interface. At the same time, backup-tables will be arranged, which are required for the repair function, to avoid undesired cancelations of research objects. The required database relations will be accomplished by the object-ID and are the basis for accessing the database. This refers to all four existing tables, to offer the users a widespread and structured overview about the research object.

In the context of the project, the region of Saarland, Rhineland-Palatinate and Lorraine/France was checked for representative objects and case studies, which were eligible for the researches with non-destructive methods. At this point, just a few significant examples were adduced to show up the function of the testing methods. Subsequently to each measurement, the task was about to link the gathered data with an acquired 3D-model. For that case, it will be possible for the viewer, to allocate the inspected damaged part exactly, to be able to recognize the part on site later on the building. Beyond that, all inspected buildings are located in an online map, to submit a spatial coherence of the research object. So, the connection between the researches and the results were possible to show up visually in order to be able to offer municipial policymakers a base for the guidance. With this guidance, further approaches will be able to decide.

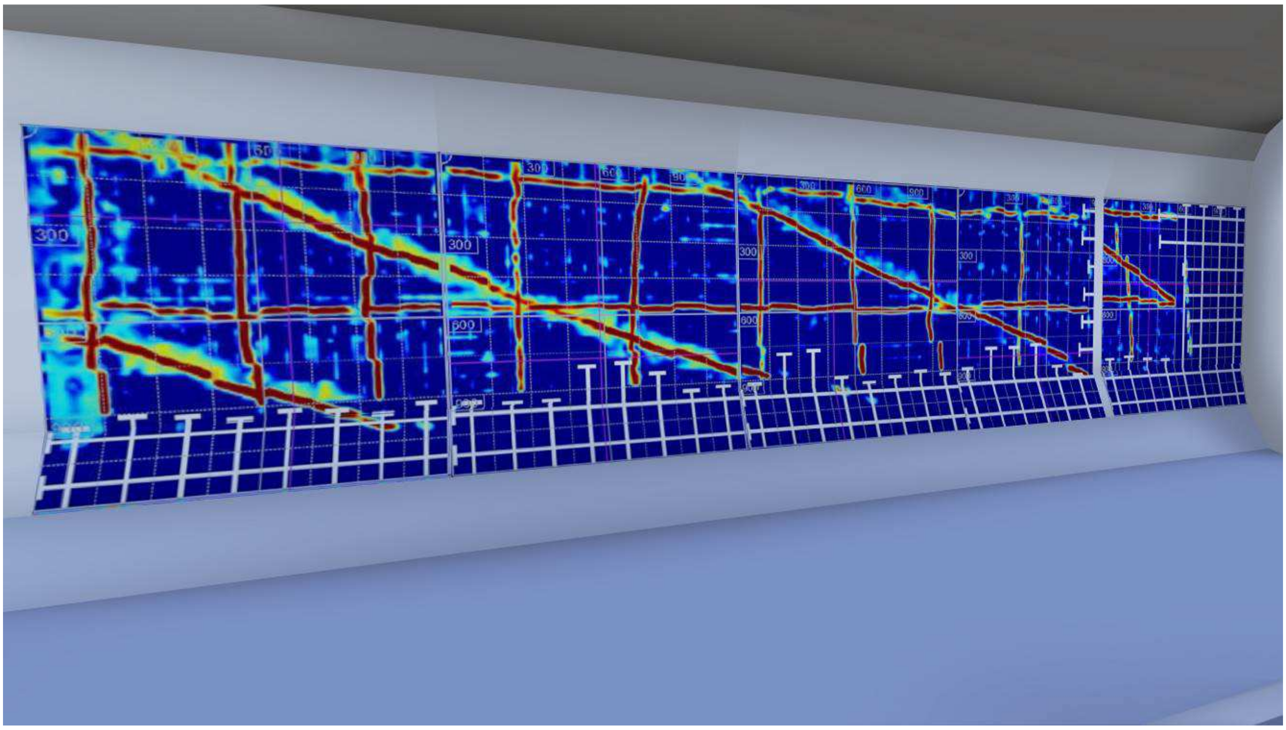

Figure 5: Generic detailed view of a infrared scan inside the bridge of Rosbruck/France (Own source)

4.2 Functionalities for communication of the platform

The configuration of a planning and communication platform is connected with several challenges, from which all required functionalities can be extrapolated. On the one hand, there's the management of the geodata and on the other one the modular usage for the cross-border project group. As described previously, the web-based geographic information system contains a variety of functions. The user interface has a selection of different cartographic bases, which includes a terrain map, two different street maps and a satellite map. A selection by the user can be made on every zoom level. Furthermore, a search function is also available for all research objects and testing investigations. The map contains relevant informations concerning the project partners as well as indicators to the type of study objects with a distinction between infrastructural and cultural buildings. The database even contains the following additional information about the buildings:

- Name of structure
- Specific details as text
- Year of construction
- Thumbnails
- List of tests
- 3D-models
- Other project-related documents, such as plans or detailed pictures

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The study list of an object can have multiple entries and can be edited by the user independently. Other attachments can be added at this point. The entire WebGIS-platform can also be adjusted to the erespective needs. By selecting the respective investigation, a new window with additional damage details containing the following points can be implemented:

- Name of the investigation
- Priority (low, medium, high, none)
- Status (pending, taken, completed)
- Costs
- Damage class
- Period of tests
- Type of measure
- Preview image of an examination

It is possible to record the costs of the specific testings and damages in order to visualize these amounts online within graphs in a time period. It also allows therefore a monitoring of testing methods in terms of the financial capacity for specific projects.

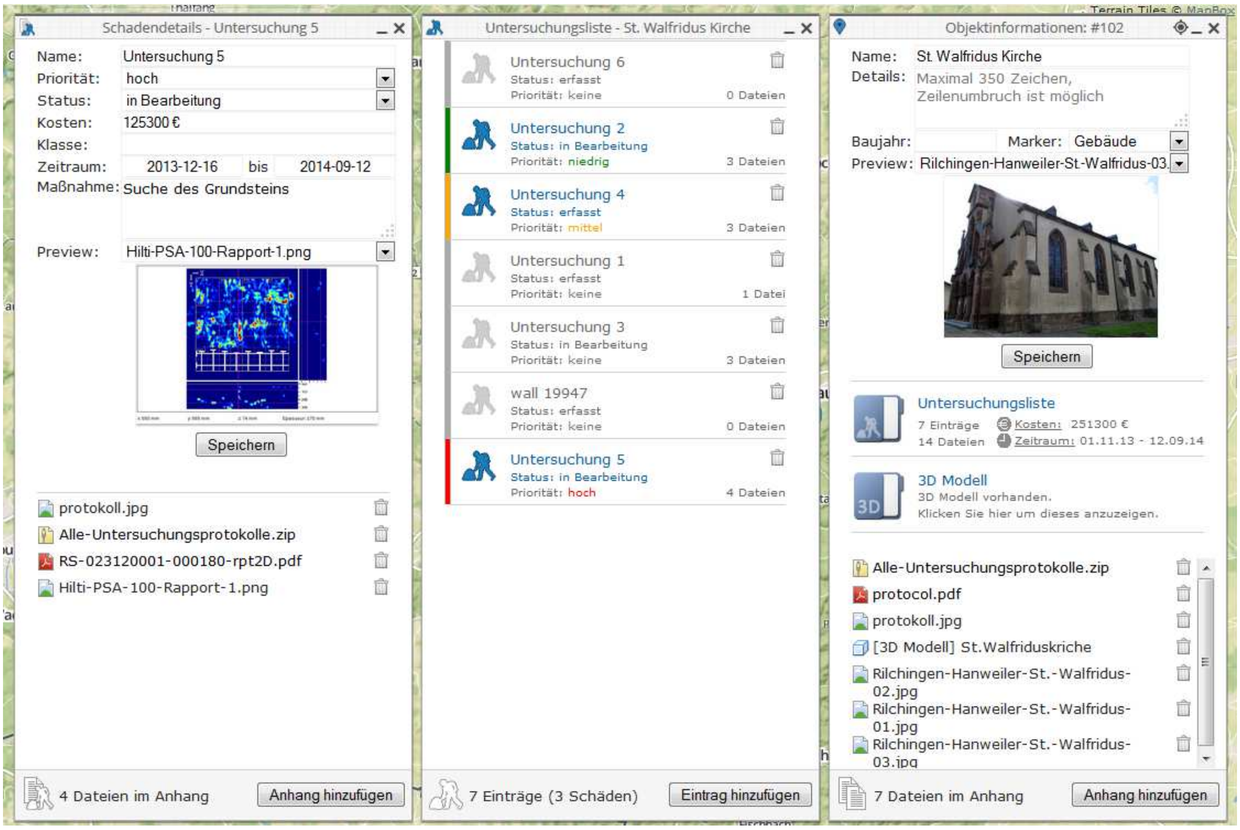

Figure 6: Object informations, investigation list and damage details (Own source)

Another focus of the developed WebGIS is on the ability to visualize 3D-models. To achieve the best possible usability, the use of widely accepted standards was important in the project. Hence, the format

3D-PDF is used to embed the visualizations into the website, also with previously selected fixed viewpoints. However, it is also possible to freely navigate within the 3D-model.

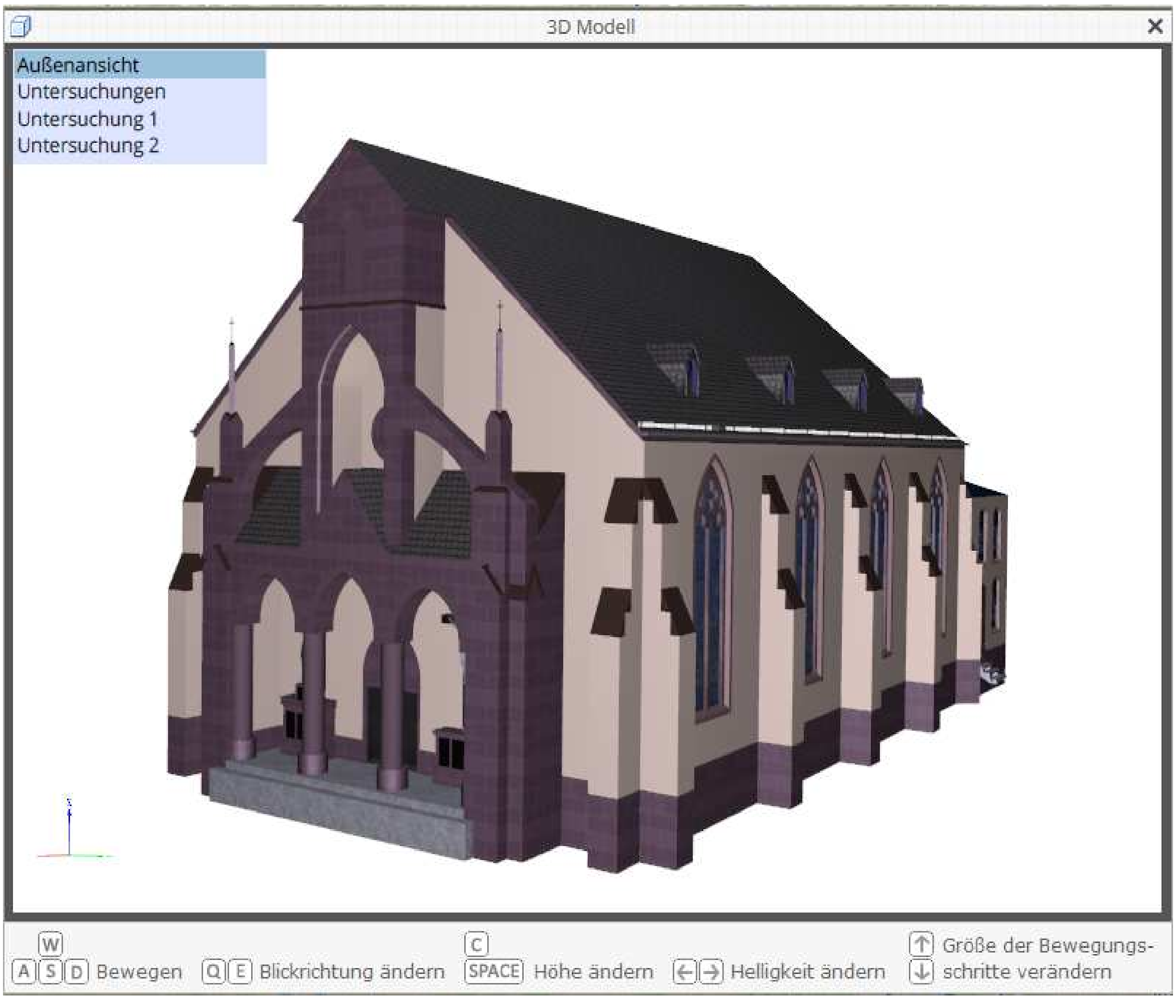

Figure 7: 3D-model with a detailed view to the researched parts inside the building (Own source)

The platform enables scientists and policymakers to combine geolocated studies and visual results of various. This link offers numerous advantages for planners and the planning process arise (Kebbedies 2013 p.13). The illustrated WebGIS platform especially provides planners a flexible and open instrument, which can be used for planning-related solutions. Main focus for the project was that each project participant has a tool which enables them to view current conditions and examination of buildings. Hence, it should also serve policymakers to easy present a current status reports to committees and easily to draw attention to special issues.

5 SUMMARY

As part of the funded INTERREG IVa-project CURe MODERN, a network of specialized partners from the Saarland, Lorraine and Rhineland-Palatinate was established. The combination of structural inspection by non-destructive testing methods for monitoring and damage diagnosis with a WebGIS platform is a novel approach, that enables new planning opportunities and a flexible exchange of information in the cross-border context. The WebGIS platform in the CURe MODERN project provides the basis for a cross-border cultural database that allows to manage and visualize different objects and their associated tests. It is important to build a common database in order to ensure the best possible cooperation between different actors in a cross-border area. The aim of the project, to use sensory non-destructive testing methods and to make this information available on a larger scale for spatial planners, was achieved. The merged information and test results may be useful both for internal communication, presentation and mediation for the local decision-makers. By the use of a WebGIS, no additional software is needed and an access from a standard installed browser is possible. Through the use of open source software, a free and flexible approach could be achieved. Though, the disadvantages has to be considered as well. The custom-made WebGIS is accompanied with the usual problems of a prototypical implementation which includes individual aspects in terms of the stability.

For cross-border cooperations, the EU funded project “CURe MODERN” represents an enormous importance, because the variety of partners from different regions, countries and disciplines is exemplary for many European regions. Each partner has its own background, which has to be bundled in the context of the project. Thereby, the preparation of the communication platform can only be seen as a first step to more integrated solutions. This is particularly important for the European spatial data infrastructure. Comparable solutions as to be constructed corresponding to the INSPIRE Directive (Infrastructure for Spatial Information in the European Community). Furthermore, technical advancement in the context of mobile devices to host such platforms will go on. In addition, it is considered a fundamental point, especially in such complex themes, with an embracing constellation of actors to initiate further cross-border cooperation projects, to be prepared for upcoming emerging transnational issues in the context of infrastructure monitoring. In conclusion, the EU funded project is a great success, because many damages on significant buildings were inspected and the members of project were able to work out action requirements to obtain most of the research objects. The demonstrated WebGIS platform was even able to show up policymakers the urgency to act on making decisions concerning about special buildings in order to obtain them. In one case, the inspection revealed, that a building need to be rebuild, so the construction work will start soon.

6 ACKNOWLEDGEMENT

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Data Science Technologies for Vibrant Cities

Oksana Smirnova, Alexander Vodyaho, Nataly Zhukova

(Oksana Smirnova, PhD, St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences (SPIIRAS), 39, 14 Linia VO, St. Petersburg, Russia, sov@oogis.ru)
(Alexander Vodyaho, Prof, St. Petersburg Electrotechnical University (LETI), 5, Popova str., St. Petersburg, 197376, Russia, aivodyaho@mail.ru)
(Nataly Zhukova, PhD, St. Petersburg Electrotechnical University (LETI), 5, Popova str., St. Petersburg, 197376, Russia, nazhukova@mail.ru)

1 ABSTRACT

Smart Cities forced IT technologies make a significant step in their development. A new generation of agile knowledge based software applications and systems have been successfully designed and implemented. Wide capabilities of the agile applications were sufficient to meet the complete set of requirements of smart cities. Fast transformation of modern cities from smart cities to vibrant cities throws new even more complicated challenges to information technologies. While smart cities assumed wide usage of agile means and tools for solving applied tasks, applications for vibrant cities must provide agile environment for exploring and managing of all types of data, information and knowledge. Agile environment must be flexible enough to support iterative data processing and analyses procedures that can be easily reorganized or changed depending on context. The aim of agile environment creation and support is to extend a set of used mathematical, technological and program solutions. In the paper it is proposed to build applications for vibrant cities using agile data science methodologies and toolsets within the commonly used approaches for developing agile information systems.

2 INTRODUCTION

The history of the modern society formation contains a number of evolution and revolution stages that sequentially followed each other. The processes of society development at early stages were forced by the need to survive. The progress engine of the industrial and postindustrial information societies is desire to reduce amount of time and financial resources required for producing all kinds of commonly consumed and innovation products, to have easy access to resources sufficient to satisfy physical, cultural and spiritual needs, to reach high level of life safety. At the industrial stage the economical sphere was considered as the target sphere of the development, high level of social sphere development was archived at the postindustrial stage. Now the society has to solve a number of new problems arisen within the industrial and postindustrial stages. The great number of created and used technical objects can lead to a variety of technogenic dangers, the natural environment has been considerably damaged and needs recovery, amount of consumed natural resources has to be reduced and substituted by alternative sources, the social sphere needs further development and improvement.

To solve these problems new highly technological solutions that can substitute existing solutions in comparatively short period of time are required. Significant amount of resources is required to produce technologies that will provide new level of quality. The major part of the available resources is now spent to support the existing society infrastructure. To free the resources for archiving the new technological level of the society development all spheres of human activities have to be precisely coordinated. It assumes human collaboration in using technical and natural resources, products provision and consumption.

Cities and towns are centers of the modern society development. They reflect the state of the society, its latest achievements and trends of further evolution of the society. An essential part of citizens are open to all kinds of innovations that potentially can improve quality of their life. Cities and town provide fertile ground for new economical, organizational, technological and technical solutions creating, implementing and approving. High concentration of population in cities, citizens' active social positions, high dynamics of life, large variety of the consumed products and services, strong requirements to their quality and accessibility throws new challenges to cities and forces cities rapid development.

The overwhelming majority of citizen professional and private activities in the modern information society are part and parcel of all kinds of information consumption and production. They gather, store, process and analyze data, transform it into information and knowledge. The results of the researches of the leader IT companies, for example, International Data Corporation (IDC, http://www.idc.com/), showed that amount of

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produced data is doubling in size every two years and will reach 44 zettabytes by 2020 [1]. Data is created by more than 2 billion people and millions of enterprises, millions of sensors and communicating devices. Diverse software is created and used to analyze expanding data streams, find hidden values and dependencies in it. Mined information and knowledge create new challenges and provide wide opportunities to enhance the real world. Big amount of gathered data used in new ways provide huge potential for enterprises development. Ability of enterprises to derive benefits of data and to obtain competitive intelligence completely defines their demand by the society and further successful development.

IDC pointed out that in 2013 only 22% of available data was considered as a candidate for analysis, less than 5% of that was actually analyzed and less than 1% of it was really used. In order to increase amount of consumed data, enterprises have to be reorganized into companies designed for data, information and knowledge (DIK) transformation adaptable to ever changing rushing environment.

Well founded theories and techniques for analytical data processing have been developed in the sphere of data science. Data science is extraction of knowledge from data [2]. It includes models and methods drawn from many fields within the areas of mathematics, statistics, and information technologies. Data science techniques are used for researches in biological and medical sciences, social sciences, economics, business and finance that have rich data sources.

From the perspective of modern cities data science has to become an integral part of vibrant cities informational infrastructure that encompasses both physical and organizational structures needed for operation and evolution of the human society. It will take determination and skilled workforce to find the way and put to use data science for cities and towns welfare.

3 DATA SCIENCE

Data Science has appeared more than 10 years ago as a response to acute need in theory for processing and analyses of data with 3Vs defining properties or dimensions - volume, variety and velocity. The term "Data Science" was introduced by Prof. William S. Cleveland [3]. Data science allow discover true business needs by taking ownership and management of the entire modeling process (Fig.1): collecting and managing data, information and knowledge, building / extending models and deploying models into production [4]. In narrow sense Data Science is a discipline targeted on extracting knowledge from data that can be used to predict and explain future and past observed events. Data science structure and goals are mostly defined by the DIKW (Data, Information, Knowledge and Wisdom) model, also known as DIKW Pyramid or DIKW Hierarchy [5, 6, 7]. The model represents structural and/or functional relationships between data, information, knowledge and wisdom. Two views [6, 8] of the DIKW model are shown in Fig.2.

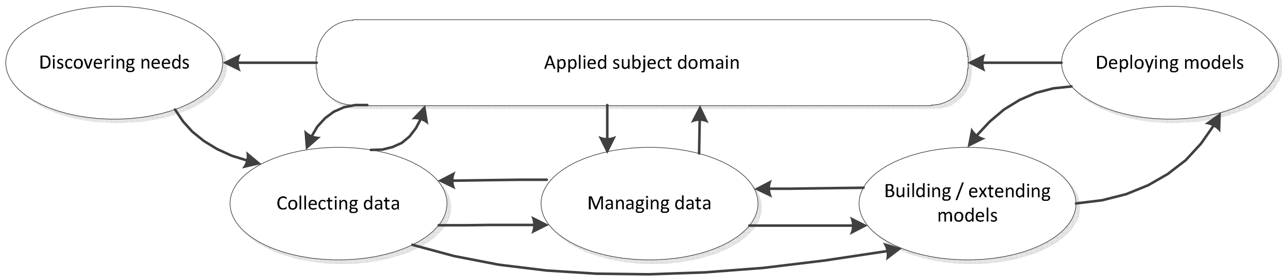

Fig. 1. Structure and steps of modeling process

Russell Ackoff' defines the terms used in the DIKW pyramid considering them as the key categories that form the content of the human mind: data is symbols; information is data that is processed to be useful; knowledge is application of data and information; wisdom is evaluated understanding of data, information and knowledge (Table 1).

The transitions between the nodes in the DIKW chain allow extract meaning from data and create data products. The transitions require single or multiple transformations of data, information, knowledge or wisdom. Data Science incorporates varying means capable to support complicated transformations. The techniques and theories used in data science refer to many fields, including math, statistics, data engineering, pattern recognition and learning, advanced computing, visualization, uncertainty modelling, data warehousing, and high performance computing. For example, John Hopcroft and Ravindran Kannan in

Foundations of Data Science [9] include into the list of the clustering techniques and algorithms a k-means algorithm, a greedy algorithm for k-center criterion clustering, spectral clustering, recursive clustering based on sparse cuts, kernel methods, agglomerative clustering, algorithms based on dense submetrices and communities calculation, flow methods, methods for finding local clusters without examining the whole graph and some other methods. The number of data science algorithms exceeds several thousand and is constantly increasing in response to new data, new applied problems and permanently changing requirements to the solutions.

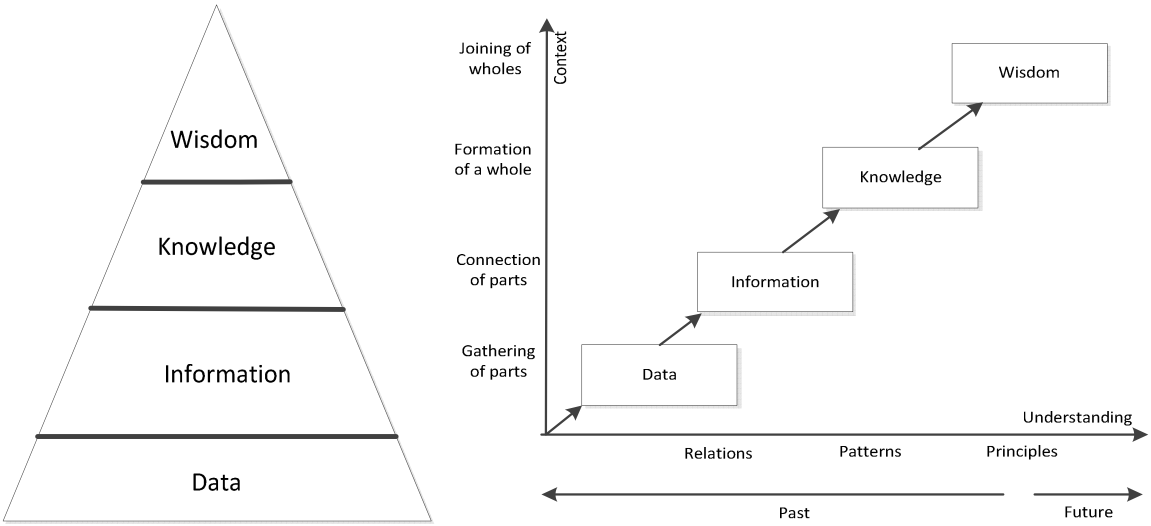

Fig. 2. Views of the DIKW model: left (a) DIKW hierarchy, right (b) DIKW chain.

№	Motion	Question to answer	Properties
1	data	-	Data is raw. It simply exists and has no significance beyond its existence (in and of itself). It can exist in any form, usable or not. It does not have meaning of itself.
2	infor-mation	who? what? where? when?	It is data that has been given meaning by way of relational connection. This meaning can be useful, but does not have to be. In computer parlance, a relational database makes information from the data stored within it.
3	know-ledge	how?	Knowledge is the appropriate collection of information, such that it is intent to be useful. Knowledge is a deterministic process. Knowledge can be amassed. This knowledge has useful meaning, but it does not provide for, in and of itself an integration such as would infer further knowledge. Synthesization of new knowledge from currently and previously held information and knowledge requires its understanding. Understanding is an interpolative and probabilistic process. It is cognitive and analytical.
4	wisdom	why?	Wisdom is an extrapolative and non-deterministic, non-probabilistic process. It calls upon all the previous levels of consciousness, and specifically upon special types of human programming (moral, ethical codes, etc.). It gives us understanding about which there has previously been no understanding, and in doing so, goes far beyond understanding itself.

Table 1. DIKW hierarhy notions description

4 SUBJECT DOMAIN MODELS

City and town infrastructure involves millions of various technical objects, natural objects and complexes of objects. IBM has developed a general intelligent semantic model (ISMP model) for smart cities [10] and a number of its customizations for separate regions. A fragment of the model is shown in Fig.2 (a).

Data about the objects is continuously gathered using embedded and external sensors. Behavior of the objects is defined by needs of solving applied problems and requires objects interaction. The results of the objects activities are influenced by the environment in which the objects are functioning. Influence factors can refer to economic, social, political spheres or the objects can be impacted by natural phenomena. Objects can be also affected by both predictable and unexpected events. The result of joint influence of totality of the factors and events on the objects' states, behavior and their capability to solve the end tasks at particular time and in particular place is considered as a situation [11].

From the point of view of modeling processes development and execution description of the subject domain of cities and towns infrastructure can be simplified to three key notions: measurements, objects and situations (Fig.2 (b)).

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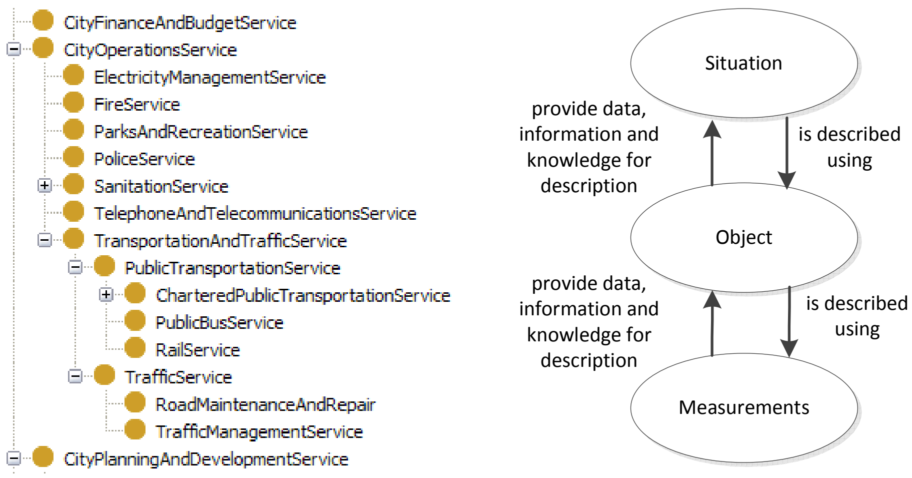

Fig. 2. Complex and simplified descriptions of the subject domain of city and town infrastructure. left (a) complex description, right (b) simplified description

High complexity of the notions required design and development of the specialized informational models for representing data, information and knowledge about each of the notions. The proposed models have four key features:

i) to build the models it is necessary and sufficient to have the results of the parameters measurements;

ii) the levels of the models are oriented on extracting knowledge out of data and information;

iii) relations between the notions are oriented on generalization of data, information and knowledge of the subject domain;

iv) representations of data, information and knowledge used in the models are completely compatible with representations of the results of the methods and algorithms that refer to data science.

Descriptions of objects in the models are based on processing and analyses of the objects characteristics. Values of the characteristics are obtained as the results of measurements processing. Descriptions of the situations are built using the descriptions of objects that are directly or indirectly involved or can be involved into the situations or can potentially influence on them. The defined notions and the supported relations allow reflect the actual state of the cities and towns infrastructure sufficiently enough to solve the problems of the infrastructure understanding and in time management.

The schematical structures of the models for representing measurements (MIM), objects (OIM) and situations (SIM) are given in tables 2-4. The models are functional multilevel models that contain systematized data, information and knowledge about the notions. The general metainformation about the measurements, objects and situations is out of the presented models scope. The models are targeted on providing operational DIKW of the subject domain and results of their processing.

Level	Element of the model	Description	Provider / consumer
L1.1	Structured binary stream	Parameters of the initial structured binary streams received from the object	- / MIM
L1.2	Initial results of the parameters measurements	Results of the objects parameters measurements represented in the form of time series or separate measurements	- / MIM
L1.3	Pre-processed results of the parameters measurements	Results of the parameters measurements processing	- / MIM
L2.1	Segment based representation of the results of the parameters measurements	Representation of the time series of parameters measurements in the form of a sequence of piece-wise constant segments	MIM / OIM
L2.2	Class based representation of the results of the parameters measurements	Representation of the time series of parameters measurements in the form of a sequence of classified segments	MIM / OIM
L2.3	Alphabet based representation of the results of the parameters measurements	Representation of the time series of parameters measurements using a predefined alphabet	MIM / OIM

Table 2. Informational model of the results of object parameters measurements

The model can be build taking into account information about measurements time and location or without the time-space buinding.

Level	Element	Description	Provider / consumer

L1.1	Functional parameters measurements	The list of the results of the parameters measurements / results of measurements processing with the defined location in space and time	MIM / OIM
L1.2	Signal parameters measurements	The list of the results of the parameters measurements / results of measurements processing with the defined location in space and time	MIM / OIM
L2	Parameters characteristics	Characteristics of the objects calculated using the results of measurements processing	OIM / OIM
L3.1	Physical - oriented parameters estimations	Estimations of the results of measurements in the context of parameters physical nature	OIM / SIM
L3.2	Object – oriented parameters estimations	Estimations of the results of measurements in the context of the objects properties and state	OIM / SIM
L3.3	Complex parameters estimations	Estimations of the objects parameters in the context of the known dependencies of parameters behaviour	OIM / SIM
L4	Mismatches and deviations	Mismatches between the parameters expected and actual behaviour; deviations between parameters actual behavior and predefined patterns	OIM / SIM

Table 3. Informational model of objects

Informational model of the objects can be used to store and provide information about the whole object, its separate functional componemts, in particular, systems and subsystems, or separate structure elements, including blocks, agregates and nodes. Information about the objects can be obtained or improved on the base of the information about the objects components and elements.

Level	Element	Description	Provider / consumer
L1.1	Objects involved in a situation	List of the objects and description of the objects directly or indirectly involved into the situation	OIM / SIM
L1.2	Relations between objects	Relations between the objects involved into the situation	OIM / SIM
L2.1	Context dependent descriptions	Descriptions of the objects with consideration of the diverse factors that influence the situation	External sources / SIM
L2.2	Events dependent descriptions	Descriptions of the objects with consideration of separate events or sequence of events that influence the course and / or the intensity of the situation development	External sources / SIM
L3.1	Situation related processes	The list of the processes and the descriptions of the processes related to the situation lifecycle, including situation emergence, development and resolution	SIM / SIM
L4	Mismatches and deviations	Mismatches between the expected and actual evolution of the situation	SIM / SIM

Table 4. Informational model of the situations

Similarly to the model of the objects the model of the situations can be considered at different levels – the levels of elementary situations of different scales and the level of the whole situations.

Elements of models are supposed to be described using OWL / OWL Schemes to provide interpretability of data, information and knowledge at the machine level.

5 DATA, INFORMATION AND KNOWLEDGE TRANSFORMATIONS

Modeling processes allow reveal and define the majority of the business processes. The processes assume application from one up to several hundreds of diverse methods and algorithms or their combinations. The processes are defined in terms of the subject domain. The set of the algorithms, their settings and the sequence of their application depend on the context of the solved problems. The set of the algorithms can be properly defined only during processes execution and has to be constantly adjusted.

Agile technologies based on agile concept introduced in [12] were developed within IT. They have been recently successfully spread to the area of data, information and knowledge processing and analyses [13]. The agile DIK processing is based on the idea of:

- defining taxonomies for data, information and knowledge and results of their processing systematization and classification;
- defining a system of patterns of different levels of abstraction to describe business processes of the applied subject domains and the subject domain of DIKW processing;
- detailing the patterns using logical rules according to processed data and available information and knowledge.

The considered approach can be successfully used in conditions of the limited number of high level business process. The restricting didn’t contradict the requirements of the smart cities [14]. For vibrant cities the task of apriori definition of the processes can be hardly solved. It generates a new need to build business processes in dynamics using logical rules and taxonomies.

A process can be described by defining the start point (SP), the end point (EP) and the path. The start point defines initial conditions in which the process is demanded and created. The end point is the target to be archived as the result of the process execution. The structure of the processes defined in dynamics can be both linear and non-linear.

According to the considered subject domain model the processes are described in a three dimensional space (Fig. 3). The dimensions are the type of the content, the type of the representation and scale of representation. Three types of content are considered: data, information and knowledge. For DIK representation MIM, OIM and SIM models can be used. The scale of DIK representation depends on the analyzed notion – measurements, objects or situations. In fig. 3 an example of the path that allows acquire data about a situation using initial measurements is given. The figure shows general direction of the path. In fact, the path defines the sequence of data, information and knowledge transformations implemented at different scales.

The transformation is a complete of major change in the structure and the contents of data, information or knowledge. The transformations can be of two types – vertical transformations and horizontal transformations. Transformation types are defined according to their references to the levels of JDL model (Data Fusion Model) [15]. The model was maintained by the JDL Data Fusion Group and has become the most widely-used method for categorizing data fusion-related functions. The levels of the model are: sub-object data assessment, object assessment, situation assessment, impact assessment, and process refinement. Horizontal transformations are transformations executed at one level of the JDL model. Transformations that support transitions between levels refer to horizontal transformations. In separate cases, for example, for the subject domain of measurements processing, sublevels are defined for the levels of the JDL model [16]. Transformations used for sublevel transitions are also considered as vertical transformations.

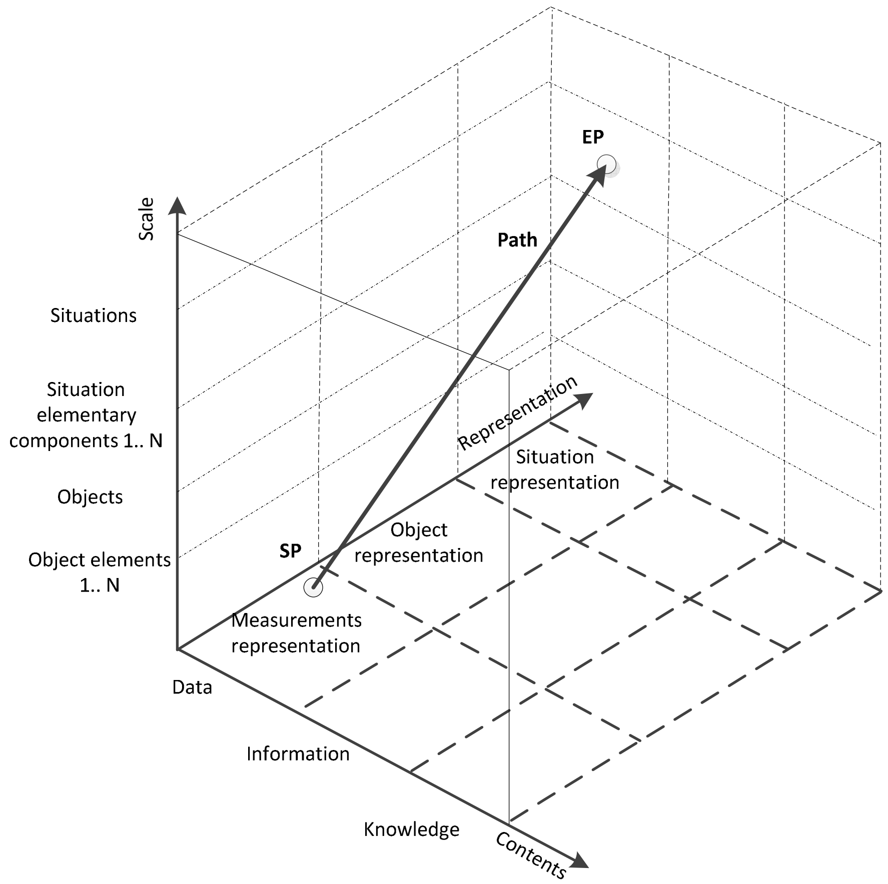

Fig. 3. 3D space for business processes representation

Six forms of transformations for DIKW are considered: “data” → “data”, “information → information”, “knowledge → knowledge”, “data → information”, “information → knowledge”, “data → knowledge”. The first three forms refer to horizontal transformations and the last three transformations are vertical transformations. In addition backward horizontal transformations “information → data”, “knowledge → information” are supported for neighboring scales.

The sequence of data, information and knowledge transformations at the scales of signals, objects and situations is given in Fig.4. It is a projection of the path shown in Fig.3 on the Contents and Scale axises. The path from the SP to the EP shown in the figure is a typical path that can be modified according to users needs. The results of DIKW processing can be generalized to the level of the subject domain. At the level of the subject domain dependencies between diverse situations can be reveiled. The set of the considered notions can be extended with the notion “wisdom”. To acquire and to use “wisdom” in the sequence of the transformations the definition of the notion is supposed to be narrowed. For different levels of JDL model term “wisdom” has different sense. It can be defined as “higher level knowledge” or “knowledge about knowledge”.

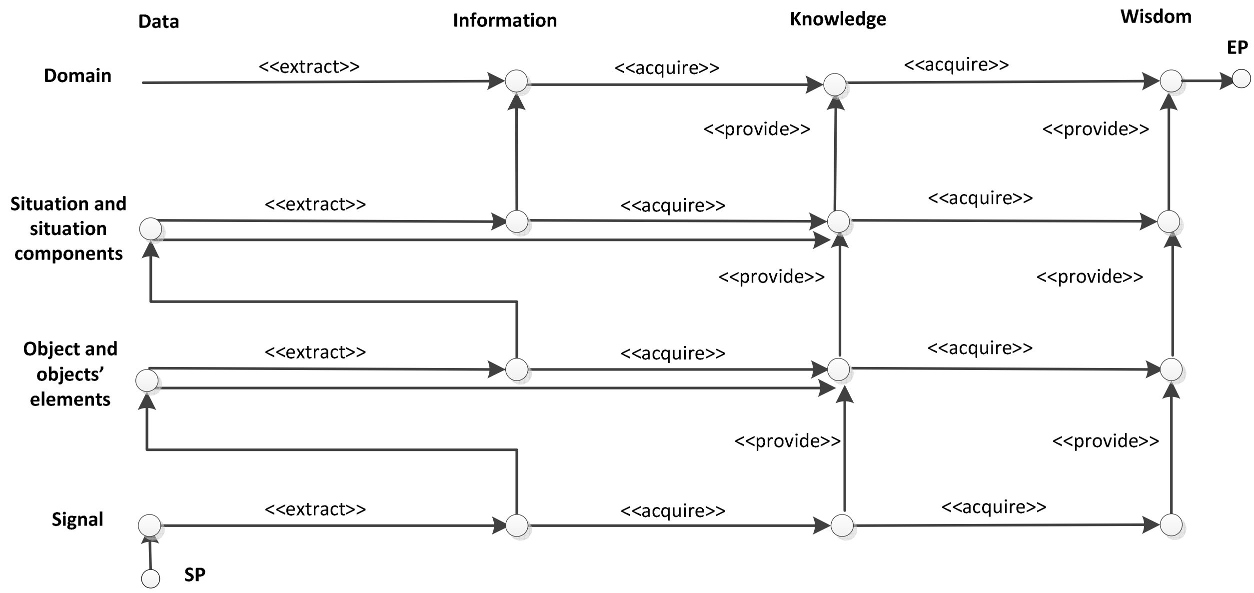

Fig. 4. The sequence of data, information and knowledge transformations at different scales

The set of the admissible operations for data, information and knowledge transformations is not limited. It can be defined for the applied subject domains according to the specialized requirements of the solved problems. For solving the majority of the problems three groups of operations are used: harmonization, integration and fusion. The operations are applicable to data, information and knowledge. According to [17] harmonization can be treated as standardization of data; the results of harmonization are supposed to be consumed by a great number of users. Integration is considered as association of data (access to sources of the information) for the decision making and modeling oriented on solving current problems. Fusion is a formal basis for expressing approaches and defining tools for associating data from various sources. Its purpose is to obtain information of higher quality; exact definition of "information quality" depends on a subject domain. Applicability of the groups of operations for implementing transformations is defined in Table 5.

DIK	Data	Information	Knowledge
Data	harmonization	integration	fusion
Information	operations for inverse transformations	harmonization	fusion
Knowledge	operations for inverse transformations	operations for inverse transformations	harmonization

Table 5. Informational model of the situations

Harmonization, integration and fusion of DIK can be done using diverse groups of methods and algorithms. The procedures of the operations, methods and algorithms selection and estimation are based on application of logical rules. The logical rules check:

i) correspondence of the requirements to input data and processed data;

ii) correspondence of the expected results to the needs of the consumers;

iii) fitting the field of application;

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iv) compliance to the restrictions;

v) fulfilment of preconditions before methods and algorithms execution;

vi) fulfilment of postconditions after methods and algorithms execution.

In addition logical rules can express recommendations for the methods and algorithms application in diverse conditions.

To use operations, methods and algorithms in transformations each of them must have complete OWL-based description. Logical rules have to be described using notations interpretable by inference machines.

The sequence of the transformations that defines the path (Fig. 3) is build as the result of solving an optimization problem. It is necessary to find the path in the 3D space for business processes representation that allows reach the end point from the start point. The logical rules defined for the operations are considered as restrictions. There are no limitations for optimization methods that can be used to solve the problem. They are selected mostly according to the available computational resources.

6 CASE STUDY

At the step of the smart cities development a considerable number of interconnected smart grids have been developed. They allow manage energy, water, transportation, public health and safety, and other aspects of a smart citis in concert to support operation of critical infrastructure [18, 19].The smart city is considered as an "organism" that is supposed to work together as an integrated whole [20, 21]. It is expected that vibrant cities using new integrated solutions and developed smart grids will transfer into a greater, highly responsive urban ecosystem. Ecosystems are communities of living organisms in conjunction with the nonliving components of their environment [22].

The results of the analyses of the urbant climate of several regions, for example, presented in [23], showed that the processes of land transformation and city growth determine radical changes in urban landscape morphology that affect air temperature and energy exchange. The influence of urbanization on local climate is much more intensive than, for example, global warming. The main cause of it is the rapidity of human made changes related to natural processes. The alteration of urban climate can be investigated by a network of sensors that monitor the climate parameters. The infractructure required for monitoring the state of the environment is rarely well supported. As the result, the time series' of hydrometeorological data are not available at a suitable spatial density at all desired scales [23]. It defines the need to build regular grids of envoronmental parameters using avaibable measurements. The data about the environmental parameters becomes outdated quickly. To have actual information about the ecosystem state at every turn it is nesseccary to recalculate the grids in operational mode.

The procedure of building regular grids of the parameters values includes preprocessing stage and regularization stage. The description of the stages and the transformations assumed for each of the stages can be found in [24, 25].

The preprocessing stage includes four main substages:

- describing initial measurements, sources of the measurements and related information in terms of the intelligent semantic model;
- quality control of the initial measurements using a set of computational procedures;
- exclusion of dupblicated values;
- reduction to standart vertical levels.

At each of the stages one or several methods and algorithms can be used. As an example lets consider the group of interpolation methods (Fig. 5) used in buisness processes executed at the preprocessing substages and the conditions of their application.

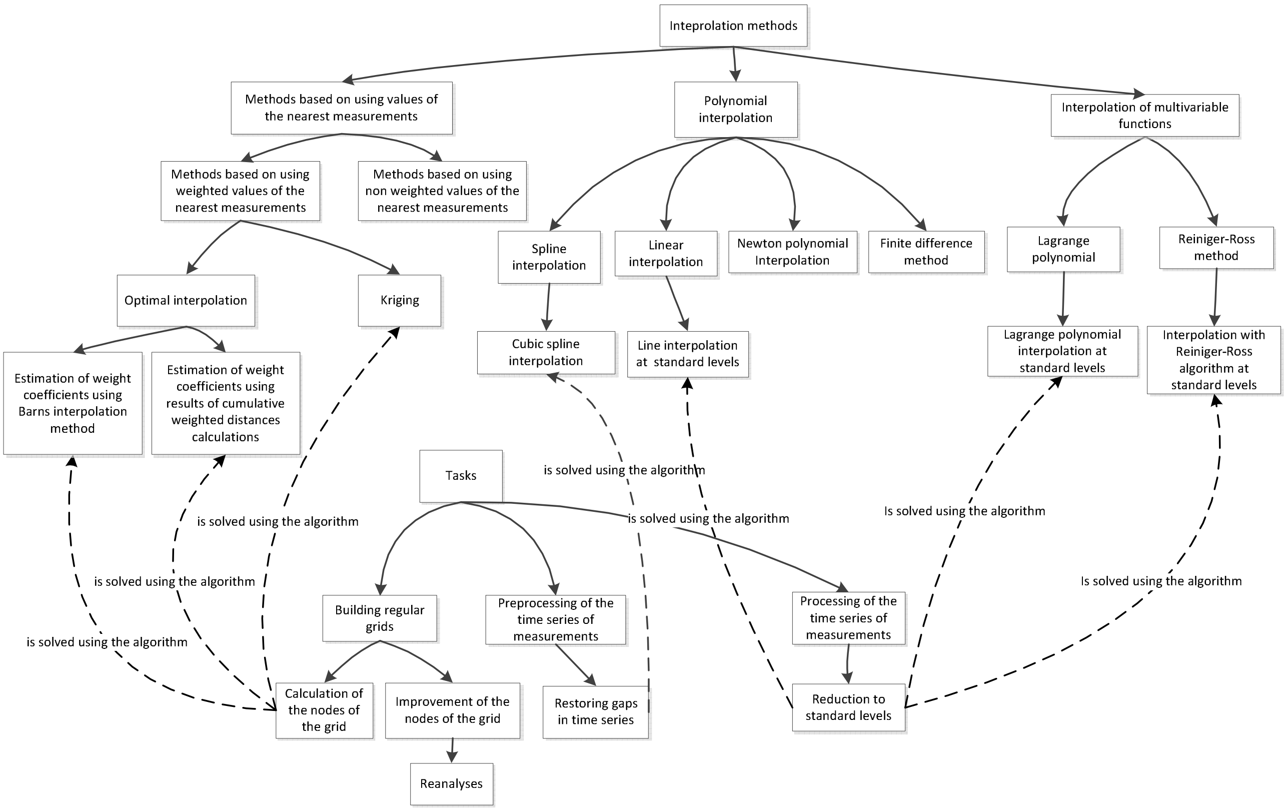

Fig. 5. The hierarchy of the interpolation algorithms and their relations to the solved tasks

At the stage of excuding the dublicated values initial measurements or the values of the interpolated profiles can be analyzed. In the second case the cross-linear interpolation methods are aplied to match the values of the profiles.

Time series of measurements may have gaps. To restore the gaps in time series the cubic spline interpolation method is included into the sequence of methods executed within the buisness processes of the preprocessing stage.

Reduction to standart levels can be fulfilled using linear, Lagrange or Reiniger-Ross interpolation methods [23]. The method is selected according to the number of the dimensions of the measurements. The complete list of the dimensions include latitude, longitude, hight or depth, time.

The hierarhy of the interpolation methods and algorithms used in buisness processes for monitoring the state of the environment and their relations to the solved tasks is partly represented in Fig.5.

7 CONCLUSION

In the paper an approach to transition of modern cities from smart cities toward vibrant cities is discussed. It is proposed to build applications for the vibrant cities using agile data science methodologies and toolsets. It is suggested to use standard approaches for developing agile information systems that must be flexible enough to support iterative data processing and analyses procedures that can be easily reorganized or changed depending on context.

Key problems of building applications for vibrant cities by means of using agile data science methodologies and toolsets within the commonly used approaches for developing agile information systems are discussed.

Main advantages of suggested approach are following:

- flexibility. Possibility of interaction with other components provided by external developers. The set of used components can be easily replaced by any other components with similar functionality;
- scalability. New information and knowledge can be added to a system using standard editors;
- high level of integration with other information systems. System can be implemented as a separate service and is included into a set of other services;

- low cost of development and support. Ready solutions are used for implementation of vibrant city applications. Only few new components are required.

Future work is to be oriented on expansion of the knowledge base and development of new algorithms for dealing with data, information and knowledge in the frames of vibrant city concept. Creation of big knowledge bases allow to solve such problems as estimation of current state of the city ecosystem in terms of existing and future problems, i.e. to solve real city problem on "wisdom level".

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Data-based Collaboration on a Grand Scale

Markus Mayr, Paolo Fogliaroni

(Dipl. Ing. Markus Mayr, TU Vienna Department of Geodesy and Geoinformation, Gusshausstraße 27-29 1040 Vienna, mayr@geoinfo.tuwien.ac.at)
(Dr.-Ing. Paolo Fogliaroni, TU Vienna Department of Geodesy and Geoinformation, Gusshausstraße 27-29 1040 Vienna, paolo@geoinfo.tuwien.ac.at)

1 ABSTRACT

Modern spatial planning strongly relies on computer systems such as Computer-Aided Design tools (CAD) and Geographic Information Systems (GIS). These, in turn, depend upon Database Management Systems: complex computer systems designed to optimize data storage and retrieval. In this paper we try to sketch a short survey of current DBMS technologies for the non-expert by overviewing their history, targets, strengths, and weaknesses. The goal is to make the spatial planning community more aware of the present and developing technologies such that future projects started can take advantage of the most suitable technology.

2 INTRODUCTION

Over the years, methods and techniques employed in spatial planning evolved from good old ink and paper to complex computer systems that allow, for example, for geo-location, automatic computation of light exposure, traffic analysis, and so on.

Modern spatial planning strongly relies on continuously more advanced computer systems such as Computer-Aided Design tools (CAD) and Geographic Information Systems (GIS). Moreover, thanks to technological improvements, the amount of data that these computer systems are able to handle and make available to spatial planners increases quickly and steadily. Nowadays, a planner can easily access information about the population density of an area, the distribution of shops and roads, and average rainfall levels. This abundance of information is helping the planner to make better-informed decisions.

Present trends in the planning field also started to incorporate the idea of public participation and volunteered information (M.Foth et Al. 2009). In such scenarios, laymen are involved in the planning process as they can provide the planner with detailed local information that is typically not present in official data bases (Goodchild, M. F. 2007 and R. Sieber 2006). They can also provide suggestions or expectations about the future development or requalification of a certain area (A. Poplin, 2012).

Thus, on their most basic level, both, present and future spatial planning activities strongly rely on so-called Database Management Systems (DBMS). These are complex computer systems designed to optimize data storage and retrieval.

The scope of this paper is to provide the spatial planning community with an overview of database technologies and to discuss their strengths and weaknesses. The aim is to make the community more aware of present and developing technologies so that future projects started by the community can take advantage of the most suitable technologies, rather than the de-facto standards.

The paper starts in Section 3, sketching the historical evolution and the main principles and motivations underlying the de-facto standard Relational Database Management System (RDBMS). Later, in Section 4, the focus is shifted on more modern demands driven by social and collective projects. We discuss what properties a database should have to support such projects and which particular technology affords for them. At the end of this section we also discuss how the majority of present companies (including big internet colossuses) partially insist in utilizing some parts of RDBMS even though they have been proven to be inadequate to address modern requirements. Section 5, discusses a definitely edge-cutting topic: the semantic web and linked data. These are core topics when dealing with collaborative and public participatory projects. In parallel we discuss graph databases as the more straightforward technology to address the inherent challenges. Finally, Section 6 concludes the paper.

3 RDBMS

In 1970, E.F. Codd introduced the formal foundation for relational database management systems (RDBMS) Codd (1970) . His new model superseded the first and second generation of database management systems

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that were based on flat files and hierarchical structures ("Existing noninferential, formatted data systems provide users with tree-structured files or slightly more general network models of the data.") . This first generations managed to cope with increasing volumes of data and kept them separated from parts of software that was not central to the data storage. But, as Codd (1970) states, "future users of large data banks must be protected from having to know how the data is organized in the machine (the internal representation)".

This and a couple of additional concepts that increased the reliability of relational systems together with their adoption by big companies like IBM ensured the distribution of this new kind of database system. Over the last decades, RDBMS were heavily optimized, became multi-user compatible and ensured consistency. They were perfectly suited for the monolithic structure of computer systems at that time and also did not stand in contrast of a more hierarchical way of thinking about data. For many applications they are still the best choice.

3.1 Architecture of RDBMS

The typical architecture of a RDBMS is one to multiple tables that are linked with one another to produce results to queries provided in the so-called SQL query language (see figure 1).

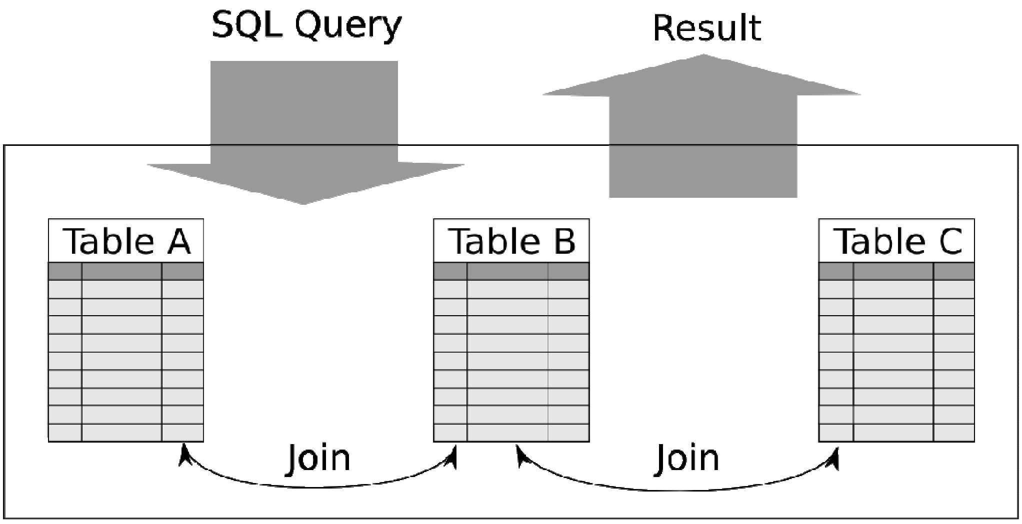

Fig. 1: Requesting data from a traditional RDBMS

These tables are very rigid and their structure should, once defined, not be changed (e.g. removing a column). Doing so could break existing constraints or queries. This means that the data structure which is developed once for an RDBMS is fixed. Later changes are costly.

It is very common that one SQL query requests information that is distributed among multiple tables. These tables have to be joined to query all data to answer the query.

3.1.1 ACID

A well known term that describes properties of a RDBMS is "ACID". This stands for [A]tomicity, [C]onsistency,[I]solation and [D]urability. Its origins lie in a paper from Gray and others (1981) and are more concretized by Haerder and Reuter (1983) .

- **Atomicity** means that each operation or collection of operations on the database is performed as a whole. If this is not possible, this operation is not performed at all.
- **Consistency** ensures that one operation is executed on a database with a valid status and leaves a valid database behind. Valid in this sense means that the database satisfies all constraints and limitations set up by the database engineer.
- **Isolation** is an important property for multi-user operation. Simply put, it ensures that operations don't interfere with one another.
- **Durability** makes data in the system permanent. An unforeseen event should not result in the loss of any data. There are mechanisms in place that ensure the storage of data even in the event of power loss during a save procedure.

These four properties are the cornerstones to enabling a transaction-based system: Everything that was called an operation above can also be called a transaction.

3.1.2 Transactions

Transactions are the key for multi-user access to a RDBMS and can either read from the database, write to the database, or both. Depending on the kind of transaction, the portion of the database that is accessed during its execution is locked to all other users.

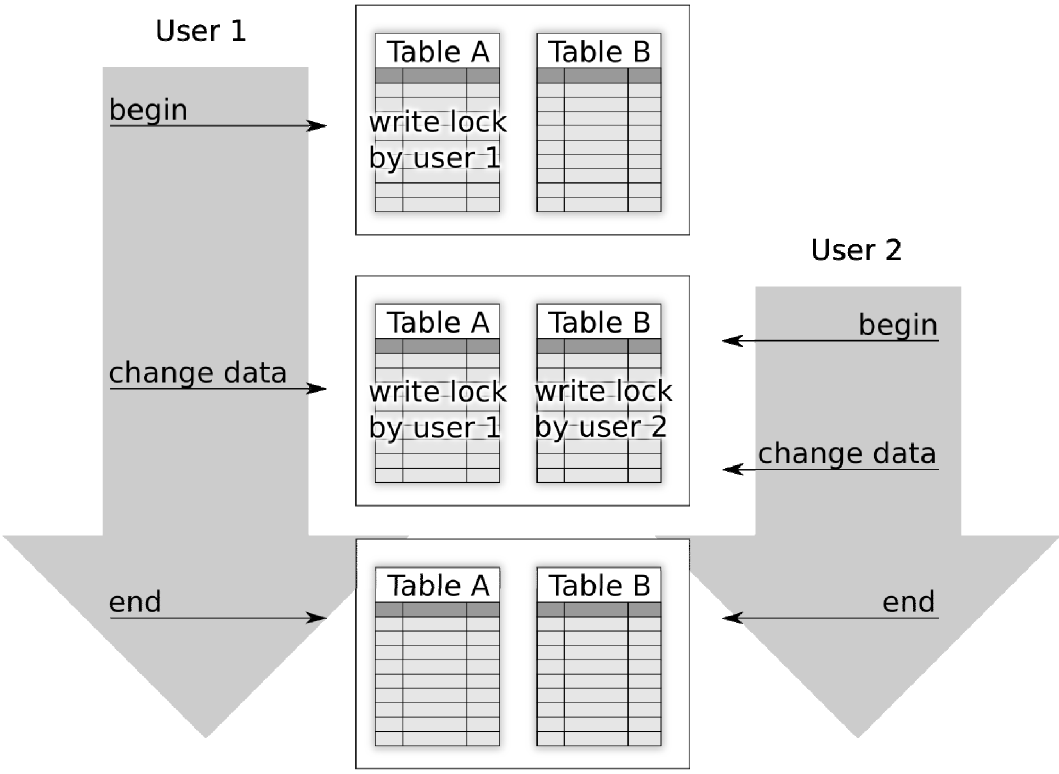

Fig. 2: The transactional locking of a RDBMS

Figure 2 shows a situation where user 1 and user 2 are locking a single table because they want to write to it. There is no problem here, because user 1 is not interested in table B and user 2 is not interested in table A. Each of these two transactions can be performed without interference. If user 2 would want to write to table A while it is locked by user 1, this transaction would have to wait.

In reality there exist multiple locking levels and different strategies to cope with conflicts, but the information presented here suffices to draw a general picture. More information about the transactional locking system is provided by (Kemper & Eickler 2011).

3.2 Problems with traditional RDBMS

There are two central problems that arise when using a traditional RDBMS with many users:

(1) When there is a huge amount of users, they will produce a great number of locks which interfere with other users' access to the database. Also, the locks are managed by a "locking manager" which is a resource intensive process.

(2) As soon as there is either a very high amount of data in the database, it becomes necessary to split it up to be stored on multiple single computers. A relational database system is not built for this. Since its structure depends on relations between tables which have to be checked when performing most queries, the separation of data is reduced to nearly nothing.

Imagine a service developed to support civic participation. It is very successful and is not allowed to have any down time. Otherwise, the image of the system in the public's view would be damaged. It is very difficult to scale a system as such up with an RDBMS to provide more capacity or to increase response times by moving part of the data to servers nearer to the clients while keeping the original structure as it is.

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Since technology as a tool has to adapt to changing circumstances and not the other way around, we need two solutions: a more effective way to deal with database locks and more distribute-oriented database management systems.

4 SYSTEMS FOR COLLABORATION

Different database systems that strive for overcoming the deficiencies discussed in this chapter have been developed. Cattell (2011) gives an overview of many of these NoSQL ("not only SQL") databases and describes their peculiarities. There also exist undertakings to adapt existing RDBMS according to some of these concepts (e.g.ScaleBase_Inc. (2014)).

4.1 Theory

First, we will look at some of the theoretical concepts that are beneficial to supporting large scaled collaborative data-based work.

4.1.1 CAP theorem

The CAP theorem was proven in 2002 by Gilbert and Lynch (2002) and describes the fact, that out of three main properties of a distributed database system ([C]onsistency, [A]vailability and [P]artition Tolerance), only two can be achieved at the same time (see figure 3).

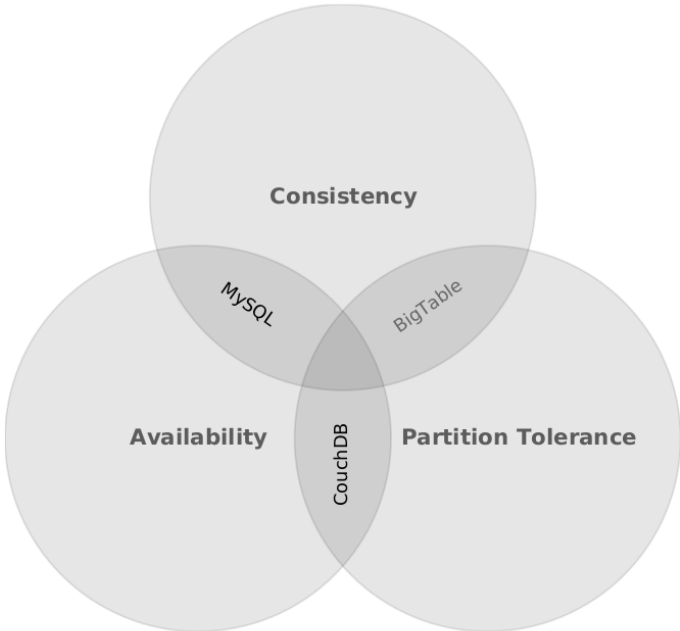

Fig. 3: The CAP Theorem and its relation to three different database-systems

- **Consistency** describes the status that every single instance of a distributed database reflects the same state. There is no difference in data on each of these systems. This is a challenge when there are lots of changes to the database. In a consistent system, all these changes have to be transferred to the other instances before these are allowed to operate again. Already in 1979, the problem was given a lot of thought by Lindsay et al. (1979).
- **Availability** simply means that the system has to be able to respond to requests all the time.
- **Partition Tolerance** assures that the system is not affected by the loss of one single instance of the distributed database.

Traditional RDBMS, like the widely used "MySQL" database, can provide consistency and availability, but fail to provide partition tolerance. Other database-systems like the document-based "CouchDB" are unable to guarantee consistency. What they offer instead is called eventual consistency which means, that over an infinite span of time, all database instances will be consistent – but not at once. In many applications, strong consistency is not needed (e.g. in social networks it does not matter if a comment pops up one second later).

4.1.2 Deatomization

One principle of RDBMS is that data should be stored in atomized form. This means that every kind of information should be stored in a table unique to this type of information. While in reality, mostly because of practical and performance reasons, this is not exercised to its absolute extent, an example for this would be a dataset of inhabitants: In the first table, each person is assigned an ID number. In a second table, the person's names are related to their ID. To store addresses, a third table is used in the same manner. Later, at query time, the different parts that belong together are assembled from these different tables and presented as result. When dealing with a decentralized system, it is imperative to avoid the need to assemble data from different tables (which is called "join"). Every join means more database instances that need to be queried, more time that has to be waited for a result and more traffic for the network connection.

Instead of splitting information, the target is to keep together data that belongs together. Kinds of database-systems that make heavy use of this method are document-based databases. One single document, which corresponds to one database entry, contains all information about a single entry. In case of the previous example of a database about inhabitants this would mean that every person is represented by one single document. This document contains all information about one person. Deatomization plays a major role when performing queries in distributed systems, as we will discuss in later sections.

4.1.3 Multi Version Concurrency Control

The Multi Version Concurrency Control mechanism (MVCC) is an alternative to the transaction-lock system. The key attribute is that readers never block writers and writers never block readers. This method is explained by looking at a document based NoSql databases named CouchDB.

Anderson, Lehnardt and Slater (2010) explain this system: "Documents in CouchDB are versioned (...). If you want to change a value in a document, you crate an entire new version of that document and save it over the old one. After doing this, you end up with two versions of the same document, one old and one new. ". The new document then is compared to the old one and, if the old one was not changed by another user in the meantime, the new document replaces the old one. If the old document was changed, an error message is produced and the database programmer has to implement a method to resolve this conflict. This system is compared with the transactional-lock of RDBMS by Anderson et al. (2010): "Under high load, a relational database can spend more time figuring out who is allowed to do what, and in which order, than it does doing any actual work.".

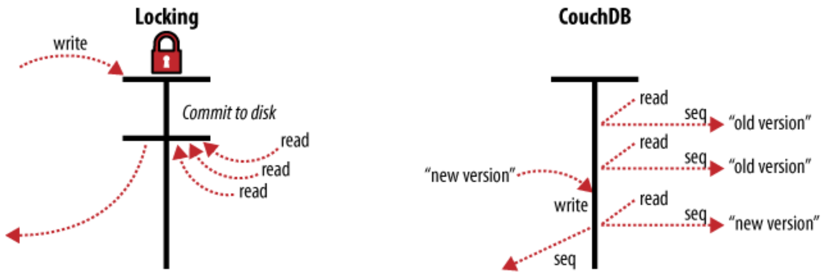

Fig. 4: A transactional locking mechanism vs. a multi-version concurrency control (image souce: (Anderson et al. 2010))

In figure 4 the two systems are visualized. On the left side, one can see that requests are blocked until a lock is released. On the right side, access to one database entry is always possible. When storing a new version, the old version is replaced after its version has been verified.

A Multi Version Concurrency Control mechanism can lift a lot of load on a database server when dealing with lots of concurrent users. The downside of this mechanic is that a method has to be implemented on the client to resolve possible conflicts. The database server is not influenced by this.

4.1.4 Queries

In 2008 Dean and Ghemawat (2008) published a new query method developed by Google to support distributed database systems. They named it "map-reduce". It is very well explained by their abstract: "Users specify a map function that processes a key/value pair to generate a set of intermediate key/value pairs, and a reduce function that merges all intermediate values associated with the same intermediate key.".

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Given a dataset, a function specified by the user is executed for each entry in this dataset. This function may do whatever the user pleases and produces one to many output entries. These resulting entries are then processed by the optional reduce function that is performing a summarizing activity, also specified by the user. This technique benefits greatly from a deatomized dataset.

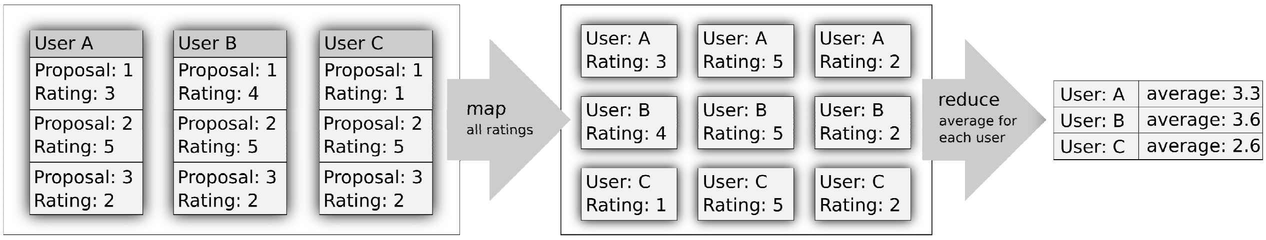

Fig. 5: Requesting a user's average voting by map-reduce

To illustrate this procedure, think of a civic involvement process where any user can rate three proposed planning drafts by using the numbers 1 through 5 (see figure 5). This data is stored in a document-based database where each document is identified by the user's name as key ("User A", "User B", "User C") and a list of ratings for each proposal as value. We want to know what the average rating of each user is to find out which persons are in general more likely to accept any planning procedure. We perform this query by first using a map function that produces a collection of key/value pairs, each describing one rating (the value) for one user (the key). Next, we run a reduce function that, per user, counts all the ratings and devides them by their total sum. The result is the average rating per user.

The catch of key/value queries is that they can be performed on a collection of data without the need to join any external dataset. If the data is split among two computers, each can perform a map without the other. The results can be collected later.

The map-reduce method enables querying on distributed systems. One does not have to think about how to construct a database query to avoid pitfalls like too many joins. Map-reduce queries are designed especially for this purpose.

4.2 Examples

We will look at some of the companies that deal with similar problems: many users, high availability and fast queries.

4.2.1 Google

In their research paper Chang et al. (2008) present a database system used and developed by Google named Bigtable. It is built to store vast amounts of information up to the amount of petabytes. It is used by Google to power most of their services, ranging from their web indexer to Google Earth, and many more. While it is an oversimplification, one can describe a Bigtable database as a single table without joins that is optimized for a huge amount of data. It supports multi-dimensional indexing through the inclusion of time as a third dimension.

This system is proprietary and only used by Google internally. There exist similar open source implementations called Hbase and Hypertable. Khetrapal and Ganesh (2006) did a comparison of these and preferred Hbase because of its stability.

4.2.2 Facebook

Facebook uses a relational database management system as backbone (namely MySQL). To achieve the possibility to distribute their data stores even with an RDBMS, they avoid joins and store data in a way that made little use of the features a RDBMS has to offer. While there is no statement about this from Facebook directly, it seems like the company started with well known web-technologies but was overrun by its own success. The technology chosen did not scale natively with the increasing user base all over the world.

While Facebook is heavily modifying the system chosen to adapt it to their circumstances, they use different non-relational database engines for different purposes. Originally only for their inbox search, a unique solution named Cassandra was developed (Lakshman & Malik 2010). This system is published as OpenSource and also used by other companies. It was developed to be expecially fast and fault tolerant in a distributed network and is optimized for reading data from the database. For its Facebook Messages application, a system called Hadoop is used (Borthakur et al. 2011) which is somewhat similar to Googles Bigtable solution. For analysis of its immense cloud of data, a combination of specialized database software is used, as stated by Thusoo et al. (2010): “A lot of different non-RDBMS components come together to provide a comprehensive platform for processing and providing data at Facebook.”

4.2.3 Twitter

Similarly to Facebook, Twitter started out with the traditional RDBMS MySQL. Soon, its limits were reached. Facebooks database system Cassandra was implemented together with an abstraction layer for MySQL called Gizzard, enabling this database to be distributed by providing more than a simple RDBMS (Cole 2011) . For other different scenarios, various other database systems are used.

As described by Metz (2014),by now Twitter has developed an own solution called Manhattan. For this system, the previously discussed topics were taken into account. One main point Manhattan makes is to allow the user to select whether strong consistency or eventual consistency is preferred.

4.2.4 Amazon

As described by DeCandia et al. (2007), Amazon uses an own database system called Dynamo (in its newest version named DynamoDB). The affordances for such a system are described as follows: "Reliability is one of the most important requirements because even the slightest outage has significant financial consequences and impacts customer trust. In addition, to support continuous growth, the platform needs to be highly scalable.". To achieve this kind of reliability, the Dynamo database system sacrifices consistency by making it optional. In their paper, DeCandia et al. (2007) make it clear that the topmost priority is partition tolerance. There is no failure allowed. The shopping chart has to be available all the time, even when a tornado destroys a single data center. Vogels (2009) gives an in-depth report on how this eventual consistency is managed at Amazon. The set up of a system with this level of reliability and scalability is greatly facilitated by embracing the theoretical points mentioned before.

5 THE META-LEVEL: MODELLING COLLABORATION

We have looked at which techniques are available to cope with vast amounts of data coming from many users. There is yet a second aspect: when looking at collaborative networks, there exists a special kind of data structure that is suited for modelling network structures: So-called Graphs.

5.1 Neo4j

A very prominent example for graph databases is a rather young company called Neo Technology. They offer a pure graph database called Neo4j. What is so unique about this database is that it does not only model its data as a graph but actually stores it as such. Robinson, Webber and Eifrem (2013) describe this system in depth.

The big gains of using this technique are the profoundly different analytical methods offered by a graph database. It becomes possible to query for relations of the graph in a very efficient manner. This is a time consuming task when using RDBMS. An example of such a query would be “all people that have up to a third grade relative who likes to go biking”.

An alternative to Neo4j is Cayley, a true open source graph database developed by Peters et al. (2014). Its origins lie within the technology used by the Google Freebase engine (Bollacker,Evans,Paritosh,Sturge & Taylor 2008), "(...) a practical, scalable tuple database used to structure general human knowledge.".

5.2 Resource Description Framework (RDF)

When talking about graphs, collaboration and huge amounts of information, is becomes unavoidable to mention RDF. Nearly any kind of information can be stored by so-called "rdf triples". These triples constitute the base-granularity of all data to be stored and are one prerequisite to achive a maximum of interoperability between different sources of data. Abadi,Marcus,Madden and Hollenbach (2009) say about this: "(…) the ‘Resource Description Framework’, or RDF, represents data as statements about resources using a graph connecting resource nodes and their property values with labeled arcs representing properties. Syntactically, this graph can be represented using XML syntax (RDF/XML). This is typically the format for

RDF data exchange; however, structurally, the graph can be parsed into a series of triples, each representing a statement of the form < subject, property, object > (...)". Many efforts are made to make distributed sorage and processing of triples as efficient as possible.

The driving force behind research about RDF is the liked data project. As said by Wood,Zaidman,Ruth and Hausenblas (2014), "Linked Data makes the World Wide Web into a global database that we call the Web of Data.". (figure 6 shows the current state of the linked data cloud with each node representing one single source)

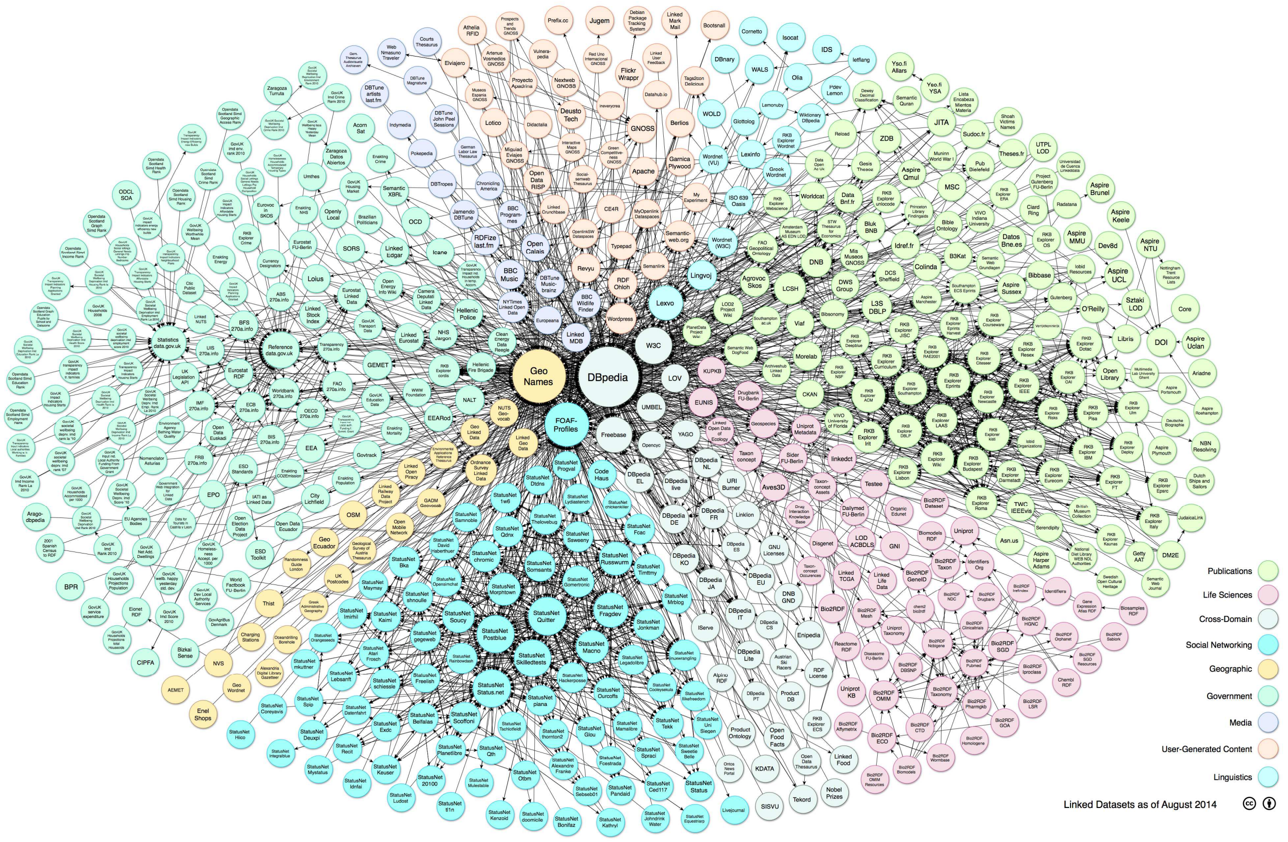

Fig. 6: Linking Open Data cloud diagram 2014, by Max Schmachtenberg, Christian Bizer, Anja Jentzsch and Richard Cyganiak. http://lod-cloud.net/

They further explain that "The term Linked Data refers to a set of best practices for publishing and connecting structured data on the Web using international standards of the World Wide Web Consortium." . To explain all the aspects involved is not the scope of this paper, but one can state that this is a huge project with great implications on how information might be handeld in the future. From a technological perspective it is still very young but its implications concerning data handling, data processing and data sharing are huge.

6 CONCLUSION

It becomes clear that the demands on database systems have changed: from stand-alone monolithic solutions needed in 1970s, today we are in need of more flexible and distributed alternatives that can cope with structured and, especially, low- or un-structured data.

The solution is not to "overload" present techniques by developing cumbersome workarounds to enable unsupported features. Rather, one should take advantage of the whole arsenal of new methods and techniques that are natively able to cope with problems arising when building collaborative and public participatory systems.

Obviously, one has to know about them in order to make a wise and informed decision, as was the aim of this paper: to make the spatial planning community more aware of the state-of-the-art and uprising technologies.

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reviewed paper

Developing Interface of Information Systems for Preparation of Climate Change Responsive City Plan

Piyali Bandyopadhyay

(Piyali Bandyopadhyay, Project Scientist-I, Central Pollution Control Board, Delhi, PhD Scholar, Paschim Vihar, Delhi)

1 ABSTRACT

During the last few years climate change has become a growing worldwide environmental concern. The vulnerability of cities to climate change is largely underestimated. There is no established or standardized set of city indicators that measures the effects of climate change on cities and assesses those risks and the role that cities play for, example, in contributing to greenhouse gas (GHG) emissions. Energy consumed in heating and lighting of residential and commercial buildings generates nearly a quarter of GHGs globally and transport contributes 13.5 per cent, of which 10 per cent is attributed to road transport (McCarney 2009). According to the Clinton Foundation, large cities are responsible for about 75 per cent of the GHGs released into our atmosphere. Other way there is no system has been developed yet to collect, collate and disseminate the information. A city has planned without accounting the climate change of city and its consequences. City is a cause of climate change and vice versa its subsequent victims of its affect. Given that half of the world's population started to live in cities by 2007, it is no exaggeration to say that the battle against climate change will be won or lost in our cities.

According to 2011 census of India the total population of India is 1.2 billion the annual growth of population is 1.8%. In India, the urban population is 377 million as per 2011 census, which accounts for 31.6 percent of the total population. Due to rapid industrial growth, the urban population is increasing rapidly. The population is largely concentrated in a few large cities and 35 metropolitan cities, which accounts for 35.4% of the total urban population. The urbanization in India mainly is due rural to urban migration of population. The challenges of urbanization in India are unprecedented in scale and significance. One of the expected impacts of climate change on Indian subcontinent is a general increase in both the mean minimum and mean maximum temperatures by two to four degrees centigrade (Sharma et al. 2006). A 10 to 15 per cent increase in monsoon precipitation in many regions, a simultaneous precipitation decline of 5 to 25 per cent in semi-arid and drought-prone central India, and a sharp decline in winter rainfall in northern India is also projected (Ramesh and Yadava 2005). Carbon emissions, climate change, and their economic and ecological impacts on India's cities are inevitably correlated.

The nation lacks comprehensive, robust, and credible information systems to inform climate choices and evaluate their effectiveness. In this context it is necessary to mention that the content of the master plan of any city contains various aspects that depict the morphology of the city except information on weather, climate , climate change and causes and consequence relationship between climate and city . For a sustainable city plan an integration of information systems where the input will arrive from both urban and environmental sector . In India Ministry of Urban Development has launched National Urban Information System (NUIS) Scheme (March 2006) to develop GIS data bases for towns/ cities in the country. Another initiative by Ministry of Environment, Forest and Climate Change is Environmental Information System (ENVIS) which aims to collect, collate, store, retrieve and disseminate environment related information across the country . ENVIS and NUIS individually act as a self sufficient information system for disseminating information in their respective fields but individually none of them is able to address the climate change issues in urban areas. For preparation of climate change responsive city plan the information input should integrate both ENVIS and NUIS. Developing an interface between ENVIS and NUIS can enable these two systems more affective individually as well as jointly towards climate change responsive City plan.

2 BACKGROUND

During last few years climate change has become a growing worldwide environmental concern. One of the most remarkable characteristics of climate change is increase in temperature, so it has been mainly recognized as 'global warming'. This warming has been attributed to enhanced greenhouse effect produced, among others, by increased amounts of carbon dioxide from burning of fossil fuel since Industrial Revolution (Houghton, 2004). Global warming is already having noticeable consequences, and will likely lead to more devastating ones. Some of the impacts of this phenomenon on environment and human beings are, changes in distribution of rainfall and temperature, migration and even extinction of animals and plants,

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the spread of diseases to new areas, and melting of glaciers and ice caps (Parry et al., 2007), with consequences of sea level rise and water availability. These impacts on ecosystems are obviously different and more or less severe depending on the region of the world. Effects of climate change, for example, could be more devastating in tropical regions, where more than 50% of the earth's surface is located (between 300 N and 300S) and 75% of the world population lives (Thompson, 2000).

The vulnerability of cities to climate change is largely underestimated. There is no established or standardized set of city indicators that measures the effects of climate change on cities and assesses those risks and the role that cities play, for example, in contributing to greenhouse gas (GHG) emissions. To the extent that cities promote use of cars, urban sprawl is also often associated with climate change. Energy consumed in heating and lighting of residential and commercial buildings generates nearly a quarter of GHGs globally and transport contributes 13.5 per cent, of which 10 per cent is attributed to road transport (McCarney, 2009). It can safely assume that a sizeable portion of this volume of emissions is generated in cities. According to the Clinton Foundation, large cities are responsible for about 75 per cent of the GHGs released into our atmosphere. Other way there is no system which has been developed to collect, collate and disseminate the information related to cause and effect relation between City and climate change. A city has been planned without accounting the climate change of city and its consequences. City is a cause of climate change and vice versa its subsequent victims of its affect (Figure: 1).

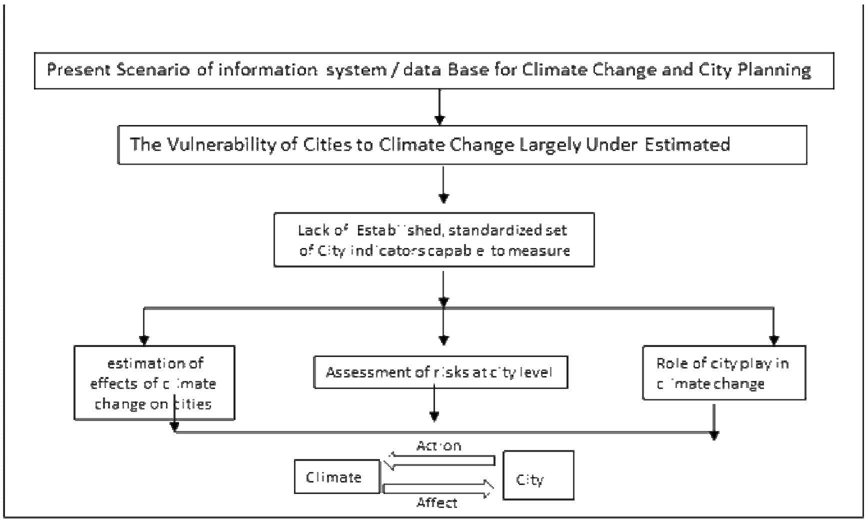

Figure: 1 City is a cause of climate change and vice versa

3 URBANISATION IN INDIA

According to 2011 census of India total population of India is 1.2 billion, annual growth rate of population is 1.8%. In India, the urban population is 377 million, which accounts for 31.6 percent of total population. The population is largely concentrated in a few large cities and 35 metropolitan cities, which accounts for 35.4% of total urban population. As per 2011 census total no of town is 7935. The urbanization in India mainly is due rural to urban migration of population. However, the higher productivity seen in urban areas is contingent upon the availability of quality infrastructure services. Urban economic activities are dependent on infrastructure, such as power, telecom, roads, water supply, and mass transportation, coupled with civic infrastructure, such as sanitation and solid waste management. Challenges of Urbanization in India are unprecedented in scale and significance. The fast growing metropolitan cities in India has contributed negatively in the development process through different issues. Lopsided pattern of urbanization and inadequate investments has led to serious deficiencies in urban infrastructure and services like housing, transport, water supply, sanitation and social infrastructure especially in small and medium size cities.

3.1 Consideration Climate change in Master Plan preparation

The master plan of any city of India contains various aspects that depict the morphology of the city like Regional and Sub-Regional Frame, Population and Employment, Urban limit/ Municipal Areas, Shelter, Trade and Commerce, Wholesale Trade, Industry, Government Offices, Environment, Conservation of Built Heritage, Urban Design, Transportation, Social Infrastructure, Physical Infrastructure, Mixed Use

Regulations, Landuse Plan, Development Code etc, but there is no section on weather, climate and climate change.

In case Delhi of where estimated CO2 emission from the metropolis itself is around 15.42 million metric Tons, in Delhi Master Plan 2021 in the section of environment the increase in temperature, emission of GHG are not mentioned. Issues related to GHG emission from various sectors , projected GHG emission from existing city life as well as from proposed development/ change in landuse are totally neglected. Variation in daily minimum and maximum temperature, temperature dissimilarity in the core and periphery of the city, variation in spatio-temporal distribution of rainfall are not considered during Master Plan preparation. The proposals are delivered in isolated matter. The features of urban sectors are not integrated with its counter part of environmental factors. The gaps in consideration of aspects related Climate Change in City Planning practice are mainly due to the following reasons:

(1) Limited Knowledge of Climate Change Adaptation: The critical gap is lack of knowledge about both the processes of climate change and also its impacts. Also, the measures identified by the stakeholders deal mostly with mitigation (afforestation, sustainable transport), and not with adaptation. Knowledge about possible adaptation mechanisms specific to the local context is missing. This gap can be potentially addressed through conducting workshops with various stakeholders at local state and national level.

(2) Lack of information and lack of formal mechanism of information exchange: One of the emergent gaps is the lack of reliable, accessible data sets. While some data is available with the government, and with a couple of NGOs, it is highly problematic that data is not available in the public domain. Most of the information with the government can be accessed through the Right to Information Act. But it remains a project in itself to access and collate the data in different places especially spatial data required for planning at a city level. By using spatial data sets available in public domain, some of the constraints can be overcome.

(3) Limited Planning Capacities and Restrictive Planning Processes and Institutions: Most of the cities have limited internal capacity to plan beyond the immediate project at hand. Moreover the planning process itself is protracted, and still driven primarily by land-use planning, that often fails to incorporate the current risks and resource constraints. The institutions dealing with planning are fragmented- the municipal corporations, the development authorities, and the town planning institutions all have a role to play. This is a gap that has to be addressed if public systems oriented adaptation has to take place.

4 INDICATORS TO ADDRESS CLIMATE CHANGE AND CITY PLANNING URBAN AREAS

While assessment on climate change and risks to cities is quite diverse and varied. Four broad categories are identified for considering urban vulnerabilities associated with climate change by IPCC, 2007 as under:

(1) Alterations in temperature include warmer and more frequent hot days and nights in cities termed as heat island effects. Cities at their core tend to be 1 to 10°F (0.56 to 5.6°C) warmer than their surrounding suburbs and rural areas (Science Daily, 2003). This is caused by extensive paving, high densities of buildings and minimal green space and fauna in city cores resulting in an increased number of heat related deaths.

(2) Alterations in precipitation mainly frequency and intensity in cities can cause pressure on, and deterioration of, water and sanitation infrastructure, particularly for weak and/or aging municipal infrastructure facilities. In addition, these alterations create adverse effects on the quality of surface and groundwater, contaminate water supply, create waterborne diseases, increase risk of deaths, infectious respiratory and skin diseases, disrupt settlements, commerce and transport due to flooding.

(3) Alterations in storm intensity affect power outages and disruption to the public water supply; disruptions to settlements associated with flood and high winds; migration of population under stress; loss of property; increased risks of deaths, injuries, and water and food-borne diseases and post-traumatic stress disorders.

(4) Sea level change include permanent erosion and submersion of urban land and settlements; loss of property and livelihood; costs of coastal protection; costs of land-use relocation; decreased freshwater availability due to saltwater intrusion and salinity in estuaries and coastal aquifers; increased risks of deaths and injuries by drowning in floods; rising water tables and impeded drainage; destruction of urban infrastructure; and long-term effects on economic growth.

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To analyze the climate change cause and consequences in city level the following hypothetical aspects has been worked out with the help of literature study, personal experience and discussion with the experts (Figure : 2).

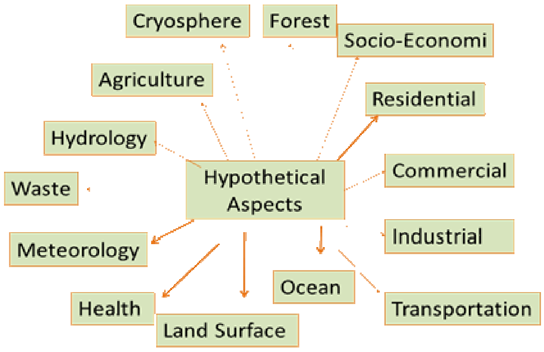

Figure :2 Hypothetical Components of Climate Change and City Planning

5 OVERVIEW OF NGIS AND MAJOR INFORMATION SYSTEM FOR INTEGRATION

5.1 National GIS (NGIS)

During 12th Five year Plan of India the centre of attention is on the development of agriculture; manufacturing, infrastructure, rural connectivity, health and education services and with special challenges to address vulnerable/deprived areas. Planning Commission of India felt the need for a new paradigm and Governance regimes with considerable change – moving from the traditional allocation systems to determining equitable systems. This would require a scientific mapping of the needs/aspirations/desires and limitations of the beneficiaries and society, especially the most disadvantaged; transparent systems of inclusivity of citizen participation and entitlements; guaranteed development/service delivery with high-level of accountability of governance systems and a very effective (feed-back) and responsive redressal system.

To handle this national development demand there was a requirement of multi-sectoral information regime "powered by very efficient national information system that would have to be the foundation for the governing and the governed - bringing the assessment of development needs, bridging disparity and gaps, bringing equity. The modules like, City-GIS service, Water –GIS, GIS for Disaster Management Support GIS for Infrastructure sector, Env-GIS for Environment and Climate Change, Weather-GIS and ES-GIS - weather and climate coastal zone management of NGIS can be utilised for interface.

5.2 Environmental Information System (ENVIS)

The Environmental Information System acronymed as ENVIS was implemented by the Ministry of Environment, Forest and Climate Change for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders. ENVIS is a decentralized computerized network database system consisting of the focal point located in the Ministry and a chain of network partners, known as ENVIS Centres located in the potential organizations/institutions throughout the country.

In order to develop ENVIS network as a comprehensive distributed environmental information network system, the ambit of ENVIS was extended to cover all the States/UTs of the country. Presently, the ENVIS network consist of 76 ENVIS centres link to apart from the focal point located in the Ministry, out of which, 30 Centres are on State Government Departments dealing with the Status of Environment and related issues of the concerned State Government and the remaining 46 have been set up on various environmental disciplines covering from air pollution, water pollution, noise pollution, biodiversity, solid waste management, ecology and ecosystems, environmental education, NGOs, media and even environmental parliament, coastal ecosystem, clean technology, etc.Functionally, it is a decentralized system of ENVIS Centres mandated to develop a distributed network of subject-specific databases

Both the Focal Point and ENVIS Centres in their assigned subject-areas are developing the requisite databases on identified parameters in order to disseminate information concerning their subject-areas to the user concerned. In order to disseminate information online almost all the ENVIS Centres have developed their interactive databases in their assigned subject-areas for requisite dissemination. The ENVIS Focal Point has also developed a comprehensive interactive website for online coordination with all its network partners as well as dissemination of information to the users whenever required.

The focal point of ENVIS has developed a comprehensive database with GIS interface known as Indian State Level Basic Environmental Information Database (ISBEID) on 17 modules in various subject areas of environment and its associated fields which are quite relevant to the State ENVIS Centres. This will assist the State ENVIS Centres to produce the State of Environment report for he concerned states/UTs,

5.2.1 Indian State Level Basic Environmental Information Database (ISBEID)

In order to develop the databases on environment and its related parameters and to make it online to the Ministry for to and fro information flow, a web enabled software, namely, Indian State Level Basic Environmental Information Database (ISBEID) was developed by ENVIS in collaboration with National Informatics Centre (NIC). The objective for development of this software is to cover the gap in environmental data dissemination with regard to vast parameters such as air pollution, water pollution, forestry, land resources, flora and fauna, etc. In total there are 17 modules. Initially, the database consisting of 23 modules in various environmental fields was tested on pilot basis by Eight States with 12 modules in two phases. There are two components of ISBEID application, namely, Management Information System (MIS) and Geographic Information System (GIS).

5.2.2 NUIS – National Urban Information System

Ministry of Urban Development has launched National Urban Information System (NUIS) Scheme in March, 2006 to develop GIS databases for 137 towns / cities in the country in two scales i.e., 1:10,000 and 1:2000. As on date the total number of towns in NUIS Scheme is 152. In addition utility mapping in 1:1000 scale will also be undertaken for 24 towns. Apart from spatial data, the Scheme has another component i.e. National Urban Data Bank and Indicators (NUDBI).

Components of NUIS Schemes

The NUIS scheme comprises two major components. They are:

- Urban Spatial Information System (USIS) – Includes development of GIS based multi –hierarchical database, with application tools to support Master/Zonal plan preparation; Urban Local Bodies(ULB) administration and utilities management.
- National Urban Databank and Indicators (NUDB&I) – Includes designing and establishing a comprehensive data bank and integration of these parameters to support planning and derive indicators for National Urban Observatory (NUO) for monitoring the health of urban settlements.

Content of NUIS Scheme

Under NUIS Scheme the development of information system is in three levels. They are:

I. Development/Master plan Level (1:10,000 scale)

II. Zonal Plan (1:2000 scale)

III. Utility Mapping (1:1000 scale)

Indicators for NUO Database: This data base has Six modules namely:

I. Background :

II. Socio-Economic Development

III. Infrastructure

IV. Transportation

V. Environmental Management

VI. Local Authorities

VII. Housing

VIII. Ministry of Urban Development

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6 NEED FOR DEVELOPMENT OF INTERFACE BETWEEN ENVIS AND NUIS TO ADDRESS CLIMATE CHANGE IN URBAN AREAS

6.1 ENVIS in light of Climate change and city Planning:

ENVIS was implemented by the Ministry of Environment & Forest for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders. 76 ENVIS centres are dealing with the state-wise status of Environment, air pollution, water pollution, noise pollution, biodiversity, solid waste management, ecology and ecosystems, environmental education, NGOs, media, coastal ecosystem and clean technology. ENVIS has both Management Information System (MIS) and Geographic Information System (GIS).The interactive database of ENVIS on Climate, Industrial, Residential, Vehicular Pollution, Disaster, Electricity Consumption, Energy Consumption, Non Renewable Energy, Renewable Energy , Actual Forest Cover by Density Class, Distribution of Forest Cover, Forest Produce, Joint Forest Management Committee, Mining in Forests, Recorded Forests, Category of Industry, Mining & Quarrying, Housing, Transport, Clean Technology, Effluent Treatment plant , Type of Waste aspects is efficiently capable to handle the environment related issues of urban areas. ENVIS is capable to handle efficiently database on environmental status at city level and build a baseline data source for city's environment study. But ENVIS not able to provide information related to urban sectors e.g landuse. Moreover, transportation network, trip generation, Housing , infrastructure etc., Spatial data of ISBEID is in 1:250,000 scale not fit for city planning, it can only provide point source data on environmental aspects (Figure :3) .

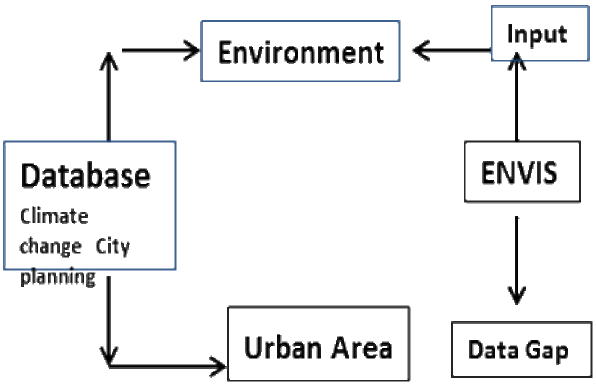

Figure: 3 ENVIS to address Climate change and city Planning

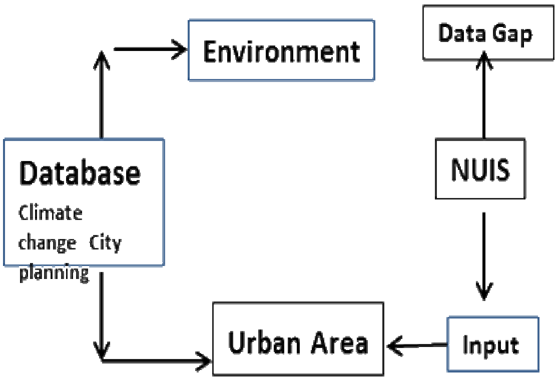

Figure 4: NUIS to light of Climate change and city Planning

6.2 NUIS in light of Climate change and city Planning:

Ministry of Urban Development has launched NUIS comprising of GIS databases for towns / cities in the country in 1:10,000 and 1:2000 scales. This information system also contains utility mapping in 1:1000 scale. The modules of NUIS covers the entire database required for the preparation of Master/Developmental Plan. It covers every aspects Master/ City Plan. As on date the total number of towns in NUIS Scheme is 152. NUIS Includes development of GIS based multi –hierarchical database, with application tools to support Master/Zonal plan preparation; Urban Local Bodies(ULB) administration and utilities management. It Includes designing and establishing a comprehensive data bank and integration of these parameters to support planning and derive indicators for National Urban Observatory (NUO) for monitoring the health of urban settlements. NUIS has developed a system to Integrate conventional data sources with modern data sources to develop GIS database. The information system has the capacity to develop automated integration/application techniques in GIS to provide inputs for Master/Zonal Planning and utilities management – to be utilized by the urban planners/administrators/decision makers. It is a decentralized data generation, storage and manipulation system at various levels of planning. In the present practice of master plan/ city plan/development plan preparation the environmental aspects specifically deviation in normal distribution of temperature and rainfall, occurrence of super store, flood, accumulation of GHG etc data bases are meagerly considered. But for sustainable city planning environmental data base is equally important akin to urban information. During the course of master/developmental plan preparation both these aspects should be united.

7 ENVIROURBAN INTERFACE

In order to address the climate change in urban area combination of ENVIS and NUIS provide input data base that can handle the data requirement more efficiently. An interface namely ENVIROURBAN between these two information systems i.e. ENVIS and NUIS developed by two different Ministries; Ministry of Environment and Forests and Ministry of Urban Development respectively can complement the data gap of each other. The ENVIROURBAN interface can act as key data contributor to address the climate change and city planning in isolation as well as in combination The Comparative analysis of these two systems can represent the compatibility of these two information systems towards developing the interface for Climate change and City Planning (Table -1 Compatibility Analysis of Systems) Figure : 5 establish the need for development of Interface.

ENVIS	NUIS
Provide information related to environment across the country	Provide information related urban areas of India
The level of information is State Level and District Level	The level of information is at City level
It had 76 centres across the country	Information is available for 137 towns in 10,000 & 1:2000 scale 24 towns in 1:1000 scale 153 towns under NUO
ENVIS has 10 types centres dealing with various aspects of Environment	Uniform data set
ENVIS Centre provides information in form of report format	Provides information Spatial Data and Attribute data
ISBIED provides information in MIS and GIS	All the data are GIS based
The Spatial Data are available in 1:2,50,000 scale	The Spatial Data are available in 1:10,000, 1:2000 and 1:1000 scale

Table 1: Compatibility Analysis of ENVIS & NUIS

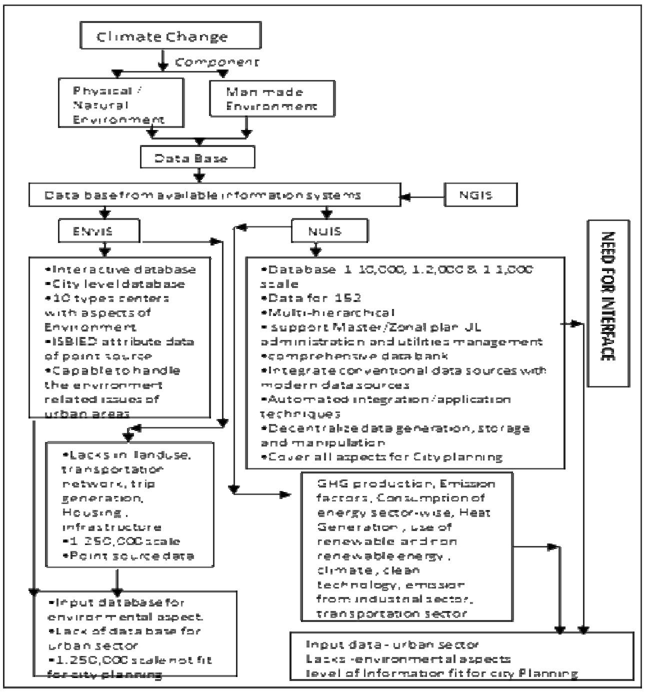

Figure 5 : Need for Development of ENVIROURBAN Interface

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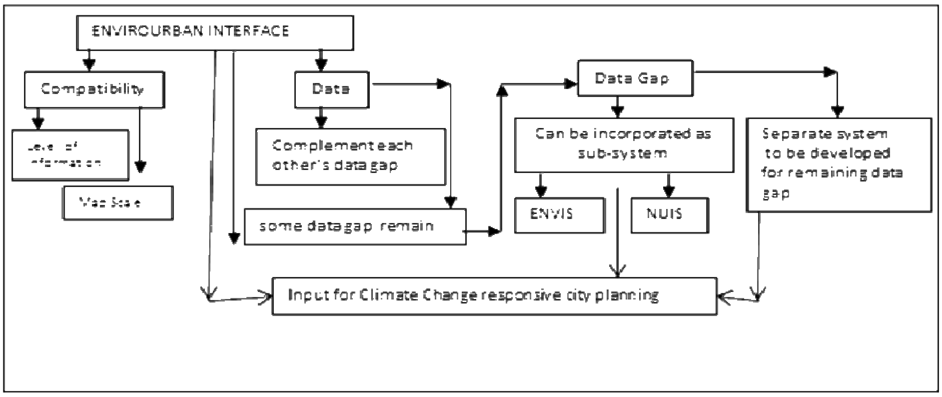
7.1 Data Status - Post ENVIROURBAN Interface

The Interface developed between ENVIS and NUIS is largely complementary and integration by nature. It integrates information in the form of map, attribute data and annotation. Figure 6 show the post interface status of availability of information in respect of the indentified indicators, data base for Climate change and City Planning (Figure :6).



There are some data and information gap which still persists after establishment of interface. The data gap related to Environment field may be added, append with ENVIS as a sub-system. Similarly information related to urban sphere can be added with NUIS as sub-system of NUIS. The information, which is very unique by nature for example Health related information is not directly related with NUIS and ENVIS, it can be added with other information system (Present/Future) or can be developed as a stand-alone system.

8 CONCLUSION:

India's first National Action Plan on Climate Change (NAPCC) has been fixed outlining existing and future policies and programs addressing climate mitigation and adaptation. The plan identifies eight core "national missions" viz. National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a "Green India", National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge for Climate Change. Under Indian Network for Climate Change Assessment (INCCA) Steps have also been taken to increase capacity at the institutional level for conducting research into Climate Change science and making necessary assessments. The Ministry has already set up a network, namely the Indian Network for Climate Change Assessment (INCCA) comprising of 127 research institutions tasked with undertaking research on the science of Climate Change and its impacts on different sectors of economy across various regions of India. INCCCA has helped the Ministry put together its Green House Gas (GHG) Emissions Inventories and in carrying out other scientific assessments at more frequent intervals. The interface of existing information system will act as a tool for Planning reference, hotspot detection and tracing for implementation.

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This section (pp. 237-248) was removed upon specific request of the author(s).

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🏆 *reviewed paper*

EmoCycling –Analyse von Radwegen mittels Humansensorik für Kommunen

Dennis J. Groß, Christoph Holderle, Johann Wilhelm

(Dennis J. Groß, University of Kaiserslautern – Department for Computer Aided Design in Urban Planning and Architecture (CPE), dgross@rhrk.uni-kl.de)

(B.Sc. Christoph Holderle, University of Kaiserslautern – Department for Computer Aided Design in Urban Planning and Architecture (CPE), holderle@rhrk.uni-kl.de)

(Johann Wilhelm, University of Kaiserslautern – Department for Computer Aided Design in Urban Planning and Architecture (CPE), wilhelmj@rhrk.uni-kl.de)

1 ABSTRACT

Viele Kommunen klagen über eine hohe innerörtliche Verkehrsbelastung durch Kraftfahrzeuge. Dabei ist dieserZustand oft selbst verursacht. Die Bevorzugung des motorisierten Indivudualverkehrs (MIV) gegenüber dem Rad- und Fußverkehr führt zwangläufigzu einem hohen Pkw-Aufkommen im Straßenverkehr. Diese Dominanz zeigt sich auch im Straßenquerschnitt: Oft führen entlang stark befahrener Straßen nur schmale Fuß- und Radwege. Die dadurch entstehende Gefahr umgeht die ortsansässige Bevölkerung, indem sie selbst für Kurzstrecken mit dem Auto zum Bäcker, Metzger oder die Kinder zur Schule fährt (Follmer et al. 2008: 10). Dies führt wiederum zu einer weiteren Erhöhung der Pkw-Nutzung im Straßenverkehr. Um dieser Spirale entgegenzuwirken, muss eine Reduzierung des Pkw-Anteils sowie eine Stärkung des Fuß- und Radverkehrs im Modal Split erfolgen (Modal Shift). Hierbei sind verschiedene Fragen zu beantworten: Warum benutzen Bürger so selten das Rad? Wo besteht ein geringes Sicherheitsempfinden? Wie kann es lokalisiert werden? Wo besteht kurzfristig- und wo langfristig Handlungsbedarf?

Im Rahmen des Projekts EmoCycling 2013 (Buschlinger et al. 2013, Höffken et al. 2014) fand bereits eine Analyse von Radwegen mittels Humansensorik und Wearable Computing(Exner et al. 2012) statt. Hierbei wurden Probanden mit Smartbändern ausgestattet. Die dadurch aufgezeichneten Daten ließen Rückschlüsse auf das psycho-physiologische Verhalten (Stress) zu. Mittels Videoaufnahmen konnten in der nachgehenden Analyse die Ursachen (Trigger) für die negativen emotionalen Einflüsse identifiziert und mittels GPS lokalisiert werden.

Auf dem bisherigen Forschungsstand aus vorangegangenen Projekten der emotionalen Stadtkartierung aufbauend(Höffken et al. 2008, Zeile et al. 2010), wird in diesem Usecase ein neuer Analyseschritt eingeführt. Das Paper stellt eine Methode zur Identifizierung der (Stress-)Auslöser und deren Kategorisierung vor.Dieses Verfahren ermöglicht es, Synergien zwischen den auftretenden Effekten zu erkennen, welche erst im Verbund zur psychologischen Belastung führen.

Der Aufbau des Papers sieht zunächst die Einordnung in den aktuellen Forschungsstand vor. Anschließend wird die Methodik vorgestellt und detailliert auf die Auslöser (Trigger) für vermeintlichen Stress eingegangen. Zudem wird der Nutzen der Methodik für die Kommune sowie die Rolle des Planers diskutiert, ehe abschließend ein Ausblick in die weitere Entwicklung gegeben wird.

2 EINLEITUNG

Betrachtet man die aktuelle Entwicklung in Deutschland, wird Radfahren immer beliebter. Nicht nur als Freizeit- und Sportgerät, sondern auch zunehmend als Verkehrsmittel für Kurzstrecken. Parallel steigt der Unmut in der radfahrenden Bevölkerung über Unsicherheit im Straßenverkehr. Der Radfahrende wird als Verkehrsteilnehmer nicht gleichermaßen von Autofahrern beachtet.Radwege oder sonstige Installationen sind nicht ausreichend vorhanden (vgl. SZ-Online 2014).Gleichzeitig wächst ein weiterer Trend in der Bevölkerung – das Self-Tracking (Moma 2014). Hierbei messen und analysieren Menschen mit Sensoren, Smartphones und Apps ihre eigenen Körperdaten wie Puls, Kalorienverbrauch oder Schrittzahl. Ein Beispiel, ist die Bewegungen QuantifiedSelf (http://quantifiedself.com/).

Beide Trends lassen sich miteinander vereinen. Den Ansatz des Messens von Körperdaten im urbanen Kontext verfolgt die Thematik des EmoMappings. Hier werden Körperhaften zusätzlich in Emotionen interpretiert.

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3 STAND DER FORSCHUNG

Auch EmoCyclingzählt zur Methodik des EmoMappings. Dieser Begriff beschreibt die Kartierung eines Raumes durch Emotionen der Raumnutzer. Durch verschiedene Körpersensoren werden Vitaldaten wie Puls, Hautleitfähigkeit oder –temperatur gemessen. Der Mensch reagiert auf eine Situation im Raum. Mittels Sensoren können die physiologischen Reaktionen auf die Situation aufgezeichnet und kartiert werden. Gewissermaßen wird der Mensch selbst zum Sensor. Aus den so gewonnenen Daten können bisher subjektiv bewertete Szenarien durch die objektive Messung verifiziert bzw. falsifiziert werden.

Zahlreiche Projekte haben sich bereits mit der Erfassung physiologischer Daten und deren emotionalen Interpretation beschäftigt. Neben „Mapping People“ (Zeile et al. 2009); „Emotionale Stadtkartierung“ (Höffken 2010); „Smart Sensoring as a Planning support Tool for Barrier free Planning“ (Zeile et al. 2011); „Sensing the City“ (Bergner et al. 2012) und „Humansensorik in der räumlichen Planung“ (Exner et al. 2012), sind vor allem das aktuelle Projekt der StiftungRheinland-Pfalz für Innovation „Sensor Map RT“ in Zusammenarbeit mit dem DFKI Kaiserslautern, der Universität Trier sowie das Projekt der Deutschen Forschungsgemeinschaft (DFG) „Urban Emotions“ in Zusammenarbeit mit den Universitäten Heidelberg und Salzburg zu nennen. Der hier behandelte Usecase dient dem letztgenannten Projekt und basiert ebenfalls auf dem Bachelorprojekt „EmoCycling“ (Buschlinger et al 2013).

4 METHODIK

Die bisher angewandte Methode bedient sich drei Messinstrumenten. Das Sensorarmband sammelt die Vitaldaten. Das GPS-Gerät zeichnet die geographischen Koordinaten auf. Eine Kamera filmt alle Szenarien (vgl. Abb. 1). Im Folgenden werden die verwendeten Geräte beschrieben:

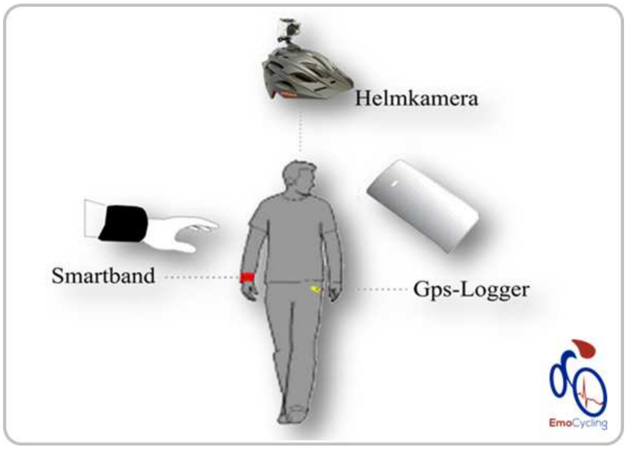

Abb. 1: Technische Ausstattung der Probanden

Das Smartband wurde von Bodymonitor (www.bodymonitor.de) entwickelt.Es wird mit zwei selbstklebenden Elektroden am linken Unterarm oberhalb des Handgelenks angebracht (Wearable). Durch Anschalten des Geräts wird die sofortige Aufzeichnung aktiviert. Diese beinhaltet die Messung der Bewegungsrichtung entlang der drei Raumachsen (triaxiale Beschleunigung) sowie der Außentemperatur, der Hauttemperatur (kardiovaskulär) und der Hautleitfähigkeit (elektrodermale Aktivität). Vor allem die beiden letztgenannten sind zur Auswertung des psycho-physiologischen Verhaltens der Probanden relevant. Um die Bedeutung zu verstehen, ist zunächst zu erläutern, wie der menschliche Körper auf eine psycho-physiologische Belastung wie Stress reagiert.

Stress ist eine Kombination aus den Emotionen Angst und Ärger (Kreibig 2010). Angst tritt insofern auf, dass der Proband befürchtet, ihm könnte etwas zustoßen. Ist eine heikle Situation (knappes Überholmanöver) überwunden, empfindet er auch Ärger darüber. Was geschieht im Körper? Der Proband hat zunächst einen erhöhten Herzschlag. Daraus resultiert eine steigende Durchblutung der Extremitäten, was die Aktivität der Schweißdrüsen zur Folge hat (Bergner 2010: 69). Der Proband transpiriert. Der Schweiß auf der Haut führt zu einer besseren elektrischen Leitfähigkeit. Das Smartband misst diese elektrodermale Aktivität.„In Übereinstimmung mit Emotionsforschern liegt eine negative Erfahrung dann vor, wenn […] kurz danach die Hauttemperatur abnimmt (Bergner et al. 2011: 435)“.

Nach Abschalten des Geräts können die Daten (.txt-Format) von der integrierten 1GB-SD-Karteper Mini-USB auf den PC übertragen werden.

Anschließend werden mit Hilfe des Programms STATA SE (www.stata.com) die Daten bearbeitet. Bereits existierende Skripte helfen hier bei der einfachen Aufbereitung. Von den Rohdaten wird die „Erste Ableitung“ der Verlaufskurve von Hauttemperatur und –leitfähigkeit errechnet(vgl. Zeile et al. 2013: 132).Im Einzelfall kann es zu starken Abweichungen der Messwerte (Artefakten) kommen, welche einer manuellen Bearbeitung bedürfen. Am Ende der Auswertung stehen zwei binärcodierte Spalten (vgl. Abb.2). Diese werden nach dem folgenden Schema interpretiert: Sobald drei Sekunden nach einer Reihe direkt aufeinanderfolgender merklicher Veränderungen der Hautleitfähigkeit eine Reihe direkt aufeinanderfolgender Veränderungen der Hauttemperatur erscheint, ist ein (Stress-)Ereignis identifizierbar. Zu diesem Zeitpunkt kann bereits die Aussage getroffen werden, in welcher Sekunde seit Beginn der Aufzeichnung eine negative Beeinträchtigung stattgefunden hat.

317	-1	0
318	0	0
319	1	0
320	1	1
321	1	1
322	1	1
323	-1	1
324	-1	1
325	-1	1
326	-1	1

Abb. 2: „Endprodukt“ der Auswertung, Binärcode

Das zweite Instrument, der GPS-Tracker, dient der Verortung der gemessenen Vitaldaten im Raum. Hierbei wird der „i Blue 747“ der Firma „Transsystems“ verwendet. Durch einen Zeitstempel, der manuell im Moment des Einschaltens (sowie Ausschaltens) des Smartbands gesetzt wird, ist eine spätere Synchronisation beider Geräte ermöglicht. Nur durch eine exakte Synchronisation kann die Datenvalidierung erfolgreich sein. Per Mini-USB wird das Gerät zunächst mit dem PC verbunden. Mit dem „LoggerTool“ werden die GPS-Daten überspielt und im .csv-Format gespeichert. Die GPS-Daten können abschließend mit den Vitaldaten zusammengefügt werden. Somit kann jedes Ereignis sekunden- und ortsgenau festgehalten werden. Der Import in ein Geoinformationssystem (GIS) ermöglicht diverse Visualisierungsmöglichkeiten (z.B. in Wilhelm 2014: 45f.). Häufig wird zur Darstellung der Hotspots eine Heatmap (vgl. Abb.3) verwendet. Nach diesem Schritt ist bereits eine quantitative Analyse möglich.

Abb. 3: Heatmap Usecase Osthofen

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Nach diesen zwei Schritten, können Aussagen dazu getroffen werden ob, wann und wo ein negativer Einfluss stattgefunden hat. Die Ursache bleibt weiterhin unklar. Dieerfassten Hotspots können aber mittels Videodetailliert analysiert werden. Zur Aufzeichnung wird eine GoPro Hero 2 Kamera verwendet. Mit ihrer Kompaktheit ist sie dafür geeignet, durch einen Brustgurt am Oberkörper befestigt zu werden. Der Weitwinkel sowie eine Auflösung von 1920x1080 Pixel sorgt für ein großes, detailliertes Blickfeld.Die Aufzeichnung wird im mp4-Format gespeichert. Die so entstehenden Videosgeben Aufschluss über die möglichen Ursachen für die Reaktion. Diese Auslöser, Trigger genannt, werden in bisherigen qualitativen Analysen lediglich oberflächlich betrachtet. Sowohl für die qualitative als auch für die bisherige quantitative Analyse und Bearbeitung ist die planerische Begleitung nötig.

5 TRIGGEREFFEKTE & KATEGORISIERUNG

Nur wenn die Ursachen bekannt sind, kann auch die Wirkung beeinflusst werden. Daher ist es in der qualitativen Analyse wichtig, die Auslöser (Trigger) für den „Stress“ zu benennen und ihr Zusammenspiel zu erkennen. Doch welche räumlichen und anthropogenen Auslöserim Verkehrsraum führen bei Radfahrenden zu einer emotionalen Belastung?

Das Videomaterial des EmoCycling-Projekts 2013 (Buschlinger et al 2013) sowie des Usecase Osthofen 2014 identifizierten zunächst 13 Trigger. Dabei ist anzumerken, dass diese Auflistung keinesfalls als abschließend zu betrachten ist. Sie dient vielmehr als erster Ansatzpunkt zur Ursachen-Wirkungs-Analyse.

Die Trigger unterscheiden sich stark hinsichtlich ihrer Ursache und ihres Zusammenwirkens. So gilt es grundlegend in drei gleichwertige Kategorien zu unterteilen. Unterschieden wird zwischen horizontalen, vertikalen sowie anthropogenen Effekten. Im Folgenden werden die einzelnen Kategorien näher erläutert:

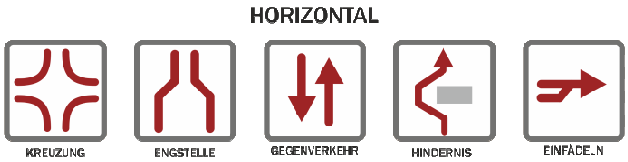

Abb. 4: Horizontale Triggereffekte

(1) Horizontale Effekte [HE] (Abb. 4) sind Trigger, die in der Ebene stattfinden. Hierzu zählen neben Knotenpunkten (Kreuzungen und Einmündungen) auch Engstellen, Gegenverkehr, Hindernisse sowie das Einfädeln.

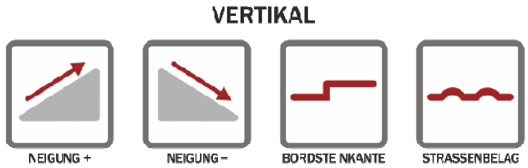

Abb. 5: Vertikale Triggereffekte

(2) Die vertikalen Effekte [VE] (Abb. 5) treten im dreidimensionalen Raum auf. Sowohl eine positive oder negative Neigung als auch Bordsteinkanten und der Straßenbelag (z.B. Schlaglöcher) sind in diese Kategorie einzuordnen.

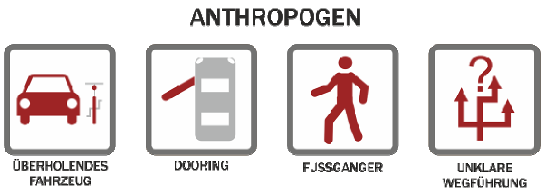

Abb. 6: Anthropogene Triggereffekte

(3) Während die ersten beiden Kategorien einen räumlichen Charakter haben, wird die dritte Kategorie der anthropogenen Effekte [AE] (Abb. 6) erheblich durch den Menschen verursacht. Sie können einerseits vom Radfahrenden selbst ausgehen wie Desorientierung durch eine unklare Streckenführung. Andererseits kann die Ursache auch bei anderen Verkehrsteilnehmern liegen. Auftretende Fälle sind Fußgänger, Überholmanöver von motorisierten Fahrzeugen sowie das plötzliche Öffnen von Fahrzeugtüren (Dooring).

Zur bisher angewandten Analyse werden nun die kategorisierten Triggereffekte hinzugefügt. Dieser Schritt stellt somit den Übergang von der reinen Datenerfassung und quantitativen Analyse zur Interpretation und auch qualitativen Analyse dar. Er dient als Grundlage für abzuleitende planerische Maßnahmen. Der Kompetenzbereich des Planers in der Methodik des EmoCyclings beginnt hier.

6 SYNERGIEEFFEKTE

Ein Synergieeffekt ist das Ergebnis des Zusammenwirkens mehrerer Faktoren, welche sich gegenseitig verstärken. Auf den planerischen Kontext übertragen heißt das: Eine enge Straße allein führt nicht zwangsläufig zu Stress. Ein riskantes Überholmanöver eines Fahrzeugs, bedingt durch diese Engstelle, führt dazu. Anhand ausgewählter Auszüge aus dem Videomaterial des Usecases werden verschiedenste Szenarien genauer betrachtet. Sie sollen häufig auftretende Synergieeffekte veranschaulichen.

Aus den bisherigen Analysen des EmoCycling-Projekts 2013 waren vor allem Knotenpunkte negativ aufgefallen. Der Usecase Osthofen zeigt, unter Zuhilfenahme der kategorisierten Triggereffekte, ein differenzierteres Spektrum an Ursachen für ein negatives Befinden der Probanden.

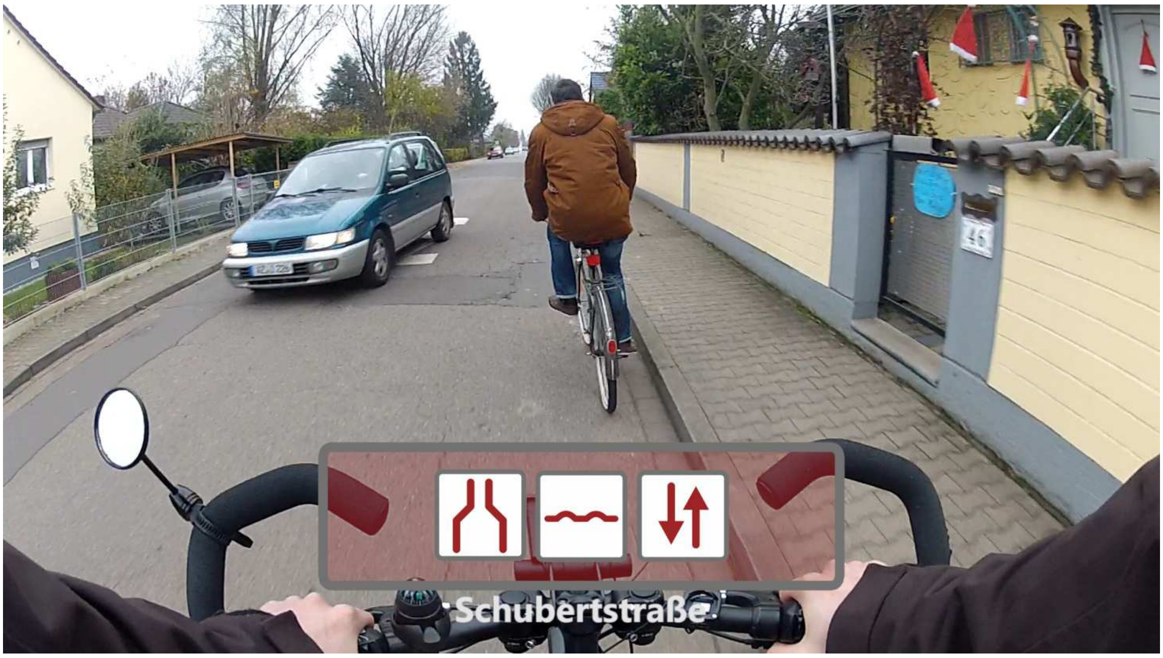

Abb. 7: Szenario 1 – Engstelle, Straßenbelag, Gegenverkehr

Abb. 8: Szenario 2 – Überholen, Neigung (-), Engstelle

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Das erste Szenario (vgl. Abb.7) zeigt zwei horizontale und einen vertikalen Trigger. Der Straßenbelag (vertikaler Effekt) allein ist vermutlich kein Auslöser für ein negatives Empfinden, zumal ohne den Gegenverkehr genug Platz zum Ausweichen gegeben ist. Bei angemessener Straßenbreite ist auch die Auswirkung des Gegenverkehrs (horizontaler Effekt) vermutlich zu vernachlässigen. Dieses Szenario führt erst durch das gleichzeitige Auftreten aller drei Effekte zu einem negativen Ereignis. Die Engstelle (horizontaler Effekt) führt beim gleichzeitigen Begegnungsfall dazu, dass der Radfahrende dem Schlagloch nicht ausweichen kann.

Das zweite Szenario (vgl. Abb. 8) zeigt eine schmale Ortsdurchfahrt. Hier sind alle drei Kategorien vertreten. Aufgrund von ruhendem Verkehr auf der Gegenseite wird die Fahrbahn verengt (horizontaler Effekt).Die hohe Verkehrsbelastung, der damit verbundene Gegenverkehr, geben nur wenige Möglichkeiten des Überholens. Dies führt zu einer Autoschlange hinter den Radfahrenden und Ungeduld seitens des Autofahrenden. Bietet sich dann die Gelegenheit des Überholens (anthropogener Effekt), wird meist sehr knapp überholt. Hinzu kommt die erhöhte Geschwindigkeit des Radfahrenden durch das Gefälle (vertikaler Effekt). Dadurch entstehen zusätzliche Unsicherheiten. Während die erhöhte Geschwindigkeit sowie das Gefälle womöglich keine negative Belastung für den Probanden darstellt, führt das knappe Überholmanöver des Fahrzeugs zu einem solchen Ereignis.

Abb. 9: Szenario 3 – Engstelle, Fußgänger

Auch in Szenario drei (vgl. Abb. 9) wird die emotionale Beeinträchtigung durch eine Engstelle (horizontaler Effekt) induziert. Ohne Begegnungsverkehr ist der Weg ausreichend dimensioniert. Allerdings ist hier stets mit Passanten (anthropogener Effekt) oder anderen Radfahrenden zu rechnen.

Nach einem gemeinsam genutzten Radweg fehlt eine Rückführung auf die Straße. In diesem vierten Szenario (vgl. Abb. 10) treten gleich vier Trigger in Erscheinung. Der Proband sieht sich zunächst vor dem Problem, wie sich die weitere Streckenführung gestaltet (anthropogener Effekt). Es besteht lediglich die Möglichkeit, sich über den hohen Bordstein (vertikaler Effekt) in den fließenden Verkehr einzufädeln (horizontaler Effekt). Zudem sind die Fußgänger (anthropogener Effekt) auf dem Bürgersteig zu berücksichtigen. Die Situation wird vor allem durch die Kombination von Desorientierung, eine Unsicherheit durch den hohen Bordstein und den schnellen Verkehr, zur Belastung.

Abb. 10: Szenario 4 – Bordstein, Einfädeln, Unklare Wegeführung, Fußgänger

Abb. 11: Szenario 5 – Straßenbelag, Kreuzung

Wie bereits in EmoCycling 2013 erkannt, führen Knotenpunkte häufig zu emotionaler Belastung. Häufig ist dies fehlenden Radverkehrsführungen und Unüberschaubarkeit geschuldet. In diesem fünften Szenario(vgl. Abb. 11) verhindert die hohe Einfriedung die Übersicht über die Kreuzung. Eine fehlende Haltelinie nimmt zusätzliche Sicherheit.

Die Abbildung 12 entstand ebenfalls durch die Analyse der Videos von 2013 und 2014. Sie verdeutlicht die Zusammenhänge zwischen den Kategorien und ihrer einzelnen Effekte.Sie zeigt alle 13 Trigger kreisförmig angeordnet und in drei Sektoren (den Kategorien entsprechend) unterteilt. Dadurch soll das Zusammenspiel der Kategorien und Trigger miteinander visualisiert werden. Auffällig ist, dass in den meisten Synergieeffekten die Neigung eine Rolle spielt. Eine Ursache dafür kann die Beeinträchtigung der Neigung auf die Geschwindigkeit sein. Bei höherer Geschwindigkeit sinkt die Reaktionszeit des Probanden auf weitere Ereignisse. Eine Verlangsamung hat eine höhere Beanspruchung des Gleichgewichtsinns zur Folge, was die mögliche Aufmerksamkeit bzw. Konzentration verringert. Ein solches Netzdiagramm ermöglicht es, die Synergieeffekte übersichtlich darzustellen und häufig wiederkehrende Phänomene zu entdecken. Aus diesem konkreten Fall lässt sich z.B. die Empfehlung ableiten, dass die meisten Synergien kompensiert werden können, indem vor allem horizontale und vertikale Effekte stärker berücksichtigt werden.

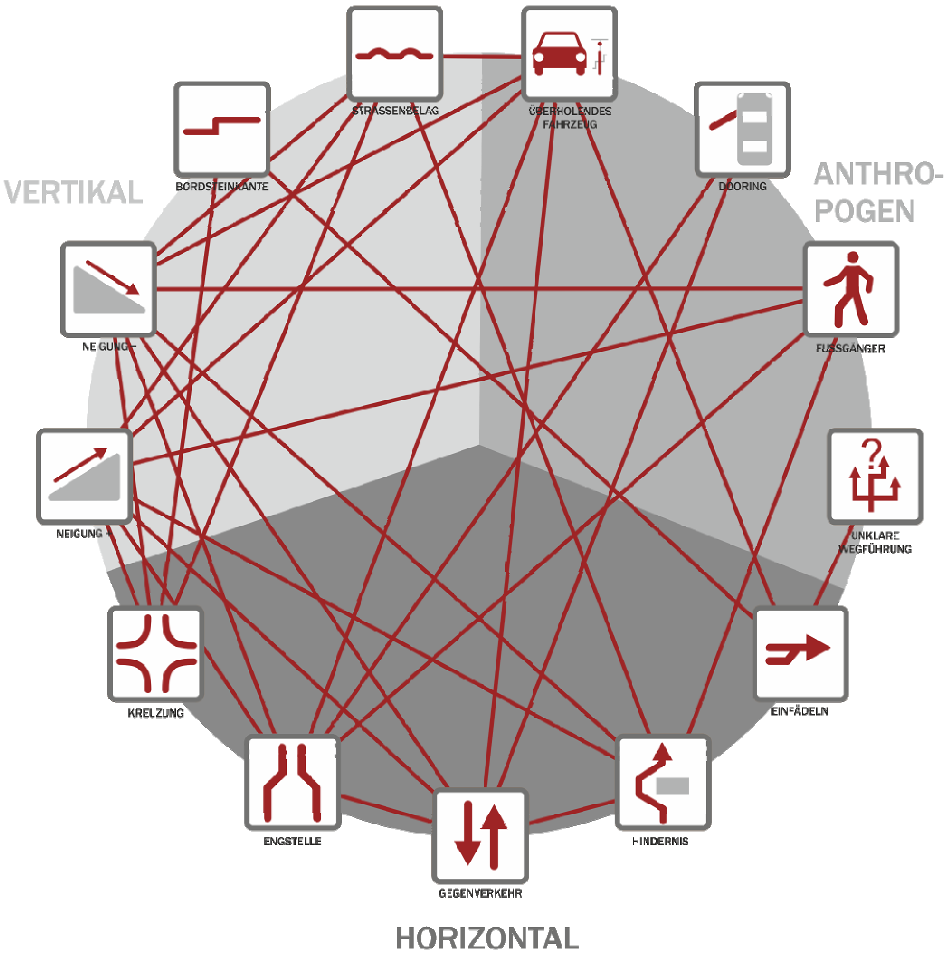

Abb. 12: Netzdiagramm – Synergieeffekte

7 USECASE OSTHOFEN

Die Stadt Osthofen gehört der Verbandsgemeinde Wonnegau an und liegt im Landkreis Alzey-Worms in der Region Rheinhessen (Bundesland Rheinland-Pfalz). Sie zählt 8.700 Einwohner und ist gemäß der Landesplanung als Grundzentrum ausgewiesen.

In einem Kooperationsprojekt zwischen dem Masterkurs Stadtumbau und –erneuerung der TU Kaiserslautern, dem DFG-Projekt „Urban Emotions" und der Stadt Osthofen fand eine Untersuchung der verkehrstechnischen Aspekte Osthofen statt. Zunächst wurden verschiedene Quell- und Zielpunkte des örtlichen Verkehrs lokalisiert. Während Quellpunkte zumeist Wohngebiete sind, zählen Versorgungseinrichtungen des täglichen Bedarfs, Kulturstätten, Bildungsstätten sowie überörtliche Verkehrsknotenpunkte zu den Zielpunkten. Aus den so gewonnenen Erkenntnissen wurden zwei Rundkurse erstellt. Sie verbinden viele der relevanten Punkte, sodass eine realitätsnahe Streckenführung entstand, die den herkömmlichen Bewegungsmustern der örtlichen Bevölkerung ähnlich ist. Genauere Daten könnten durch aufwendige Verkehrszählungen gewonnen werden. Der Aufwand für diese Vorarbeiten kann je nach Größe der Kommune stark variieren, betrug aber in diesem Fall ca. einen Arbeitstag. Auch die Auswertung der Daten kann mit anschließender Formulierung von Maßnahmen einen Arbeitstag in Anspruch nehmen.

Beide Routen beinhalten alle Straßenkategorien des örtlichen Verkehrs. Hierzu zählen Hauptverkehrsstraßen, Sammelstraßen, Anliegerstraßen sowie verkehrsberuhigte Bereiche. Die aktuelle Situation zeigt nur ein geringes Maß an installierter Radverkehrsinfrastruktur. Obwohl hier eine Route des Landes-Radwegenetzes (Rheinterrassen-Route) verläuft, existieren nur vereinzelt Radwege im Seitenraum der Straßen. Das Verkehrsaufkommen während des Testlaufs war entlang der Hauptverkehrsstraßen als stark frequentiert einzustufen. In allen weiteren Straßenkategorien war die Frequenz erheblich geringerer Natur.

Jeder der gefahrenen Kurse hatte eine Länge von ca. fünf Kilometern. Die beiden Kurse wurden ohne Unterbrechung gefahren. Die Fahrtdauer betrug ca. 45 Minuten. Mit Ausnahme der drei Unterführungen und einer Steigung/einem Gefälle von 6% entlang der Hauptverkehrsstraße im Ortskern war die Reliefenergie nur gering. Die Wetterverhältnisse waren trocken und kalt, sodass keine Beeinträchtigung der Fahrbahn, und somit des Fahrverhaltens, durch Nässe gegeben war.

Zwei Probanden befuhren die Strecke, wobei lediglich einer mit den drei erforderlichen Instrumenten bestückt war. Mit der Kamera wurde die Fahrt des vorderen Probanden in der Verfolgerperspektive aufgezeichnet. Nach dem im vierten Kapitel beschriebenen Auswertungsverfahren konnte anschließend die Videoanalyse erfolgen. Die Planer betrachteten zunächst, wo bzw. wann ein (Stress-)Ereignis geschehen war, und sichteten den Ausschnitt im Video. Die Auslöser (Trigger) für das Ereignis wurden festgehalten, indem die entsprechenden Symbole (vgl. Abb.4-6) in der Karte (vgl. Abb. 13) festgehalten wurden.

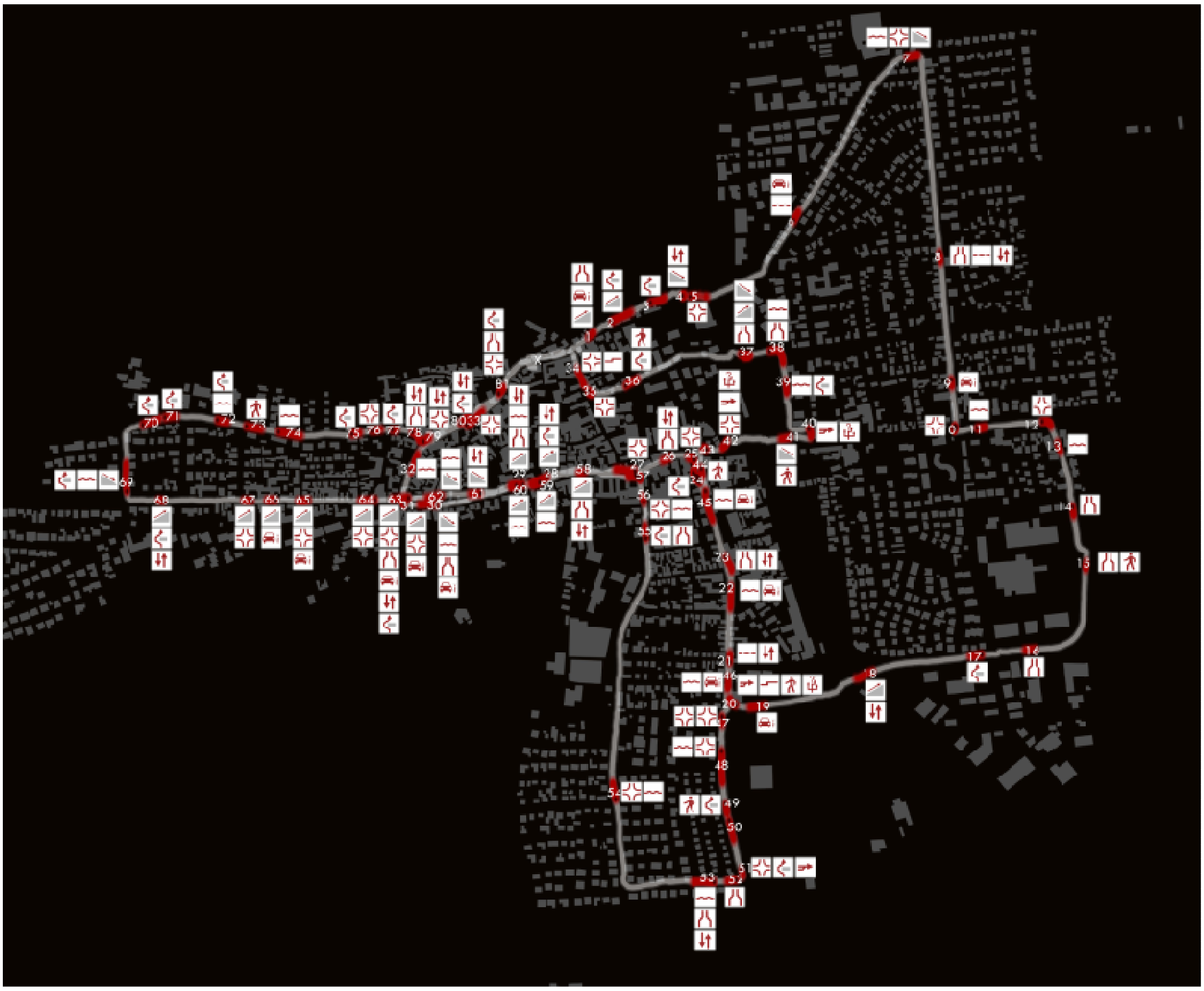

Abb. 13: Auswertung Videoanalyse

Parallel entstand ein Triggerkatalog, in welchem neben den Triggern, die Erfassung weitere Informationen wie Zeit, Straßennamen oder Geschwindigkeit stattfand. Am Ende der Auswertung waren 81 Ereignisse zu verzeichnen. Die drei häufigsten Trigger waren: an erster Stelle in 28 von 81 Fällen (34%) Knotenpunkte, zweitens in 25 von 81 Fällen (30%) schlechte Straßenbeläge und am dritthäufigsten Engstellen, in 19 von 81 Fällen (23%). Mit Hilfe dieser Erkenntnisse konnten die Studierenden des Masterkurses ein Paket konkreter Handlungsempfehlungen für Osthofen formulieren, welche sich leicht auf andere Kommunen übertragen lassen.

Empfehlungen für kurzfristig umzusetzende Verbesserungen sind neben konkreten Einzelmaßnahmen die Reparaturen des Fahrbahnbelages (vertikaler Effekt), Einfädel- oder Querungshilfen (horizontaler Effekt) sowie abgesenkte Bordsteine (vertikaler Effekt). Darüber hinaus können durch optische Maßnahmen kostengünstig und einfach schnelle Verbesserungen erzielt werden, beispielsweise durch die Ausweisung von Schutzstreifen (horizontaler Effekt). Diese bilden einen Schutzraum für Radfahrer, der nur im Bedarfsfall ohne Gefährdung des Radverkehrs von Kfz überfahren werden darf. Schilder oder Piktogramme auf dem Boden helfen bei der Orientierung für Radfahrer (anthropogener Effekt) und steigern die

Aufmerksamkeit bei den Autofahrern. Ein langfristiger Schwerpunkt sollte auf der fahrradfreundlichen Umgestaltung von Kreuzungen liegen. Die Analyse ergab als Ursache oftmals eine Mischung aus unklaren Verkehrsverhältnissen an den Kreuzungen, sowie unzureichende Sichtverhältnisseoder zu hohe Geschwindigkeiten durch die Autofahrer.

Der Usecase Osthofen dient somit der erstmaligen Anwendung der Triggereffekte und zeigt beispielhaft, wie sich die Arbeit des Planers im Prozess des EmoCyclings gestaltet und welche Ergebnisse für die kommunale Planung erzielt werden können.

8 FAZIT

Die Bedeutung des Radverkehrs hat, wie zu Beginn erwähnt, in den vergangenen Jahren, zugenommen. Aufgrund steigender Energiepreise sowie dem gleichzeitigen ökologischen Sinneswandel ist ein Umstieg auf das Fahrrad sinnvoll. Um diesen Modal Shift zu beschleunigen und alle Bevölkerungsgruppen zu erreichen müssen bauliche Mängel, die auch das Sicherheitsempfinden beeinträchtigen, behoben werden. Der Usecase Osthofen zeigt, wie individuelle Defizite schnell und effizient erkannt werden können. Zusätzlich bietet die Methode die Möglichkeit, umgesetzte Maßnahmen im Nachgang zu testen, um somit eine Erfolgskontrolle durchzuführen. Bei den bestehenden und vorgestellten Ansätzen ist der Planer noch stärker in den technischen Prozess während der Aufzeichnung und Auswertung eingebunden. Ziel bei der weiteren Entwicklung ist es, dass alle technischen Abläufe nahezu automatisiert verlaufen, sodass sich der Planer auf die inhaltliche Arbeit konzentrieren kann. Dazu zählen:

(1) Die Lokalisierung von Quell- und Zielpunkten

(2) Das Erstellen einer realitätsnahen Streckenführung

(3) Die Bürgerbeteiligung und das Akquirieren von Probanden

(4) Die Sichtung des Videomaterials auf Grundlage der Karten (Heatmaps)

(5) Das Erkennen der Triggereffekte und ihrer Synergien

(6) Das Ableiten konkreter Handlungsempfehlungen zur Minderung der Effekte

(7) Die Bürgerbeteiligung und Diskussion der Analyse

(8) Die nachträgliche Kontrolle der umgesetzten Maßnahmen (Monitoring)

Die Methodik weist noch technische Schwächen auf, welche aber durch stetig neue Entwicklungen mit Projektpartnern und generelle technische Neuerungen behoben werden können. Auch sind die Anschaffungskosten für die Messgeräte noch relativ teuer. Da der Trend des Self-Trackings den Markt stark positiv beeinflusst, ist davon auszugehen, dass verwendbare Gerätschaften zukünftig kostengünstiger werden. Zudem werden neuentwickelte GPS-Geräte auch immer genauer, während die „i Blue 747“ momentan noch mit bis zu 15m Abweichung messen. Die Nutzung von Smartphones als unterstützende Sensoren zur Messung des GPS-Signals oder des Schallpegels wird bereits praktiziert. Durch Programme/ Applikationen wird es künftig möglich sein, die Daten in Echtzeit auszuwerten, sodass noch vor Ort per Videoanalyse Triggereffekte analysiert werden können.

Die Frage des Datenschutzes ist durchaus bei der Messung von Vitaldaten berechtigt. Die aktuellen Entwicklungen sehen die Entscheidung beim Teilnehmer, welche Daten er preisgeben möchten und inwieweit er damit der Gesellschaft helfen möchte.

EmoCycling bietet für Kommunen ein schnelles Tool zur Identifizierung von Problemstellen im Straßenverkehr für Radfahrende. Sobald die wissenschaftliche Evaluation in den nächsten zwei bis vier Jahren der Forschung abgeschlossen ist, eignet sich die Methodik auch für private Planungsbüros. Ortsfremde können innerhalb weniger Stunden Teile des Radverkehrsnetzes (visuell und „emotional“) erfassen, analysieren und die Ergebnisse mit der Bevölkerung diskutieren und umsetzen.

9 AUSBLICK

Zwar entsteht bereits nach wenigen Messungen eine Argumentations- und Handlungsbasis zur planerischen Aktivität, doch sollten zukünftige Projekte eine größere Probandenzahl aufweisen, um auch Unterschiede zwischen Nutzergruppen zu erforschen. Wie ist die emotionale Beeinträchtigung von Betagten im Vergleich zu Schulkindern? Ist ein Pendler „stressresistenter“ als ein entspannter Wochenendradler? Dies ist durchaus auch als Appell an Stadtsoziologen oder Verkehrspsychologen zu verstehen.

Die Vision der Entwickler dieser Methodik ist, dass langfristig jeder Bürger mittels App und einem eigenen Sensor für die benötigten Vitaldaten, sofern er es möchte, jederzeit seine Daten zur Verfügung stellt. In Echtzeit und flächendeckend kann das Verkehrsnetz einer Kommune analysiert werden und so auch auf temporäre Ereignisse Einfluss genommen werden. Damit Radfahren wieder attraktiver wird.

10 DANKSAGUNG

Unser Dank gilt allen Studierenden des Bachelorprojekts 2013 sowie des Masterkurses des Moduls Stadtumbau/ Stadterneuerung. Auch unseren Projektpartner aus den beiden Forschungsprojekten Sensor Map RT und Urban Emotions gebührt der Dank. Die Studie entstand im Rahmen des DFG-Projektes “Urban Emotions - Methodenentwicklung zur Gewinnung von Kontextuellen Emotionsinformationen für die Räumliche Planung auf Basis von Echtzeit-Humansensorik und Crowdsourcing-Ansätzen in Sozialen Netzwerken” mit dem Förderkennzeichen ZE 1018/1-1 und RE 3612/1-1.

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reviewed paper

EmoVision – Potenziale von EmoMapping in der räumlichen Planung

Johann Wilhelm, Daniel Broschart, Peter Zeile

(Johann Wilhelm, TU Kaiserslautern, Fachgebiet CPE, Pfaffenbergstr. 95, 67663 Kaiserslautern, wilhelmj@rhrk.uni-kl.de)
(MSc. Daniel Broschart, TU Kaiserslautern, Fachgebiet CPE, Pfaffenbergstr. 95, 67663 Kaiserslautern, dbroscha@rhrk.uni-kl.de)
(Dr.-Ing. Peter Zeile, TU Kaiserslautern, Fachgebiet CPE, Pfaffenbergstraße 95, 67663 Kaiserslautern, zeile@rhrk.uni-kl.de)

1 ABSTRACT

Nicht nur die Geschwindigkeit der Entwicklungen im technologischen Bereich nimmt immer mehr zu, sondern auch der Einfluss, den diese Entwicklungen auf den Lebensalltag haben. Der technische Fortschritt verändert damit auch zunehmend die Disziplin der räumlichen Planung. Ein Beispiel dafür ist die Entwicklung des Internets, das mittlerweile in der dritten Evolutionsstufe (Web 3.0) angekommen ist und einen stetig wachsenden Anteil an verorteten Informationen bietet. Daher ist es naheliegend, dass diese Stufe auch Geoweb genannt wird. Mit diesem Umstand verbunden, leisten gegenwärtig internetfähige Mobilgeräte – wie die Smartphones – ihren Beitrag zur Gestaltung des Alltags, ganz im Sinne des Ubiquitous Computing bzw. dem Internet of Things. Somit trägt fast jeder Mensch mittlerweile ein mit Sensoren ausgestattetes Gerät mit sich, das über GPS-Ortung verfügt.

Für die Raumplanung eröffnet dieser Umstand neue Möglichkeiten und Potentiale der Datengewinnung und –analyse, welche unter den Begriff Raumsensorik fallen. Einen Schritt weiter geht die Humansensorik im Kontext der räumlichen Planung. Sie nutzt den Menschen selbst als Sensor, z. B. indem sie seine Emotionen erfasst und verortet. Mit ihrer Hilfe kann man die emotionale Wirkung der Umwelt auf den Menschen erforschen. Diese Technik wird EmoMapping genannt und lässt sich in induktive und deduktive Prozesse unterteilen. In der räumlichen Planung lässt sich diese Methode auf verschiedene Art und Weise einsetzen, z. B. zur Analyse von Verkehrsinfrastruktur, der Wirkung von städtischer und natürlicher Umwelt auf den Menschen oder sogar die emotionalen Einflüsse der Umgebung auf das Kaufverhalten eines Kunden in der Innenstadt oder in einem Kaufhaus. Diese Arbeit gibt einen Überblick über das Thema EmoMapping und beleuchtet die Möglichkeiten und Potentiale des Einsatzes dieser Methode in der räumlichen Planung.

2 EINORDNUNG DES FORSCHUNGSSTANDES

2.1 Emotionen in der Raumplanung

„Emotionen haben einen zentralen Platz in unserem Leben. Sie bestimmen entscheidend unsere Persönlichkeit und sind an allem beteiligt, das für unser Überleben wichtig ist“ (Wassmann 2002). Aus diesem Grund spielen Emotionen auch in der Raumplanung eine wichtige, aber bisher noch indirekte Rolle. Sie spiegeln nicht nur das Wohlbefinden und den Gemütszustand wider, sondern haben auch einen unmittelbaren Einfluss auf die mentale Gesundheit des Menschen.

Der Schutz der Gesundheit des Menschen ist im deutschen Recht unter anderem in Artikel 2 GG, §2 Abs. 1 UVPG und schließlich auch im §1 Abs. 6 Nr. 7 BauGB, verankert. So ist es die Pflicht der räumlichen Planung den Menschen vor Emissionen und umweltbezogenen Auswirkungen auf seine Gesundheit zu schützen und für gesunde Wohn- und Arbeitsverhältnisse zu sorgen. Genau wie die physische Gesundheit, gilt es auch die mentale bzw. psychische Gesundheit zu schützen. Hierzu gehören auch Freizeit und Erholung, die maßgeblich für das Wohlbefinden und die mentale Gesundheit verantwortlich und damit ebenfalls Planungsgegenstand sind.

Grund für diese Verknüpfung des Raumes mit den Emotionen des Menschen ist die Tatsache, dass das räumliche Umfeld, z. B. sein Wohnort, seine Arbeitsstätte und die Orte, an denen er seine Freizeit verbringt, eine maßgebliche Wirkung auf seine emotionale Lage hat und damit auch auf seine Gesundheit. Das Problem dabei ist allerdings, dass das menschliche Wohlbefinden bisher nur sehr aufwendig zu beurteilen und damit auch schlecht quantifizierbar ist. Einen möglichen Ansatz dieses Problem zu lösen bietet das EmoMapping, eine Methode, mit der sowohl subjektive als auch objektive emotionale Einflüsse des Raumes auf den Menschen aufgenommen und verortet werden.

2.2 Entwicklungen im Bereich der Raumsensorik

Raumsensorik oder auch Spatial Sensing ist die Messung und Beobachtung von raumrelevanten Geschehnissen mit Hilfe von im Raum vorhandenen oder tragbaren Sensoren. Er baut auf dem Begriff Urban

Sensing auf, der 2008 von Cuff, Hansen und Kang in ihrem Artikel „Urban Sensing: Out of the Woods“ (vgl. Cuff, Han¬sen, Kang 2008) definiert wurde. Diese Art von Monitoring System wurde im deutschsprachigen Raum erstmals 2012 in dem Paper „Humansensorik in der räumlichen Planung“ (Exner et al. 2012) als Raumsensorik bezeichnet.

Diese Technologie ermöglicht es, neue Erkenntnisse und Perspektiven für die Raumplanung – oder im Speziellen auch für die Stadtplanung – zu gewinnen und einen neuen Zugang zu Informationen zu eröffnen. Diese können dabei helfen Ressourcen besser zu nutzen und damit die urbane Gestalt oder Infrastruktur zu verbessern. Solche Informationen bieten eine Basis für intelligente Analyse- und Monitoringmethoden, die wiederum unabdingbar für Smart Cities und Smart Rural Areas sind (vgl. Exner 2013:66).

2.2.1 Vernetzung von Raumsensorik

Die Kommunikation und Verknüpfung von diesen Sensordaten erfolgt über Netzwerke. Solche „Geosensornetzwerke sind eine Form von Sensorinfrastrukturen, die aus einer Vielzahl an Sensoren bestehen, die sich selbst organisieren, drahtlos miteinander kommunizieren, Messungen durchführen, auswerten können und damit Beobachtungen verschiedenster Gebiete und Phänomene ermöglichen“ (Exner 2013:37 nach Bill 2010). Die Sensoren können in einem internen Netz miteinander verbunden, aber auch direkt an das Internet angeschlossen sein. Laut Ratti gibt es drei Quellen von sensorischen Daten, die für die Raumsensorik relevant sind (Exner 2013:40 nach Ratti 2012:5):

- „Erfassen von Daten von bereits installierter Infrastruktur, welche in der Regel zwar zu einem ande¬ren Zweck errichtet worden sind, sich aber im Sinne von Monitoring nutzen lassen
- Daten von eigens errichteten Sensornetzwerken, welche speziell für den Monitoring-Zweck errichtet worden sind
- Daten der Bürger, die als Sensoren für die Stadt agieren“

Das Internet ist schon lange keine reine Informationsplattform mehr, sondern dient nunmehr der Kommunikation und als Plattform für soziale Aktivitäten. Damit stellt es „(…) das Fundament für infrastrukturelle Grundlagen für Bottom-Up, Crowdsourcing und User-Generated-Content (UGC) dar“ (Exner 2013:46). Die aktuelle Evolutionsstufe des Internets ist laut Streich das Geoweb oder auch Web 3.0 (Streich 2011:24). Diese Entwicklung wird das Methodenrepertoire der Stadtplanung verändern, welches nach Streich in Richtung einer „smart urban crowdsourcing mit Geoweb Methoden geht“ (Streich 2011:237).

Einen universellen und mobilen Sensor tragen gegenwärtig die meisten Menschen jeden Tag mit sich. Das Smartphone ist die ideale Basis für Sensoren und dient dabei auch selbst als Sensor. Funktionen wie GPS, WLAN, mobiles Internet und Bluetooth prädestinieren dieses Gerät als Schnittstelle für andere Sensoren. Gleichzeitig verfügt das Smartphone über Beschleunigungssensoren, Mikrofone, Kameras und oft auch einen zusätzlichen Lichtsensor und kann so auch ohne Zusatzgeräte Sensordaten erzeugen, speichern, verarbeiten und versenden. Durch das allgegenwärtige Vorhandensein von Smartphones in der Gesellschaft wird die Idee des Ubiquitous Computing Wirklichkeit.

2.2.2 Wisdom of the Crowd

Streich schreibt, dass wir in einer „Wissensgesellschaft“ leben, in der sich das Wissen mit Hilfe von technischen Systemen und Netzwerken auf die sozialen Akteure verteilt, die miteinander in Beziehung stehen. Jeder Akteur trägt in dieser Gesellschaft seinen persönlichen Beitrag zum Wissen bei, indem er selbst Informationen zur Verfügung stellt und die Informationen anderer evaluiert (vgl. Streich 2011:52). Dieser Prozess wird auch Crowdsourcing genannt. Dieser Begriff wurde 2006 erstmalig in dem Artikel „The Rise of the Crowdsourcing“ im Wired – Magazin erwähnt.

Der Prozess, der hinter dem Begriff Crowdmining steht, stellt einen Gegensatz zu Crowdsourcing dar. Er wurde 2008 auf der Webplattform Trendwatching.com definiert und kommt aus dem Bereich des Crowd-Based Business. Dieser Begriff leitet sich aus dem Data-Mining ab, einem Prozess, bei dem verschiedene Informationen mit oder ohne Kenntnisnahme der Nutzer aus vorhandenen Daten im Internet extrahiert werden, um daraus wertvolle Profildaten zu generieren (Streich 2013:106).

Crowdsourcing als induktiver Prozess und Crowdmining als deduktiver Prozess, erheben die Daten über die „Crowd“, also die Bevölkerung und bilden die Basis zur Aufgliederung verschiedener Ansätze der Datengewinnung wie bei der Raumsensorik. So können sensorische Daten mit geographischer Position sowohl über induktive, also von der Bevölkerung ausgehenden Prozesse gewonnen werden, als auch im Gegensatz dazu durch deduktive Prozesse, durch einen außenstehenden Interessenten der Informationen initialisiert.

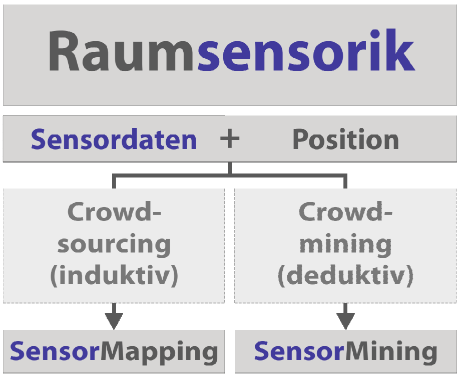

Abb. 1: Raumsensorik Systematik (eigene Darstellung)

2.3 Humansensorik in der Raumplanung

Die ökonomischen, ökologischen und sozialen Belange des Menschen stehen im Mittelpunkt der Raumplanung. Diese Belange spiegeln sich deshalb auch in der, einer Planung vorangehenden, Bestandsaufnahme und Analyse wider. An dieser Stelle können die Entwicklungen im Bereich der Raumsensorik helfen, den Lebensraum des Menschen effizient und gründlich zu untersuchen. Denn obwohl der Mensch mit seinen subjektiven Eindrücken bei dieser Analyse im Fokus steht, wird er oft nicht hinreichend in die Untersuchung miteinbezogen. Dabei kann der Mensch nicht nur Träger von Sensoren sein, sondern auch selbst als subjektiver Sensor dienen. Diesen Ansatz hat Goodchild 2007 erkannt und in seinem Artikel „Citizens as Sensors“ beschrieben (Goodchild 2007). In Abgrenzung zur Raumsensorik nennt man diesen Ansatz mit anthropozentrischem Charakter auch Humansensorik.

Seit einigen Jahren entwickelt sich im Bereich der Humansensorik ein Forschungsfeld, das für die Raumplanung von besonderer Bedeutung ist: Das EmoMapping. Die Idee dabei ist, emotionale Einflüsse oder „Stimulierungen“ zu erfassen und geographisch zu verorten, um eine sogenannte „emotionale Stadtkartierung“ durchzuführen (vgl. Zeile 2010:217). Dabei geht es nicht nur darum, dass Sensoren Informationen über den Menschen sammeln, „sondern auch Menschen subjektive Messung wie Sinneseindrücke, Empfindungen oder persönliche Beobachtungen beitragen. So können Menschen als Sensoren mit kontextueller Intelligenz und umfassendem lokalem Wissen fungieren“ (Resch et al. 2011:1). In dem Bereich EmoMapping werden in diesem Paper folgende drei Methoden unterschieden:

2.3.1 EmoTagging

Das Aufnehmen und Verorten von subjektiven Informationen über den emotionalen Zustand einer Person, in dem sie sich selbst reflektiert und diese Information selbst veröffentlicht, wird als EmoTagging bezeichnet. Diese Methode kann angewendet werden, indem die Person ihre positiven oder negativen Eindrücke retrospektiv z. B. über eine Webplattform verortet oder neuerdings auch unmittelbar vor Ort mithilfe des Smartphones übermittelt. Letzteres hat enorme Vorteile gegenüber einer retrospektiven Verortung, weil die Eingabe direkt mit einem Ort- und Zeitstempel versehen und in Echtzeit mit dem Internet synchronisiert werden kann.

2.3.2 PsyPhyMapping

Ein weiterer Ansatz zum Verorten von Emotionen im Raum ist das psychophysiologische Monitoring bzw. Mapping (PsyPhyMapping). „Die Psychophysiologie untersucht Zusammenhänge zwischen bestimmten physiologischen Abläufen im Körper und emotionalen bzw. kognitiven Prozessen“ (Kirsten-Stammen 2008). Die Methode baut auf der Erkenntnis auf, dass z. B. durch Wahrnehmung bedingte emotionale Reaktionen physiologische Veränderungen im Körper hervorrufen können, die man sensorisch erfassen und zuordnen kann. In dieser Arbeit wird zwischen zwei verschieden Ansätzen der psychophysiologischen Analyse unterschieden.

Eine Theorie der psychophysiologischen Analyse beschreibt das Messen und Interpretieren von elektrodermalen Körperreaktionen. Mit dieser Methode hat Christian Nold in seinem Projekt „Bio Mapping“

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schon erste Erfahrungen in dem Bereich EmoMapping gemacht (vgl. Nold 2009). Das vom ihm benutzte „Bio Mapping Tool“ soll in Verbindung mit einem GPS-Logger den „emotional arousal“, also die emotionale Erregung feststellen und verorten können, um damit „Emotion Maps“ zu erstellen. Einen Schritt weiter ist Dr. Georgios Papastefanou mit seinem tragbaren Sensor namens „BMS Smartband“ gegangen. Im Gegensatz zur von Nold verwendeten Analysetechnik, bei der nur die Hautleitfähigkeit gemessen wird, wird bei der Methode von Papastefanou sowohl Hautleitfähigkeit als auch Hauttemperatur gemessen, um nicht nur eine neutrale Erregung festzustellen, sondern negative Empfindungen, z. B. Stress interpretieren zu können. Dabei werden mit Hilfe von Mustererkennung die Steigungen der Parameter Hautleitfähigkeit und Hauttemperatur miteinander verglichen (vgl. Bergner 2010).

Die andere Theorie besagt, dass psychische Belastungen auch aufgrund der kardiovaskulären Reaktivität, also Veränderungen des Herz-Kreislauf-Systems, identifiziert werden können (vgl. Turner 1994). Von entscheidender Bedeutung dabei ist die Herzratenvariabilität (HRV) Sie „beschreibt die mehr oder weniger rhythmischen Schwankungen der Herzrate“ und ist eine Art „Globalindikator für psycho-neuro-kardiale Prozesse“ (Mück-Weymann 2002). Für die Emotionserkennung als solche ist allerdings nur ein bestimmter Teil der HRV relevant, die additional heart rate, bzw. der durch emotionale oder mentale Beanspruchung verursachte Anteil der aktuellen Herzfrequenz (Myrtek, Foerster, Brügner 2001). Aus diesem Grund wird auch der Begriff „Emotionale Herzfrequenz“ synonym verwendet, da die Erhöhung der Herzfrequenz in diesem Fall „nicht durch zusätzlichen metabolischen Umsatz von neu aufgetretener Bewegung ausgelöst wurde, sondern durch einen zentralen, in der Regel emotionalen Auslöser und dadurch begründeten erhöhten Sympathikotonus zustande kam. Die emotionalen Auslöser können dabei positive oder negative Emotionen beinhalten“ (Rohbeck 2007:27). Aktuelle Entwicklungen im Bereich PsyPhyMapping werden im Projekt SensorMapRT erforscht (Exner et al. 2015).

2.3.3 EmoMining

Die dritte und letzte Methode zur Erfassung von Emotionen mit räumlichem Kontext ist das EmoMining. Bei dieser Technik geht es darum Emotionen aus schon vorhanden Daten zu extrahieren, wie es bei DataMining passiert. Mit dem Unterschied, dass es sich ausschließlich um Informationen handelt, die Rückschlüsse auf die emotionale Lage der Person liefern. Solche Daten können vorwiegend aus sozialen Medien, wie z. B. Twitter oder Facebook bezogen werden. Extrahiert werden diese Informationen über sogenannte Schnittstellen oder APIs mit Hilfe von „Machine Learning“ Methoden und Computerlinguistik (vgl. Roberts et al. 2012). Diese Technik spielt für die Raumplanung eine besondere Rolle, wenn zusätzlich zu den Informationen die geographischen Positionen mit extrahiert werden.

2.3.4 Urban Emotions Projekt

Diese drei Methoden des EmoMappings, also EmoTagging, PsyPhyMapping und EmoMining können nicht nur individuell angewendet sondern auch beliebig kombiniert werden. Dieser Ansatz wird im dem von der Deutschen Forschungsgesellschaft geförderten Projekt „Urban Emotions“ (vgl. Zeile et al. 2014, Resch et al. 2015) für dieses Paper und die zugrundeliegende Bachelorarbeit mit dem gleichen Titel entstanden ist (Wilhelm 2014). In diesem Projekt sollen Informationen aus allen drei Methoden miteinander verknüpft werden, um sich gegenseitig zu validieren. Dazu werden Technologien wie das Geoweb und Smartphone - Apps zu Hilfe genommen, die speziell für diesen Zweck entwickelt werden.

2.4 Datenschutz vs. Datenbewusstsein

Datenschutz bedeutet, dass Personen vor dem Missbrauch ihrer personenbezogenen Daten geschützt werden. Solchen Daten sind z. B. Namen, Geburtsdaten, Kontodaten, Adressen, Berufe und Arbeitsstätten sowie Informationen zur Religion oder Parteizugehörigkeit. In der heutigen Informationsgesellschaft bzw. „Wissensgesellschaft“ (Streich. 2011) hat das Thema Datenschutz an Bedeutung gewonnen. Wir sind in der Lage zu jeder Zeit und an jedem Ort Informationen aus dem Internet abzurufen und Informationen zu veröffentlichen. Ebenfalls ist es somit auch möglich, dass jederzeit Daten ohne unsere Kenntnis oder sogar ohne unser Einverständnis gesammelt werden.

Die stetig wachsenden Mengen dieser Daten sorgen dafür, dass bei den persönlichen Informationen, die bereitgestellt werden, der Überblick verloren geht und viele Menschen diese Prozesse nicht weiter kontrolliert. Gleichzeitig haben diese Daten nur einen immateriellen Wert, weshalb es schwierig ist, diese zu schützen. Grund dafür ist, dass in der heutigen Gesellschaft noch kein ausreichendes Bewusstsein für den

Schutz personenbezogener Daten vorhanden ist, vor allem im privaten Bereich. Wenn allerdings Daten von öffentlicher Hand oder für nicht private Zwecke gesammelt werden müssen, verpflichten sich die Sammler gesetzlich zum Datenschutz, wie im BDSG (Bundesdatenschutzgesetz) geregelt.

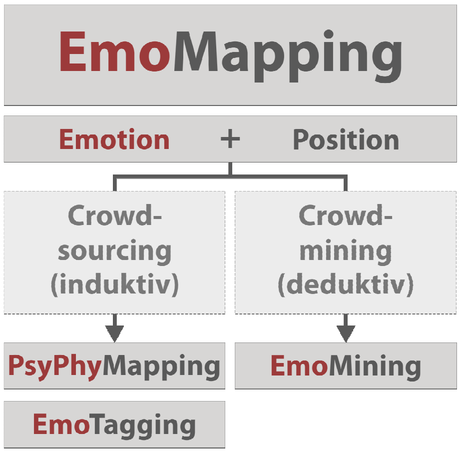

Abb. 2: EmoMapping Systematik (eigene Darstellung)

Diese Problematik spiegelt sich auch in der Raum- und Stadtplanung wider. Auch in diesem Bereich werden zunehmend Daten gesammelt und archiviert. Solche Daten können klassisch z. B. durch empirische Erhebungen gesammelt oder auch durch mobile Sensoren und Smartphones erhoben werden. So kann auch die Verknüpfung zur Raumsensorik geschlossen werden, bei der das Sammeln von Daten eine wichtige Rolle spielt. Auch hier ist es wichtig, die Daten sicher und anonym zu erheben und zu speichern, um das Verknüpfen von Daten und Personen zu vermeiden, wie es in der „De-Facto-Personalisierung" beschrieben ist (vgl. Exner 2013:239). Unter datenschutzrechtlichen Gesichtspunkten sind Crowdmining Prozesse als besonders kritisch zu betrachten, weil dort unter Umständen Daten ohne die Kenntnis oder sogar ohne das Einverständnis der Bürger gesammelt werden.

Die Angst vor dem Überwachungsstaat ist schon seit dem Roman „Nineteen Eighty-Four" (Orwell 1949) tief in einigen Teilen der Bevölkerung verankert und wurde 2013 durch die globale Überwachungs- und Spionageaffäre weiter verstärkt. Somit wächst die Bevölkerungsgruppe sehr stark, die Datenschutz und Anonymisierung sehr ernst nimmt und ein sehr geringes Vertrauen in datenorientierte Prozesse hat. Zum anderen gibt es eine noch größere Bevölkerungsgruppe, die keinen Überblick über die Nutzung ihrer Daten hat und sich nicht ausreichend mit dem Thema auseinandersetzt. Aus dem Grund ist es wichtig als Datensammler das Thema Datenschutz sehr ernst zu nehmen, die Bevölkerung über den transparenten Gebrauch ihrer Daten zu informieren und somit Vertrauen und ein Bewusstsein für die persönlichen Daten zu schaffen.

3 EMOMAPPING – EINSATZ IN DER RAUMPLANUNG

3.1 Einsatzgebiete

3.1.1 EmoBility

Das Thema Mobilität und Verkehr hat einen hohen Stellenwert im Alltag und kaum ein anderes Thema ist so emotionsgeladen wie dieses. Oft definiert der Transport von A nach B einen erheblichen Teil des täglichen Lebens. Der Mensch ist im Verkehr teilweise erheblichen psychischen Belastungen ausgesetzt, meistens in Form von Stress. Gerade der motorisierte Individualverkehr (MIV) kann durch sein hohes Gefahren- und Konfliktpotential enorm belastend sein. Verkehrsteilnehmer sind auch wegen der Sorgfaltspflicht auf den Verkehr konzentriert und werden deshalb weniger durch äußere Einflussfaktoren abgelenkt. Aus diesen Gründen ist Mobilität ein passendes Einsatzgebiet für EmoMapping – im Folgenden auch EmoBility (Emotional Mobility) genannt.

Genauer betrachtet gib es weitere Anhaltspunkte die Analysen im Bereich der Mobilität rechtfertigen. Mit 55 % Anteil an Wegen, die zurückgelegt werden, ist das Auto das am meisten genutzte Verkehrsmittel in Deutschland. (Destatis 2013). Autofahrer sind vom Wetter weniger abhängig als die meisten anderen Verkehrsteilnehmer, wie z. B. Fußgänger oder Radfahrer und werden weniger – bis gar nicht von anderen

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Personen im Verkehr abgelenkt. Die Messungen können bequem in den Alltag integriert werden, z. B. auf dem Weg zur Arbeit oder zum Einkaufen. Des Weiteren können die psychischen Belastungen von Verkehrsteilnehmern in der Stadt und in peripheren Gebieten verglichen und Pendlerverhalten analysiert werden. Der Hauptgrund für eine Analyse des Straßenverkehrs liegt allerdings bei der Identifikation von Gefahrenstellen, die bisher mit klassischen Methoden nicht entdeckt oder anders wahrgenommen wurden. Denn die Verbesserung der Sicherheit im Straßenverkehr ist das oberste Anliegen der Verkehrsplanung; immerhin sind 2011 in Deutschland 2,4 Millionen Verkehrsunfälle registriert worden, mit über 4000 tödlich Verunglückten (Destatis 2013).

Allerdings wird der übermäßige Einsatz des MIV aus ökologischen und gesundheitlichen Gesichtspunkten gegenwärtig stark kritisiert. Viele Kurzstrecken könnten ebenso schnell, kostengünstig, ökologisch und gesundheitsfördernd auch mit dem Fahrrad überwunden werden. Allerdings ist der Radverkehr in vielen Städten in Deutschland dem MIV untergeordnet, was dazu führt, dass oft nicht genügend oder schlecht konzipierte Radverkehrsinfrastrukturen vorhanden sind. Aus diesem Grund ist Fahrradfahren im Verkehr einer Stadt oft mit enormen emotionalen Belastungen und vor allem auch Angst und Stress verbunden. An dieser Stelle könnte EmoMapping helfen unsichere und belastende Punkte in der Radverkehrsinfrastruktur ausfindig zu machen und zu verbessern. Für das emotionale Monitoring während des Radfahrens oder Fahrens eines PKW eignet sich vorwiegend die Methode PsyPhyMapping, da während dessen kaum Interaktion mit sozialen Medien oder dem Smartphone möglich ist.

Prinzipiell ist auch die Analyse von Fußwegen mittels EmoMapping möglich, immerhin liegt der Anteil der zu Fuß zurückgelegten Strecken bei etwa 24 % (Destatis 2013). Allerdings gibt es Faktoren, die die Validität der Messungen stark beeinflussen, z. B. äußere Einflüsse, die gerade zu Fuß am stärksten zum Tragen kommen. Zwar ist es möglich vereinzelt Aussagen über Fußgängeranlagen wie Brücken, Querungen, Unterführungen, oder Kollisionspunkten mit anderen Verkehrsteilnehmern zu treffen, doch lassen sich zu Fuß andere Quellen emotionaler Beeinflussung besser bewerten, wie im folgenden Kapitel beschrieben.

3.1.2 EmoEnvironment

Es liegt in der Natur des Menschen seine Umgebung zu Fuß zu erkunden und das ist auch die natürlichste Fortbewegungsart. Während des Laufens kann, je nach Geschwindigkeit die umgebende Umwelt besonders gut wahrgenommen werden, ergo hat diese dabei auch einen besonders hohen Einfluss auf den Menschen. Genau um diese Analyse geht es im folgenden Einsatzgebiet – dem EmoEnvironment (Emotional Environment).

Mit dem Trend der Reurbanisierung wächst der Anteil an der städtischen Bevölkerung seit einigen Jahren wieder. Also werden in Zukunft immer mehr Menschen in einer städtischen Umgebung leben und arbeiten. Die Lebensqualität in Städten ist allerdings stetiger Kritik ausgesetzt. Gründe dafür sind Engegefühle, Verkehrslärm und -abgase, Hektik und wenig Grün- und Freiflächen. Diese Faktoren sind je nach Stadt zwar unterschiedlich ausgeprägt, doch das Thema der Lebensqualität innerhalb der Stadt ist für die Stadtplanung essentiell. An dieser Stelle setzt EmoMapping an. Diese Methode kann dabei helfen städtische Bereiche zu identifizieren, die einen besonders positiven oder negativen Einfluss auf die Bevölkerung haben. Diese Bereiche können besondere Plätze mit Aufenthaltsqualität, optisch ansprechenden Gebäuden oder architektonisch wertvollen Dominanten sein. Aber auch Angsträume, dunkle oder enge Gassen, Areale mit einem schlechten Ansehen oder einfach schlecht zugängliche Bereiche und Barrieren sind Teil der Betrachtung.

Als Ausgleich für das städtische Leben sollen öffentliche Grünflächen als Spiel-, Sport-, und Erholungsbereiche dienen. Solche Flächen sind z. B. Parks, Gärten oder außerhalb liegende Wald- und Freiflächen. Die erhoffte Erholungswirkung tritt allerdings nicht immer ein. Manchmal können Lärm, mangelnde Verschattung, Windtunnelwirkung, Lichtreflektionen oder die Umgebungsbebauung störende Einflüsse haben. Oft sind solche Faktoren im Vorfeld aber schwer einzuschätzen, vor allem die psychische Wirkung auf den Menschen. Z. B. können unterschiedliche Geräuschquellen als unterschiedlich störend empfunden werden, wie Straßenlärm und Geräusche spielender Kinder. Auch der Einfluss von konstanten und unregelmäßigen Geräuschen kann unterschiedlich störend wahrgenommen werden. Da die Erholungswirkung nur subjektiv beurteilt werden kann, eignet sich EmoMapping zum Identifizieren von Mängeln in Grünanlagen und der Erforschung von Verbesserungspotentialen.

3.1.3 EmoShopping

Das Leben in einer Stadt besteht nicht nur aus Mobilität, Wohnen, Arbeiten und Erholung. Auch soziale Aktivitäten, Tourismus und Handel spielen eine wichtige Rolle, vor allem im innerstädtischen Bereich, z. B. in den Fußgängerzonen. Gerade dort spielt der Einzelhandel eine wichtige Rolle für die Attraktivität und Wirtschaft einer Stadt. Zwar profitieren Tourismus, Einzelhandel und soziale Aktivitäten von einander, andererseits können sie sich auch gegenseitig stören. Genau wie das generelle Verhalten des Menschen, hängt auch das Kaufverhalten von seiner emotionalen Lage bzw. von seinem Gemütszustand ab. An dieser Stelle können durch EmoMapping, Faktoren gefunden werden, die negativen oder positiven Einfluss auf das Kaufverhalten haben und diese dann weiter erforscht werden. Mit Hilfe von modernen Methoden der Ortung im Innenbereich könnte diese Methode in Zukunft auch in Einkaufszentren und Galerien angewendet werden.

3.2 Umsetzung

3.2.1 Ablauf

Der grundlegende Ablauf eines EmoMappings ist immer gleich. Die Unterschiede ergeben sich vor allem aufgrund der Art (EmoTagging, PsyPhyMapping, EmoMining) und teilweise auch des Einsatzgebietes. Bei der Konzeptionierung einer Studie sind folgende Fragen einer empirischen Erhebung sinnvolle Anhaltspunkte: Wie ist die Fragestellung der Untersuchung? Oder wie gestaltet sich die Stichprobe? Des Weiteren gehört die Vorbereitung der Datenerhebung ebenfalls zum Konzept und sollte vorher gründlich geplant werden, denn verschiedene Arten von Datenerhebungen können auch unterschiedliche Ergebnisse liefern. Sollten die gewählten EmoMapping-Methoden noch nicht automatisiert ablaufen, sollte auch vorher auf Datenformate, Software und Kompatibilitäten in die Planung einbezogen werden. Der allgemeine Ablauf eines EmoMappings ist aber grundsätzlich identisch und wird in der folgenden Grafik veranschaulicht. Sobald das Konzept der Studie steht und der Versuchsaufbau geplant ist, kann mit der Datenerhebung begonnen werden. Hier kann, wie im Bereich der Raumsensorik und der EmoMapping-Arten auch in zwei wesentliche Prozesstypen unterschieden werden, eine induktive und eine deduktive Herangehensweise.

3.2.2 Datenerhebung

Besteht das Interesse einer Gemeinde oder Planungsinstitution, emotionsbasierte Daten zu nutzen ist es sinnvoll das öffentliche Interesse mit Hilfe einer Veranstaltung zu diesem Thema zu wecken. Dadurch können Bürger auch dazu bewegt werden selbstständig an EmoMapping-Prozessen zu partizipieren. Essentiell für diese Art von Event ist angemessene Medien- und Öffentlichkeitsarbeit im Vorfeld. Zu diesem Zweck sollte mit der Gemeinde- oder Stadtverwaltung und Presse kooperiert werden. Des Weiteren sollte ein geeigneter Standort an einem zentralen Ort in der Nähe des Untersuchungsraums gewählt und bekannt gegeben werden. Der Ablauf einer solchen Veranstaltung könnte sich so gestalten: Grundsätzlich bedarf es eines Moderators, der die Leitung des Events übernimmt und dieses anmoderiert. Dann werden freiwillige aus dem Publikum mobilisiert an einer Live-Erhebung teilzunehmen und dann mit der passenden Ausrüstung ausgestattet. Dafür sollten ausreichend Geräte und Hilfskräfte zur Verfügung stehen. Daraufhin kann die die Erhebung durchgeführt und die Ergebnisse direkt im Anschluss oder währenddessen in Echtzeit übertragen und mit den restlichen Beteiligten besprochen werden.

Alternativ dazu könnte die Gemeinde oder Planungsinstitution vorab eine Agentur beauftragen, ihre Bürger mit EmoMining verfahren zu analysieren. Dabei werden verschiedene soziale Medien sowie schon vorhandene EmoTagging-Plattformen auf emotionale Informationen mit Geobezug zu dem gewählten Bereich durchsucht, und diese Daten extrahiert. Aus mangelnder Validität und Transparenz sollten sie allerdings nicht ohne passende Prüfungen, z. B. durch andere EmoMapping-Verfahren, veröffentlicht werden.

Die induktiven Datenerhebungen zielen darauf ab das Interesse der Bürger für EmoMapping soweit geweckt zu haben, dass sie selbstständig Daten erheben und zur Verfügung stellen. Basis für diese Art Crowdsensing-Prozess ist die Quantified-Self-Bewegung, die aus Eigeninteresse Daten über sich sammelt und veröffentlicht. Für diesen Fall muss allerdings die entsprechende Infrastruktur bestehen, damit auch die passenden Daten gesammelt und möglichst an einem Knotenpunkt aggregiert werden. Diese Infrastruktur wird zwar durch die Industrie vorangetrieben, kann allerdings auch lokal durch eine Gemeinde oder Planungsinstitution realisiert werden. Dazu könnten diese, bei der Etablierung eines bestimmten Gerätes oder zumindest einer Smartphone-App helfen oder sogar selbst eine entwickeln. Optimal wäre ein Gerät, das mit Hilfe von Bluetooth und einer offenen Schnittstelle über eine Smartphone-App angesteuert und ausgelesen werden kann. Damit könnte man EmoTagging Verfahren mit PsyPhyMapping kombinieren und dabei den GPS-Empfänger und andere Sensoren des Smartphones mitbenutzen. Wie eine solche App aussehen könnte, zeigt folgende Darstellung. Solche Ansätze werden bereits in den Projekten Urban Emotions und Sensormap verfolgt (QUELLEN).

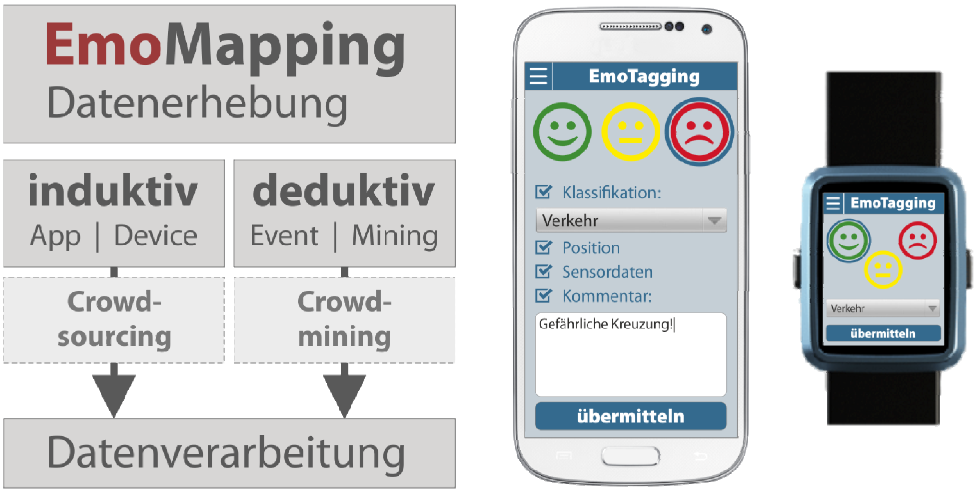

Abb. 5: EmoMapping Datenerhebung, EmoMapping App Entwurf (eigene Darstellung)

3.2.3 Datenverarbeitung

Sind die Daten für ein EmoMapping erhoben, fehlen allerdings noch einige Schritte bis tatsächliche Ergebnisse vorliegen. Die Verarbeitung der Daten beginnt bei der Aggregierung dieser und endet bei auswertbaren Informationen wie z. B. Visualisierungen. Die Schwierigkeit dabei liegt in der Kombinierung von Daten verschiedener Typen und aus unterschiedlichen Quellen. An dieser Stelle werden aktuell noch sehr viele manuelle Arbeitsschritte benötigt, wobei Skripte zur Konvertierung hier Abhilfe schaffen könnten. Sind die Daten dann vereinheitlicht, kann mit dem Aggregieren und Filtern begonnen werden. Bei kleineren Datenmengen kann hier eine GIS-Software benutzt werden, bei größeren Datenmengen wird eine komplexere Infrastruktur auf Basis von Datenbanken benötigt. Bevor diese Daten sinnvoll visualisiert werden können, müssen geostatische Analysen durchgeführt werden um z. B. Dichten für Heatmaps zu berechnen. Solche Verfahren erfolgen oft automatisch und sind mit den gewünschten Visualisierungsmethoden verknüpft. Die Einstellungen in diesem Bereich beeinflussen die Darstellung und Aussagekraft der Visualisierung allerdings erheblich. Geeignete Visualisierungsmethoden größerer Datenmengen sind vor allem Kartogramme oder Heatmaps, wie in folgender Abbildung dargestellt.

Um valide Erkenntnisse aus EmoMapping-Methoden ziehen zu können, bedarf es repräsentativer Erhebungen mit ausreichender Stichprobenzahl. Die aktuellen Methoden der Verarbeitung eignen sich allerdings nicht um große Datenmengen effizient auswerten zu können. Um dieses Ziel zu erreichen, ist es notwendig einige Prozesse zu automatisieren und eine geeignete Infrastruktur für diese Art der Daten aufzubauen. Ein Lösungsansatz um dieses Ziel zu erreichen ist eine Onlineplattform mit passenden WebGIS Funktionalitäten, mit der es möglich wäre verschiedene emotionsbasierte Daten zu importieren, die gewünschten Einstellungen und Filterungen vorzunehmen und dann direkt die passende Visualisierungen angeboten zu bekommen. In der folgenden Abbildung ist ein Entwurf einer solchen Plattform auf Basis eines schon vorhandenen WebGIS zu sehen.

3.2.4 Überprüfung der Daten

Sobald die erhobenen Daten anschaulich visualisiert wurden, können erste Erkenntnisse über räumliche Phänomene daraus abgeleitet werden. Da die EmoMapping-Methoden noch in einem experimentellen Stadium sind, vor allem das PsyPhyMapping und die Ergebnisse nicht unbedingt valide sind, müssen die Daten mit Hilfe anderer Daten überprüft und validiert werden. Dabei können sich emotionsbasierte Daten aus unterschiedlichen Erhebungen und Ansätzen im ersten Schritt gegenseitig validieren. In einem weiteren Schritt können Daten aus anderen Quellen, wie Umweltdaten, Statistiken und empirischen Erhebungen in die Überprüfung miteinbezogen werden. Unter Umweltdaten fallen z. B. Informationen wie Lärm, Luftschadstoffe und Klima, welche einen erheblichen Einfluss auf die emotionale Situation eines Menschen haben können. Unter den Statistiken sind vor allem Verkehrs- und Kriminalstatistiken relevant. Die stetige Überprüfung der Daten kann auch Hinweise auf Fehler im Konzept der Studie oder in der Erhebung aufdecken. So kann ein aus dem regelmäßigen Überprüfen der Daten ein Korrekturkreislauf entstehen, mit dem das EmoMapping-Verfahren stetig verbessert werden kann.

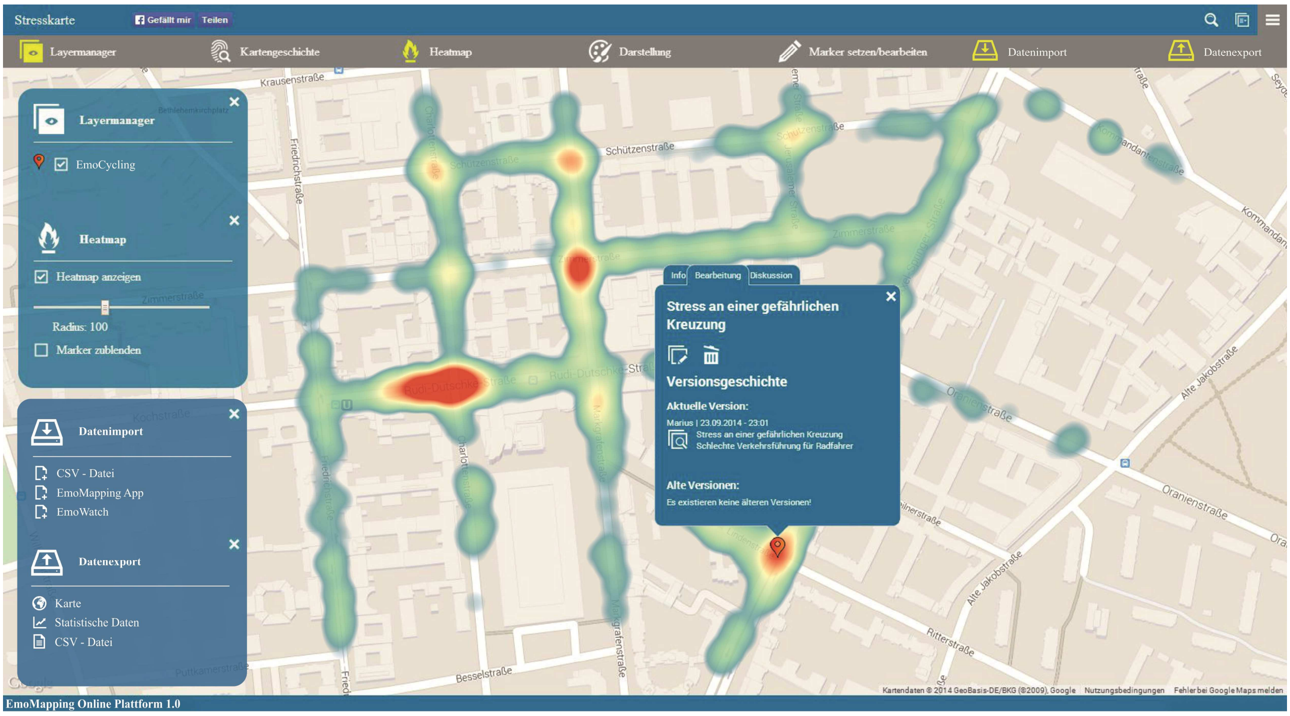

Abb. 5: EmoMapping Onlineplattform Entwurf (eigene Darstellung auf Basis von opencrowdmaps.de)

4 FAZIT UND AUSBLICK

Wie schon erwähnt befindet sich die Methode EmoMapping noch im Anfangsstadium, vor allem die Anwendung in der Raumplanung ist noch experimentell. Es besteht noch erheblicher Forschungsbedarf, bis sich diese Methode im Repertoire eines Planers wiederfinden kann. Allerdings sind die Potentiale schon erkennbar. Ein Schlüsselelement dieser Potentiale ist die Möglichkeit emotionale Einflüsse im Raum zu quantifizieren, was eine sehr viel effizientere Erhebung und Verarbeitung solcher Informationen ermöglicht als bisherige Methoden, wie Befragungen. Des Weiteren können durch EmoMapping und insbesondere PsyPhyMapping, emotionale Einflüsse nicht nur quantifiziert sondern auch objektiviert werden. Das erzeugt eine andere Sichtweise auf die Reaktionen der Menschen auf ihre Umgebung als die subjektive, meist rekursive Variante. Dieser Umstand eröffnet neue Möglichkeiten räumliche Phänomene zu identifizieren, die bisher im Wirkungsgefüge einer Stadt noch nicht gänzlich erforscht sind. Ein weiterer Aspekt ist die Identifizierung von Gefahren- und Störquellen, die vorher nicht bekannt waren oder anders wahrgenommen wurden.

Um EmoMapping in Zukunft praktikabel anwenden und valide Erkenntnisse erzeugen zu können muss die gesamte Methode und vor allem die dahinter stehenden Technologien weiter evaluiert und verbessert werden. Aus diesem Grund müssen Forschungsprojekte neben den Grundlagen auch die Anwendung dieser Methode untersuchen. Diese Erkenntnisse können nämlich darüber hinaus auch helfen die Sensoren zu testen und im besten Fall zu verbessern. Weiterer Forschungsbedarf besteht auch bei dem Identifizieren und Testen, nicht nur der erwähnten, sondern auch weiterer Einsatzgebiete und Anwendungsmöglichkeiten für EmoMapping.

Zusammenfassend lässt sich sagen, dass der Einsatz von EmoMapping in der räumlichen Planung viele Potentiale bietet, die sich zum aktuellen Stand der Forschung allerdings nicht alle nutzen lassen. Der Forschungsbedarf richtet sich nicht nur an die Erforschung und Evaluierung der EmoMapping-Prozesse selbst sondern auch an die Entwickler der Sensoren, Software, Plattformen und Apps. Hier ist es empfehlenswert, dass mehr Kooperation zwischen den Beteiligten stattfindet um passende Lösungen für den Bedarf auf diesem Bereich zu decken.

5 DANKSAGUNG

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reviewed paper

Enhancing Stakeholder Participation in Urban Mobility Planning: the NISTO Evaluation Framework

Imre Keseru, Jeroen Bulckaen, Cathy Macharis

(dr. Imre Keseru, Vrije Universiteit Brussel, MOBI Mobility, Logistics and Automotive Technology Research Centre, Pleinlaan 2, 1050 Brussels, Belgium, imre.keseru@vub.ac.be)

(Jeroen Bulckaen, Vrije Universiteit Brussel, MOBI Mobility, Logistics and Automotive Technology Research Centre, Pleinlaan 2, 1050 Brussels, Belgium, jeroen.bulckaen@vub.ac.be)

(Prof. dr. Cathy Macharis, Vrije Universiteit Brussel, MOBI Mobility, Logistics and Automotive Technology Research Centre, Pleinlaan 2, 1050 Brussels, Belgium, cathy.macharis@vub.ac.be)

1 ABSTRACT

Public participation and stakeholder involvement have become core prerequisites of a comprehensive and fair transport planning process. In this paper, we show how the multi-actor multi-criteria analysis (MAMCA) methodology can enhance urban and regional mobility planning and decision-making by considering conflicting stakeholder objectives and helping to identify synergies and disagreement between different stakeholder groups. We suggest the application of MAMCA as part of the NISTO evaluation framework that offers tools to appraise small-scale mobility projects through a toolkit of multi-criteria analysis, MAMCA and target monitoring. MAMCA provides a tool to appraise the preferences of the stakeholders involved or affected by a project. It is based on assessing the evaluation criteria of the different stakeholder groups rather than appraising the project based on a set of common criteria agreed on with all stakeholders at the beginning of the process. Therefore the evaluation shows which implementation alternatives or scenarios each group would prefer and allows for a straightforward comparison of preferences across all stakeholder groups. The application of the MAMCA is demonstrated through the initial results of the evaluation of five demonstration projects in North-West Europe. We show that MAMCA is suitable for a range of mobility projects since it can handle the diversity of stakeholder groups and their objectives. In addition it offers the practitioner a well-structured way of carrying out the whole evaluation process. The application of MAMCA also has the added value of broadening the evaluation process to a wide range of stakeholders instead of limiting it to experts. As opposed to previous approaches, the MAMCA methodology aims to provide a balanced evaluation process where the stakeholders have equal weight, i.e. no priority is given to decision makers, users groups or experts. Our analysis of the process of the identification of stakeholders and their objectives also suggests that there is no generic recipe for the range of stakeholders to be involved in different projects, their objectives and the data that needs to be collected for the evaluation. The MAMCA methodology will be offered to practitioners as a simple-to-use web-based software tool that can collect stakeholder objectives and weights, as well as the input of experts and monitoring data for the evaluation of the alternatives and display the outcome on graphs. Therefore we hope that the tool will improve participation in urban decision-making and evaluation thorough the better integration of diverse stakeholder preferences.

2 INTRODUCTION

Public participation and stakeholder involvement have become core prerequisites of a comprehensive and fair urban transport planning process. A shift towards participative planning and evaluation has been detected, with stakeholders integrated into different stages of the decision-making process (Booth and Richardson 2001). The latest Urban Mobility Package of the European Commission states that Sustainable Urban Mobility Plans (SUMP) should promote citizen and stakeholder engagement, as urban mobility is about the people that live and work in cities (European Commission 2013).

Current guidance documents offer a range of tools to practitioners to involve stakeholders in various stages of the planning process including evaluation and monitoring. These tools (e.g. newsletters, web based forums, focus groups, workshops), however, only offer generic participatory instruments and no concrete techniques and methodologies are offered for a pragmatic approach to involve stakeholders in ex-ante appraisal and ex-post evaluation.

The NISTO (New Integrated Smart Transport Options) project aims to develop an evaluation framework and toolkit for small-scale mobility projects. The evaluation framework is based on the principles of sustainability, enhanced stakeholder participation and ease of use.

A combination of multi-criteria decision analysis techniques and participatory methods have been shown to be particularly well-suited for the involvement of stakeholders (Macharis, de Witte, and Ampe 2009). The

MAMCA methodology developed by Macharis (2000; Macharis, Verbeke, and De Brucker 2004) combines traditional multi-criteria decision aid (MCDA) techniques with explicit stakeholder participation. It allows for the consideration of conflicting stakeholder objectives as well as tangible and intangible evaluation criteria.

The objective of this paper is to present how the NISTO framework integrates stakeholders into the evaluation process through the multi-actor multi-criteria analysis (MAMCA) methodology. The next sections briefly introduce the NISTO evaluation framework, present the MAMCA methodology and its application on the NISTO demonstration projects. Since the project is still ongoing it is only possible to show the results of the identification of stakeholders, their objectives and criteria as well as the weighting. The results of the evaluation of the alternatives will be available in the second half of 2015.

2.1 The NISTO project

NISTO is a collaboration between academic institutions (Vrije Universiteit Brussel, Belgium; Cardiff University, UK; NHTV – Breda, the Netherlands), as well as regional and local stakeholders in mobility planning (Boulogne Développement – Boulogne-sur-Mer, France; MOBIEL21 – Leuven, Belgium; Regionalmanagment Nordhessen – Kassel, Germany; CENTRO – Birmingham, UK). The project partners are developing an appraisal and evaluation framework for small-scale urban and regional mobility projects. It is being tested on five demonstration projects, which reflect a wide variety of mobility-related projects from across North-Western Europe: intelligent information provision for transport users in Wolverhampton (UK), a bicycle rental scheme in Boulogne-sur-Mer (France), improving cycling connections in Noord-Brabant (the Netherlands), mapping and influencing travel behaviour through a smartphone app in Leuven (Belgium) and an integrated tourist ticket in Kassel (Germany).

2.2 The NISTO evaluation framework and toolkit

It is intended that the NISTO framework will be used by a wide range of professionals (including transport planners, policy and strategy developers), therefore it combines tools that are already known to the potential users. At the same time the framework also goes beyond the state of the art by extending stakeholder involvement and enhancing evaluation through the application of the combination of these tools. The framework also intends to adapt these tools or the combination thereof to urban mobility projects, by developing a set of evaluation criteria and indicators specific to urban and regional mobility and involving the stakeholders that are relevant for this theme.

The NISTO framework is composed of two main elements:

(1) A set of evaluation tools to assess projects based on the general NISTO objectives of smart and sustainable urban transport, and

(2) A set of criteria and indicators, including:

(a) a set of predefined core criteria and indicators that are used to assess project sustainability; and

(b) a set of optional criteria and indicators that reflect local project characteristics and are used in the evaluation based on stakeholder preferences.

NISTO includes four evaluation tools (Fig. 1)

(1) Assessment of sustainability by multi-criteria decision analysis.

(2) Assessment of stakeholder preferences by multi-actor multi-criteria analysis.

(3) Assessment of policy achievement by monitoring project targets.

3 A STRUCTURED AND PRAGMATIC APPROACH TO STAKEHOLDER PARTICIPATION

3.1 The MAMCA methodology

To enable the structured participation of a wide range of stakeholders in the evaluation (e.g. citizens, transport users, different levels of governments, transport operators, local businesses etc.) we propose the application of the multi-actor multi-criteria analysis (MAMCA) in the NISTO framework. MAMCA allows the consideration of conflicting stakeholder objectives and helps to identify synergies and disagreement between different stakeholder groups (Macharis, Verbeke, and De Brucker 2004). It is based on assessing the evaluation criteria of the different stakeholder groups rather than appraising the project based on a set of criteria agreed on with all stakeholders at the beginning of the process. Therefore the evaluation shows which implementation alternatives or scenarios each group would prefer and allows for a straightforward comparison of preferences across all stakeholder groups.

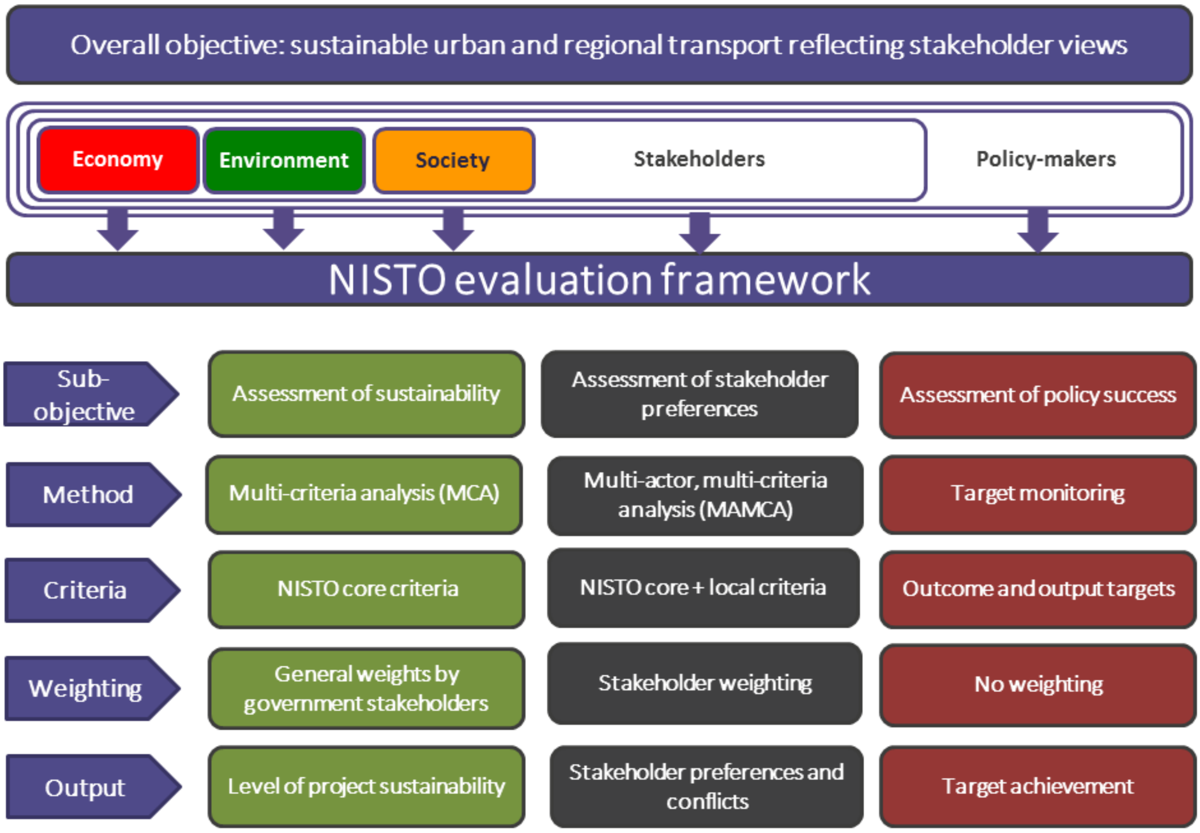

Fig. 1: The NISTO evaluation framework

The MAMCA methodology has seven steps as shown in Fig. 2. First, the alternatives that are to be evaluated are defined by consulting relevant decision-makers or experts with knowledge of the problem. Then the stakeholders and their objectives are identified by the decision analyst. At this stage stakeholders may provide additional ideas for the alternatives. In the third step, evaluation criteria based on the stakeholder objectives are identified for each stakeholder group with direct involvement of the stakeholders. Next the stakeholders are asked to weight the relative importance of their criteria. In the fourth step, criteria are operationalised by the decision analyst through indicators that provide a way to measure the contribution of each alternative to the stakeholder criteria. In the fifth step, alternatives are evaluated by experts and an evaluation matrix is constructed; the contribution of each alternative to the objectives of the stakeholders is also aggregated. In the sixth step, alternatives are ranked for each stakeholder group based on the evaluations. The last step is the implementation of the project, taking into account the views of the stakeholders, which potentially provides a feedback loop to the definition of alternatives (see the first step) (Macharis, de Witte, and Ampe 2009).

3.2 The MAMCA in NISTO

3.2.1 Identification of stakeholder groups

Initially, we identified relevant stakeholder groups for urban mobility planning based on a review of 14 guideline documents for stakeholder consultation as well as scientific papers. The following main groups have been identified: government, the public and citizens, transport operators, businesses (e.g. retail and offices) and transport users.

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Then we investigated how these groups can be assigned to each demonstration project. As generic groups did not provide sufficient coverage of the stakeholders involved or they provided too general categories of stakeholders, new groups were added and some of the above categories were subdivided depending on the characteristics of the projects (transport modes affected, spatial extent, target groups etc.).

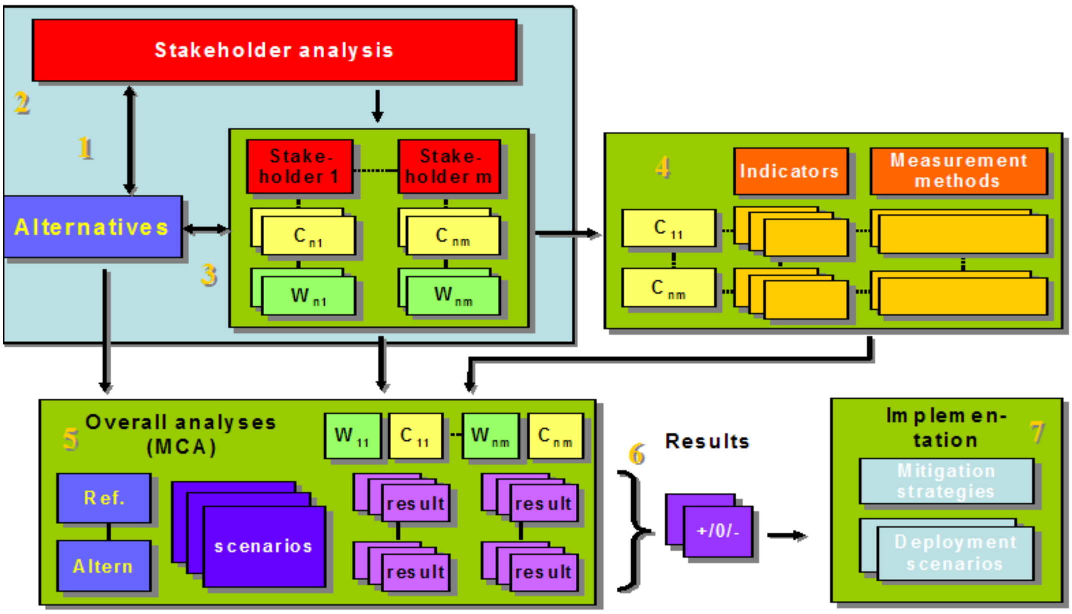

Fig. 2: The steps of the MAMCA (Macharis, Verbeke, and De Brucker 2004)

Table 1 presents the stakeholder groups identified for each demonstration project. The initially identified five groups were expanded with tourists in Boulogne where the project specifically aims to promote the use of bicycles (Boulogne) by them. Also experts were added as an additional category in Leuven since the project's secondary objectives is to provide travel data collected by smartphones for transport planning. Employees were consulted in Boulogne and Wolverhampton since the project aims to decrease local unemployment by providing jobs to young people in Boulogne and the public transport improvements target employees of a large employment site in Wolverhampton. The diversity of stakeholder groups demonstrates that the identification of stakeholders need to consider the project objectives and the groups that are most affected by the project. Therefore generic categories have to be reviewed to adapt the consultation process to local circumstances.

3.2.2 Definition of stakeholder objectives and criteria

Objectives are derived from the goals of the project. They are short-term actions to be taken in order to achieve long-term goals (Dziekan et al. 2013). Therefore objectives need to be closely related to the expected output and outcome of the project. They should be clear, concise and achievable (Kaparias and Bell 2011). In traditional multi-criteria analysis the stakeholders agree on a set of common objectives at the beginning of the evaluation. In MAMCA, however, the often diverse objectives of the stakeholder groups are preserved and used throughout the evaluation process.

In order to ease the selection of objectives a list of the most important potential objectives of urban mobility projects have been compiled based on the review of relevant literature:

- Support a competitive economy
- Improve cost-effectiveness of transport
- Provide access to key destinations and services
- Reduce air pollution
- Reduce noise pollution

Stakeholder group	Wolverhampton	Boulogne	Nord-Hessen	Noord-Brabant	Leuven
Tourists		■			
Local tourism organisations			■		
Employees at the demonstration site	■	■			
Local residents	■	■		■	■
Local and regional government	■	■	■	■	■
Local businesses (shops, hotels, leisure facilities, restaurants)	■	■	■	■	■
Other businesses (businesses in the vicinity of the demonstration site)	■				
Public transport operators	■	■		■	■
Public transport authority			■		
Public transport users	■	■			■
Experts					■
Citizens (users of the smartphone app)					■

Table 1: Stakeholder groups identified for the NISTO demonstration projects

- Reduce greenhouse gas emissions
- Reduce energy consumption
- Enhance the quality of the urban environment
- Promote equity (fairness and affordability)
- Improve safety
- Improve security
- Improve public health

These objectives were then translated into criteria and they were grouped under the three pillars of sustainability (Table 2). In a traditional multi-criteria analysis, criteria reflect the potential impacts of an alternative. In the MAMCA methodology, however, criteria indicate the objectives of the stakeholders (Macharis, de Witte, and Ampe 2009).

Economy	Environment	Society
Economic activity	Land consumption	Safety
Cost effectiveness	Greenhouse gas emissions	Security
Reliability and travel time	Air quality	Health of citizens
Public funding of transport	Resource use	Liveability
	Noise	Equity
		Socio-political acceptance
		Accessibility for people with special needs

Table 2: The general NISTO criteria grouped under the three pillars of sustainability

Stakeholders were invited to select their objectives from the predefined list and also to propose additional objectives that they could not find in the list. We then consolidated the list of objectives and criteria in order to avoid any overlaps between them and also to ensure that they relate to the outcome (e.g. improve liveability in the city centre) of the project rather than outputs (e.g. reduction of car traffic in the city centre).

Each stakeholder group chose 4-6 objectives. We demonstrate the diversity of the evaluation criteria of the stakeholder groups in Table 3, where criteria identified for the governmental stakeholders in each demonstration project are summarised. Seven of the criteria have been selected from the NISTO criteria list (Table 2), while additional criteria were added for quality of data for transport planning in Leuven and for parking problems in Boulogne. Within the seven NISTO criteria the focus of the various governmental stakeholders was also different. Air pollution, socio-political acceptance were applied in four out of five demonstrations, equity, economic activity, efficient public funding of transport and greenhouse gas emissions were used at two demonstration sites respectively.

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Criteria	Wolverhampton	Boulogne	Nord-Hessen	Noord-Brabant	Leuven
Economic activity					
Public funding of transport					
Greenhouse gas emissions					
Air quality					
Health of citizens					
Equity					
Socio-political acceptance					
Improve quality of data for transport planning					
Reduce problems due to the lack of parking spaces					

Table 3: Evaluation criteria of the government stakeholder groups for each NISTO demonstration project

3.2.3 Criteria weighting

In the MAMCA methodology, stakeholders are given the opportunity to express their preferences concerning the relative importance of their evaluation criteria. This is facilitated by eliciting weights to each criteria by each stakeholder group (Macharis, de Witte, and Ampe 2009). In the NISTO project we used The Analytic Hierarchy Process (AHP) to elicit the weights, since it offers an easy-to-understand method. Stakeholders compare two criteria at a time and give their relative preference between the two criteria using a 5-point scale (Table 4). Stakeholders were asked which of the two criteria is more important for them with respect to the demonstration project. Then they chose the appropriate rating on a scale that ranges from ‘equal importance’ of the two criteria to ‘extreme importance’ of just one of the criteria. The demonstration partners organised local workshops or meetings with stakeholders in order to discuss the weights and carry out the weight elicitation.

Equal importance	Crit. A					x					Crit. B
Criterion A is very important, criterion B is unimportant	Crit. A	x									Crit. B
Criterion A is slightly more important than criterion B	Crit. A			x							Crit. B

Table 4: Example of the AHP method to elicit weights for two criteria

The weights elicited by each member of a stakeholder group have been aggregated by weighted geometric mean. The weights express the importance attached by the stakeholders to their own criteria. We demonstrate the outcome of the weighting procedure with the NISTO demonstration in Nord-Hessen, Germany, where an integrated tourist ticket is being trialled. Hotel guests who book a special offer of the hotels receive the Meine Card + that provides free access to leisure facilities and free public transport in the region around Kassel. 40 stakeholders in the region were asked in a survey to weight their criteria. The aggregated results are shown in Figure 3. The weights express the different priorities of hotel owners and leisure facilities. While leisure facilities expect a higher number of visits (weight 0.44), hotels gave a high weight to longer stay of the guests (e.g. higher number of nights) (weight: 0.34). Gaining new target groups through the MCP card came as second for both stakeholder groups (weight 0.27). The criteria of these two stakeholder groups also demonstrate that transport planning and evaluation often requires an interdisciplinary approach since the objectives of some stakeholders are not directly related to transport. Hotel owners and leisure facilities are primarily interested in increasing the number of guests or the length of their stay in order to increase revenues and they do not have any transport related objectives.

For the public transport authority the most important criteria (weight 0.51) is to increase equity, i.e. the accessibility of rural areas and affordability of public transport. Interestingly, cost efficiency only comes as second (weight: 0.26). The reason for this is probably that the weighting was carried out by the representative of the regional transport association (Nordhessischer Verkehrsverbund) and not by a transport operator. The tourism organisation attached the highest weight to equity, in the sense of making tourism and travel affordable in the region (weight 0.49). On a similar note better accessibility of attractions by public transport was given a relatively high weight (0.25).

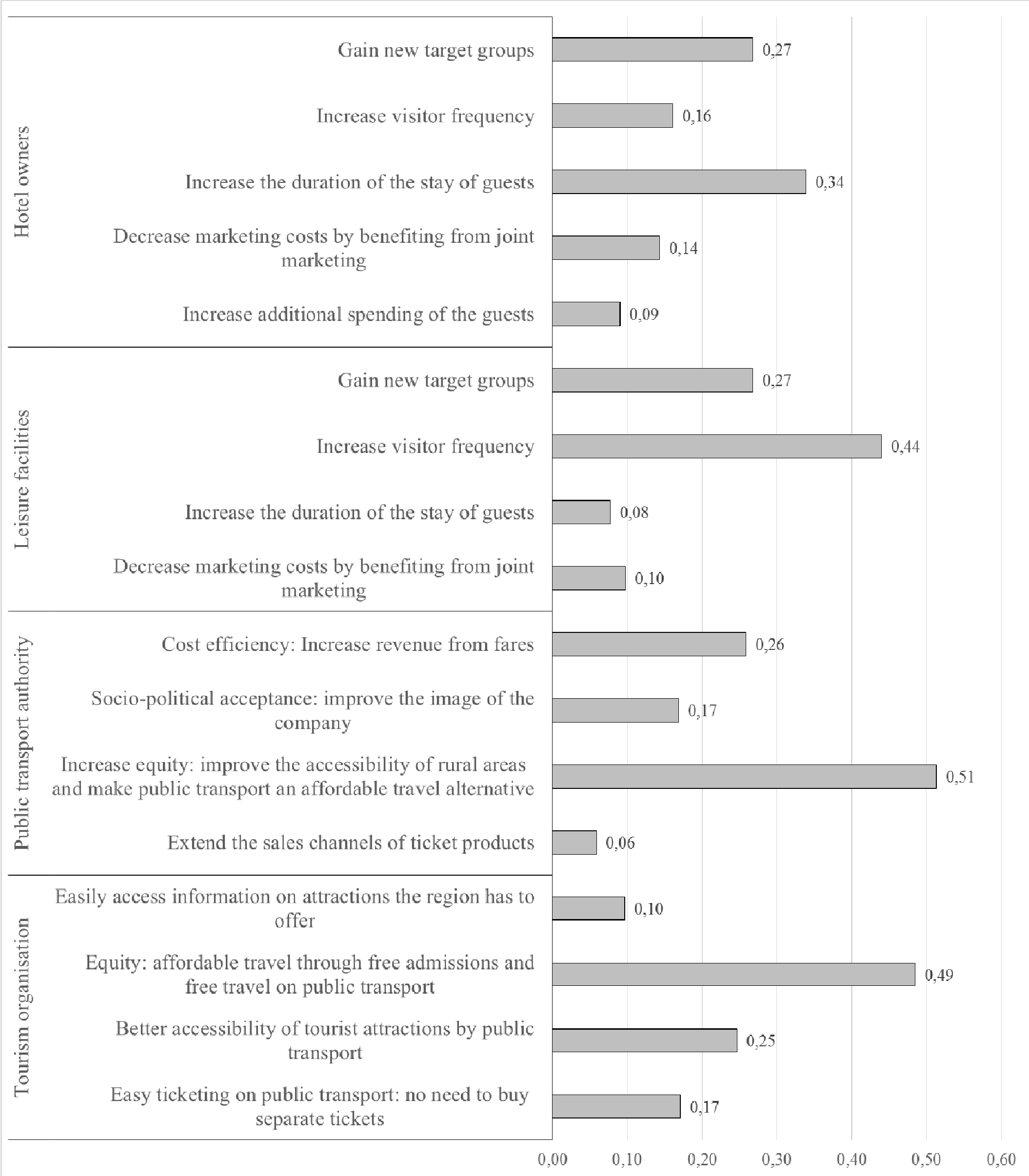

Fig. 3: Scores of the weights per stakeholder (the weights for the government stakeholders are still being collected)

3.2.4 Definition of indicators

Indicators are used to measure the performance of each alternative on each criterion. One or more indicators can be linked to each criterion. Both qualitative and quantitative indicators are possible. Quantitative indicators (e.g. number of accidents, noise emission) are based on measurement or modelling, while qualitative ones (e.g. equity, socio-political acceptance) are outcomes of qualitative surveys or expert evaluation. The measurement method for each indicator is also defined in this step (Macharis, de Witte, and Ampe 2009).

For criteria that are included in the NISTO criteria list, indicators have been pre-defined based on a review of best practice of evaluation of 19 urban mobility projects from North-West Europe. For any new criteria proposed by a stakeholder in addition to those included in the NISTO criteria list the appropriate indicators have been defined in a data collection plan based on a discussion with the project partners about the feasibility of data collection and the budget available.

3.2.5 Evaluation of alternatives

In the further stages of the evaluation the project alternatives will be evaluated on the criteria of the stakeholders based on data we are collecting at each demonstration location. The evaluation is based on the comparison of baseline data on the indicator (e.g. level of air pollution before the implementation of the project) with either the forecast data on the same indicator (in case of ex-ante appraisal) or actual

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measurements (in case of ex-post evaluation). The performance of the alternatives will be assessed through pairwise comparisons or direct rating depending on the availability of data from the demonstration sites (Macharis, Turcksin, and Lebeau 2012). This step will be carried out by experts who have extensive knowledge of the specific field or problem.

3.2.6 Overall analysis

In this step, an evaluation matrix is constructed that aggregates the weights assigned by the stakeholders to each criterion and the scores of the scenarios from the previous step. Several MCDA methods can be used for the overall analysis. In the NISTO framework we apply the PROMETHEE method to construct the evaluation matrix (Brans 1982) since it avoids trade-offs between scores and simplifies the evaluation procedure (Macharis et al. 2004).

This analysis produces a ranking of the scenarios for each stakeholder group displayed on the multi-actor view, which shows which scenarios are supported or opposed by a particular stakeholder group (Macharis 2007; Macharis 2004). It highlights the strong and weak points of each scenario and indicates the potential points of conflict or synergies. In addition, the strengths and weaknesses of each alternative or scenario are also indicated for each stakeholder group. Based on this information it is easier for the decision-maker to find consensus or revise the original project alternatives. The stability of the ranking is assessed by sensitivity analysis in order to see if the results change when the weights are modified.

Since the evaluation of the alternatives will only be carried out at a later stage of the project Fig. 4 shows an example of the multi-actor view from a previous case study where four scenarios to improve sustainable mobility in the city centre of Leuven, Belgium were appraised. The horizontal axis represents the stakeholder groups involved while the vertical one displays their preference scores. The coloured lines represent the scenarios. The graph shows that car users as well as retail and businesses have significantly different preferences compared to the other stakeholders. Therefore while the car-free city centre scenario is preferred by the most stakeholder groups it does not offer the highest level of consensus since it scored as the least favourable scenario for car drivers. Smart road user charging appears to be a better solution since it was chosen as a second best alternative by most stakeholders.

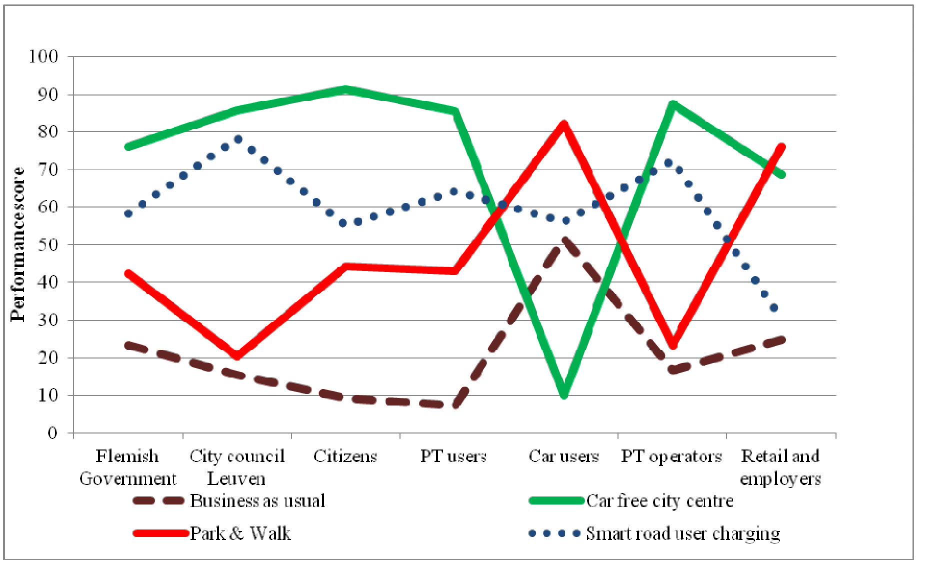

Fig. 4: Multi-stakeholder view of MAMCA

4 CONCLUSION

The MAMCA methodology integrated into the NISTO evaluation framework presented in this paper offers a structured methodology to appraise urban and regional mobility projects based on the objectives of stakeholders and by collecting data for project-specific indicators. Since urban and regional mobility projects have a wide range of stakeholders who have diverse objectives, MAMCA provides a methodology that takes all these different interests into consideration instead of relying primarily on the evaluation of experts. As opposed to previous approaches, the MAMCA methodology aims to provide a balanced evaluation process where the stakeholders have equal weight, i.e. no priority is given to decision makers, users groups or experts. As we showed through our demonstration projects, the methodology can easily be adapted to the specific requirements of projects in terms of range of stakeholders involved, diverse stakeholder objectives and criteria and availability of qualitative and quantitative data for monitoring.

On the one hand the methodology can show how the different stakeholder groups view the importance of their objectives through the weighting procedure. This step highlights which criteria are the most significant ones for the stakeholder groups. In the further stages of the evaluation, the overall analysis will highlight similarities and differences in the preferences of the stakeholders based on the monitoring of indicators and evaluation of experts.

Our analysis of the process of the identification of stakeholders and their objectives also suggested that there is no generic recipe for the range of stakeholders to be involved in different projects, their objectives and the data that needs to be collected for the evaluation.

In the next stage of the research, the ex-post evaluation of the performance of the alternatives identified for each demonstration project will be carried out based on the data that is currently being collected at each partner location. The results of the evaluation will provide guidance to decision makers for the further development of the NISTO demonstrations and similar mobility projects. The results of the MAMCA will be compared to the outcome of the sustainability assessment (MCA) in order to highlight possible differences and synergies between the different evaluation methods. At the same time we hope to be able to give recommendations concerning the application of each method to small-scale mobility projects.

The MAMCA framework will be offered to practitioners as a simple-to-use web-based software tool that can interactively collect stakeholder objectives and weights, as well as the input of experts and monitoring data for the evaluation of the alternatives and display the outcome on graphs. We hope that the tool will improve participation in urban decision-making and evaluation through the better integration of diverse stakeholder preferences.

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Evolution of Mobility Governance in Flanders – Opening up for Bottom-up Initiatives or Suffering from Lock-in?

Suzanne Van Brussel, Luuk Boelens, Dirk Lauwers

(MSc. Suzanne Van Brussel, Ghent University, Vrijdagmarkt 10/301 – 9000 Ghent, suzanne.vanbrussel@ugent.be)
(Prof.dr.ir. Luuk Boelens, Ghent University, Vrijdagmarkt 10/301 – 9000 Ghent, luuk.boelens@ugent.be)
(Prof.ir. Dirk Boelens, Ghent University, Vrijdagmarkt 10/301 – 9000 Ghent, dirk.lauwers@ugent.be)

1 ABSTRACT

Mobility policy in Flanders lacks a clear discourse on implementingthe policy objectives for 2020 and beyond. Though mobility planning can show success stories, mobility problems seem to aggravate. For supra local mobility projects in Flanders the executive power often lies with deconcentrated administrations at the level of the province, this is e.g. the case for public transportation and major roads, where province boundaries impede public transport projects across borders. For local mobility plans, the local administration and council have the power. But as these local mobility plans have highly formalised procedures, they tend to be rigid frameworks oradministrations and risk to be suffering from lock-in. There is a need fornew dynamics in mobility policy in reference to present developments. Here bottom-up or outside-in initiatives can be regarded as the key to real change. To that end radical changes in the organisation and mobility planning itself are necessaryto meet these new inititiaves from the bottum-up and outside-in. Next to hardware and software approaches or innovations to turn mobility planning more sustainable, we additionally propose in this paper an 'orgware' solution, demonstrated in some case studies. In these cases key actors of bottom-up projects and their associations with other actors are visualised. Furthermore barriers and potentials for implementation are formulated leading onto recommendations for further research in order to improve the implementation of the policy objectives.

2 INTRODUCTION

Mobility policy in Flanders seem to aggravate, especially in cities. Brussels and Antwerp are for instance the most congested cities in the world according to Inrix traffic scorecard (http://www.forbes.com). Since many Flemish people commute everyday to work in Brussels and because the Brussels region is strongly embedded or even situated within the Flemish road network, the Brussels mobility problem is also a Flemish one. With Antwerp as second most congested city the Flemish mobility system is fragile. But apart from congestion also noiselevel and air quality are part of themobility issues. The growing car park and travelled kilometers only raise the total exhaust emission level and, cause negative environmental and health effects. Mobility policy objectives therefore incorporate operational objectives to improve access, accessibility, safety, liveability and want to reduce the negative impact on the environment. These objectives will focus for instance on the elimination of competitive advantages for cars, by providing better alternatives. Optimized public transport services will be provided and walking and cycling will be stimulated for the shorter distances, predominantly within the city. Also the hotspots of emissions will be dealth with in the city.

But as it often happens, the implementation of mobility objectives is another thing. Mobility policy in Flanders lacks a clear discourse on how to reach these policy objectives for 2020 and beyond. Even the approval of the most recent mobility plan by the Flemish government and advising councils has not yet been finished. We believe this absence of an unambiguous and consistent mobility planning relates toan increasing complexity characterizing the current mobility related problems. First, mobility is highly inter-relational connected to other domains; for instance economics, social and spatial structure (or land use), infrastructure and vice versa(Bertolini, 2012). Mobility at the same time also acts upon multiple governance levels as well; it ranges from local municipalities to the whole Flemish region. On the one hand, decisions and developments within these various interrelational domains have enormous impacts on mobility and mobility policy. On the other hand infrastructural interventions also have consequences for land use. The environment and the environmental health are inextricably linked to mobility and spatial structure as well, resulting in sustainability and liveability conditions. Hence various policy domains are involved within the influence sphere of mobility, and thus have to cooperate to achieve the policy objectives. But here some serious internal problems become visible. Different policy domains neither work together well nor communicate well. In fact their policy is even not always harmonized, so that some domains act contradictionary. Second, there is a growing body of various actors and upcoming initiatives involved in mobility. Some of these

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innovations act on the management or governance level.For instance Uber is competing with the highly formalized taxi-sectors; bike and car sharing systems or even driverless cars challenge the management side of mobility and cause often implications for legislation. What happens in case of an accident, who is to blame? Are these systems reliable? Next to that civic (activist) groups are coming up and are challenging traditonal pathdependencies of mobility planning. Hence, to overcome problems of implementation these new extern actors have to become involved in the planning process. To deal with complexity, instead of or at least next to focusing on the technological ('software') or infrastructural ('hardware') innovations to achieve set targets, there is a need to focus additionally and even more specific on an up-to-date governance approach of mobility planning. There is a growing need to become involved in the evolving network of (new) mobility actors, their interconnections and manner of inter-communication to improve the outcomes of infrastructure or mobility projects(Boelens, 2009; Straatemeier & Bertolini, 2008; Switzer, Bertolini, & Grin, 2013).

Here the orgware aspect is to be considered among the software and hardware aspects of the system in order to function(Dobrov, 1979; Smits, 2002). Already in 1979, although rather situated in technological sphere, Dobrov (1979) points out that there are numerours interactions between the hardware, software and orgware and that their role is of major importance for future (scientific/technological) progress. He argues that there are certain circumstances that requirea systems (software-orgware-hardware) approach to be adopted by future-oriented policy making to accomplish technological changes.One of which goes as follows; "The growing complexity of of newly created technological systems, the diversity of their forms and the intensification of their ties with other systems: this circumstance determines the character and dynamic structure of the positive and negative consequences of the functioning of technological systems" (Dobrov, 1979, p. 80). He proposes orgware as: " a set of organizational arrangements specially designed and integrated using human, institutional, and technical factors to support appropriate interaction of the technology and external systems"(Dobrov, 1979). This definition can also be applied for spatial planning and mobility and is in line with our actor-network approach and our perspective on the evolution of governance, where different actors and their influence over the others and over the context is revealed. Following Dobrov (1979) the orgware can be situated or devided in to levels; The macro orgware consists of a set of economic and legal regulations, whereas the operational orgware (micro level) focusses on the organization-structural solutions, procedures for management and for interactions with other organizations. In our research and with our cases, we try to expose the mobility macro orgware of the Flemish region.

This paper starts by giving an overview of the most important evolutions in the field of spatial planning and mobility planning. Policy decisions and decrees that have had a major impact will be mentioned. By drawing this overview, it becomes clear that planning strategies at hand lack the capacity to deal with complex cases that have consequenses for different policy fields(Bertolini, 2012). Two mobility cases will confirm in a third chapter this hypothesis of a growing complexity and an increasing fragility of the present planning institutions. The selected cases are examples of mobility planning regarding the internal and external problems of mobility. They address the importance of involvement of a range of actors and the choice for a convenient scale of the specific local mobility problems. Note that the outcomes of the planning of these projects are not necessary good (if any at all). The first case is the MOZO study, in response to higly undesirable development of cut-through traffic within the southeastern edge of Antwerp. The second case deals with the completion of the Antwerp inner ring road through the Oosterweel link project. From these cases we will finally draw some conclusions and sketch a preliminary outline for future mobility planning research taking adaptive orgware into its most predominant focus point.

3 MOBILITY IN FLANDERS

3.1 Planning practices and discourses: a chronological overview

It is only since the late 1990's with the Spatial Structure Plan for Flanders that there was an intention to adopt a more proactive way of spatial planning. Before this Spatial Structure Plan for Flanders, spatial planning was limited to the elaboration of binding sub-regional, local and detailed zoning plans. Following a zonation principle, the map of Flanders had been coloured in different colour zones, corresponding to different destinations of authorized land use. But the plan was not able to reduce the housing sprawl that had already started before the zonation, as earlier policy decisions had been favouring suburban development. In 1997 planning adopted a more strategic way of thinking with the Spatial Structure Plan for Flanders, formulating long term visions and focussing on the involvement a broad field of actors (Albrechts, Healey, & Kunzmann, 2003). The establishment of a structure plan for the Flemish region was soon to be followed by structure plans for the provinces and municipalities. A structure plan is typically highly formalised, not only regarding the resulting document but also in terms of the planning procedure. The bottom-line of the plan was to counteract urban sprawl by initiating the concept of ‘deconcentrated clustering’; meaning that the already spread out urban developments (deconcentrated) were preserved but resisted any further sprawl (clustering). Another important evolution that came along with the structure planning was the decentralisation tendency going on in Flanders as elsewhere (Lauwers & Gillis, 2010). This had also led to the shift of the actual power from the regional administrative department to the provincial branches. With regard to the portfolio of mobility, this became apparent through the categorization of the road network (Lauwers & Gillis, 2010). It is important however to make the distinction between ownership and control or management over the infrastructure on the one hand and the functional road categorization on the other hand.

There are only two owners of road infrastructure in Flanders, namely the Flemish Government and the local municipalities. The corresponding management and exploitation associated with these owners are respectively the Flemish Agency for Roads and Traffic (AWV) and the local municipalities themselves. To make it more complex, the functional categorization of the road infrastructure holds three main levels corresponding to the involved planning authorities: 1) the highways and primary roads, which mostly correspond to the roads under control of the Flemish region, of which implementation happens by the Flemish Agency for Roads and Traffic; 2) the secondary roads, which are only under planning control of the province, that depend for the implementation on the regional or the local authorities; 3) the local roads, that are under the responsibility of the municipalities. However there are also roads under the management of the Flemish Agency for Roads and Traffic (AWV) that have been categorized as local roads. Especially in cities, where highways or primary roads are radiating into the city and are interfering with the local road network, often fuzzy and complex situations occur. Mobility planning in these places becomes more complex regarding the planning versus implementation context.

Since the millennium break some major new evolutions came up in mobility planning. Since 2000 the Flemish regional mobility plan had been set out and was finally established in 2003. This plan was and still is the legal basis for today’s administrative mobility governance, since a draft version of the new mobility plan of 2010 had been postponed due to the negative advice of the Mobility Policy Council (MORA). On the local level, a lot of municipal mobility plans have been developed since 2000. These local mobility plans (LMPs) in Flanders typically hold sustainability objectives, public involvement and agreements with higher authorities. Municipalities can obtain approval for their mobility plan from the public transport company (vervoersmaatschappij De Lijn) and the Agency for Roads and Traffic (AgentschapWegenenVerkeer, AWV). This Agency holds the exploitation of the highways as well as the primary road network, expanding even within and across municipal networks. Consequently the approval of AWV should guarantee the complementarity of the local plan with respect to the higher level mobility plans. Besides municipalities can only obtain funding from higher authorities for mobility projects if first the broader vision on mobility has been clarified via these local mobility plans. Following a study carried out for the state-of-the-art of sustainable urban mobility plans in 2012, 90 per cent of the Flemish municipalities had an approved LMP at that time, which is quite a high percentage compared with other European countries (Rupprecht Consult, 2012). Figure 1 shows that most of the municipalities had an approved LMP (green colours) in 2010, were preparing an actualization of the former one (which formed still the legal basis) or were drawing a new one (pale yellow colour). Only a few municipalities didn’t have an approved LMP in 2010 as is shown in red. This number has yet been reduced to seven percent of the municipalities at the moment (http://www.mobielvlaanderen.be/mobiliteitsbeleid).

Hence, Flanders’ mobility governance system is considered to be amongst the most well organized in Europe (Rupprecht Consult, 2012). This resulted not only from the high percentage of approved LMPs, but also from the included government incentives, and the involvement of different actors. However, this kind of mobility planning also has its limiting aspects. First, local mobility plans are highly formalized, leaving no room for the involvement of new actors or initiatives in the planning process. Altering interest and innovative ideas of new actors in reality don’t find their way into the mobility debate. At its best only the usual suspects (mostly traditional intermediary organizations) are involved in the debate. The mobility planning therefore appears to be threatened by a lock-in regarding the planning procedures and involved actors. Although much has to be

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expected from new actors in a context of budget cuts and the phasing out of the welfare state. Second, local mobility plans can deal only with mobility problems within the municipal territory. Nevertheless, some municipalities, predominantly in the direct vicinity of cities, often encounter cross-border mobility issues (e.g. cut-through traffic or transit traffic). For these issues an inter-municipal mobility plan is more appropriate, bundling not only the rather limited workforces, but also dealing properly with cross-border mobility issues on an intermediate level. Moreover, municipalities together can sometimes create enough critical mass to enforce new public transport trajectories from the public transport provider. An example of an inter-municipal mobility plan is discussed in the third chapter.

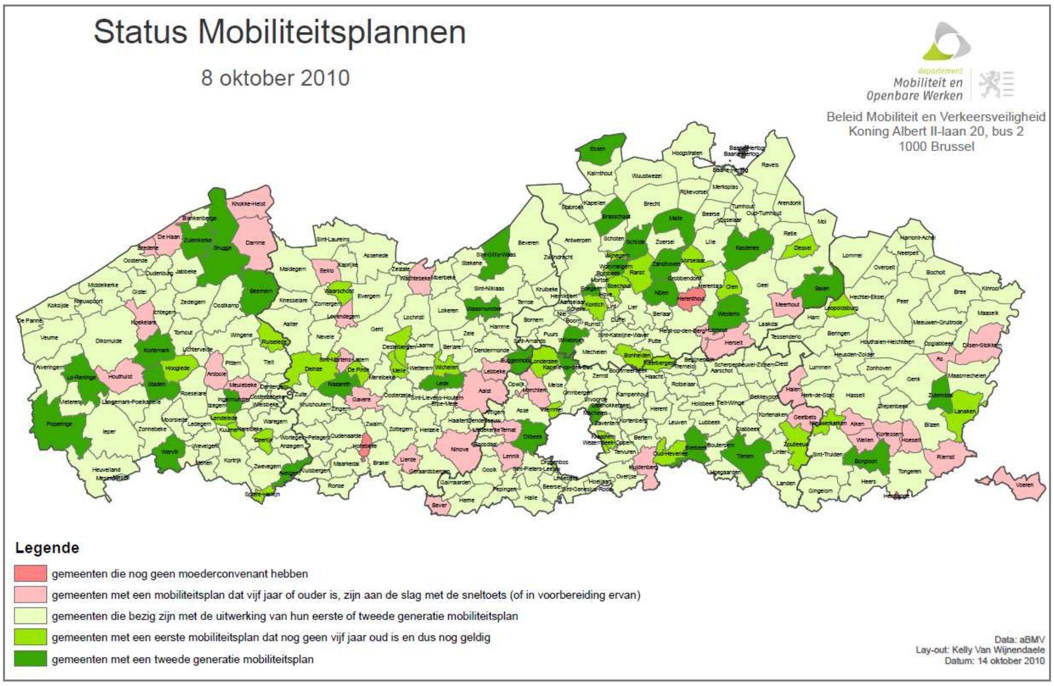

Figure 1: Status of Local Mobility Plans in 2010 (DMOW, 2010 http://www.mobielvlaanderen.be/).

During the 2000's the Flemish government hasalso started to prepare a more ambitious spatial plan, the 'green paper' for spatial policy in Flanders (BRV, BeleidsplanRuimteVlaanderen), to replace the spatial structure plan of 1997 (and later versions of the plan). The green paper has been approved in 2004, but the actual policy plan procedure is still ongoing. After a rather silent period, the BRV has recently officially been restarted and is expected to be finished at the end of 2016. It will cope with a much longer period, drawing Flanders' future in 2050.The BRV will also deal with sustainable and environmental issues. Economic growth will have been linked in this document to a liveable and sustainable development (RWO, 2012, pp. 12-14). Moreover for the first time an intention of integration of the policies for land use and mobility, which has not been the case with earlier spatial structure plans, nor mobility plans. The first attempt of the BRV, did not really connect to the mobility plan, rather only referred to it. Hence theMORAinsisted that a more integrated vision on mobility and spatial planning was necessary(Mobiliteitsraad, 2014). Consequently the BRV was at first not approved by the Flemish parliament and stranded before the last elections in May 2014. At that time, the administrations of spatial planning and mobility planning could not showaccordance. There was no shared or integrated spatial-mobility view, althoughthiswas initially foreseen in the BRV. With the official restart the integration is to be addressed, but the Flemish Mobility Plan procedure has not yet been officially restarted again…

In the domain of mobility the right on Basic Mobility[1] has been initiated in 2003, guaranteeing a minimum public transport supply in even the most sprawled urban areas. At the same time the prevailing spatial plan

[1] The Basic Mobility decree, established in 2002 by the Flemish Government, guarantees a minimum mandatory public transport supply in residential areas. This minimum supply depends on or is proportional to the kind (and often size) of the involved residential area, distinguishing metropolitan areas, urban areas, suburban areas, smaller urban areas and rural areas. Each of these categories of urban development have clear set operational objectives for public transport regarding the distance to a transit hub, the frequency of the public services, etc. The implementation of this right on basis mobility started in 2002 and was expected to be finished in 2007. The public transport company (De Lijn) was appointed to carry out the project (http://www.mobielvlaanderen.be).

for Flanders proposes the concept of 'deconcentrated clustering', to resist further sprawl. Moreover the domain of Spatial Planning has been dominated by law and geographic planners, while the domain of mobility has been dominated by the civil engineers in Flanders. Both domains follow their own path dependencies and are acting apart from each other. Even more they are often opposing each other instead of working together, ignoring their interconnectedness. However also mobility policy itself doesn't seem to follow a clear path. On the one hand the Basic Mobility decree and the concerning expenses express the focus for a qualitative public transport supply. But on the other hand tax benefits for company cars are about equally large[2], and are even amongst the highest in the world (De Smet, 2014). Hence we could speak of a Flemish Mobility policy that lacks a clear discourse.

Furthermore a number of mandatory impact assessments and strategic advisory councils were established around 2005. These institutions and assessments have certainly prolonged the planning processes to improve quality and to minimize externalities. In 2004 for instance the 'Minaraad', the advising council for the Flemish government concerning environmental and nature associated issues, was founded. This council was then soon followed by the mandatory Environmental Impact Assessment reports (EIA, MER, milieu effectenrapportage) for big projects with possible important externalities for the environment. Later on in 2006 a mobility council for the Flemish government was established. Followed in 2009 by the set out of an assessment specifically for mobility impacts: the Mobility Impact Assessment (MIA, MOBER, mobiliteitseffectenrapportage). And also the mobility test (mobiliteitstoets) became compulsory, a rather brief document, screening the potential mobility impact for the smaller mobility projects (http://www.mobielvlaanderen.be/). Nevertheless all these new institutions and assessments have also further formalised and extended the complexity of up-to-date and innovative space-mobile interventions.

In the next chapter the growing complexity encountered by the planning and the implementation of new mobility projects will become clear. The cases will show whether present government strategies can deal with the increasing complexity or not. From these cases opportunities and difficultiesconfronting the government are elaborated and finally conclusions are drawn.

4 CASE STUDIES

4.1 Selection of two cases

With two cases we want to invigorate the need for an orgware approach accomplish the transition towards a more sustainable mobility. Both cases are dealing with complex mobility and liveability problems. The two projects include various scale levels (governance levels) and therefore need an integrated approach. The first case is the MOZO-platform project resulting from the previously conducted SLUIZO-study. The controversial project of the Oosterweel link is the second case.

The chapter will deal with the two cases separately. First, the occasion and context of the projects isspecified. Further, the involved actors and the project process are described. Ultimately, the project outcomes and remarks on the process are formulated. The focus hereby lies on the interconnections betweenthe various actors resulting in networks involvedin the project.

4.2 Case 1: Mobility in south-eastern edge of Antwerp (MOZO-project)

4.2.1 Occasion and objectives

The MOZO-project resulted from the increasing need to cope with mobility issues, shared by several municipalities[3] in the south-eastern edge of Antwerp,in a broader and more integrated manner. The main driver of the process was the perceived cut-through traffic, that was indicated as problematic for accessibility safety and liveability by all of the municipalities. Because local mobility plans could not solve these cross border problems and because the municipal administrations lack the appropriate time and budget to carry out inter-municipal strategic planning studies, the municipalities addressed their issues to the Flemish Government. (Arckus, 2007; Leys, 2015). Besides, these municipalities are rather small, with often very little

[2] Data on public transport expenses for the regions retrieved from (Belgisch Staatsblad, 2014; Service Public de Wallonnie, 2014; Vlaams Parlement, 2013)data on company cars tax advantages retrieved from(De Smet, 2014)

[3] The municipalities involved in the study area are: Aartselaar, Boechout, Borsbeek, Edegem, Hove, Kontich, Lier, Ranst, Wijnegem, Wommelgem and Zandhoven

primary roads on their territory. That is another reason why the Flemish Agency for Roads and Traffic (AWV) doesnot or even cannot intervene, for the infrastructure agency focuses on its own responsibilities, namely the primary road network. As a consequence the municipalities saw no other solution than to address their issues at a higher planning leveland the SLUIZO study (Cut-through traffic study in the south-eastern edge of Antwerp, Sluipverkeer in de zuidoost rand van Antwerpen) was launched. Later this study would lead to a MOZO-platform for permanent further consultation, evaluation and monitoring of the more integrated mobility problems across these municipalities(Leys, 2015). In figure 2 the road infrastructure network of the study area is shown. It is remarkable that no clear carrying (tangential) network in the area is available. Congestion onthe primary road infrastructure then causesunintended transit traffic on the underlying carrying network. Consequently, the traffic passes through the municipal cores in the area, as can be seen in figure 3 and 4.

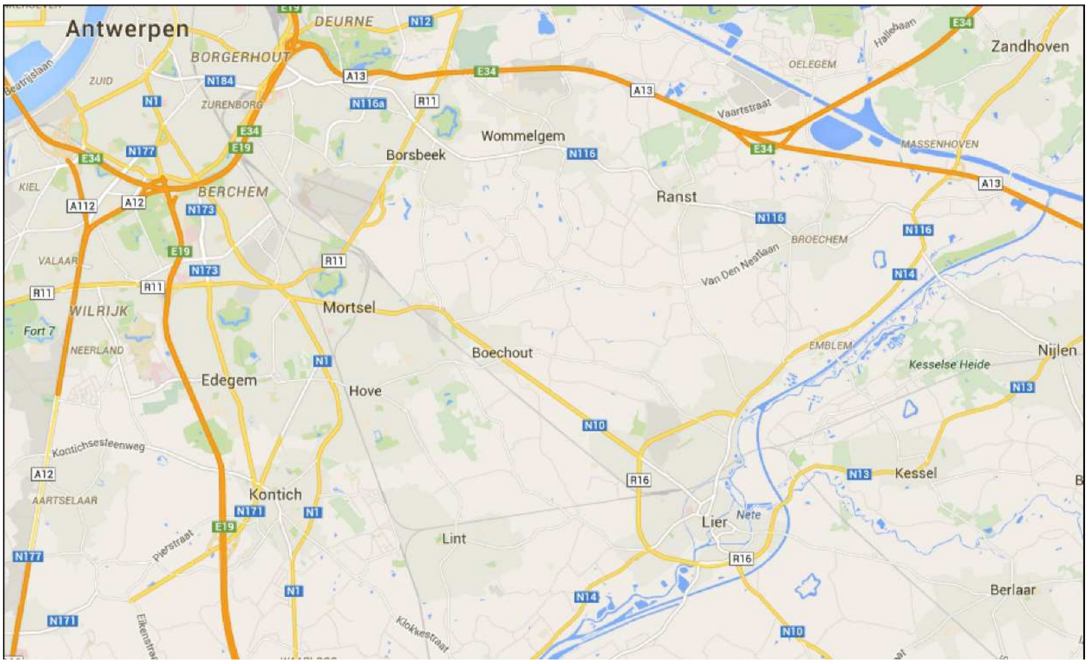

Figure 2: Situation and road infrastructure within the SLUIZO study area (Google Earth, 2015, https://www.google.be/maps/)

Figure 3: Live Traffic Info (Tomtom, 2015, http://livetraffic.tomtom.com/, 25/02/2015, 16h50)

When the municipalities first came together for the SLUIZO-study, they clearly stated that the result of the project could not be a new study, but rather a bundling of the literature and existing data on mobility for the area.[4] But in the end the perceived big body of mobility literature appeared to be very limited for the specific SLUIZO issue. Nevertheless, the budget for new research was restricted and not much new information could be collected. Yet SLUIZO focused on traffic flows within the area and on the public transport supply (Leys, 2015). The interactions or travel patterns within the SLUIZO-area, that were perceived as cut-through traffic, are shown in figure 3.

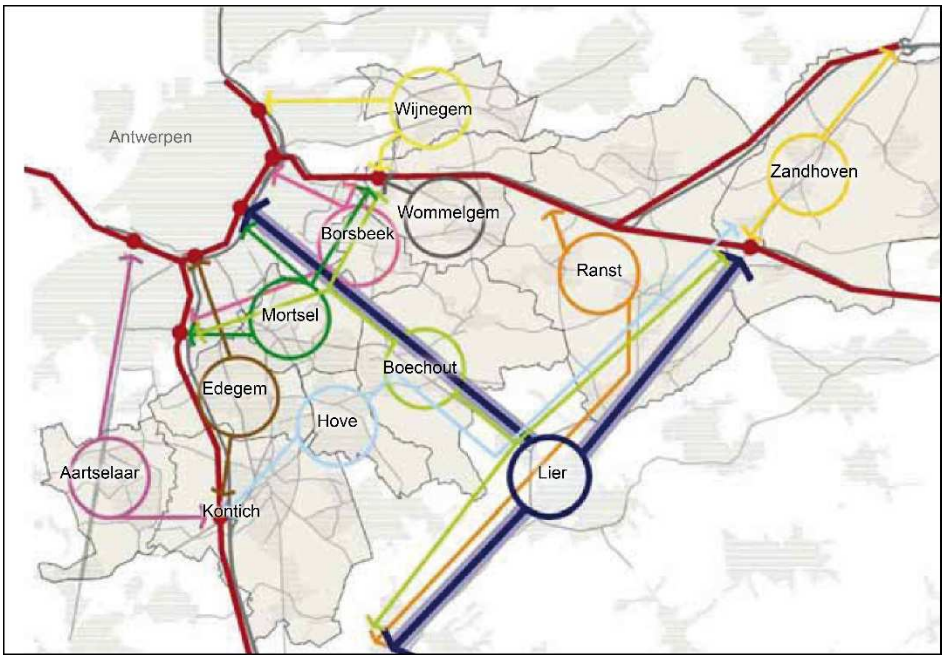

Figure 4: Internal travel patterns from municipalities within the SLUIZO area, often perceived as cut-through traffic (Figure 14, Arckus, 2007, p. 51, own adaptation)

In stating the problem definition it became apparent that the participating municipalities had different perceptions on cut-through traffic, which is also shown in figure 4. Some municipalities for instance took also the traffic from neighbouring municipalities to their own territory into account as cut-through traffic. When all these viewpoints on the perceived problem were brought together, the actual issue to tackleappeared to be the lack of a carrying (tangential) road network for in-and outgoing traffic in the study area. The congestion on the highways and the primary roads and the lack of transit flow on this primary road network was in fact the real driver of the problems in this area. And for that also the name, that initially referred to the cut-through traffic (SLUIZO study), later changed to the MOZO-project, incorporating the broader mobility picture of the area, resulting finally in the MOZO-platform(Arckus, 2007; Leys, 2015).

The SLUIZO study has led to a common definition for the cut-through traffic, a broader vision for the mobility within this Antwerp edge and action plans per work package to obtain this vision. The permanent consultation platform for managing these higher level mobility issues was also an important objective. The platform had to obtain a support base among the municipalities for the broader mobility issues. In addition the MOZO-platform was a new institution for carrying out research, for making strategic and integrated plans for the area. Third the platform was established to guarantee the quality of the local policy mobility proposals and interventions (Leys, 2015).

4.2.2 Actors & Project process

The initial incentive for the SLUIZO-study and MOZO-platform came from the bottom-up, from perceived cut-through traffic and mobility problems encountered by the municipalities Aartselaar, Boechout, Borsbeek, Edegem, Hove, Kontich, Mortsel, Ranst, Wijnegem and Wommelgem. Later in the process also the municipality of Zandhoven became involved in the project. The Flemish Government was addressed in the search for a solution. This decision was supported by the participating municipalities(Leys, 2015).

[4] Note that such studies are in fact secondary sources. They are not conducted for the same purpose, they may carry a lot of information, however this is not direct applicable to the SLUIZO- study area. So mainly secondary sources are useful, but they are often not sufficient.

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SLUIZO-Study

The SLUIZO-study was conducted by the Arckus consultancy group, following a consultation structure at three levels or tracks. The first level was the research track existing of the Arckus team or the project leader. The second track consisted of the policy preparation and the more technical assistance and was named the project group. The third track was rather political, where the final choices for implementation were to be made. This track wascalled the steering group. Between the three planning tracks a lot of interaction was organized in the form of interactive workshops and consultations. Moreover it was crucial that the tracks would co-evolve towards a solution or aconsensus(Arckus, 2007, pp. 17-19).

In a first phase of the study, the mobility literature on the concerning area was analysed by the research group in order to gain overviewof the available research. For the problem definition of the SLUIZO-study both bottom-up (from the municipalities) and top-down (from the infrastructure agency) based definitions of cut-through traffic were taken into account. This twofold problem definition showed that not cut-through traffic was the driver of the mobility issues, instead congestion on the principal road network and the lack of a carrying secondary road network caused the real mobility problems. Both the municipalities and the Flemish Agency for Roads and Traffic then had to list the bottlenecks within their territory, resulting in a problem tree (Arckus, 2007).

In a second phase the project group came up with solutions based on their technical knowledge, leading to a solution tree. This tree was then further elaborated in four different future scenarios, mainly focussing on how and where to implement the carrying road network (e.g. where freight traffic would be allowed). These scenarios held a vision for the longer term and included operational objectives that were immediatelyachievable. From the four initially suggested scenarios an integrated scenario was then composed, including all the strengths of the basic four scenarios. Afterwards the operational objectives were translated into tables of measures, clustered according to the relevant policy field, see figure 5. Of the suggested measures some were then further selected as quick wins, feasible on the short term and at relatively little expense(Arckus, 2007, pp. 21-23,94,98,161). Figure 1showsthe three involved policy domains or arenas taken into account for the interventions: the spatial structure context, the transport context and the infrastructural context. However the latter was much more elaborated than the others, indicating a strong focus on the infrastructural layer and the domination of an engineering approach in mobility planning. In the end of 2007 the final version of the study was published, leaving action plans and infrastructural measure catalogues to the municipalities.

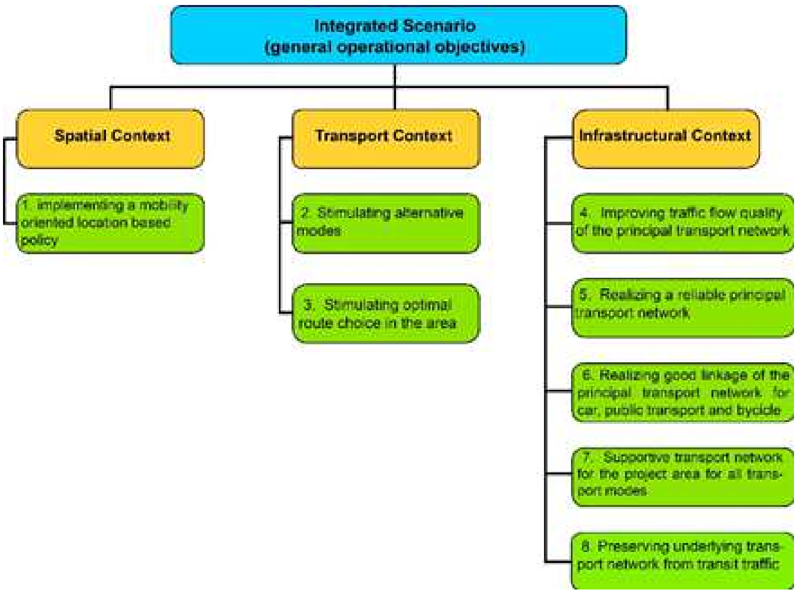

Figure 5: SLUIZO-study outcomes of an integrated scenario, suggesting measures per theme and context (Arckus, 2007, p. 7, own translation)

MOZO-platform

The MOZO-platform was to be established in a next step, but only in the end of 2008 the platform was actually initiated. The platform had its own administration financed by the Flemish government and was initially thought of as a pilot for other intercommunal problems. The responsibilities of the platform wereto follow up the suggested interventions of the municipalities, and to reject theinfeasible ones. Also strategic and bilateral consultations and collaborations between two or more municipalities were undertaken from this platform. Other regions with cross border mobility issues such as the region aroundMechelen and the Noorderkempen were interested in such an intermediate planning level platform as well.This showed the broader need for this kind of institution(Leys, 2015). Unfortunately the results of the platform were not (yet) directly visible on the ground, however this is partly due to the quick-win focus adopted in the SLUIZO-study. For this, some municipalities and politicians lost their faith in the MOZO-platform and in the need for this platform. The operational budget was questioned: “Why would a platform with little or no feasible outcomes receive money, while there is less and less money for the municipalities’ infrastructure?” (Vlaams Parlement, 2008). During the activities organized by the platform little engagement came from the public actors, namely the Flemish Agency for Roads and Traffic (AWV), the public transport company De Lijn and the municipalities themselves. At that time different ministers for the policy domain of Infrastructure and of Mobility rather worked against each other than cooperated. Moreover transparency lacked in the decision making process and a clear and open communication repeatedly failed. A lack of commitment and trust between the various partners (ministries, municipalities, infrastructure agency, public transport company) made the platform bleed to death, even before it could show its capacities (Leys, 2015).

4.2.3 Project outcomes and discussion

Only a few of the list of SLUIZO measures have been realized. With the abolishment of the MOZO-platform there is however no intermediate institution anymore to deal with the broader and more strategic mobility issues properly. Yet the demand for such an institution has remained, as local administrations are still limited in time and in budget. In addition, the critical mass needed to achieve new public transport trajectories for buses and trams calls for intercommunal collaborations too. Furthermore, the municipal budget for infrastructure has decreased the last five years. As a consequence of all this, local administrations now are typically looking for quick ad hoc solutions, focusing on their own territory (Leys, 2015).

In the literature on the orgware or governance approach for innovations several researchers mention the importance of intermediary organizations, often called ‘innovation intermediaries’ or ‘innovation’ brokers (Klerkx & Leeuwis, 2009). Following quote is especially recognizable for the MOZO case: “These innovation intermediaries emerge in response to a perceived suboptimal degree of connectivity between relevant actors…”(Johnson, 2008; Smits & Kuhlmann, 2004). The MOZO-platform can be seen as an innovation intermediary. It is established to deal with broader mobility issues in a strategic way, on an new and intermediary planning level. However, there are a number of tensions concerning the establishment and embedding of these innovation intermediaries(Klerkx & Leeuwis, 2009), as we have seen in the MOZO case too. The platform is silently abolished even before it has got the opportunity to show its qualities. A lack of political engagement and trust between the various administrations and government levels and between the munipalities themselves were the core problem. The MOZO platform eventually evolves into a so called ‘discussion platform’, due to shady communication and intransparant policy agendas. Consequently, the operational budget for this platform is publicly questioned and municipalities call for more actual and visible infrastructure interventions. Thejustification for public spending for innovation intermediaries is at stake, since a proper consideration or impact evalutation method of the intermediary organizations is not available (Klerkx & Leeuwis, 2009).However the municipalities themselves initially expressed the need for such an intermunicipal mobility planning platform. The MOZO-platform, initially perceived as a good and even necessary intermediate planning level, has not received a proper consideration. The effects in solving the mobility issues of the area, as expected by the the actors are not (yet) achieved, in spite of the considerable investment made on the organizational levels. This is parallel to Dobrov’s findingsabout orgwareand managerial apsects of technology in his call for an orgware approach. The difficulty of becoming embedded is here also apparent, as the different actors (municipalities, government agencies and higher authorities) have difficulty apprehending the nature and value of the intermediary’s activities (confer Klerkx & Leeuwis, 2009).

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4.3 Case 2: Oosterweel Link – completing the inner ring of Antwerp

4.3.1 Occasion and objectives

Figure 6: The Lange Wapper‘ overpass as landmark for the province of Antwerp (http://www.bavo.biz)

The Oosterweel link project comprises the closing of the inner ring road of Antwerp. The idea of the completion of the inner ring structure of Antwerp was first introduced by a left bank activist group resisting the intentions for a suggested greater outer ring of Antwerp. This outer ring, already on the agenda in the 1970s, was planned to pass through the left bank development. Resisting this idea, the activists suggested a completed inner ring instead, leaving the left bank untouched. Their idea was taken up by the former governor of the Antwerp province,Camiel Paulus. He saw a huge architectural project for his province in the completion of the inner ring with an extra Scheldt tunnel crossing next to an enormous overpass over two docks and the northern edge of the city. This 'Lange Wapper' overpass was designed as landmark and as the crowning glory of the governor's work and of the later Masterplan 2020 of Antwerp, see figure 6(Lauwers, 2012).

The initial plans for the project were rather based on an architectural - engineering approach than embedded in a broader mobility vision. The fact that the complete inner ring structure was never mentioned in any planning document at the time, neither in the ongoing debate, showed the lack of being embedded in a broader mobility rationale. The problem definition was rather narrow, since it onlyfocused on congestion (Lauwers, 2012). Environmental health, liveability and sustainability issues were not yet adopted in the programme, which would change later when the project had become controversial and had got an increasing resistance since the years 2008-2012.

After several revisions, as we shall see in the next paragraph, the plan has been adapted to the changing context of environment, sustainability and liveability issues. The most recent Oosterweel link plan ismore embedded in a mobility framework, than it was at first. The problem definition now also covers the creating of green space, the optimizing of liveability and the increasing of accessibility of city and port (Lauwers, 2012; Rosquin, 2010)

4.3.2 Actors & Project process

Here an overview of the key points in the Oosterweel link history is given, see also figure 7.The Oosterweel link, providing for a complete inner ring road around Antwerp, started as a seamless project of architectural nature. In 1995 the Flemish Agency for Roads and Traffic (AWV, AgentschapWegenenVerkeer) was to develop a Master plan for Antwerp. The governor of the Antwerp province was captivated by the idea of a completed inner ring structure to deal with the congested traffic around Antwerp. An extra Scheldt crossing through an overpass design (see figure 6) would provide the solution to the traffic malaise. The Antwerp master plan took shape during the following years. New roads, tram projects, cycling lanes and the Oosterweel link were measures taken up in the plan. In 1999 the mayor of Antwerp, Steve Stevaert, launched a feasibility study for closing the inner ring, which would be executed by Grontmij consultancy. In the study Grontmij initially came up with 6 different trajectories for the closing of the ring, but in extremis a seventh trajectory was included: later known as the BAM- trajectory. This trajectory was retained, however no clear reason for the choice of this trajectory was publicly known. The trajectory was an optimized medium trajectory of an already suggested one. The BAM-trajectory consisted of a tunnel underneath the river Scheldt that would come to the surface in the former municipality Oosterweel and would turn into a double deck overpass from there to the connection with the R1 (existing part of the ring) in Merksem(Rosquin, 2010).In 2000 the city of Antwerp, the Antwerp Province, the Flemish government, the port of Antwerp and the public transport company supported the plan under the guidance of the governor. In 2001 a temporal research group was established, named TV SAM, in order to prepare the projects for the master plan. Whenthe study work was finished, TV SAM (temporary joint research group Antwerp Mobile, 'tijdelijkevereniging-studiegroepAntwerpenmobiel') was replaced by BAM in 2003, (Management Company Antwerp Mobile, 'BeheersmaatschappijAntwerpenMobiel', where the focuswas on the management function. In the years that followed the implementation of the BAM-trajectory was made legally possible. In 2005 the environmental impact assessment (EIA) of the plan had been approved by the Flemish government. The regional spatial implementation plan was finalized as well during the end of 2005.

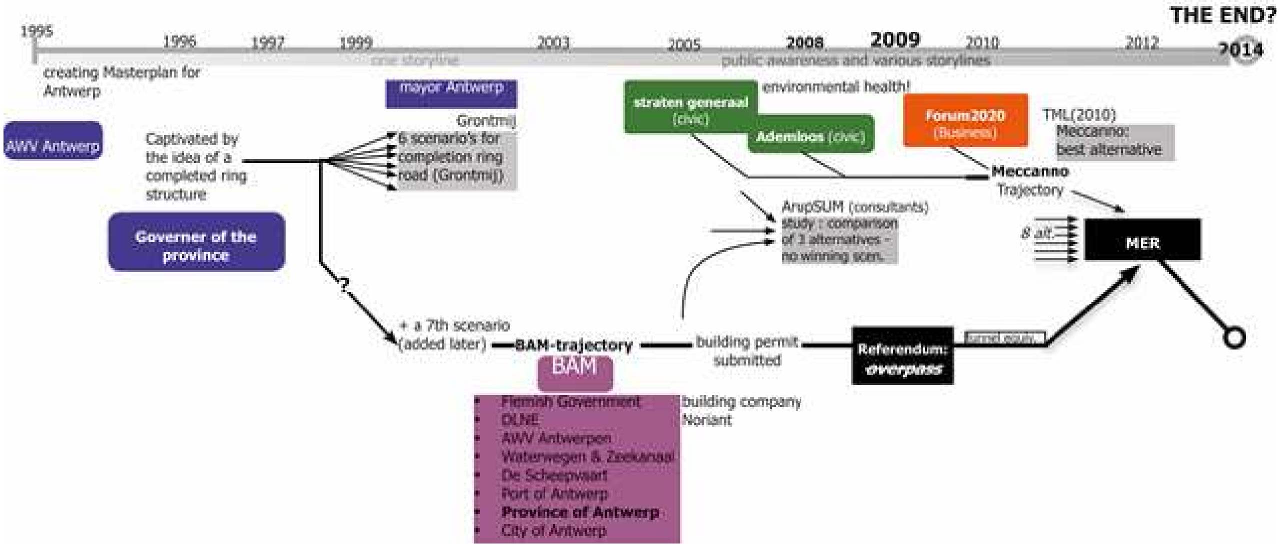

Figure 7: Oosterweel link planning process from 1995 till 2014 (Own elaboration)

Since the second half of 2005 opposition had grown. Antwerp citizens did not accept the government's choice for the BAM-trajectory and went into resistance. From this time on the Oosterweel link project became controversial and resistance was increasing. The activist group 'stRaten-generaal' came up with an alternative trajectory, which provided for a longer tunnel under the river Scheldt and in which the city that was situated further north than the BAM proposed. They abolished the idea of the double deck overpass as was mentioned by the BAM. In spite of this increased resistance and the proposed alternatives, the BAM decided to continue their project and made a deal withNoriant, for the implementation of the project(Rosquin, 2010).

By 2008, much more critical voices came into the debate. The price and financing of the project was questioned, even more because of the financial crisis in Europe. When in 2008 a new activist group 'Ademloos' (i.e. 'breathless') interfered into the debate, focusing on the health impact of the project, the Flemish government requested a new study of the alternatives, conducted by Arup-SUM. This study had to take into account the alternatives suggested by among others stRaten-generaal and the BAM. Only, there was no alternative that excelled for all measured parameters. The Flemish government then chose again for the BAM-trajectory, though it became clear that extra research had to be carried out. In 2009 a referendum was held for the Antwerp citizens. The implementation of the Oosterweel link was to be clarified.In the referendum the Antwerp citizens had to choose either for the tunnel or for the overpass variant, in the end the tunnel that was voted for. The trajectory itself was not at stake. Meanwhile the BAM had already submitted a building permit. But by 2010 another activist group, consisting of business sector actors in Antwerp, called the 'forum for mobility Antwerp 2020', had launched a new trajectory proposal, which they worked out together with the other opposition groups, Ademloos and stRaten-generaal. Their 'Meccano' trajectory redirected the transit traffic before reaching the inner part of the ring, via two extra connections or 'braces' (Rosquin, 2010).

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In 2010 the final decision in the Oosterweel link debate was promised by the Flemish government, suggesting an overall solution. The problem definition and objectives had to be broadened. A multimodality viewpoint was adopted instead of interventions solely focussing on the infrastructural road traffic layer. Hereafter, the Masterplan 2020 was approved, which held the actualized version of the former master plan for Antwerp. Though a study carried out by TML (Transport & Mobility Leuven) showed that the Meccano trajectory was preferable to the BAM-trajectory, the tunnel version of the Oosterweel link following the BAM trajectory wasincorporated in the master plan, together with some other infrastructural interventions in the southern part of Antwerp. In 2012 a new EIA wasconductedboth to assess the different alternatives and their impacts on health and environment once again and to get an idea of the best possible alternatives. This EIA had been conducted by Antea group.There were numerous alternatives proposed eight of which were selected and incorporated in the EIA.These could then still vary in different exploitation methods (e.g. toll tunnel, fright traffic ban). In 2014 the EIA had been finished on the basis of which the government finally and without much explanation chose for the Oosterweel link by the BAM-trajectory (J.V.A., 2014; Rosquin, 2010).

Resistance however got a new breakthrough since a collective of spatial planners and architects started the Ringland initiative. Ringland came up with the idea of an overall underground ring, giving more green space to the citizens and reducing noise and emission impact at the city surface. This idea referred to the partly underground M30 ring road in Madrid, that had already been realized in the period of 2004 – 2007. In some three months' time, by the end of January 2015,Ringland had collected more than 100 000 euro, by symbolically selling the potential land on the surface of the ring (4m² for €20). This crowd funding money was destined for a mobility study, a cost benefit study and a liveability study (E.D.M., 2015).

4.3.3 Project outcomes and discussion

Now that the trajectory is finally decided, the mode of implementation of the plan is another question. End January 2015 a new regional spatial implementation plan (RSIP) for the Oosterweel link (following the BAM-trajectory) has been approved. In this RSIP the government leaves the possibility of the underground ring road, but opposition groups strongly disagree (BELGA, 2015). Further steps that have to be tackled are the preparation of a new EIA for the project and the submission of a new building permit (Vergauwen, 2015). Nonetheless the first preparatory construction works have already started begin 2015. And at the end of 2016 the actual Oosterweel link construction will have been initiated (http://hoevlothet.nu).

In short, in the beginning of the 1990s till the first half of the 2000s the planning process follows a seamless path. In contrast since 2005 the opposition has grown, certainly after 2008, when the leading actor, the former governor of Antwerp, retires. Different alternatives and various actors have become involved since. The government is losing grip on the situation, as also shown by the revision of the EIA and the various requested studies. The opposition becomes more and more well organized, they collect knowledge independently and they easily find each other through social media. The number of actors has only increased over time, as can be seen in figure 7. This case further shows a lack of transparency in the decision making process and agenda setting, rather decisions are technocratic shielded and have not been taking into account the concerns of the citizen groups and local (Lauwers, 2012). Instead of an internally situated problem as seen in the first case, here the actual problems are rather externally caused. A continuous change of involved actors predominantly outside the decision making group have had influence on the implementation mode of the project, but also postponed the project construction several times, through legal actions focussing on health and environmental impacts of the project. Though, the congestion problem was at first not seen as a mobility issue, let alone an environmental or health issue, thanks to opposition groups the debate gained depth in these fields. As a consequence the activist groups, often perceived as negatively for the project process by the decision group, have had a major impact on the debate. The focus turned from an architectural landmark to a project where health and environment are considered.

5 CONCLUSIONS AND PROSPECTS

Present mobility governance policies and strategies are not sufficient to deal with the more complex mobility problems. The two selected cases experienced a growing complexity of different actors and agendas with objectives that were not always transparant or well communicated. Following Rupprecht Consult (2012),Flanders' local mobility planning occurs to be among the best in Europe, however the praised participative process is not well suited to broader (cross-level, cross-border) mobility issues or projects as we've seen in the cases. None of the cases had much of an outcome, let alone a good one.

In the first case, the MOZO-platform was silently abolished even before it had got the opportunity to show its qualities. The problem with the MOZO-platform was rather internally caused. There was a lack of political engagement and trust between the various administrations and government levels and between the munipalities themselves. The MOZO platform evolved eventually into a kind of 'discussion platform', as one participant called it, due to shady communication and intransparant policy agendas. The operational budget for this platform was therefore publicly questioned. Municipalities called for more real infrastructure interventions. However the municipalities themselves initially expressed the need for such an intermunicipal mobility planning platform.

The second case, the Oosterweel link,was an already longlasting project that started off seamlessly but got an increasing resistance over time. The project took off as an architectural land mark infrastructure project that would solve the congestion and regular traffic jams on the Antwerp ring road, by completing the inner ring through an overpass construction. The governor of the Antwerp province took the lead and guided the project through the first then years without much resistance. Nevertheless, after his retirement in 2008, no specific actor replaced him and in the meantime opposition to the plan had grown. Opposition groups came up with new alternatives to the proposed Oosterweel link and carried out their own studies. The congestion problem was at first not seen as a mobility issue, let alone an environmental or health issue, but along with the opposition groups, the debate gained depth in these fields. Nevertheless, the government retained the Oosterweel link project, however the decision making was rather technocraticly shielded and still not taking into account the demands of the involved actors. Though the debate is not finished yet. Ringland activists collected in the end of 2014 more than 100.000 euro from crowdfunding, in order to execute additional research. The opposition against the project became more and more well-organized and is came up with their own studies to confront the government. Leaving these external actors out of the debate for so long has only worsened the trust in the government strategies and has delayed the project progress, while these actors could have contributed a lot to the debate.

Both case studies show that a reorganization of traditional planning institutions and networks is needed to overcome both internal and external problems for implementation. From these cases we can answer our central research question: mobility planning suffers from a lock-in situation and leaves no room for external actors to come into the debate. In order to make the turn towards a more sustainable mobility and to come up with succesfull mobility plans it is necessary to include the needs and demands of all actors involved with mobility from the beginning. Moreover, next to this increasing opposition and internal complextity of multilevel/multidimensional governance, new intiatives and actors pop up (partly induced by the telecom sector) and are challenging traditional mobility planning to its very core. Uber is competing with the highly formalized taxi-sectors; bike and car sharing systems or even driverless cars challenge the management side of mobility and cause often implications for legislation. As a result long term, strategic planning seems to have had its days; or at least needs to be flanked by a more or less situational, non-linear mobility planning in order to deal with these fragmentated, fuzzy inititiaves. The scale of the planning has to be adapted to the need of the specific mobility issues. A priori planned long term mobility futures are more and more missing the mark; rather a series of tactics should be adopted to facilitate the demands of actors.

In order to reach the operational mobility objectives a substantive mobility turn has to be launched. Rigid institutional frameworks don't fit anymore.Real dynamics are to come from the outside-in and from the bottom-up, resulting in a well suited adaption of the organization of mobility with respect to the demands. New upcoming innovations and actors in the field of mobility will only increase complexity in the future. Therefore perspectives demand a changefroma focus on hardware (and/or even software) solutions, towards 'orgware' solutions. Up till now mobility policy has mainly been focussing on interventions in the infrastructural networks, on change in mobility behaviour or on the technological level (e.g. emission reduction). Next to these, we want to address in this paper the need for a more appropriate perspective on mobility governance to deal with environmental and health challenges. Therefore we suggest an actor-network approach within different arenas of mobility, where actors, organizations and institutions coact. We would like to call this additional approach an orgware approach, existing next to a software (technology, knowhow) or a hardware approach (infrastructure). The orgware approach has to come up with solutions for the governance of complex actor-networks in the (direct and indirect) field of mobility.

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Exploration and Imagination of City Futures in Science-Fiction

Moritz Maikämper, Carolin Pätsch

(Dipl.- Ing. Moritz Maikämper, BTU Cottbus-Senftenberg, Konrad-Wachsmann-Allee 2, 03046 Cottbus, Germany, moritz.maikaemper@b-tu.de)

(Dipl.-Ing. Carolin Pätsch, BTU Cottbus-Senftenberg, Konrad-Wachsmann-Allee 2, 03046 Cottbus, Germany, paetsch@b-tu.de)

1 ABSTRACT

Whilst urban planning is regularly based on the scientific state of the art, Science-Fiction (Sci-Fi) creators are free to implement more improbable aspects which may look ‘mad’ from today’s view. This paper focuses on the question what urban planning can learn from urban future created in Sci-Fi works.

The articleis based on empirical data from a research project named “Sci-Fi Cities – urban futures in art, literature and video". The study was conducted by an interdisciplinary team of researchers at Brandenburg University of Technology, Germany, including experts from media science, urban planning, architecture and visual arts.

The aim of the study is to analyze how future cities work in Sci-Fi and if respective what urban policy formulation can learn out of it. The timeframe set starts from the 1970ies and focuses on Sci-Fi works dealing with a future being still prospective from today’s view. The geografical emphasis is put on the Western culture (Europe, US, Japan) since the study aims in providing deductions for the German context. Sci-Fi works from different media as movies, literature, comics, computer games are taken into account.The project was assigned by the Federal Institute for Research on Building, Urban Affairs and Spatial Development in Germany (October 2014 until March 2015).[1]

2 URBAN PLANNING AND FORESIGHT

Cities are focal points in society’s progression and development. At the same time, they are hotspots of risks and threats as natural disasters, military or cyber attacks (Rötzer 2006). Imagining the future of cities and regions therefore requires not only to make plans and to implement them but also to find strategies to avoid risks.

Urban planning is always made for the future. As the way we plan our cities at least partially determines the future, it is important to know for which future we are going to plan (cf. Acatech 2012: 13).As there is not the future but a range of possible future worlds, the use of different means like foresights, prognoses and scenarios has been integrated into spatial planning strategies for decades (Neumann 2010). Common scenarios for a city or region relate i.e. to the population figure.

The scientific state of the art and the methods approved determine the foresight of future development undertaken by scientists. Altough this prevents fortunetelling it may restrict the scientists’view on the future. In comparison, Sci-Fi creators have more liberty to think about likely or unlikely developments (Steinmüller 2010).

The study conducted by the authors builds on this approach:The aim of the study isto bring Sci-Fi future imagination into the urban planning discurse to enlargen the pool of ideas forfuture cities. Despite their different background, Sci-Fi cities’ creators can provide foresights on cities’ development in the sense of an early warning mechanism. Therefore, a detailed question of the study is: Which areas of planning action need special attention to prevent developments and to facilitate positive Sci-Fi visions?

3 AN APPROACH TO THE SCIENCE-FICTION GENRE

Sci-Fi is, among grotesque, fairy tales and gothic novels,a part of speculative fiction. The term Sci-Fi goes back to the 1920ies when Hugo Gernsberg edited the pulp magazine Amazing Stories (Midal, Clemens, 2008: 11ff, 91ff). Nowadays, Sci-Fi is a part of popular culture: Sci-Fi imaginations are represented in films, literature, comics and games, partly in visual arts as well. They are referenced in fan discurses, in particular in the internet (fan art, cf. Zaremba 2010).

[1] The study was conducted by aninterdisciplinary team consisting of Steffen Krämer (media scientist), Moritz Maikämper and Carolin Pätsch (urban planners), Bodo Rott (artist) and Belinda Rukschcio (architect) from Brandenburg University of Technology Cottbus–Senftenberg.

One important aim of Sci-Fi creators is to entertain. However, Sci-Fi works regularly criticize the existing world (Midal 2014). Steinmüller formulated the general aim of Sci-Fi by the imagination of "what if" based on a novelty (2010). Sci-Fi works act like a mirror of current trends and developments:They pick current themes, reformulate them and bring them back intothe discurse. This gives Sci-Fi the potential to design future, even for a popular audience (Steinmüller 2010). Nevertheless: Sci-Fi is not strictly linked to the future. Itrather means a side step from its contemporary origin (Midal 2014).

There is not a single definition of Sci-Fi (cf. for some: The Encyclopedia of Science Fiction: 1979). Regarding the experimental and explorative focus of the study, a broad definition of the genre Sci-Fi has been choosen, taking into account the view of Sci-Fi editors, authors, magazines, fans and secondary literature.

Although Sci-Fi is rooted in the imagination of technological future, city imagination plays an important role in Sci-Fi (Redmond 2004). In the 1970s, Sci-Fi city imagination was i.e. tightly linked to real development. Itdirectly commented on urban problems of US cities (Wolfschlag 2007): By that time, over-population and following problems were an important issue (Sobchack 2004). In some cases, real cities are the model for Sci-Fi cities. Despite the fact that distopian futures are dominating, there are examples giving positive Sci-Fi (city) visions, i.e. within specific political settings as in the German Democratic Republic (GDR).

One typical aspect of Sci-Fi is a division of semantic spaces. These spaces are defined by specific characteristics and stay in opposition to other semantic spaces. They can be congruent to topografical spaces or apart from them (Krah 2004). A classic Sci-Fi division i.e. is terrestrial vs. extraterrestrial. A city and its surrounding rural area can provide a similar division. Sci-Fi imagination of human societies ranges from space realities leaving the surrounding of the earth to existing urban scenes.

There is a long tradition of utopian city representations referring to other spaces without being linked to specific timely aspects (Koselleck 2000). The capture of the concept of utopia by Sci-Fi added the dimension of time to future urban portrayals. This refers to the aim of utopia in Sci-Fi: the goal of an ideal society, achieved by technical and moral progress (Kuon 2013). However, most of Sci-Fi works refer to a distopian future. In contrast to utopia, dystopia is a place of misfortune (Kuon 2013). This acts as a warning exaggeration regarding the way of living together (Kruschel 1995).

4 URBAN SCI-FI FUTURES

In the empirical approach Sci-Fi works showing urban areas and aspects were collected. 53 of them, providing a broad range regarding different media and the time and place of creation, were selected for a detailed analysis. The analysis was done with a grid of categories from media science and urban features, pertaining to:

- Settings andparadigmatic places
- Normative oppositions, represented by semantic worlds and themes
- Urban aspects as governance, technical and social infrastructure, typologies.

The analysis revealeda quantitative range of data in order to answer the question if Sci-Fi city imaginations offer a sufficiant complex urban picture. The amount of layers refered in the selected works show varieties from less than 10 to 19 out of 20 layers of the analytical grid. It became obvious that the amount of refered layers in literature and film is the highest. Nevertheless comic and games show a wide range of layers whereas visual arts employ relatively few layers which might partly due to the type of visualization. The quantitative analysis indicates that Sci-Fi imagination can be relevant for urban planning: Sci-Fi works show a kind of complexity of urban issues rather than fragmented urban scenes.

Beside the quantitative analysis, some Sci-Fi works were analyzed qualitatively to get comprehensive urban portrayals. Explicit visions of future cities are given in terms of urban transportation as well as the role of media and communication systems. Governance scenarios are less explicit but of same importance for comprehensive urban portrayals.

The analysis points out that governance aspects show a political systemin 90% of the analyzed media. In these systems, the stakeholders, their interest and the ways of rule extend beyond the existing ones. Main stakeholders are often firms, the state or the military, ruling within a totalitarian system. Techniques of territorial, biopolitical and psychological control exist in several works. The territorial control in Elysium

(2013) i.e. shows border control, resident permits and obligation of identification by a central administration. The territorial control implicits the possibility of central steering.

Regarding the architecture in future cities, the following results came forth: Construction materials shown are similar to the current ones whereas dimensions of buildings and cities differ from existing urban structures of the 20th century. By urban structures of inside and outside (building – open space or city – rural area) oppositions are shown. Nevertheless, open spaces are rarely part of Sci-Fi imaginations: If they are part of the urban scenery, they play a central role for the story and are used excessively or in unfamiliar ways, i.e. as settlement for the homeless (*Die kommenden Tage*, 2010), or as location for a multi-storey parking garage (*Traffic Problem*, 1976). In *Logans Run* (1976) nature is used as central element and opposite semantic space to the city.

Information about transportation structures exist in 47/53 works. This may be due to the fact that transit is a major part of the plot and carrier of the Sci-Fi story. The films *Cloud Atlas* (2012), *The 5th Element* (1997) and *Blade Runner* (1982) show a wide variety of transportation structures, mostly as modification of forms already known. Sci-Fi traffic scenarios show modifications of access and control to public transport and the way of use.

Although technical infrastructure is often part of Sci-Fi scenarios, it becomes explicit in less than half of the analyzed works. Two examples of Sci-Fi infrastruture scenarios are *materials cycles* and *environmental degradation*. In the visual art work *City of Slaves* (2005-2008) a materials cycle without emissions and disposal is shown. *Soylent Green* (1973) focusses on scarce ressources and degradation of the environment. *Soylent Green* represents a scenario based on the ecology discourse from the 1970s whereas the first shows the cycle from the 2000s' perspective. What applies for technical infrastructure also applies for social infrastructure: it is made explicit if it is part of the theme or scenario of the Sci-Fi work.

Nearly half of the Sci-Fi works analyzed use existing cities, headed by New York, as spatial reference. These works are from the media film, literature and comic. Existing references play a minor role in Sci-Fi games and visual arts.

5 LEARNING POTENTIALS FROM SCIENCE FICTION

Although there is a series of urban forms in Sci-Fi imagination which emerge in different times, the Sci-Fi story development is parallel to urban planning paradigms and the discurses have hardly any intersections, apart from the mentioned inspiration in the US of the 1970s. Sci-Fi references are based in other Sci-Fi stories or in current references of the author, which either could be current public discurses or personal interests of the respective creator. Despite the independance between urban and media science disciplines there are common features among themwhich have to be revealed in order to find interconnections between the both.

Notwithstanding classified Sci-Fi city forms, i.e. dome city, island city of edge city, used in Sci-Fi are not directly transferable to existing urban forms, they seem to be compatible for urban theory. The models of one field are used heuristically in the other field. In *Planet of Slums* (2006), Mike Davis i.e. uses the terminology "off-worlds" from the movie *Blade Runner* (1982) to explain anurban development. Vice versa, William Gibson uses the urban term “sprawl” to explain the metropolitan network between Boston and Atlanta. The use of film references in urban theory, i.e. in Planet of Slums, serves as container for several characteristics at the same time: The film *Blade Runner* addresses geografical segregation as well as the power of a global company. Davis thereby manages to use multidimentional references not having any direct urban theory equivalent. Apart from this hermeneutic use of terminology, professional urban planning or architecture literature is rarely referenced. However, professional references are more likely if the Sci-Fi creator himself is familiar with the other discipline.

AsSci-Fi works offer a complex city imagination (see ch. 4: Urban Sci-Fi Futures) and methodological assets (see next paragraph), they are worth to be taken into account for urban planning issues.However secondary literature dealing with sci-fi in different media is rare. Good examples taking cities into account are Robert Sheckley's *Futuropolis. Impossible Cities of Science Fiction and Fantasy* (1978), dealing with examples of architecture, arts, comics, graphic illustration and literature, and the *Visual Encyclopedia of Science Fiction* (1977), dealing with comics, magazines, books, movies and other media, ordered by themes including cities.

Whilst urban planning regularly is based on the scientific state of the art, Sci-Fi creators are free to implement more improbable aspects which may look ‘mad’ from today’s view. Although Sci-Fi creators methodically build their story on esthetic considerations (Steinmüller 2010), they create internal coherance and ‘realistic’ images for the sake of entertaining and creating a good story.

Sci-Fi scenarios show a direction which can be tested on plausibility and effects on their respective context. Their content complements on themes – the traditional object in media science – which represent the subject. The analysis revealsthemes like *limitations of governmental power*, *medical provisions* or *technical influences on the livelyhood*(see fig. 1). Based on the underlying situation, the respective scenario shows a utopian or dystopian manifestation. Extracted frequent scenarios are: *ultra-judiciary*[2], *uneven medical treatment and intelligent machines*.

Scenariosare one typeof future foresight in the sense of "it could be like that". The term scenario is not limited to the media science perspective on Sci-Fi. Scenarios are also a very common instrument in urban planning methods (see ch. 2).Scenarios are not used for predictions of the future. They are employed when fixed prognoses are not possible. "[…] scenarios are hypothetical sequences of events constructed for the purpose of focussing attention on causual processes and decision points" (Kahn, Wiener 1967, p. 6). Kahn and Wiener herby stress the selective character of scenarios centering one aspect and constructing possible developments.This is the common ground of Sci-Fi scenarios and urban planning scenarios. Due to the fact that Sci-Fi scenarios are not neutral and objective (Steinmüller 2010) they are more qualified for foresight than Sci-Fi themes.

According to Steinmüller (2010), the effects shown in Sci-Fi sceanrios are relevant for foresight because there are several matches of Sci-Fi scenarios and real developments. Nevertheless he denies Sci-Fi the capability for foresight of implementation of inventions. For technical novelties the match often reveals Sci-Fi images far from reality (ibid.2010). This stresses the potential of Sci-Fi to be used as an early warning system for urban development.

In both fields scenarios construct possible developments in the sense of a foresight. Nevertheless their purpose is different: Scenarios in strategical urban planning are a tool to deal with incertanties (Neumann 2011, 171) and fathom different development directions, whereas scenarios in Sci-Fi aim in entertaining and warning. The latter is one of the reasons why Sci-Fi scenarioscould be employed to fathom development directions in urban development. In addition, scenarios are a possible interconnection of Sci-Fi and urban planning, because they are used in both fields to illustrate possible directions of development. They equally refer to their respective context which makes them testable. Sci-Fi scenarios can be used as methods in urban planning because they communicate by pictures. Furthermore, Sci-Fi is a type of popular art and factor future creation (Steinmüller 2010). Due to the belonging of Sci-Fi to popular culture, Sci-Fi scenarios represent a type of foresight which can mobilize people and be a mind opener. Sci-Fi employed as impact assessment could be helpful for scientific foresight as well.

The interconnection of Sci-Fi and urban planning reaches beyond the methodological sphere. The study questioned whether Sci-Fi works give links to new fields of action in urban policy formulation. The underlying empirical analysis of the works indicates that Sci-Fi scenarios are relevant for urban development. Areas where urban planning can learn from Sci-Fi wereidentified by comparing them with current urban challenges in Germany and wider societal themes.

Due to their content, challenges of urban development in Germany in 2013 seem to be compatible with the themes identified in the analysis of the Sci-Fi works (see fig. 1). It is obvious that several challenges resemble common Sci-Fi themes. Some Sci-Fi themes could be connected to different urban challenges. This is the case for capitalism in Sci-Fi, which reflects the general subject of poverty of the municipalities due to financial crisis, polarization of income and unemployment as well as privatization of public services and economization of the public administration. The compliance might base on the broad character of the Sci-Fi themes but it is more likely that the interconnection exists because of the inspiration of Sci-Fi authors by current discurses. Due to the fact that in the 1970s Sci-Fi was close to urban development, some fields could have been derived from this area and be referenced in later creations.

[2]An extreme or autonomous judiciary not being subject to political control.

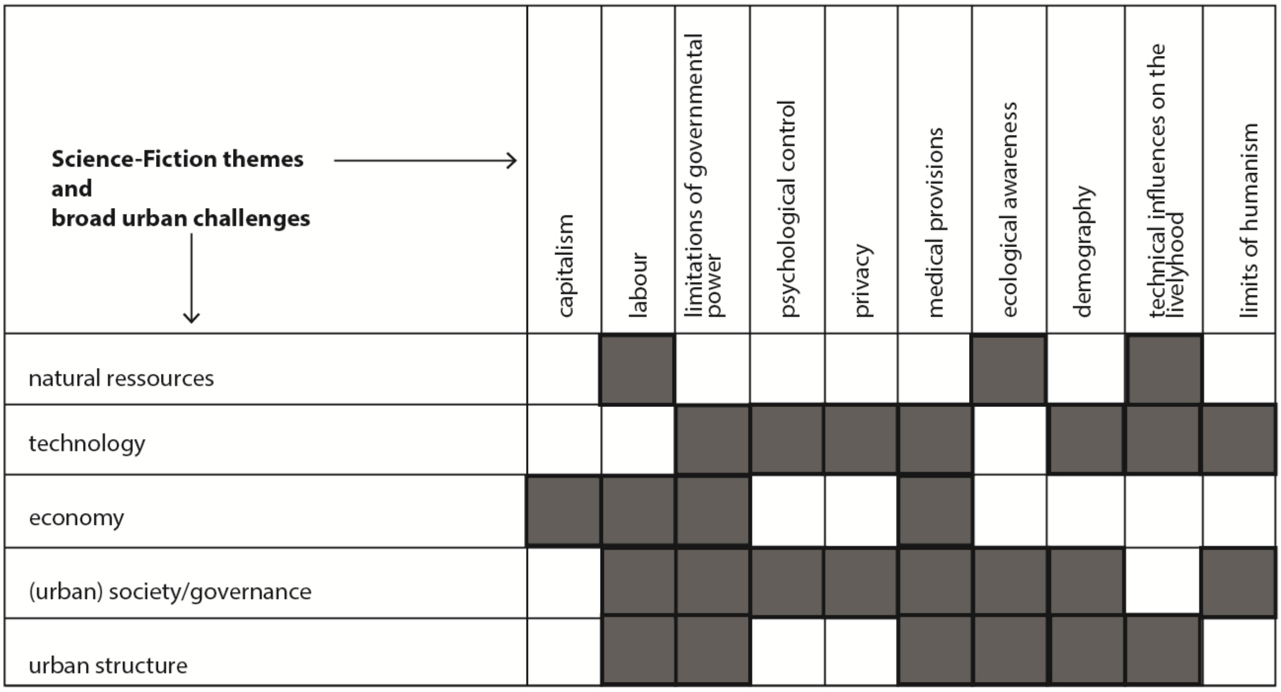

Fig. 1: Grid challenges and Sci-Fi scenarios (summarised presentation)

The Sci-Fi themes *capitalism,psychological control*[3], *privacy*[4] *and limits of humanism*[5]arethe ones least equivalent tocurrent urban challenges. This gap may base on the fact that most of these subjects do not represent classical urban planning subjects. Nevertheless these themes might gain importance for urban planning in the the future, i.e. by genetical research.

The match of wider societal themes currently discussed are i.e. the surveillance and control of public space in cities due to crime and terror threats. More and more, public transport spaces as well as public spaces in cities are under video surveillance. This restricts the freedom of use in these areas. Further it includes the risk of missuse of data by state secret services, a scenario which is omnipresent since the wikileaks affair. Currently this is more an issue for domestic politics and law, however, it has to be consideredfor urban planning and design. Adaptations in urban design and transport design are necessary in order to include augmented security requirements into the city space. Urban policies dealing with these issues are necessary. The examples show the proximity of current development trends to urban Sci-Fi scenarios. The film *Brazil* (1985)i.e. shows the consequences of missuse of personal data.

As a result of the study, fields of future urban policy action can be formulated. It is evident that even though the manifestations in urban sphere are not quite sure at the moment, policy makers have to be aware of themes named in Sci Fi. In addition research can promote knowledge generation;government subsidies can direct the development. The current discourserelated to *smart cities* shows that themes formerly not evident for urban issues become more and more important.

6 CONCLUSION

Urban policy formulation can learn from Sci-Fi: As the study illustrates, Sci-Fi works show a broad range of specific urban aspects, i.e. how public space can look like or how traffic might be organised in the future. Further, Sci-Fi scenarios can be an indicator for social and cultral trends. Urban planning using scenarios therefore can widen up its focus to integrate more improbable aspects by refering to Sci-Fi works. In the perception that Sci-Fi does not want to project the future but rather shows a side step of the existing world (Midal 2014), urban fields of action can be identified from Sci-Fi imaginations. Sci-Fi can help to train future thinking, open the mind to overcome barrieres of thoughts and open up popular future expectations

[3]The control of the citizens by drogues, hypnosis or control of dreams.
[4]Changesin present public-private divisions.
[5] Ethical questions dealing with hybrid beings or the transition between humans and maschines.

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(Steinmüller 2010). In this sense Sci-Fi can show in which areas risks and challenges for vibrant city futures are situated.

Nevertheless it seems necessary to pursue the connectionbetween media science and urban planning. As futorology uses methods of both, media sciences and urban planning, in terms of hermeneutic and modelling instruments,this might be a helpful interface.

The empirical research was based on the genre Sci-Fi. Related genres like fantasy may offer similar insights from differentdiscurses. The method of the study could be extended and integrate fantasy and other forms of speculative fiction for further inquiries.

Planning for vibrant cities and regions means to think in options because the future is uncertain. The use of scenerios in urban planning canhelp in this regard. Sci-Fi works offer potential fields for urban policy formulation however traditional urban policy fields are equally important.The results of the study should encourage planners to think outside the box to get a complex vision of future cities. Sci-Fi scenarios can be a valuable source in this regard.

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Cloud Atlas (film, direction: Tom Tykwer, 2012)
Die kommenden Tage (film, director: Lars Kraume, 2010)
Elysium (film, direction: Neill Blomkamp, 2013)
Logans Run (film, director: Michael Anderson, 1976)
Soylent Green (film, direction: Richard Fleischer, 1973)
City of Slaves (visual art work, Atelier van Lieshout, 2005-2008)
The 5th Element (film, direction: Luc Besson, 1997)
Traffic Problem (literature, author: William Earls, 1976)

reviewed paper

Factors Affecting Land-Taking Processes in Italy at the Regional Scale: Empirical Findings from Sardinia

Sabrina Lai, Corrado Zoppi

(Doctor Sabrina Lai, Department of Civil and Environmental Engineering and Architecture, University of Cagliari, Via Marengo, 2 - 09123 Cagliari, Italy, sabrinalai@unica.it)
(Doctor Corrado Zoppi, Department of Civil and Environmental Engineering and Architecture, University of Cagliari, Via Marengo, 2 - 09123 Cagliari, Italy, zoppi@unica.it)

1 ABSTRACT[1]

Land take is a process of significant relevance in the countries of European Union (EU), defined as the "Change of the amount of agriculture, forest and other semi-natural and natural land taken by urban and other artificial land development" (European Environment Agency, 2013a).

In 2011, the European Commission (EC) put in evidence that an important milestone for the EU should be to reach the goal of no net land take by 2050, and to take under strict control the impact on land-taking processes of the EU policies in the new Structural Funds programming period (2014-2020) (Communication of the EC to the European Parliament COM(2011) 571 of 20.9.2011).

In a previous paper, we analyzed the land-taking process in the period 2003-2008 through the land cover maps of Sardinia, made available in 2003 and 2008 by the Sardinian regional administration (Zoppi and Lai, 2014), as related to factors which are identified as relevant variables in several studies concerning land take, such as area size, accessibility, proximity to main cities and small settlements, to the coastline, or to nature conservation areas.

In this paper we study the Sardinian land-taking process in two time periods, 1960-1990 and 1990-2008. We assess if, and to what extent, these factors reveal similar, or different, effects in the two periods, and try to identify consistencies concerning the determinants of land take.

2 INTRODUCTION

We define land take as the "Change of the amount of agriculture, forest and other semi-natural and natural land taken by urban and other artificial land development" (European Environment Agency, 2013a). Findings and discussion proposed in this paper build upon the results of a previous paper (Zoppi and Lai, 2014), whose main points is worth summarizing here to make it clear to the reader how we address the issue of land take and what perspective we assume in order to assess the influence of physical, socio-economic and planning code factors on land-taking processes.

Land take amounted to more than 1,000 km2 per year between 1990 and 2000, and to about 920 km2 between 2000 and 2006 (European Commission, 2011), which means that the objective of no net land take by 2050 (Communication of the EC to the European Parliament COM(2011) 571 of 20.9.2011) would imply a decrease rate of about 800 km2 per year.

Italian figures concerning land take show that in 2009 a 7.3 percent of the Italian land had an artificial land cover (European Commission, EUROSTAT, 2012), with an average growth rate of about 6 percent between 1990 and 2000 and of about 3 percent between 2000 and 2006 (ISPRA, 2011, p. 479).

To provide a comprehensive, agreed-upon definition of land take is rather difficult. Let us consider, for example, the Land Use and Cover Areas frame Survey (LUCAS) of EUROSTAT (European Commission, EUROSTAT, 2010), and the COoRdination de l'INformation sur l'Environnement (CORINE) Land Cover vector map (CLC) of the European Environment Agency (EEA) of the EU (European Environment Agency, 2013b). In LUCAS, "artificial land", that is land taken by land-taking processes, is classed into two main groups, that is "built-up" and "non built-up" areas, where the former are further classed according to the number of floors of their buildings, while a separated sub-group is represented by greenhouses (Technical reference, document C-3 - Land use and Land Cover: Nomenclature, pp. 14-16). In CLC, "artificial surfaces" are classed into four groups (CORINE Land cover - Part 2: Nomenclature, p. 1): i. urban fabric; ii. industrial, commercial and transport units; iii. mine, dump and construction sites; and, iv. artificial, non-agricultural

[1] This essay comes from the joint research work of the authors. Sections 1, 2 and 6 have been jointly written by the authors. Corrado Zoppi has taken care of sections 3 and 5. Sabrina Lai has taken care of section 4 and has revised the whole essay and checked its comprehensive consistency.

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vegetated areas. Even though both LUCAS and CLC address the issue of artificial land cover, propose definitions of artificial vs. non-artificial land cover, and identify artificial and non-artificial areas, they greatly differ from each other.

Here, consistently with our previous paper (Zoppi and Lai, 2014), we do not propose a judgment on the rightness or wrongness of land take; rather, we analyze land-taking processes in order to detect what factors, and possibly to what extent, can be considered relevant to explain the phenomenon.

We implement our analysis with reference to the Sardinian region, one of the two major islands of Italy. We study the determinants of the dynamics of Sardinian land-taking processes in two time periods, 1960-1990 and 1990-2008, and assess these processes in terms of variables influencing land take, in order to evaluate if, and to what extent, these factors reveal similar, or different, effects in the two periods, and try to identify consistencies concerning the determinants of land take.

As of today, no detailed maps are available to describe, measure and compare land take over a large period of time in Italy. The European Environment Agency (EEA) does produce and make available land-cover maps but only from 1990 onwards[2]; moreover, the resolution of the map is not fully appropriate at the regional scale. Therefore, because we aimed at studying the process at the regional scale and by looking at a much larger space of time, we chose to study land take by integrating various sources as follows:

(1) two vector layers belonging to the dataset of the Regional Landscape Plan of Sardinia (RLP) (produced in 2006 and available from the regional geoportal[3]) that respectively describe historic settlements, defined as urbanized areas as of the end of the XIX century on the basis of the maps produced by the (then) Royal Geographic Italian Military Institute, and urban developments as of the end of the 1950's, which in Sardinia were usually built adjacent to the historic settlements, preserving their comparatively high density and compactedness together with the characteristics of older urban tissues and of the architectural features of the built environment;

(2) a vector layer produced by the EEA and describing Urban Morphologic Zones (UMZ) as of 1990[4]; these are defined by the EEA as "sets of urban areas laying less than 200m apart" and are identified on the basis of a selection of appropriate subclasses of the CLC class "artificial surfaces" contributing to the urban tissue and function;

(3) the 2008 Corine Land Cover Map produced by the Regional administration of Sardinia and available from the regional geoportal[5]; this is a vector dataset from which we selected only polygons belonging to the first-level CLC class "artificial surfaces".

The three above datasets differ in aim and resolution and for this reason they were preprocessed to avoid inconsistencies. As Figure 1 shows, such inconsistencies were corrected by means of basic geoprocessing operations.

Hence, we use the Sardinian CLC-based land-cover maps for 2008, the EEA's UMZ for 1990, and the above mentioned layers of the RLP to detect artificial land cover and land take in 1960.

In the CLC classification, non-artificial surfaces are classed into four classes (at Level 1): i. agricultural areas; ii. forests and semi-natural areas; iii. wetlands; and, iv. waterbodies. The land-taking process is identified in this study as the passage of areas from non-artificial classes, either in 1960, for the period 1960-1990, or in 1990, for the period 1990-2008, to the artificial land-cover class, either in 1990, for the period 1960-1990, or in 2008, for the period 1990-2008. Our analysis shows that Sardinia has experienced an increase in artificial land from 0.54 percent in 1960 (13,090 hectares) to 1.59 percent in 1990 (38,182 hectares), to 3.25 percent in 2008 (78,379 hectares).[6]

[2] Corine Land Cover 1990, 2000 and 2006 raster maps available at http://www.eea.europa.eu/data-and-maps/data/ (covering respectively 25, 39 and 37 countries); data for Italy are provided in all of the datasets [accessed February 24, 2015]

[3] http://www.sardegnageoportale.it/index.php?xsl=1598&s=135976&v=2&c=8831&t=1 [accessed February 24, 2015].

[4] http://www.eea.europa.eu/data-and-maps/data/urban-morphological-zones-1990-2 [accessed February 24, 2015].

[5] http://www.sardegnageoportale.it/index.php?xsl=1598&s=141401&v=2&c=8831&t=1 [accessed February 24, 2015].

[6] These findings are quite consistent with data on land take provided by ISPRA, the National Agency for Environmental Protection and available at http://www.isprambiente.gov.it/files/comunicati-stampa/2014/Tabelle_consumo_di_suolo.pdf [accessed February 24, 2015].

Table 1 lists the variables that describe non-artificial and artificial land cover and their descriptive statistics. Such variables refer to spatial units identified with the 377 municipalities of Sardinia.

This paper is organized as follows. In the third section we discuss the set of variables that we use as covariates to frame land-taking processes in Sardinia. Explanatory and dependent variables are described and spatially represented in the fourth section, and correlations between covariates and the dependent (land take) variable discussed.

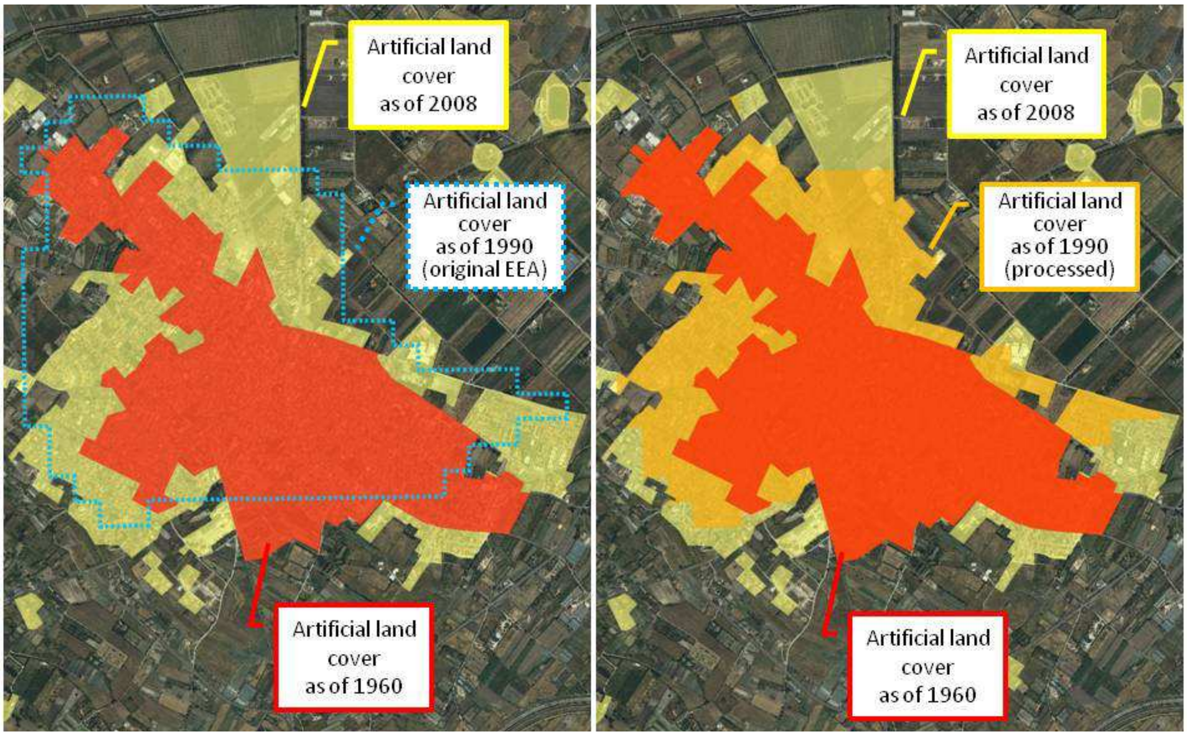

Figure 1: Analysis of changes in artificial land cover between 1960 and 2008: an example showing correction of inconsistencies due to differences in map resolutions.

The fifth section presents the results of regression models which use the land take variable and covariates in order to analyze if, and to what extent, these factors reveal similar, or different, effects in the two periods, and tries to identify consistencies concerning the covariates of land take. In the concluding section, we discuss consistencies related to the determinants of land take in order to identify factors that should be taken into account to define regional planning policies to limit or possibly prevent land take, and, by doing so, help implementing the EC recommendation on no net land take by 2050 into the EU regional policies.

3 FACTORS RELATED TO LAND TAKE

We consider land take as related to physical and planning code determinants, and to a social variable, that is residential density (Sklenicka et al., 2013; Huang et al., 2006), and as a possible consequence of pressure for future land development (CRCS, 2012).

We use the same covariates used by Zoppi and Lai (2014), classed as follows.

Variable	Definition	Mean	St.dev.
NURB1960	Municipality's non-urbanized areas in 1960 (ha) (source: RLP, Spatial Dataset of the Regional Geographic Information System of Sardinia, next SDRGISS[7])	6,353.51	6,157.73
NURB1990	Municipality's non-urbanized areas in 1990 (ha) (source: CLC, SDRGISS)	6,286.95	6,081.00
NURB2008	Municipality's non-urbanized areas in 2008 (ha) (source: Corine Land Cover Map of Sardinia – 2008 Edition, level 1, next CLCMS08, SDRGISS)	6,180.33	5,963.59
PLT6090	Percentage of municipal area whose land cover changed from non-urbanized to urbanized between 1960 and 1990	1.05	2.58
PLT9008	Percentage of municipal area whose land cover changed from non-urbanized to urbanized between 1990 and 2008	1.89	2.35

Table 1. Definition of land-cover variables and descriptive statistics.

[7] Available from the Regional Geoportal, http://www.sardegnageoportale.it/index.html [accessed February 24, 2015].

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(1) Physical factors:

(a) average size, slope and distance from the closest urban center of a municipality's non-artificial-land areas in 1960 or in 1990, which became artificial in 1990 or in 2008 (Sklenicka et al., 2013; Cheshire and Sheppard, 1995; Palmquist and Danielson, 1989);

(b) accessibility, that is (Stewart and Libby, 1998), 1. endowment of roads which connect regional town and city centers, which the Italian Code concerning Road Regulation (Italian law enacted by Decree n. 1992/285) classifies as "Highways", "Main extra-urban roads" and "Secondary extra-urban roads;" 2. proximity to the regional administrative capital city, that is Cagliari, which is also the most important city center of the region; and, 3. proximity to the nearest province administrative center;

(c) distance from the coast, since in Sardinia the-so called "coastal-strip" (CS) is considered a "strategic resource, vital for the achievement of sustainable development in Sardinia, that requires integrated planning and management" by art. 19 of the Planning Implementation Code (PIC) of the Regional Landscape Plan of Sardinia[8] (RLP); due to particular restrictions in force in the CS, it was believed that land take would occur in the proximity of the CS, as discussed by Dewi et al. (2013), who found that the establishment of protected areas in Asian and African tropical forestry regions determines an increased exploitation of the marginal lands just outside the protected areas.

(2) Planning-code-related factors:

(a) endowment of protected areas; it would be exptected that proximity to protected areas should increase the demand for new residential, commercial or recreational developments, which may possibly generate a change from agricultural to artificial land cover; from this perspective, land take is also driven by the availability of environmental amenities (Dewi et al., 2013);

(b) areas classed as "landscape components with an environmental value, defined as natural and seminatural areas" and as "agricultural and forestry areas" by the PIC of the RLP; it would be expected that it should be comparatively more difficult that such areas change their status from non-artificial to artificial land cover;

(c) areas located in the CS; these areas should be particularly unlikely to change their non-artificial land cover, as we have already discussed;

(d) areas which the planning code in force before the PIC, that is before 2006, classed as areas where land transformations and new developments were almost totally forbidden; it would be expected a positive influence of this variable on land take, at least in the 1990-2008, since the more conservative planning rules are weakened, the more land-taking processes occur, which is what happened (in year 2003) in the areas where the old regional landscape plans were not in force any more.

(3) population density; several studies put in evidence a positive agglomeration effect of this variable on land tand take (Sklenicka, 2013; Guiling et al., 2009; Forster, 2006).

Variable	**Definition**	**Mean 1960-1990**	**St.dev. 1960-1990**	**Mean 1990-2008**	**St.dev. 1990-2008**
PSIZ6090 *PSIZ9008*	Municipality's average size of areas classed as non-urbanized in 1960/1990 and urbanized in 1990/2008 (PSIZ6090/PSIZ9008) (ha) (source: RLP, CLC, CLCMS08)	4.60	7.18	2.07	1.25
SLOP6090 *SLOP9008*	Municipality's weighted average slope of areas classed as non-urbanized in 1960/1990 and urbanized in 1990/2008 (SLOP6090/SLOP9008) (percent); weight = area size (source: RLP, CLC, CLCMS08, Digital Terrain Model of Sardinia[9])	6.99	7.08	9.56	6.19
PRS6090 *PRS9008*	Municipality's weighted average distance from the closest urban center to areas classed as non-urbanized in 1960/1990 and urbanized in 1990/2008 (PRS6090/PRS9008) (km); weight = area size (source: RLP, CLC, CLCMS08, SDRGISS)	0.96	1.54	2.43	1.51
ACCESS	Endowment of roads connecting regional town and city centers per unit of municipal land area (km/km^2) (source: SDRGISS)	**Mean**	0.96	**St.Dev.**	0.47
DISTCAPC	Distance of a municipality from the regional capital city, Cagliari (km) (source: Google Maps)	**Mean**	126.46	**St.Dev.**	71.27
DISTNEAC	Distance of a municipality from the closest province administrative	**Mean**	30.99	**St.Dev.**	16.70

[8] Available at: http://www.sardegnaterritorio.it/paesaggio/pianopaesaggistico.html [accessed February 24, 2015], which includes the PIC of the RLP, its cartography cartographical zoning classes and spatial dataset.

[9] Available at: http://www.sardegnageoportale.it/ [accessed February 24, 2015].

	center (km) (source: Google Maps)				
DISC6090 *DISC9008*	Municipality's weighted average distance from the shoreline to areas classed as non-urbanized in 1960/1990 and urbanized in 1990/2008 (DISC6090/DISC9008) (km); weight = area size (sources: RLP, CLC, CLCMS08, SDRGISS)	17.23	14.98	21.05	13.91
CONSAREA	Municipality's total protected area: parks, reserves, etc. (ha) (sources: SDRGISS)	**Mean**	1,342.74	**St.Dev.**	2636.12
NAT6090 *NAT9008*	Municipality's landscape components with environmental value, defined as natural and seminatural areas, that change from non-urbanized to urbanized between 1960/1990 and 1990/2008 (NAT6090/NAT9008) (ha) (sources: RLP, CLC, CLCMS08)	2.73	13.45	10.79	22.16
AGFO6090 *AGFO9008*	Municipality's landscape components with environmental value, defined as agricultural and forestry areas, that change from non-urbanized to urbanized between 1960/1990 and 1990/2008 (AGFO6090/AGFO9008) (ha) (sources: RLP, CLC, CLCMS08)	3.12	11.25	24.11	47.93
COASTRIP	Percentage of a municipality's area included in the CS (ha) (source: RLP; SDRGISS)	**Mean**	1.22	**St.Dev.**	2.41
OLPL6090 *OLPL9008*	Municipality's area classed in the planning code in force before 2006 as areas where land transformations and new developments were almost totally forbidden, that changes from non-urbanized to urbanized between 1960/1990 (OLPL6090) and 1990/2008 (OLPL9008) (ha) (sources: RLP, CLC, CLCMS08, SDRGISS)	20.35	87.46	36.04	90.98
DENS1961 *DENS1990*	Municipality's population density in 1961 (DENS1961) and in 1990 (DENS1990) (people per square kilometer) (source: web site of the Italian Institute of Statistics http://demo.istat.it/dat81-91/COMUNI/ind_ pro.htm and website http://www.comuni-italiani.it/ [both accessed February 24, 2015])	70.02	170.80	74.73	213.84
AUTC6090 *AUTC9008*	Municipality's spatially lagged dependent variables 1960-1990 (AUTC6090, ref: PLT6090, Table 1 and Subsection 3.1) and 1990-2008 (AUTC9008, ref: PLT9008, Table 1 and Subsection 3.1)	0.99	1.56	1.82	1.27

Table 2. Definition of land-cover covariates and descriptive statistics.

Table 2 shows the variables which describe factors related to land-taking processes and their descriptive statistics.

3.1 Autocorrelation-related spatially-lagged dependent variable

If the value of a variable defined with reference to a spatial unit, such as a municipality, is correlated to the values it takes in the closest units, the variable is characterized by spatial autocorrelation. Spatial autocorrelation of the dependent variable in spatial regressions produces biases in the model's estimates. This issue can be addressed by adding a spatially-lagged dependent variable to the set of covariates (Anselin, 1988; 2003).

The presence of spatial autocorrelation of the dependent variable of our model, that is municipality's 1960-1990 and 1990-2008 percent change from non-artificial to artificial land cover (PLT6090 and PLT9008) is detected through the Moran's test (Moran, 1950; Anselin, 1988).

The Moran's test concerning the spatial autocorrelation of a variable X which takes values over a finite number of spatial units i, i = 1, …, N, is based on a statistic I defined as follows:

$$I = \frac{N}{S} \frac{\sum_{ij} W_{ij}(X_i - \boldsymbol{X})(X_j - \boldsymbol{X})}{\sum_i (X_i - \boldsymbol{X})} \qquad (1)$$

where j = 1, …, N, **X** is the mean of the components of vector X, W_{ij} is equal to 1 if spatial unit i is spatially related to spatial unit j, 0 otherwise, and S is equal to $\sum_i \sum_j W_{ij}$. The test assumes that I is normally distributed with a zero mean in case no spatial autocorrelation occurs, which is the null hypothesis of the Moran's test. If the p-value of the test is lower than 5-10%, a spatially-lagged dependent variable should be added to the set of the covariates in order to make the model unbiased, since it is very likely that the values of the dependent variable are spatially autocorrelated. The spatially-lagged dependent variables, named AUTC6090 and AUTC9008 in Table 2, are defined through the following procedure, where AUTOCORR represents a spatially-lagged dependent variable (Anselin, 1988; 2003):

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$$AUTOCORR_i = \sum_j W_{ij} \quad (2)$$

where i, j = 1, …, N.

The application of the procedure described so far to our study implies the implementation of the Moran's test. We implement a set of Moran's tests using GeoDa[10] by assuming, alternatively, that W_{ij} of (1) is equal to 1 if: i. municipality i's and j's boundaries overlap each other, at least to some extent (Order 1 in Table 3); ii. municipality j's boundary overlaps the boundary of municipality z, at least to some extent, which in turns overlaps municipality i's boundary (Order 2 in Table 3); iii. municipality j's boundary overlaps the boundary of municipality z, at least to some extent, which overlaps municipality y's boundary, which overlaps municipality i's boundary (Order 3 in Table 3).

Contiguity order	Moran's I statistic	Stand.error	z-statistic	P-value: I=0
AUTC6090				
Order 1	0.422	0.022	18.990	7.27E-57
Order 2	0.280	0.018	15.229	3.92E-41
Order 3	0.142	0.017	8.149	5.51E-15
AUTC9008				
Order 1	0.341	0.022	15.859	9.88E-44
Order 2	0.237	0.020	11.666	4.74E-27
Order 3	0.145	0.018	8.230	3.11E-15

Table 3. Moran's test concerning spatial autocorrelation of variables AUTC6090 and AUTC9008.

Table 3 shows the results of the six Moran's tests carried out, which are always significant. The most significant is the first case (Order 1), so we add a spatially-lagged dependent variable defined by (2) to the set of covariates of our model, where W_{ij} is equal to 1 if municipality i's and j's boundaries overlap each other, at least to some extent. Descriptive statistics of AUTOCORR are shown in Table 2.

4 LAND TAKE AND ITS COVARIATES: SPATIAL REPRESENTATION AND CORRELATIONS

Once three shapefiles describing urbanized areas as of (i) 1960, (ii) 1990, and (iii) 2008 were obtained (as previously stated in Section 2, from the Sardinian CLC-based land-cover maps for 2008, the EEA's UMZ for 1990, and from selected layers of the RLP spatial dataset for the end of the 1950's), it was possible to derive two further shapefiles describing those parcels of land whose land cover changed from non-artificial to artificial respectively between 1960 and 1990 and between 1990 and 2000; this in turns made it possible to calculate, for each Sardinian municipality and in the two selected time periods, the magnitude of land-take (PLT6090, PLT9008), as well as the average size of parcels whose land cover had changed from non-artificial to artificial (PSIZ6090, PSIZ9008).

Through GIS-based analyses consisting either of combinations of basic geoprocessing operations or of more advanced techniques (e.g. to estimate the values of SLOP6090 and SLOP9008, PRS6090 and PRS9008, DISC6090 and DISC9008), a geographic dataset was developed and the value of each variable for each of the 377 Sardinian municipalities was calculated, which made it possible to analyze the spatial distribution of the variables.

The values of the correlation coefficients (ρ) measuring the linear dependence between the dependent variables PLT6090 and PLT9008 (accounting for land take at the municipal level in the two time periods taken into account) and their respective sets of covariates are shown in Table 4, where some high and positive correlations are highlighted: PLT6090 is correlated to DENS1961 (ρ=0.7185) and to PSIZ6090 (ρ=0.5259), while PLT9008 is correlated to PSIZ9008 (ρ=0.6068) and to DENS1990 (ρ=0.4951). This means that, in general, the higher the value of land take, the larger the size of parcels whose land cover changed from non-artificial to artificial in the given time period, and the larger the population at the beginning of the interval under examination.

[10] Version 1.4.6. Available at https://geodacenter.asu.edu.

Dependent variable: PLT6090				**Dependent variable: PLT9008**			
	ρ		**ρ**		**ρ**		**ρ**
PSIZ6090	0.5259	*CONSAREA*	0.0405	*PSIZ9008*	0.6068	*CONSAREA*	-0.0704
SLOP6090	-0.1316	*NAT6090*	0.3361	*SLOP9008*	-0.3039	*NAT9008*	0.1846
PRS6090	0.2664	*AGFO6090*	0.3955	*PRS9008*	0.0884	*AGFO9008*	0.2476
ACCESS	0.1442	*COASTRIP*	0.4328	*ACCESS*	0.2869	*COASTRIP*	0.3823
DISTCAPC	-0.1464	*OLPL6090*	0.2904	*DISTCAPC*	-0.1901	*OLPL9008*	0.1972
DISTNEAC	-0.2438	*DENS1961*	0.7185	*DISTNEAC*	-0.3402	*DENS1990*	0.4951
DISC6090	-0.1827			*DISC9008*	-0.3408		

Table 4. Pearson product-moment correlation coefficients between the two dependent variables (PLT6090 and PLT9008) and all of their covariates listed in Table 2.

Lower, and yet relevant (between 0.30 and 0.45), are the positive correlation coefficients on the one hand between PLT6090 and COASTRIP, AGFO6090, NAT6090, and on the other hand between PLT9008 and COASTRIP. This means that, usually, higher values of land take occured in municipalities whose territory overlaps the coastal strip as defined within the 2006 RLP, and that between 1960 and 1990 land take occurred in municipalities having larger areas classed by the RLP either as natural and seminatural areas or as agricultural and forestry areas. The highest negative values of the correlation coefficient can be found on the one hand between PLT6090 and DISTNEAC and on the other hand between PLT9008 and the variables DISTNEAC and DISC9008, although the linear correlation is not as relevant as the above mentioned positive ones (ρ takes values between -0.24 and -0.34).

Maps in Fig. 2 and 3, where polygons represent Sardinian municipalities, depict the spatial distribution of the variables PLT6090, PLT9008 and of their two covariates having the highest positive values of the correlation coefficient, that is, respectively, PSIZ6090 and DENS1961 for the first, and PSIZ9009 and DENS1990 for the second.

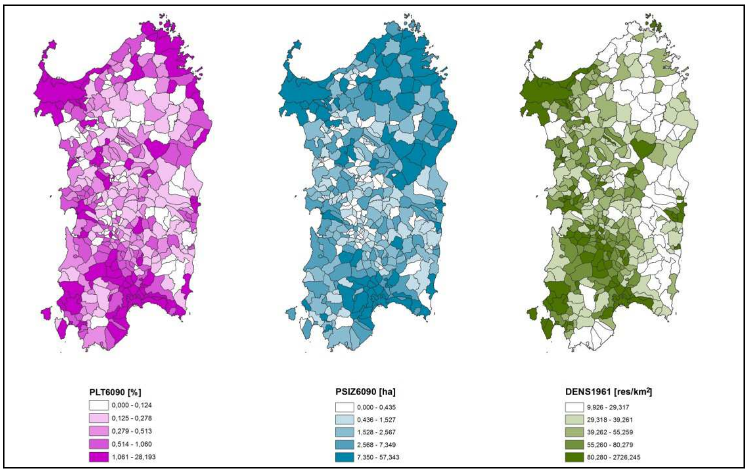

Figure 2: Spatial representation of the variables PLT6090, PSIZ6090 and DENS1961 at the municipal level (quantiles).

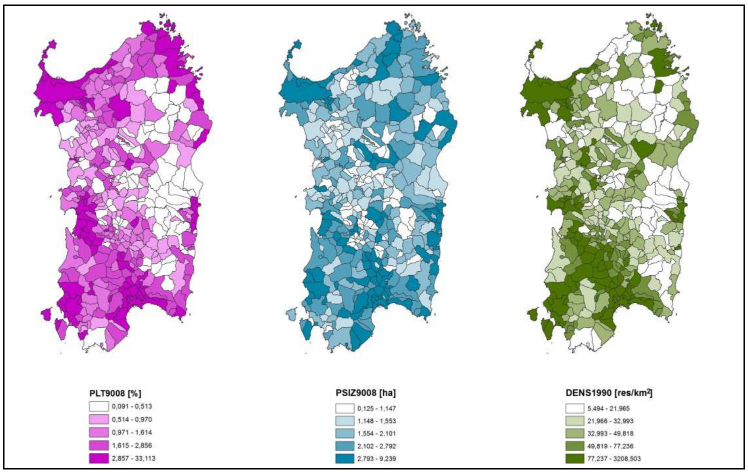

Figure 3: Spatial representation of the variables PLT9008, PSIZ9008 and DENS1990 at the municipal level (quantiles).

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5 RESULTS

We use an ordinary-least-squares (OLS) model to analyze if and to what extent each factor, which the literature quoted in the third section identifies as a possible determinant, is correlated to land take, in the two periods 1960-1990 and 1990-2008. Preliminarily, we estimate two OLS regressions for each period. The first includes the actual values of the explanatory variables described in Table 2, while the second uses their logarithms. By doing so, we assess whether the linear or the log-linear models shows the best fit. The estimates of coefficients of the variables from the two models are consistent with each other, even though the linear models' fitness is quite greater than that of the log-linear, since the values of adjusted Rs-squared related to the 1960-1990 period are about 80 percent for the linear model and about 73 percent for the log-linear, and the values of adjusted Rs-squared related to the 1990-2008 period are about 63 percent for the linear model and about 55 percent for the log-linear. Therefore, our discussion is based on the linear models' estimates.

The estimates related to the 1960-1990 period, reported in Table 5, show significant correlations (p-values less than 0.1 percent) for: (i) the average size of areas classed as non-artificial in 1960 and artificial in 1990 (PSIZ6090, positive); (ii) the landscape components with an environmental value (agricultural and forestry areas) that change from non-artificial to artificial land cover (AGFO6090, negative); (iii) the size of a municipality's environmentally-valuable landscape components (NAT6090, positive); (iv) the percentage of a municipality's area included in the CS (COASTRIP, positive); (v) the municipality's area classed in the planning code in force before 2006 as areas where land transformations and new developments were almost totally forbidden that changes from non-urbanized to urbanized between 1960 and 1990 (OLPL6090, positive); (vi) the residential density in 1961 (DENS1961, positive); and (vii) the spatially-lagged dependent variable (AUTC6090, positive).

Moreover, less significant estimates are reported for: (i) the distance of a municipality from the regional capital city (DISTCAPC, negative, p-value: 6 percent); (ii) the distance of a municipality from the closest province administrative center (DISTNEAC, positive, p-value: 7 percent); (iii) the endowment of roads connecting regional town and city centers per unit of municipal land area (ACCESS, positive, p-value: 11 percent); (iv) the municipality's total protected area; (v) the municipality's weighted average distance from the closest urban center to areas classed as non-urbanized in 1960 and urbanized in 1990 (PRS6090, negative, p-value: 14 percent); (vi) the municipality's weighted average distance from the shoreline to areas classed as non-urbanized in 1960 and urbanized in 1990 (DISC6090, positive, p-value: 20 percent).

Finally, the municipality's weighted average slope of areas classed as non-urbanized in 1960 and urbanized in 1990 does not seem to influence land take in the period.

The estimates related to the 1990-2008 period, reported in Table 5 as well, are consistent with the 1960-1990 estimates for variables PSIZ9008, PRS9008, ACCESS, DISTNEAC, CONSAREA, COASTRIP, OLPL9008, DENS1990 and AUTC9008. Variables DISTCAPC, DISC9008, NAT9008 and AGFO9008 do not seem to impact on land take. SLOP9008 does not seem to influence land take in the 1990-2008 time period as well.

6 DISCUSSION AND CONCLUSION

This paper analyzes the Sardinian land-taking processes through OLS regression models in two time periods, 1960-1990 and 1990-2008, as related to factors that are identified as relevant variables in several studies concerning land take in the mainstream literature. We tentatively consider a set of variables which includes location-related and physical determinants, and planning code-related factors. Findings are consistent with a previous study (Zoppi and Lai, 2014) concerning Sardinian land-taking processes in the 2003-2008 period.

The outcomes of both time periods show that there is a double agglomeration effect, since land-taking processes are positively and significantly related to high population density and high concentration of land that changes its status from non-artificial to artificial. This indicates that saving non-artificial land, or limiting land take, could be effectively supported by low-density settlements and extensive and light land-taking processes, since the concentration of land take in a limited number of municipalities would imply a larger extent of land which becomes artificial, being non-artificial in the first place.

1960-1990 period				
Variable	$Coefficient_i$	Stand.error	t-statistic	Hypothesis test: coefficient=0
Constant	-0.9315	0.2730	-3.413	0.0007
PSIZ6090	0.1122	0.0106	10.627	0.0000
SLOP6090	0.0018	0.0101	0.174	0.8621
PRS6090	-0.0740	0.0495	-1.494	0.1361
ACCESS	0.2315	0.1431	1.618	0.1065
DISTCAPC	-0.0018	0.0009	-1.944	0.0527
DISTNEAC	0.0073	0.0039	1.867	0.0627
DISC6090	0.0066	0.0051	1.299	0.1947
CONSAREA	-4.1E-05	2.5E-05	-1.624	0.1053
NAT6090	0.0337	0.0063	5.359	0.0000
AGFO6090	-0.0290	0.0082	-3.517	0.0005
COASTRIP	0.1483	0.0330	4.499	0.0000
OLPL6090	0.0037	0.0008	4.397	0.0000
DENS1961	0.0075	0.0004	17.616	0.0000
AUTC6090	0.4777	0.0547	8.727	0.0000
Adjusted R-squared = 0.8024				
1990-2008 period				
Constant	-1.7298	0.4922	-3.514	0.0005
PSIZ9008	0.8553	0.0679	12.588	0.0000
SLOP9008	-0.0150	0.0139	-1.073	0.2839
PRS9008	-0.0232	0.0691	-0.336	0.7372
ACCESS	0.7924	0.1869	4.239	0.0000
DISTCAPC	0.0011	0.0012	0.890	0.3741
DISTNEAC	0.0050	0.0054	0.917	0.3596
DISC9008	-0.0023	0.0076	-0.302	0.7626
CONSAREA	-7.0E-05	3.2E-05	-2.189	0.0293
NAT9008	-0.0024	0.0053	-0.450	0.6532
AGFO9008	0.0018	0.0021	0.841	0.4011
COASTRIP	0.1201	0.0443	2.712	0.0070
OLPL9008	0.0006	0.0013	0.447	0.6553
DENS1990	0.0026	0.0004	6.261	0.0000
AUTC9008	0.4222	0.0941	4.489	0.0000
Adjusted R-squared = 0.6289				

Table 5. OLS results, dependent variables PLT6090 (1960-1990 period) and PLT9008 (1990-2008 period): the regression models include the covariates of Table 2.

Secondly, the more a municipality is accessible, the more it is suitable to land-taking processes, which indicates that balancing accessibility opportunities would be a strategic regional policy in order to limit the concentration of land take and, ultimately, to mitigate the agglomeration effect which characterizes land take. This goal could be reached by increasing the endowment of public roads connecting regional town and city centers in small municipalities, giving particular care to road connections to the regional capital and province cities. Moreover, the lower a municipality's proximity to the nearest province administrative center (DISTNEAC) , the less the municipality is suitable to land take, which is an argument in favor of balancing accessibility as well.

Thirdly, we find that the presence and size of protected areas is negatively and significantly connected to land take, as expected. So, conservation of natural resources, habitats and environment could be of strategical importance in order to deal with land-taking processes, and to influence their territorial layout. This is also confirmed by the estimates of both regressions related to the covariates OLPL6090 and OLPL9008, which are positively correlated to the change of land from non-artificial to artificial. This indicates that the more conservative planning rules are weakened, the more land-taking processes occur, which is what happened (in year 2003) in the areas where the old regional landscape plans were not in force any more.

A similar phenomenon is put in evidence by the covariates NAT6090 and NAT9008, which are positively, even though significantly only in the case of 1960-1990 model, correlated to the change of land from non-artificial to artificial. This suggests, as before, that the more conservative planning rules are weakened, the more land-taking processes occur: in the case of NAT6090 and NAT9008 it is evident that the conservation character of the RLP PIC and of previous regional plans was weak if non-artificial areas defined as landscape

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components with an environmental value were allowed to change their status from non-artificial to artificial land between 1960 and 1990, and between 1990 and 2008.

The fact that protection of nature, environment and natural resources matters is also put in evidence by the absence of correlation between land-taking processes and the variable DISC9008, in the 1990-2008 time period, and the evidence of an impact of the variable DISC6090 on land take in the 1960-1990 time period. Since in the Sixties, Seventies and Eighties regional land-taking processes in Sardinia were almost exclusively concentrated in coastal municipalities, as the positive correlations between the variable COASTRIP and land take put in evidence in both periods, the non-coastal characterization of land take in the 1990-2008 period could only be related to the conservative planning rules that the regional landscape plans in force from 1990 to 2006 and the RLP, from year 2006 on, have implemented.

In this paper, we tentatively consider a set of variables which includes location-related and physical determinants, and planning code-related factors. Our analysis does not assume value judgments on land take. Nevertheless, the findings imply a set of policy statements which can be taken into account in order to influence land-taking processes, which are consistent with statements proposed in the study quoted above (Zoppi and Lai, 2014). Agglomeration effect (both in terms of land which becomes artificial being non artificial in the first place, and of residential concentration) increases the intensity of land take. As a consequence, extensive urbanization processes and planning codes that prevent the artificialization of vast contiguous areas should be effective in saving-up non-artificial land. A balanced accessibility of regional cities and towns and a comprehensive regional policy concerning protection of nature, natural resources, environment and endangered species and habitats should be important as well. Moreover, supporting restrictive planning rules concerning new development in the CS helps to counter and limit land take.

In the rest of these concluding remarks we use GIS to comment and discuss policy implications of our results through some spatial representations. Such GIS-based representations are easily reproducible with reference to other contexts of the EU NUTS 2 regions, and they allow for a pretty straightforward spatial interpretation of the results.

We started by simulating a "what-if" scenario by building upon the results of the OSL model, and more precisely upon marginal effects presented in Table 5: for each municipality, we estimated the magnitude of the impact either on the 1960-1990 or on the 1990-2008 percent change from non-artificial to artificial land cover (respectively, PLT6090 and PLT9008) that would occur if a single explanatory variable (among those taking the highest values of the t-statistic, that is, for PLT6090: DENS1961, PSIZ6090, ACCESS, CONSAREA, and for PLT9008: DENS1990, PSIZ9008, ACCESS, CONSAREA) had increased by a given quantity – that is, ten percentiles in that variable's distribution.

Figure 4 and Figure 5 present visually some of the results. As for the time period 1960-1990, the greatest change in artificial land cover is produced by implementing policies that increase the variable PSIZ6090, as up to 2.089 percent of the 1960 non-artificial land cover would have changed into artificial, if the value of the variable had increased by ten percentiles (Figure 4, left-center). The impact of the variable DENS1961 comes second, as it can amount to 1.559 percent (Figure 4, left), closely followed by the impact of the variable ACCESS, which can get as high as 0.123 percent (Figure 4, right). Impacts associated with the variable CONSAREA are always negative (Figure 4, right-center) and their peak is at 0.25 percent in absolute value.

With reference to the time period 1990-2008, the greatest change in artificial land cover is produced by implementing policies that increase the variable PSIZ9008, as up to 1.896 percent of the 1990 non-artificial land cover would have changed into artificial, if the value of the variable had increased by ten percentiles (Figure 5, left-center). The impact of the variable ACCESS comes second, as it can amount to 0.422 percent (Figure 4, right), closely followed by the impact of the variable DENS1990, which takes 0.397 percent as its the maximum value (Figure 4, left). Impacts associated with the variable CONSAREA are always negative here as well (Figure 4, right-center) and and their peak is at 0.426 percent in absolute value.

The maps also unveil a clear spatial agglomeration of municipalities taking the highest impact values associated with the variables DENS1961, ACCESS and CONSAREA (the latter, in absolute value) for the time period 1960-1990 (Figure 4) and with the variables DENS1990, ACCESS and CONSAREA (the latter, in absolute terms) for the time period 1990-2008 (Figure 5); moreover, these clusters show similar spatial patterns in the two time periods. Such a clear spatial agglomeration does not emerge, on the other hand, for municipalities having either the lowest impact values associated with PSIZ6090 (Figure 4) or the highest impact values associated with PSIZ9008 (Figure 5).

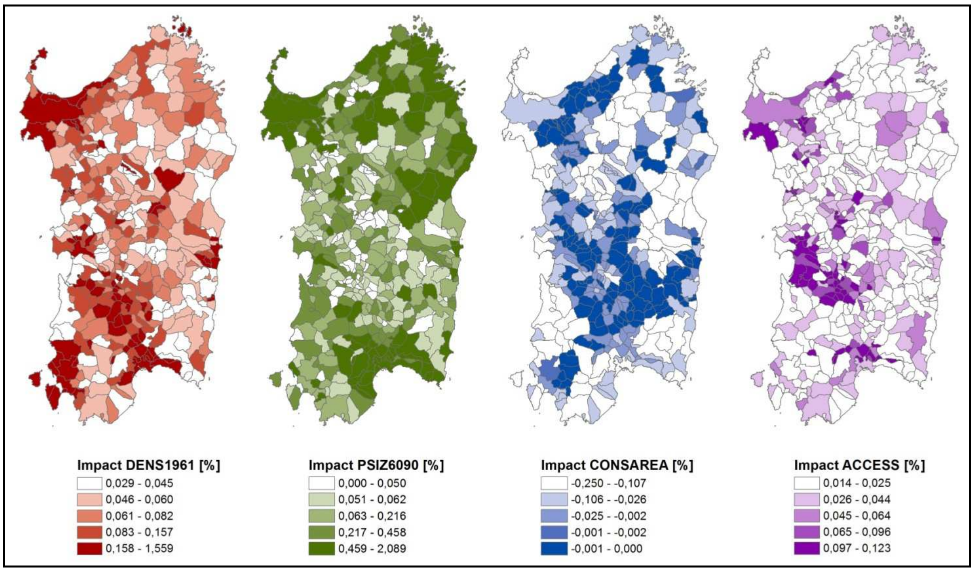

Figure 4: Spatial representation of policy implications at the municipal level: impacts on land-cover change (from non-artificial to artificial) in the 1960-1990 time period stemming from policies that increase: residential density in 1961 (left); or average size of areas whose land cover changes from non-artificial to artificial between 1960 and 1990 (left-center); or a municipality's total protected area (right-center); or its endowment of roads connecting regional town and city centers per unit of municipal land area (right) (all quantiles).

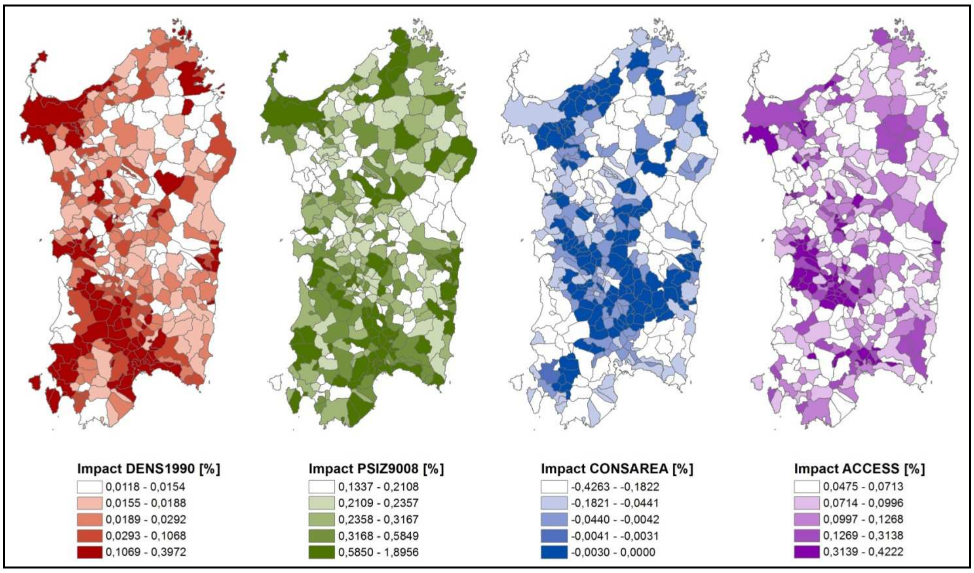

Figure 5: Spatial representation of policy implications at the municipal level: impacts on land-cover change (from non-artificial to artificial) in the 1990-2008 time period stemming from policies that increase: residential density in 1990 (left); or average size of areas whose land cover changes from non-artificial to artificial between 1990 and 2008 (left-center); or a municipality's total protected area (right-center); or its endowment of roads connecting regional town and city centers per unit of municipal land area (right) (all quantiles).

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This section (pp. 313-322) was removed due to cancellation of the author’s conference participation.

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🏆 *reviewed paper*

Grüne Stadtentwicklung der Zukunft: Visionen zur Beteiligung an der städtischen Grünflächenplanung mit Unterstützung von Augmented Reality Technologien

Susanne Raabe, Marcel Heins, Lisa Rockmann

(M.Eng. Susanne Raabe, Hochschule Anhalt FB1, Strenzfelder Allee 28,D-06406 Bernburg, s.raabe@loel.hs-anhalt.de)
(Dipl. Ing. Marcel Heins, Hochschule Anhalt FB1, Strenzfelder Allee 28,D-06406 Bernburg, m.heins@loel.hs-anhalt.de)
(Cand. B.Eng. Lisa Rockmann, Hochschule Anhalt FB1, Strenzfelder Allee 28,D-06406 Bernburg, lisa.rockmann@student.loel.hs-anhalt.de)

1 ABSTRACT

Pulsierende Städte und Regionen sind lebenswerte Orte, in denen sich Menschen gerne aufhalten. Freiräume wie Parkanlagen, Quartiersplätze und begrünte Straßenzüge sind ein wichtiger Baustein für eine lebenswerte Stadt. Unbestritten ist die klimaregulierende Wirkung von Grünanlagen auf Ihre Umgebung, die Wirkung auf die menschliche Psyche sowie auf das soziale Miteinander zum Beispiel in Kleingärten oder Gemeinschaftsgärten. Doch das städtische Grün ist in Gefahr. Im Hinblick auf die klimatischen Veränderungen werden die Anforderungen an Gehölze insbesondere der Stadtbäume weiter steigen. Nur eine standort- und funktionsgerechte Auswahl sichert vitale Pflanzen, die Ihrer visuellen wie klimaregulierenden Funktionen in der Stadt gerecht werden und sich nicht als ausweglose 'Pflegefälle' in den kommunalen Kassen niederschlagen. Was passiert wenn sich das Stadtbild ändert, andere Baumarten an Straßen und Plätzen zu finden sind. Mit der Weiterentwicklung der Informationstechnologien bieten sich auch neue Chancen der Beteiligung Um- bzw. Neugestaltungsprozessen.

Stellen Sie sich vor, Sie als Bürger können über eine App mitentscheiden, welche Baumart für Sie visuell am besten für die Neugestaltung Ihres Stadtplatzes wäre. Das besondere, die App stellt sicher, dass nur Baumarten gewählt werden können, die den künftigen stadtklimatischen Bedingungen Ihrer Stadt entsprechen. Dafür nehmen Sie vor Ort ihr Smartphone oder ein handelsübliches Tablet in die Hand, machen ein Video des gegenwärtigen Stadtplatzes und können daraufhin im Menü der App verschiedene Varianten von Baumarten und der entsprechenden Pflanzplanung auswählen, sich die Frühlings- und Herbstaspekte im Videobild anzeigen lassen und abschließend Ihren Favoriten bewerten. Die Variante, die von den meisten als Favorit ausgewählt ist, wird schlussendlich umgesetzt.

Das ist ein Szenario für die Anwendung von Augmented Reality Technologien im Bereich der Bepflanzungsplanung und im Kontext von Beteiligungsverfahren. Das Paper bezieht sich auf das Forschungsvorhaben Entwicklung und Erprobung des Prototyps eines mobilen Planungs- und Beratungssystems für die Pflanzenverwendung (mobiPlant). Im Beitrag der Real Corp 2012 "Möglichkeiten zum Einsatz von Augmented-Reality-Technologien in Verbindung mit WebGIS-Services in der urbanen Pflanzenverwendung" wurde das Forschungsvorhaben mit seinem Hintergrund und den Forschungszielen bereits vorgestellt (vgl. HEINS et al. 2012). In diesem Beitrag werden nochmals Hintergründe skizziert und der aktuelle Forschungsstand sowie Überlegungen zur Nutzung dieser Technologien für Beteiligungsprozesse in der Grünflächenplanung aufgezeigt. Zur Entwicklung des benannten Assistenzsystems (mobiPlant) werden neuste Technologien zur Visualisierung (Augmented-Reality) und weitere aktuelle Informations- und Kommunikationstechnologien miteinander in einer Fachapplikation verknüpft, inklusive der dafür notwendigen Softwarekomponenten für Tablet-PCs mit Android-Betriebssystem. Es wird beschrieben welche Funktionalitäten eine visuelle und gestalterische Bewertung einer Pflanzplanung mit dessen Raumwirkung und Dynamik (Wachstum, Jahreszeiten) direkt vor Ort ermöglichen können. Neben der Vorstellung aktueller Forschungsschwerpunkte und erster Ergebnisse wird für den Einsatz in städtischen Planungsprozessen im Anschluss ein mögliches Beteiligungsszenario skizziert und die künftige Rolle des Planers im Kontext der städtischen Grünflächenplanung diskutiert.

2 HINTERGRUND

Die Grünflächenplanung in der Stadt beinhaltet die Planung, Realisierung und Unterhaltung öffentlicher Grün- und Freiflächen wie beispielsweise Parkanlagen, Quartiersplätze und begrünte Straßenzüge. Im städtischen Raum bieten diese Bereiche Potenzial für Erholung und Freizeit und besitzen eine klimaregulierende Wirkung - kurzum sie tragen maßgeblich zu einer guten Aufenthaltsqualität in der Stadt bei.

2.1 Bepflanzungsplanung im städtischen Kontext

Der Lebensraum Stadt mit seinen besonderen Standorteigenschaften (höhere Temperaturen, beengter Wurzelraum, Wassermangel, Salz- und Abgasbelastung etc.) stellt extreme Lebensbedingungen insbesondere für Stadtbäume dar (ERMER et al., 1996; GILBERT, 1994). Die häufigsten Planungsfehler oder Probleme bei der späteren Unterhaltung von Grünflächen sind insbesondere auf Defizite hinsichtlich der fachgerechten (standort- und funktionsgerechten) Verwendung bzw. Auswahl von Pflanzenarten/-sorten (Pflanzentaxa) zurückzuführen. Fachliteratur, Leitfäden, Pflanzenenzyklopädien und „Gartenbücher" bieten jedoch heute für Profis und Laien eine umfangreiche Unterstützung bzgl. der für eine fachgerechte Pflanzenauswahl zu prüfenden Parameter (BÄRTELS, 2001; BORCHARDT, 1999; DUNNETT & HITCHMOUGH, 2004; FLL, 1999). Grünflächen besitzen im Zusammenspiel mit der bebauten Umgebung eine ästhetische Bedeutung. Sie tragen maßgeblich zu einem attraktiven Stadtbild bei und stiften Identität. Dabei steht die Stadt bei ihren öffentlichen Grünflächen in der Verkehrssicherungspflicht. Hierbei spielen insbesondere Stadtbäume, sowohl an Straßen, in Parks oder auf öffentlichen Plätzen eine große Rolle. Eine angelegte Grünfläche bedarf daher einer regelmäßigen Kontrolle und Pflege. Diese Aufgaben sind mit erheblichem Aufwand und Kosten verbunden. Ein Fehler bei der Pflanzenauswahl verursacht am Ende unnötige Kosten und Unmut.

Die Herausforderung bei der Planung von Grünflächen besteht darin, den Spagat zwischen der Beachtung der Standorteigenschaften, der ästhetischen Wirkung und dem späteren Unterhaltungsaufwand zu vereinen und diese Voraussetzungen auch in die Öffentlichkeit kommunizieren zu können. Auch bei Extremfällen wie der Fällung eines Baumes aus Gründen der Verkehrssicherung kann eine nachträgliche Vermittlung der Sachlage den potenziellen Unmut der Bevölkerung reduzieren. Städtisches Grün prägt das Stadtbild maßgeblich und der Verlust von Bäumen verursacht ebenso eine Lücke darin wie der Verlust eines Gebäudes.

2.2 Visualisierungsmöglichkeiten geplanter Grünflächen

Für die Vermittlung einer geplanten Grünfläche einschließlich ihrer Raumwirkung stehen verschiedene Möglichkeiten der Visualisierung zur Verfügung. 3D-Gartenplaner für den computeraffinen Hobbygärtner geben zwar eine einfache Hilfestellung, doch sind fotorealistische Darstellungen ebenso unmöglich wie die fachgerechte und produktgenaue Auswahl von Pflanzentaxa (DATABECKER, 2009). Branchenapplikationen für den Garten- und Landschaftsbau erlauben eine fotorealistischere Visualisierung von Vegetation und Gartenausstattung mittels Fotomontagen (DATAFLOR, 2009). Ihre Erstellung erfolgt jedoch losgelöst von der fachgerechten Auswahl der Pflanzentaxa, die hier nur teilweise durch externe Pflanzendatenbanken unterstützt wird (BÖDECKER & KIERMEIER, 1998). Für jede Perspektive muss zudem eine neue Fotomontage erstellt werden, was bei mehrmaligen Änderungswünschen von Kunden recht zeitaufwändig wird. Profisysteme zur 3D-Visualisierung, wie CAD-Fachapplikationen für die Landschaftsarchitektur (COMPUTERWORKS, 2006), 3ds Max (AUTODESK, 2009a) etc. sind in der Anschaffung sehr teuer und ihre Bedienung erfordert Spezialwissen. Das Gleiche gilt auch für die RealTime-Visualisierung von Vegetation mit entsprechenden RealTime-3D-Engines, wie Quest3D (ACT 3D B.V., 2009) oder LandXplorer (AUTODESK, 2009b).

Visualisierungen geplanter Grünflächen sind ein wichtiges Instrument in der Planungskommunikation, jedoch sind hohe Anschaffungskosten und die nötigen Spezialkenntnisse aktueller Fachapplikationen mit fotorealistischer 3-D Darstellung unrentabel. Eine Verknüpfung mit Pflanzendatenbanken zur Unterstützung einer fachgerechten Vorauswahl von Pflanzen ist aktuell schlecht umgesetzt.

3 MOBILES PLANUNGS- UND BERATUNGSSYSTEM FÜR DIE PFLANZENVERWENDUNG (FORSCHUNGSSTAND)

Im Kontext der Vermeidung von Planungsfehlern und der bildgestützten Kommunikation von Planungen im Bereich der Pflanzenverwendung ist im Zuge des hier vorgestellten Forschungs- und Entwicklungsvorhabens Ziel, eine mobile Planungs- und Beratungsassistenz auf der Basis mobiler Endgeräte mit Android – Betriebssystem zu entwickeln. Das angestrebte System soll insbesondere eine visuelle und gestalterische Bewertung einer Pflanzplanung mit dessen Raumwirkung und Dynamik (Wachstum, Jahreszeiten) mit einem mobilen Endgerät direkt vor Ort ermöglichen. Darüber hinaus kann sich der Anwender bei der funktions- und standortgerechten Auswahl von Pflanzenarten und -sorten unterstützen lassen. Dazu verknüpft der Prototyp derzeit weitestgehend getrennt gehaltene Daten zu nutzbaren Informationen. Durch die innovative

Kombination bzw. Verknüpfung verschiedener Technologien Augmented Reality (AR), web-basierten Geographischen Informationssystemen (WebGIS), Global Positioning System (GPS), Online-Datenbanken und weiteren internetbasierten Technologien wird ein System entwickelt, welches mittels einer mobilen Benutzerschnittstelle, in Form von z.B. Tablet-PCs, Handheld-PCs und Handys mit GPS, Videokamera und Internetanbindung bedient werden kann. Dieses Assistenzsystem kann künftig Garten-Landschaftsbauunternehmen, Landschaftsarchitekten, Garten-/Grünflächenämtern, Pflanzenproduzenten und auch ambitionierten Hobbygärtnern einerseits als Vor-Ort-Planungshilfe in der Pflanzenverwendung dienen. Andererseits kann es als Werkzeug zur Kommunikation und Kundenberatung in Planungs- und Bauprozessen von öffentlichen oder privaten Grünflächen seinen Einsatz finden (vgl. HEINS et al., 2012).

Ein Forschungsschwerpunkt liegt in der Ermittlung der Visualisierungsanforderungen und Testung von Verfahren zur Visualisierung von Pflanzen mit Augmented Reality Technologien für mobile Anwendungen. Ein weiterer Forschungsschwerpunkt ist die Ermittlung und Einbindung des Prototypen in einen praxistauglichen Workflow mit dem Schwerpunkt Tracking und die Verknüpfung der visuellen Komponente mit Möglichkeiten der Auswahl von standort- und funktionsgerechten Pflanzen. Hierbei wird insbesondere das Datenmanagement fokussiert und entsprechende Datenmodelle entwickelt. Im Folgenden werden die aus der Praxis ermittelten Anforderungen einschließlich erster Forschungsergebnisse und Entwicklungsstände dargelegt.

3.1 Workflow - Einbindung in den Planungsprozess

Im Rahmen des ersten Expertenworkshops mit den Praxispartnern wurde als Zielstellung für das zu entwickelnde Assistenzsystem primär die Erstberatung beim Kunden identifiziert. Durch Augmented Reality (AR) können somit schnell virtuelle Pflanzenbilder mit Bezug zu realen Objekten dargestellt werden und insbesondere eine Darstellung verschiedener Erscheinungsformen, als auch Entwicklungsphasen und Pflanzqualitäten können einfach vermittelt werden. Die Einblendung eines Grundrisses in der App ermöglicht das Nachvollziehen der Lage der Objekte zueinander. Als Screenshot kann dieser für erforderliche Detailplanungen genutzt werden.

Das System soll direkt beim Kunden aufgebaut werden können und für den Planer geringe Rüstzeiten aufweisen. Dieser Aspekt hat insbesondere Auswirkungen auf die Auswahl eines geeigneten Tracking – Verfahrens. Im Einsatzfeld der Grünflächenplanung werden großräumige Areale angesprochen, bei denen weite Entfernungen zu Objekten existieren. Für die lagesynchrone Überlagerung von virtuellen Elementen im live–Bild einer Kamera ist es notwendig, die Position und Orientierung des Endgerätes in Bezug zu seiner Umgebung zu erfassen und zu verfolgen (Tracking). Dabei lassen sich diese Tracking-Verfahren in sensorbasierte, bildbasierte oder hybride Ansätze einteilen (ZHOU et al. 2008). Das sensorbasierte Tracking (z.B. mit GPS und Kompass-Sensor im Gerät) ist für die Zukunft wünschenswert, wird jedoch aufgrund der Störanfälligkeit und der daraus resultierenden Lageungenauigkeit von mehreren Metern in diesem Projekt nicht verfolgt. Darüber hinaus ist aktuell der Planungsprozess vom erstellten 3D-Modell bis zur ersten Begutachtung in der App recht aufwendig. Die Datenmodelle dürfen nicht zu komplex in ihrer Darstellungsqualität sein, weshalb die AR-Visualisierung auf den mobilen Geräten bisher als eher enttäuschend empfunden werden kann (vgl. REINWALD et al., 2013). Im Fokus steht ein bildbasiertes Trackingverfahren mittels ID-Markern. Ziel ist es das Tracking – Verfahren so zu entwickeln, dass beispielweise ein Planer zu seinen Planungsgebieten fahren kann, ohne vorher aufwändige Einrichtungsarbeiten am PC vornehmen zu müssen. Aktuell wird ein leicht aufbaubarer Marker – Würfel mit Stativ entwickelt und getestet.

3.2 Verfahren und Softwarekomponenten zur Visualisierung von Pflanzen.

Im Einsatzbereich der Pflanzenverwendung sind viele kleine 3-D Modelle (Pflanzen) zu erwarten. Darüber hinaus wird die interaktive Nutzung der Objekte am Bildschirm eine große Rolle spielen. Ein Entscheidungskriterium für die Auswahl von Visualisierungsverfahren ist die entstehende Datengröße pro Pflanzenabbildung, da mobile Endgeräte in ihrer Leistungsfähigkeit (Prozessor) und im Speicher (Grafik- und Arbeitsspeicher) begrenzt sind. In der 3-D Visualisierung sind Pflanzen hochkomplexe Geometrien. Beim Einsatz von Pflanzen ist zu beachten, dass basierend auf Vektorgrafiken, ein Baum schnell aus mehreren tausend Polygonen besteht und die Datenmenge einer Gesamtplanung mit mehreren Pflanzen schnell sehr groß werden. Eine Alternative hierzu bieten Visualisierungen auf der Basis von Billboards.

Diese kommen mit 2 Polygonen aus, sodass eine starke Reduzierung der Datenmenge möglich ist. Aus einer Blickrichtung betrachtet ist die Visualisierungswirkung von Billboard erzeugten Bäumen sehr gut. Nachteile ergeben sich bei der Veränderung der Perspektive und insbesondere bei der Vogelperspektive (ZEILE 2010, 163). Entscheidend für die Verfahrenswahl ist der Detailierungsgrad der Darstellung (LOD). In einem Test im Außenbereich wurde mit den Praxispartnern eruiert, inwieweit die bildbasierte oder vektorbasierte Darstellung am Beispiel zweier Baumgrafiken in Frage kommt. Im Ergebnis des Tests wird das bildbasierte Verfahren in Form von Billboards für die Pflanzenvisualisierung verfolgt. Bei der Frage zum Detailierungsgrad ist eine realitätsgetreue und somit sehr detaillierte Modell-Darstellung von Pflanzen im ersten Expertenworkshop des Forschungsprojekts mit den Praxispartnern als nicht zielführend identifiziert wurden. Für die Entwicklung eines Gestaltungskonzeptes, welches in erster Linie befähigen soll einen Raumeindruck einer Pflanzung im Verlauf des Jahres zu beurteilen, ist es noch nicht wichtig genaue Pflanzenarten- und Sorten darzustellen. Für den Betrachter macht es aus der Ferne keinen Unterschied, ob es sich bei einem säulenartigen Strauch um eine Eibe (Taxus baccata ‚Fastigiata‘) oder einen Wacholder (Juniperus communis ‚Hibericus‘) handelt.

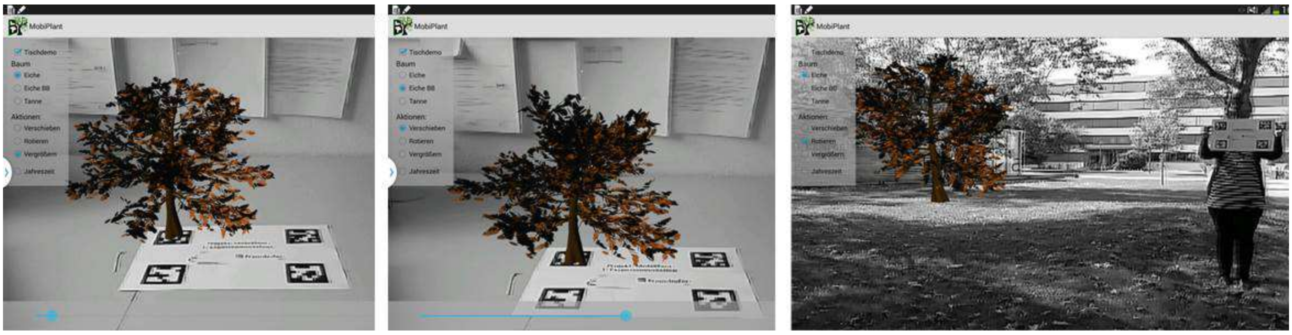

Abbildung 1: Screenshot der vom Fraunhofer IFF entwickelten ersten Test-Demo mit ID-Markern, zum Vergleich vektorbasierte Grafik (links) und bildbasierte Grafik durch die Verwendung von Billboards (Mitte); Außendemo (rechts), Hochschule Anhalt 2014

Neben der Entscheidung zum Visualisierungsverfahren wurden im weiteren Verlauf des ersten Expertenworkshops die Darstellungsanforderungen mit den Praxispartnern ermittelt. Für die Darstellung sind die Anzeige und Auswahlmöglichkeit von den Elementen Baum, Strauch, Einzelstaude, Pflanzfläche sowie weitere Gartenobjekte und Oberflächenstrukturen benannt wurden. Speziell zur Darstellung der Pflanzen ist es wichtig verschiedene Wuchsformen, die Größenentwicklung (Wuchsdynamik), Blatttextur, Farbwirkung (Laub) und Ereignisse (Blüte/Früchte, Herbstfärbung) schematisch zeigen zu können. Im Ergebnis wurde angeregt visuelle Typen zu entwickeln.

Die Visualisierungsanforderungen von Gehölzen (Baum, Strauch) und Stauden insbesondere bei Flächenpflanzungen sind sehr unterschiedlich. Deshalb wird die 3-D Grafik von Stauden in Form von zwei ineinander verschachtelten ‚Boxen‘, sogenannter Ringe abgebildet. Die Ringe können bei Bedarf einzeln in ihrer Höhe, Breite und Drehung interaktiv verändert werden. Je nach Bildgrundlage (Einzelpflanze oder Staudenmischpflanzung) entsteht ein voluminöses Objekt.

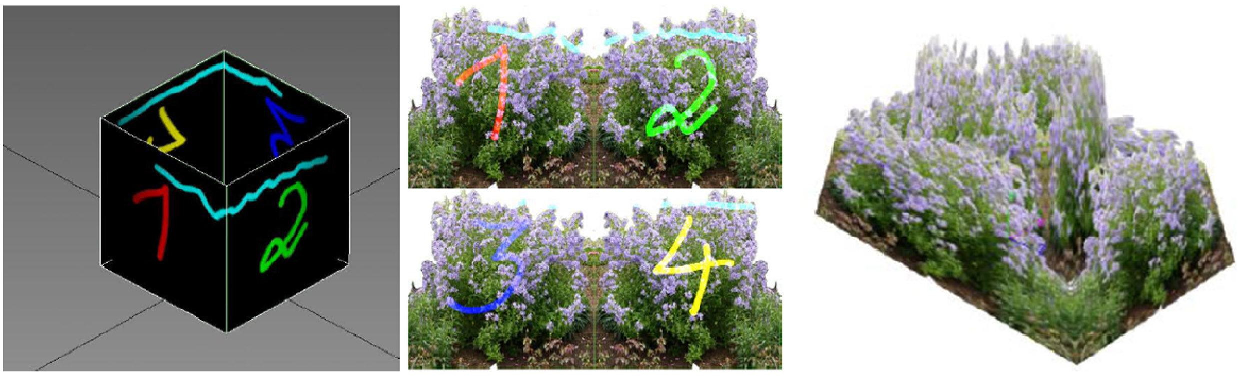

Abbildung 2: Visualisierungsverfahren für Stauden durch eine verschachtelte Geometrie, © Fraunhofer IFF, 2014

3.3 Pflanzentypen und Pflanzeneigenschaften als Basis der AR-Bilddatenbank

Der weitere Forschungsschwerpunkt ist die Untersuchung von Einteilungsmöglichkeiten von Gehölzen und Stauden in der Fachliteratur (u.a. FITSCHEN, 2007; GAIDA & GROTHE, 2000) als auch in verfügbaren

Pflanzendatenbanken. Ziel ist eine Systematik zu entwickeln, welche mit wenigen Abbildungen eine Vielzahl von Erscheinungsbildern von Pflanzen abdecken kann und die Vermittlung eines Raumeindrucks zur Bewertung einer Planung sicherstellt. Hieraus sind zunächst im Ergebnis visuelle Typen ermittelt wurden. Ein visueller Typ bezeichnet eine Gruppe von Pflanzen mit ähnlichem Erscheinungsbild auf der Grundlage von Wuchshöhe, Wuchsbreite und Wuchsform. Neben Wuchsform und -Dimensionierung sind vor allem die Blatttextur (Größe und Dichte), Blattfarbe, Blütentextur (Größe und Dichte) sowie die Blütenfarbe und Herbstfärbung entscheidende gestalterische Kriterien.

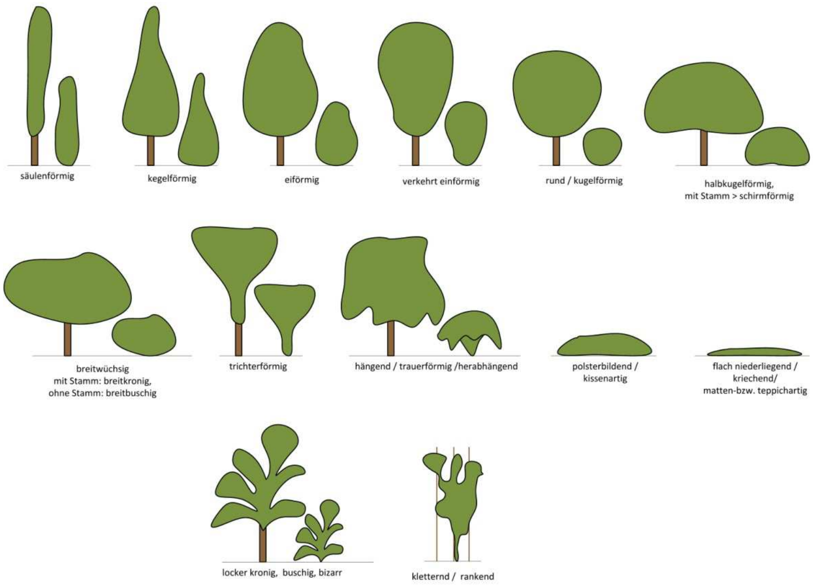

Abbildung 3: Einteilungsmöglichkeiten von Pflanzen in visuelle Typen, M. Heins, 2015

3.3.1 Darstellung der Belaubungsfarbe und Farbereignisse

Für die Darstellung sogenannter Ereignisse (Blüte, Herbstfärbung) wird aktuell an automatisierten Tools geforscht. Für die Belaubungsfarbe, die sich im Herbst ändern kann, soll nicht ein extra Billboard erzeugt werden müssen. Ziel ist einen Layer für die Textur der Belaubung als Billboard abzuspeichern, welche durch die Auswahl einer Farbe automatisch eingefärbt wird. Hierfür ist es notwendig Blattwerk und Geäst voneinander zu trennen, um die komplette Einfärbung im Ergebnis zu vermeiden. Für die AR-Bilddatenbank bedeutet das, dass eine Abbildung für das Geäst und eine Abbildung für die Belaubung dort abgelegt werden. In der Endanwendung im AR-Modus wählt der Nutzer demnach erst den visuellen Wuchstyp und kann dann beispielweise die Belaubungsfarbe auswählen. Weiterhin kann auch angegeben werden, dass dieser Baum in seiner Herbstfärbung Töne in Orange aufweisen soll.

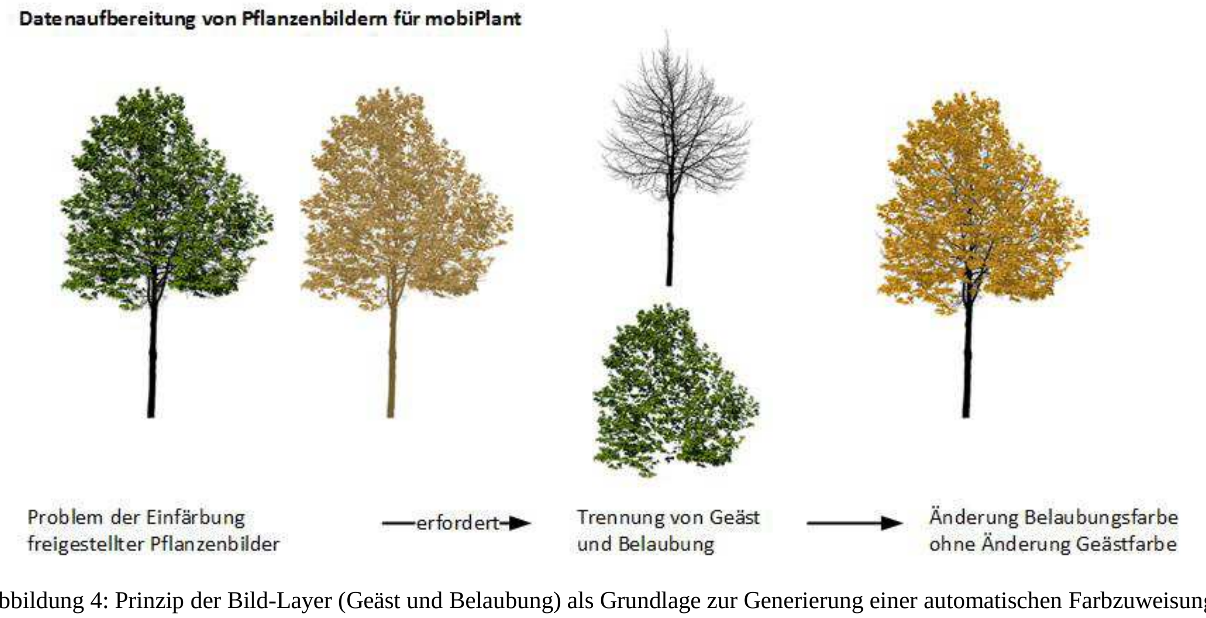

Abbildung 4: Prinzip der Bild-Layer (Geäst und Belaubung) als Grundlage zur Generierung einer automatischen Farbzuweisung; S.Raabe 2015

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3.3.2 Blattgröße und Blattdichte

Bei der Bewertung des äußeren Erscheinungsbildes einer Pflanze, spielen neben der Wuchsform und den Farbereignissen auch die Ausprägung der Blatttextur eine Rolle. Eine Hänge-Birke (Betula pendula) mit lockerer Belaubung und kleinen Blättern besitzt einen deutlich anderen visuellen Charakter und somit eine andere Raumwirkung, als beispielsweise ein Spitzahorn (Acer pseudoplatanoides). Für die Einteilung von Pflanzen in Blattgröße- und Dichte sowie Blütengröße- und Dichte ist eine Analyse belastbarer Durchschnittswerte aus Daten der Pflanzendatenbank Plantus durchgeführt wurden. Ziel der Analyse ist die Bildung von Größen-Klassen. Im Anschluss soll der jeweiligen Klasse eine Textur pro visuellen Typ zugeordnet werden können. Am Beispiel zur Ermittlung von Blattgößenklassen wird die Vorgehensweise erläutert. Für die Ermittlung von Blattgrößenklassen sind insgesamt 2955 Daten ausgewertet wurden. Die Berechnungen der Häufigkeiten wurden mit Excel ausgeführt. Begonnen wurde damit den einzelnen Pflanzengruppen (Laubgehölze, Nadelgehölze, Stauden, Gräser und Farne) ein Klassensystem zuzuordnen. Aufgrund der teilweise geringen Datenmengen (Farne 58 Datensätze, Gräser 23 Datensätze) wurde dazu übergegangen verschiedene Pflanzengruppen zusammenzufassen. Nach Vergleich der Ergebnisse wurde entschieden, allen Pflanzengruppen ein gemeinsames Klassensystem zu schaffen. Dazu wurden zwei verschiedene Varianten ermittelt. Die Entscheidung fiel auf die Variante 2 mit einer ausgeglichenen Abstufung der Klassen und Häufigkeitsverteilung darin. Problematisch bei dieser Zusammenfassung ist die Sonderstellung der Nadelgehölze die mit einem Mittelwert von 2,47 deutlich vom Mittelwert der zusammengefassten Daten (10,74) abweichen. Um eine Nutzerfreundliche Suchabfrage zu gewährleisten wird empfohlen für Nadelgehölze eine gesonderte Bezeichnung zu verwenden.

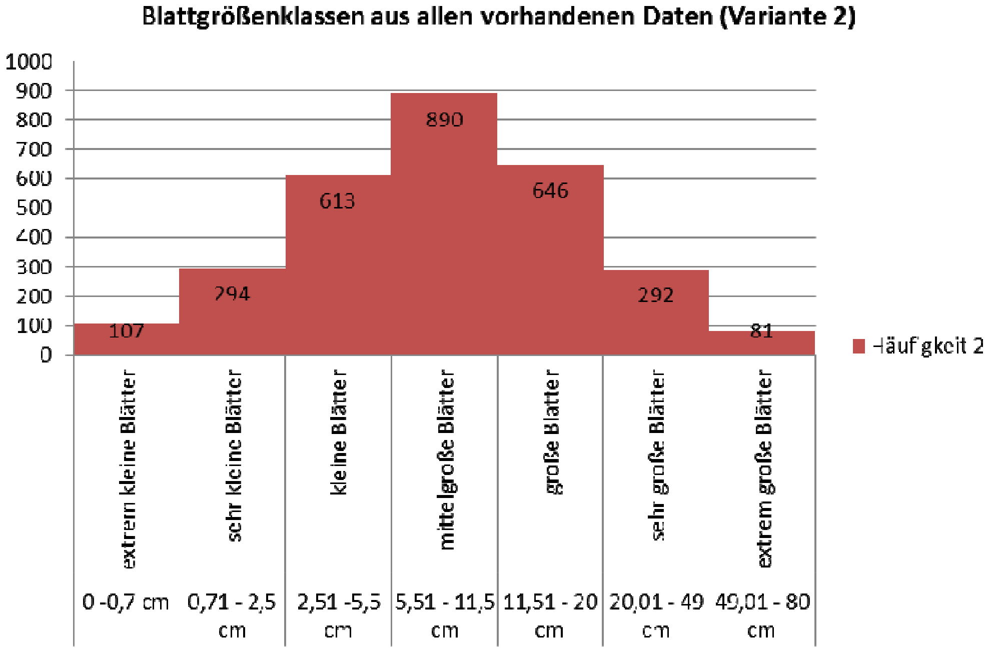

Abbildung 5: Optimierte Häufigkeitsverteilung von Blattgrößen

3.3.3 Pflanzendynamik

Pflanzen sind dynamisch in Ihrer Erscheinungsform. Geplante Grünflächen entsprechen zum Zeitpunkt Ihrer Pflanzung nicht dem geplanten Erscheinungsbild, was zu Irritationen führen kann. Deshalb ist eine weitere Herausforderung in der Visualisierung von Pflanzen ihre Dynamik, die maßgeblich in der Planung Berücksichtigung findet. Pflanzen verändern ihr Erscheinungsbild im Jahresverlauf beispielsweise durch die Frühjahrsblüte und Herbstfärbung (kurzfristige Dynamik). Pflanzen und insbesondere Gehölze verändern sich in ihre Wuchsdimensionen. Die Vorstellungskraft, wie groß und breit ein Baum letztendlich in 30 Jahren ist fällt schwer. Genauso fällt es schwer, sich bei einer neugepflanzten Baumallee die Raumdimensionen und deren visuelles Erscheinungsbild beispielsweise der zu erwartenden Herbstfärbung vorstellen zu können. Als Ergebnis der Entwicklungsarbeit ist ein Tool zur Visualisierung kurz- und langfristiger Pflanzendynamiken einschließlich der Einblendung eines Grundrisses entstanden.

Abbildung 6: Screenshot des vom Fraunhofer IFF entwickelten ersten Prototypen zur bildbasierten Baum-AR-Visualisierung mit einstellbarem Wachstum und Jahreszeiten (basierend auf WEBGL) einschließlich Einblendung eines Grundrisses

3.4 Datenmanagement und Softwarearchitektur

Für die Pflanzenobjekte ist es vorgesehen, sie in einer Art Baukastenprinzip durch die Überlagerung verschiedener Bildebenen als ein Objekt im AR-Modus anzeigen zu lassen. In der AR-Bilddatenbank sind beispielsweise für die entsprechenden Wuchsformen entsprechende Abbildungen abgelegt. Bezugnehmend zu der in 3.3 geschilderten Visualisierungseigenschaften von Pflanzen zum Herleiten visueller Typen und der Zuweisung der Pflanzeneigenschaften wird hier ein Auszug des Datenmodells für die visuellen Eigenschaften gezeigt und skizziert. Das Objekt Pflanze_Visu_Eigenschaften dient der Abbildung der konkreten Ausprägung eines Visuellen_Typs, d.h. über diese Attribute wird gesteuert welche in einem Visuellen Typ enthaltenen Grafiken (Geäst, Laub, Blüte etc.) zur Gesamtdarstellung der Einzelpflanze in der App (Live-Video-Bild) kombiniert werden.

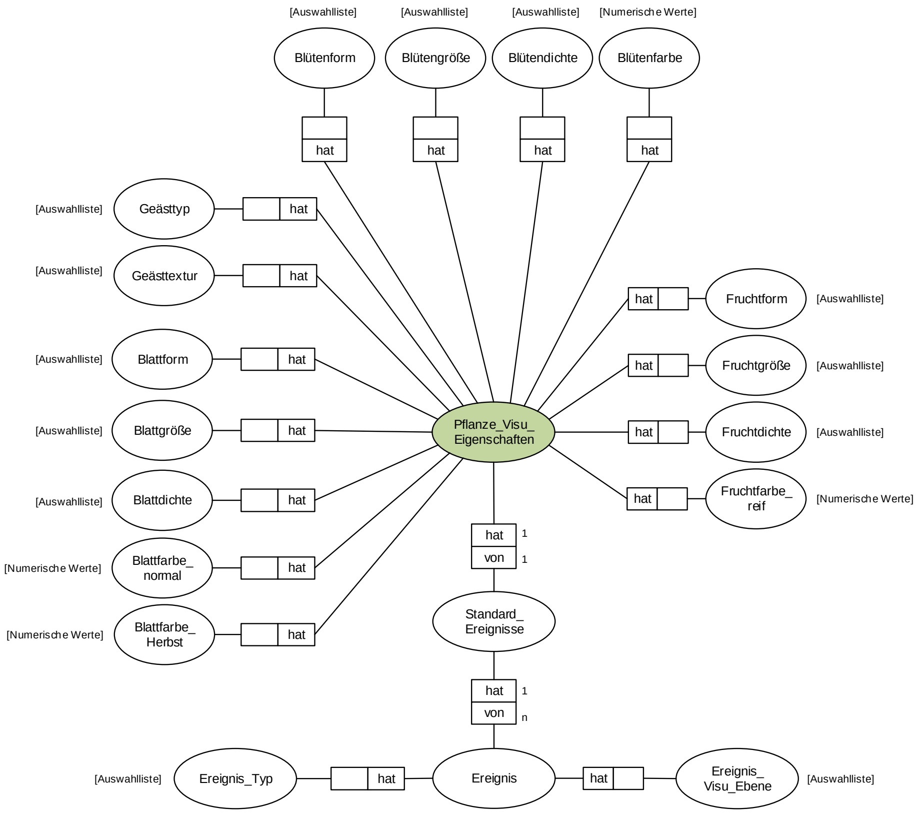

Abbildung 7: Datenmodell für die Zuordnung von Pflanzeneigenschaften, M. Heins, 2015

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Die Pflanzenvisualisierung für die AR-Komponente ist komplex und war bisher Schwerpunkt in der Forschungsarbeit der mobiPlant-App. Die Softwarearchitektur der App lässt sich grob in folgende Bereiche untergliedern: dem Endbenutzer-Frontend in dem virtuelle Objekte am Bildschirm interaktiv bearbeitet werden können, der AR-Visualisierungsdatenbank, in dem sich die Abbildungen zu den visuellen Typen und deren Pflanzeneigenschaften und Ereignissen befinden und die Anbindung an eine Pflanzendatenbank.

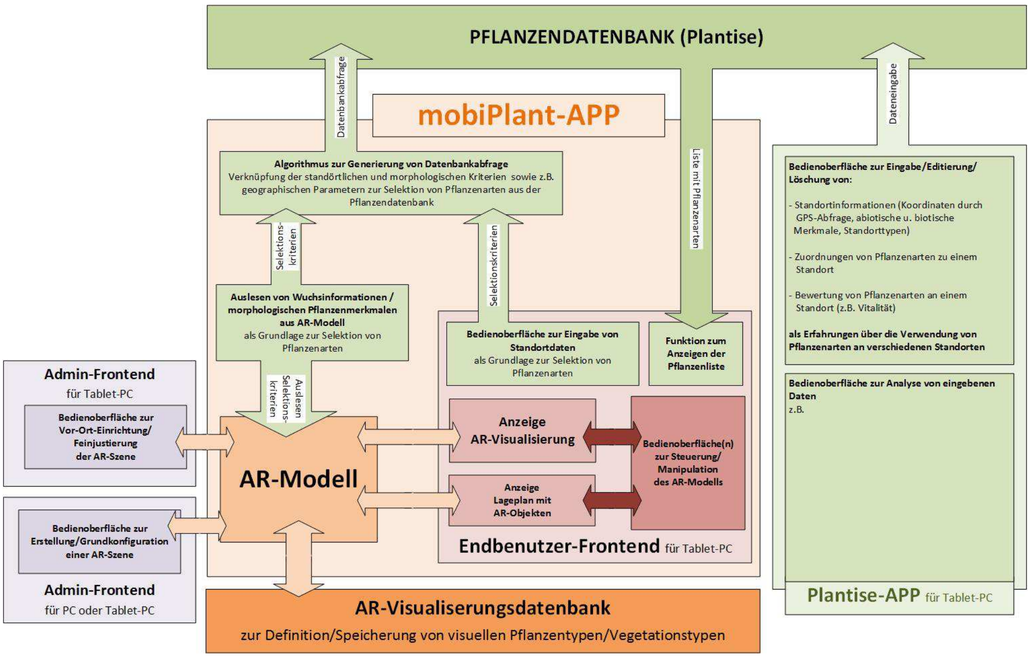

Abbildung 8: mobiPlant Software Architektur, M.Heins, 2014

4 AUGMENTED REALITY ALS CHANCE NEUER BETEILIGUNGSPROZESSE IN DER GRÜNFLÄCHENPLANUNG - SZENARIO

Ausgehend vom aktuellen Stand im Forschungsvorhaben mobiPlant und den bereits möglichen Funktionalitäten folgt nun ein mögliches Anwendungsszenario zur Bürgerbeteiligung in der künftigen Grünflächenplanung.

Beteiligen durch Mitgestalten und Informieren

Bürger können über eine App mitentscheiden, welche Baumart für Sie visuell am besten für die Neugestaltung ihres Stadtplatzes wäre. Die App stellt sicher, dass nur Baumarten gewählt werden können, die den künftigen stadtklimatischen Bedingungen ihrer Stadt entsprechen. Dafür nehmen Sie vor Ort ein Smartphone oder ein handelsübliches Tablet in die Hand, machen ein Video der gegenwärtigen Freifläche und können daraufhin im Menü der App sich zunächst für die zur Verfügung stehenden visuellen Typen (Baumformen) entscheiden. Falls nötig, kann der der Planer (Admin) im Vorfeld visuelle Typen freischalten. Im Anschluss kann man beispielsweise mit Blüten- und Blattfarben herumexperimentieren und sich die Frühlings- und Herbstaspekte im Videobild anzeigen lassen, bis einem die Auswahl gefällt. Im Anschluss kann man erfahren, welche Baumarten- und Sorten auf die ausgewählten Eigenschaften passen. Der Favorit wird ausgewählt und in einer Datenbank gesammelt. In der Auswertung der Datenbank kann der Planer erkennen, welche Baumtypen bevorzugt werden und insbesondere die Tendenz der visuelle Eigenschaften erkennen.

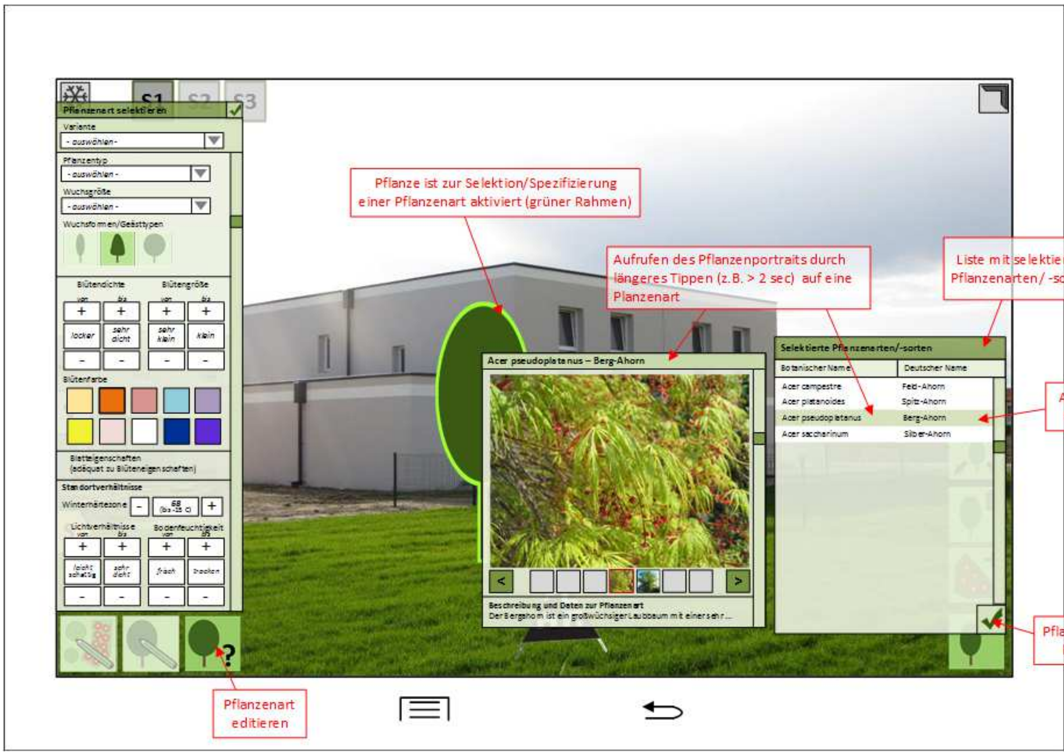

Abbildung 9: Funktionsentwurf für die mobiPlant-App, Auswahl eines visuellen Typs, die ausgewählten Pflanzeneigenschaften führen zu einer Abfrage an die verknüpfte Pflanzendatenbank, welche alle geeigneten Pflanzenarten- und Sorten auflistet. Es besteht die Möglichkeit der Betrachtung detaillierter Pflanzenfotos; M.Heins

5 FAZIT

Im beschriebenen Beteiligungsszenario wäre der Planer in der Rolle eines Systemadministrators oder direkt bei den Bürgern als Moderator mit der App im Einsatz. Augmented Reality kann die Grünflächenplanung für Laien transparenter und nachvollziehbarer gestalten und bietet sogar die Chance der Mitgestaltung. Dabei wird der Bürger befähigt neben der visuellen Entscheidungsunterstützung auch die fachlichen Hintergründe der standortgerechten Auswahl von Pflanzen zu verstehen und somit zu einer aktiven Beteiligung und Mitgestaltung beitragen zu können.

6 AUSBLICK

Der Fokus im beschriebenen Vorhaben lag bisher auf den Visualisierungsmöglichkeiten von Pflanzen und der Entwicklung der entsprechenden Datenmodelle und des Datenmanagments. Die nächsten Schritte beinhalten die Erstellung entsprechender Testdaten und dem Einpflegen in die AR-Datenbank. Weiterhin wird eine intuitiv nutzbare Bedienoberfläche für Tablet PCs entwickelt und getestet. Zudem wird auch die Verknüpfung der AR-Systemkomponente mit einer Pflanzendatenbank im Fokus des weiteren Vorgehens stehen.

7 ERGÄNZENDE ANGABEN

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FORSCHUNG AN
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reviewed paper

Historic Centers and Urban Quality: a Study Concerning Perceived Needs and Expectations

Anania Mereu, Corrado Zoppi

(Doctor Anania Mereu, Dipartimento di Ingegneria Civile, Ambientale e Architettura, University of Cagliari, Via Marengo, 2 – 09123 Cagliari, Italy, ananiamereu@gmail.com)

(Doctor Corrado Zoppi, Dipartimento di Ingegneria Civile, Ambientale e Architettura, University of Cagliari, Via Marengo, 2 – 09123 Cagliari, Italy, zoppi@unica.it)

1 ABSTRACT[1]

This paper proposes an econometric approach based on Discrete Choice Models to identify and analyze the residents' needs and expectations concerning the spatial organization of the historic neighborhoods where they live, which provides inferences on residential satisfaction's determinants.

In this framework, determinants are grouped into three distinct categories as follows: i. level of satisfaction related to house; ii. neighborhood characteristics; iii. respondents' social and demographic characteristics. The information coming from the implementation of the DCM-based analysis can be used as an important reference point for the definition of planning policies for historic centers' preservation.

In order to test and discuss its effectiveness, we use the model to analyze needs and expectations of the residents of the historic center of Cagliari, a medium-sized urban context of the Italian insular region of Sardinia.

2 INTRODUCTION

Planning and historic centers' preservation can be considered synergetic concepts (Frank and Petersen, 2002) and activities. Indeed, effectiveness of preservation is founded on analytic and detailed planning which should implement policies aimed at preserving the characteristics of historic urban tissues and at boosting their capability of being attractive for the most important contemporary urban functions, such as housing, retail shops, and financial, insurance and real estate firms (Mueller et al., 2005). Moreover, it could be important to maintain the sense of identity of the people who live there. Hence, it is necessary to implement participatory processes involving resident families, entrepreneurs, employees and shoppers (Comune di Reggio Emilia, 2005; 2011).

One of the main components of sustainable planning approaches to the preservation of historic centers implies the availability of detailed and, as much as possible, complete information on residents' perceived needs and expectations.

We propose an econometric approach based on Discrete Choice Models (DCMs) (Ben-Akiva and Lerman, 1985; Greene, 1993; Greene and Hensher, 2010) to identify and analyze residents' needs and expectations concerning the spatial organization of the historic neighborhoods where they live, which provides inferences on residential satisfaction's determinants (Lu, 1999). In this framework, determinants are grouped into three distinct categories as follows: i. level of satisfaction related to house; ii. neighborhood characteristics; iii. respondents' social and demographic characteristics. The information coming from the implementation of the DCM-based analysis can be used as an important reference point for the definition of planning policies for historic centers' preservation (Fantin, 2013).

In order to test and discuss its effectiveness, we use the model to analyze needs and expectations of the residents of the historic center of Cagliari, a medium-sized urban context of the Italian insular region of Sardinia. In figure 1, the historic centre of Cagliari with its four historic neighborhoods (Castello, Villanova, Marina, Stampace) is presented, whereas a typical alley in the neighborhood of Castello is captured in figure 2.

[1] This essay comes from the joint research work of the authors. Sections 1, 5 and 6 have been jointly written by the authors. Anania Mereu has taken care of sections 3 and 4.

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Fig. 1: Historic centre of Cagliari (Comune di Cagliari, 2011).

Fig. 2: View of a typical alley in the historic centre of Cagliari.

The DCM-based analysis is implemented through a questionnaire delivered to the residents of the Cagliari's historic center's neighborhoods (Comune di Cagliari, 2011). Through their participation in the experiment, resident families' representatives should increase their awareness of the most important issues related to the spatial organization of their urban living areas, and provide information on correlations between perceived urban quality and the three types of determinants mentioned above.

Qualitative and quantitative inferences on the correlations between residents' level of satisfaction related to the neighborhood and its determinants, generated by the DCM-based analysis, imply important arguments and indications on planning policies related to the spatial organization of the historic centers, which will be discussed in the final part of the paper, starting from the results of the DCM-based case study concerning the historic center of Cagliari.

This paper is organized as follows. The institutional and normative framework of historic centers' planning of the Sardinia region is described in the second section. In the third section, we discuss the DCM-based analysis we use to analyze the residents' perceived needs and expectations. The fourth section shows the implementation and results of the estimates of the DCM-based analysis applied to the historic center of Cagliari which uses the level of the respondents' residential satisfaction and its covariates in order to address arguments and indications on issues related to planning policies concerning the spatial organization of the historic centers. The results coming from the implementation of different discrete-choice models are presented and compared.

In the concluding section, we discuss the influence of the determinants found relevant on the level of residential satisfaction with the neighborhood, through the results of the DCM-based analysis. This influence could be taken into account to define future planning policies to increase the quality of urban life. Exportability to other urban contexts and further developments of the research work are discussed as well.

3 INSTITUTIONAL AND NORMATIVE FRAMEWORK

Cagliari is the main Sardinian conurbation, with a population of about 150,000 residents in 2012, and a regional capital city. Here, all the main offices of the regional administration are located. Furthermore, Cagliari is the main site of the Cagliari province, which includes the whole territory of Southern Sardinia. The main Sardinian University, with a student population of about 29,000 students in 2013, and the most important Sardinian Law Court are located in Cagliari. Cagliari has been identified as one of the nine main Italian metropolitan areas by the Italian Law No. 1990/142 and confirmed as one of the twelve Italian metropolitan areas by the Italian Law No. 2014/56. Therefore, it is a site where a new metropolitan province can be established if the regional administration wishes, which indicates that the importance of Cagliari as a key Italian conurbation has been officially recognized at the national level.

Moreover, the Sardinian regional administration has primary jurisdiction for land-use and urban planning, according to its special constitution. In other words, the Sardinian regional government may define Sardinian public planning policies. In fact, the Sardinian region is to some extent autonomous with respect to planning policies established at the national level.

For all these reasons, the metropolitan area of Cagliari can be considered a significant and well-defined urban environment to analyze the historiccenter-related planning policies, one which is sufficiently internally developed and integrated, and isolated from external influences as well.

In the framework of regional and urban planning processes of Sardinia, in the context of the Regional Landscape Plan (RLP), established by the Decision of the Sardinian Regional Government (DSRG) no. 36/7 of 5 September 2006, the Implementation plans of the historic centers (IPHCs) are planning tools which implement the Planning implementation code (PIC) of the RLP into the "Areas characterized by historic settlements". For these areas, the PIC defines a set of prescriptive rules and planning criteria (articles nn. 51-53 of the part of the PIC related to "Cultural and historic spatial framework", which is defined by articles nn. 47-59). More precisely, article no. 52 identifies the IPHC as a plan which has to be necessarily approved through the cooperation of the Sardinian regional administration and a municipality as a necessary precondition for a municipality to exert its ruling power over the local transformation processes related to the municipal spatial jurisdiction, which implies a considerable pressure on the local administrators in order to implement valuable and effective planning processes concerning the municipal historic centers.

Under this perspective, it is not surprising that the RLP, the first statutory landscape plan with regional dimensions produced in Italy under the new legislation, focused on the coastal zone because of the complexity of development conflicts arising from tourism (on which a large part of the economy of the island relies) and other development-related pressures, and owing to the fact that thirteen out of the fourteen previous landscape plans covering coastal areas, which contained some restrictions on coastal development, had been quashed between 1998 and 2003.

Following approval of the plan in 2006, restrictions and prohibitions (on development of land and on certain changes in land uses) stemming from the plan are currently in force, in order to protect a part of the island considered economically strategic and environmentally sensitive. Restrictions and prohibitions are set out by the plan by means of a system of rules.

The planning activity of the regional administration of Sardinia has undergone a deep change after the approval of the RLP, which establishes the directions for nearly any future planning activity in Sardinia, and requires that actual sectoral and local plans, as well as plans for protected areas, be changed to comply with its directions.

4 METHODOLOGY, SAMPLING METHOD AND QUESTIONNAIRE

This section is organized as follows. In the first paragraph, the DCM approach is presented in the context of the case study discussed in this paper. In this paragraph, we explain why we choose the DCM approach to implement our estimates and which part of the methodology is already used in other papers. Secondly, we explain the sampling method and the delivered questionnaire.

We use a discrete-choice approach since the dependent variable, that is the level of residen-tial satisfaction perceived by the residents of the historic center is ordinal. In this case, dis-crete-choice models are the most appropriate, while regression models would be preferred were the dependent variable is continuous. On the side of the explanatory variables, there is no loss of information since all the values of the variables used in the model are not subject to any transformation.

In this paper, we use a DCM approach to implement the analysis of perceived level of resi-dential satisfaction, in order to assess the influence of a set of characteristics on this variable, which are grouped into three categories: : i. level of satisfaction related to the house; ii. neighborhood characteristics; and, iii. respondents' social and demographic characteristics. This is a step further in the use of DCMs, since we implement effectively a methodology, used to study discrete-choice problems in other disciplinary contexts, in the field of policy analysis concerning regional and city planning.

4.1 Methodology

DCMs model choices among a discrete set of mutually exclusive alternatives that could be travel modes, products or, as in the case we discuss in this paper, options proposed in a questionnairerelated to residential satisfaction. For a synthetic comprehensive discussion on the DCM approach we address the reader to Zoppi and Lai (2013) which largely draws on Cherchi (2009).

As Zoppi and Lai (2013) put in evidence "Consistent with this framework is McFadden's theoretical and practical research[2], which was awarded the Nobel prize in 2000 (McFadden won the prize with Heckman). McFadden studies the issue of discrete choice under different points of view. Among these are the demand for urban transport services (1974), the choice between different transport modes (McFadden and Train, 1978), the demand for local phone services (McFadden et al., 1987), the decision-making processes of the public administration (1976).Other important applications of the DCM approach are referred to the analysis of wage mobility in Europe (Pavlopoulos et al., 2010), and to the assessment of the incidence of specific external factors on the ineffectiveness of particular clinical treatments (Ambrogi et al., 2009)." (p. 297)

Different kinds of DCMs exist, such as the binary-choice models, the multinomial logit/probit models, the event counts and the ordered-choice models (Greene, 1993; Greene and Hensher, 2010).

In particular, the ordered-choice models are suitable to analyze the determinants of a dependent variable which represents a scale of preferences. Analysis of ordered responses started in 1957, with an extension to Finney's work by Aitchison and Silvey. Aitchison's and Silvey's (1957) work was based on a sample of observations related to a species of insect, with the goal to determine the probability of observing a particular stage of the insect's life cycle at time x.Snell's work (1964), that used regression methods and variance techniques, represents the first application of ordered-choice models for the analysis of a set of scores.

The ordered-choice model-based methodology is used to study phenomena characterized by observations represented by categories of naturally-ordered outcomes. Every category is associated to a natural number which represents an ordinal ranking, with no quantitative meaning.

[2] See McFadden 1978; 1980; 2000.

There are different kinds of ordered-choice models, depending on the prior on the error distribution, such as the Logit models, characterized by a logistic distribution, and the Probit models, whose errors are assumed to be normally-distributed.

In this paper, an Ordered Logit Model (OLM) is used to analyze the relation between a discrete variable, which represents the residential satisfaction with the neighborhood where a family lives, and covariates, that are correlated to the dependent variable, which include: i. level of satisfaction related to the house; ii. neighborhood characteristics; and, iii. respondents' social and demographic characteristics.

The model operationalizes by assuming that a latent continuous dependent variable y* is linearly dependent on a vector of explanatory variables, $x = (x_1,\dots, x_k)$, through the following relation:

$$y^* = \boldsymbol{\beta}'\mathbf{x} + \varepsilon, \quad (1)$$

where $\boldsymbol{\beta} = (\beta_1,\dots, \beta_k)$ is a vector of coefficients and ε is the error term.

Vector **x**is a set of kcovariates that are assumed to be strictly independent of ε. Moreover, the components of a vector which represents a set of J+1 discrete outcomes, **y**= (1,...,J) are assumed to be related to the latent variable y* as follows.

The values of y are obtained through a censoring mechanism from y* as follows:

$$y = 1 \text{ if } 0 < y^* \leq \mu_1, \quad (2)$$

this notation indicates that we label the first of the J events as equal to 1, and that the lowest range of values of the latent variable y* corresponds to values higher or equal to zero;

$y = 2$ if $\mu 1 < y^* \leq \mu 2$;

$y = 3$ if $\mu 2 < y^* \leq \mu 3$;

….

J+1. $y = J$ if $\mu_{J-1} \leq y^*$;

where $\mu_1,\dots,\mu_{j-1}$ are unknown threshold parameters. The model assumes that the error term ε has the following properties: i. $E(\varepsilon|\mathbf{x}) = 0$ (i.e., the error term has a 0 conditional mean), ii. $Var(\varepsilon) = \sigma^2$ (i.e.: the error term has the same variance at each observation), and, iii. $E[\varepsilon_i\varepsilon_j | X] = 0$ (i.e.: the error term is uncorrelated between observations)(Greene and Hensher, 2010). The logistic form and the standard normal form for the error distribution, that lead to a OLM or to a Ordered Probit Model (OPM) respectively, are expressed by:

$$f(\varepsilon_i) = \frac{exp(\varepsilon_i)}{[1+exp(\varepsilon_i)]^2} \quad (3)$$

$$f(\varepsilon_i) = \frac{exp\left(-\varepsilon_i^2/2\right)}{\sqrt{2\pi}} \quad (4)$$

where ε has mean equal to 0 and variance equal to $\pi^2/3$ in (3) and mean equal to 0 and variance equal to 1 in (4).

The estimates of the components of the vector of coefficients**β**, indicated as the components of a vector **b** in the formula reported below, are derived from the solution of the maximization problem of the following log-likelihood function, ln L:

$$\ln L = logL = \sum_{i=1}^{n}\sum_{j=1}^{J} m_{ij} log\left[F\left(\mu_j - \mathbf{b}'x_i\right) - F\left(\mu_{j-1} - \mathbf{b}'x_i\right)\right] \quad (5)$$

where $m_{ij} = 1$ if i= j, and $m_{ij} = 0$ otherwise.

The expression in parentheses is the probability of having a particular value of y given x_i, which is represented by:

$$Prob[y = j \mid x_i] = [F(\mu_j - \mathbf{b}'x_i) - F(\mu_{j-1} - \mathbf{b}'x_i)] > 0, \; j = 0,1,\dots,J \quad (6)$$

The derivatives of (5) with respect to the componentsof vector **b**have the following form, taking account of notation (6):

$$\frac{\partial \ln L}{\partial \beta_j} = \sum_{i=1}^{n}[m_{ij} - Prob\,(y = j|x_i)]x_i \quad (7)$$

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The values of the componentsof vector **b**which maximize (5) are the solution of the system which comes from equalizing to zero the J derivatives expressed by (7).

The odds ratio, that is the ratio of the probability of higher level of residential satisfaction with the neighborhood where a house is located in case of the event related to the valute "1" of a dummy variable to the probability of the event related to the value "0", $\delta_j(x_i)$ can be computed as follows:

$$\delta_j(x_i) = \frac{Prob(y=j|x_i=1)}{Prob(y=j|x_i=0)} = \frac{[F(\mu_j - b') - F(\mu_{j-1} - b')]}{[F(\mu_j) - F(\mu_{j-1})]} \qquad (8)$$

Standard errors of the estimates of the components of vector **β** and of the odds ratios can be calculated, that are the most importantparameters to assessthe impactof the explanatory variables on the ordered variable y, and hypothesis tests based on p-values can be implemented.

4.2 Sampling method and questionnaire

A random sample of people living in the historic centerof the city of Cagliari was extracted by associating a random number to each name listed in the phone directory. About 1000 people were randomly selected. The extracted people were contacted by telephone and asked if they were willing to participate in the survey. Out of these 1000 people, just 167 people agreed to participate, implying a 16,7 percent rate of participation. 353 people explicitly refused to cooperate and another 480 did not answer the phone. The phone calls, which asked if the resident would be willing to participate in the survey and, in the case of positive answer, administered the questionnaire, were made at different times of the day. One third were made between 10.30 a.m. and 12.30, two thirds between 4 p.m. and 7.30 p.m. The rate of participation was higher in the second period (about 25 percent).

If the randomly selected person answered to the phone call, and he was willing to participate in the survey, a questionnaire of about 30 questions was administered to the respondent. The questionnaire includes questions related to:i. level of satisfaction related to the house; ii. neighborhood characteristics; and, iii. respondents' social and demographic characteristics. The questionnaire was administered through a call, instead of being sent by e-mail, because data were immediately needed and because a higher rate of participation was expectedhad the questionnaire been directly delivered.

Although the respondents showed interest in the topics, the majority refused to answer the question concerning their income level.This implies the exclusion of a variable related to this aspect from the set of covariates of the OLM and OPM.

5 MODEL IMPLEMENTATION AND RESULTS

This section presents the implementation of the DCM-related analysis and its results.

In the first subsection we define the dependent and explanatory variables whose values are derived from the delivered questionnaires, their specifications and their behavior across the survey. As we stated above, they can be grouped into three categories: i. levels of satisfaction; ii. neighborhood characteristics; iii. respondents' social and demographic characteristics.

In the second subsection we present the inferences concerning the influence of the covariates on the level of residential satisfaction perceived by the respondents estimated through the implementation of an OLM.[3]

5.1 Discussion on factors

The model's implementation implies a definition of residential satisfaction and residential environment. According to Galster (1987), residential satisfaction entails an assessment of the qualitative difference between the present and the perceived best conditions of a house's and of a neighborhood's characteristics. The quality of a residential environment depends on the house's and neighborhood's characteristics. Social aspects, that account for relations with neighbors are particularly relevant (Amerigo and Aragones, 1999).

In the literature (among many, Palmquist, 1984, Cheshire and Sheppard, 1995, Kiel and Zabel, 1999, Zoppi, 2000), a widely accepted classification of factors influencing residential satisfaction distinguishes those intrinsically belonging to a particular house and those belonging to the house's neighborhood. Palmquist

[3] We estimated the OPM as well. The results are very close to the OLM's, so we do not believe it is worth discussing them.

(1984) uses thirty-two variables to define the value of houses in seven United States metropolitan contexts. Twenty-three factors are related to a housing unit, while nine determinants concern the neighborhood where a house is located. Characteristics related to the house's neighborhood are drawn from the census data with reference to the census tract where the house is located, e.g., median age of residents, percentage of workers that has a blue/white collar job, population classified as non-white, and so on. Cheshire and Sheppard (1995) use a similar approach to the definition of the set of factors, but they add characteristics related to the zoning rules established by municipal Masterplans and urban land uses, such as industrial land, land for new residential developments, open space for leisure.

Characteristics of the neighborhoods where houses are located could possibly be either positive, in which case they are considered goods, or negative, in which case they are considered bads. Since the characteristics of neighborhoods where houses are located are locally intrinsically non-excludable and non-rivalrous they can be considered public goods or public bads. The more the quantity of a public bad, the less the residential satisfaction with the neighborhood, and vice-versa. Under this perspective, Zoppi (2000) analyzes the quantitative negative impact of widespread illegal building activity on the value of houses in the metropolitan area of Cagliari (Italy) by considering illegal buildings as a public bad, that is, a negative characteristic of the neighborhood where a house is located.

In the light of the essays quoted above and of many others which deal with the issue of the determinants of residential satisfaction, in this paper we focus on residential satisfaction with the neighborhoods where houses are located.

As we stated in the introduction to this section, we implement a OLM-based analysis of residential satisfaction, founded on information derived from the questionnaire delivered to people extracted from a set of residents of the historic center of Cagliari through the sampling method described above.

Information concerning the level of residential satisfaction, that is the values of variable yi of model (2)-(8), is expressed through the following five levels of residential satisfaction, related to the neighborhood characteristics, the respondents have to choose among:

(1) low level, y=1;

(2) medium-low level, y=2;

(3)medium level, y=3;

(4) medium-high level, y=4;

(5) high level, y=5.

Neighborhood characteristics we use in order to analyze their influence on residential satisfaction, that is the values of the components of vector x of (1), which are labelled xi in model (2)-(8), are derived from the answers to the questionnaire as well. In the following paragraphs, we indicate in parentheses the labels of the implemented OLM. These labels are used to make reference to the corresponding variables in Tables 1-2 and in the rest of the paper.

We consider positive aspects such as the perceived tranquillity (D-QUIET) of the location and the presence of services, such as schools (D_SCHOOL), public gardens (D_GARD), markets (D_MARKET), pharmacies (D_PHARM), bus stops (D_BUSST) and post offices (D_POST). Indeed, lack of services is likely to determine lower satisfaction which may cause mobility intentions and moving behaviors (Lu, 1998). Hence, a positive correlation is expected between these variables and the residential satisfaction expressed by the respondents as well as in the case of the location's tranquillity (Bonaiuto, Fornara, & Bonnes, 2003).

Negative aspects are related to the presence of problems such as (Branton & Jones, 2005; Atkinson & Kintrea, 2002) insufficient street lighting (D_STRLIGHT), deficient garbage collection (D_REFUS), lack of car parks (D_PARK), presence of water losses (D_WATLOS), bad street paving (D_PAV), noise (D_NOISE), crime (D_CRIME) and traffic (D_TRAFF). For instance, in figure 3, an area in the neighborhood of Marina with a number of car parks not sufficient to people's needs is presented.

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Fig. 3: Lack of car parks in the neighborhood Marina.

The issues, which enter as explanatory variables in the model we estimate in our analysis, should be addressed and managed through the urban planning policies defined by the political and administrative authorities of the local municipalities.

Finally, we include in our model variables which control for characteristics related to the respondents, as follows.

(1) Presence of relatives of the respondent in the historic center (D_RELAT). This variable should be positively correlated to residential satisfaction (among many, Perez, Fernandez_Mayoralas Fernandez, Rivera, and Rojo Abuin, 2001, Mohit, Ibrahim, and Rashid, 2010, Smith, 2010, Dekker and Bolt, 2005).

(2) Age (D_AGE), gender (D_GEN), education level (EDUC_LEV), employment (JOB). The age of a person reflects the stage of her/his life cycle. It is likely that the older the respondent, the higher her/his residential satisfaction, since, on the average, older, more mature people are likely to be more settled down than younger ones, who are likely to have higher expectations (Amerigo and Aragones, 1990, Dahmann, 1985, Lu, 1999). The gender variable (dummy: female) is expected to be positively correlated to residential satisfaction because women are likely to have deeper affective relations with their neighborhood and house than men (Lu, 1999). The education level represents the school degree of the respondent. It is likely that the higher the education level the lower the residential satisfaction, since a higher level of education should be related to a higher awareness of suitable residential alternatives (Van Ham, Manley, Bailey, Simpson, and Maclennan, 2012). It is likely that the higher the income related to the respondent's job the lower the residential satisfaction (Lu, 1999), since a higher income should generate a higher awareness of suitable residential alternatives. On the other hand, retirees, students, unemployed people or housewives are expected comparatively to be more satisfied with their residential neighborhood.

(3) Duration of residence (DUR_RES) and relationships with her/his neighbors (D_RELATION). It is likely that the duration of residence and good relationships with neighbors be positively correlated to residential satisfaction, since they signal a strong emotional bond between the respondent and the neighborhood where she/he lives (Amerigo and Aragones, 1997, Anderson, 2010, Dekker and Bolt, 2005, Parkes, Kearns, and Atkinson, 2002).

(4) Level of satisfaction related to the house (D_HOU_SAT). It is pretty straightforward that a positive attitude towards the house where she/he lives exerts a positive influence on residential satisfaction with the neighborhood, so we include a variable related to this issue in the set of covariates (Parkes et al., 2002, Galster and Hesser, 1981).

Variable	Definition	Mean	St.dev.
	Residential satisfaction		
NEIG_SAT	Ordered categorical variable of residential satisfaction related to neighborhood that can take five values, as follows: 1-Low level of satisfaction; 2-low-medium; 3-medium; 4-medium-high; 5-high	3.77	1.06
	Neighborhood-related variables		
D_SCHOOL	Dummy variable related to the presence of schools or university facilities near the respondent's house	0.65	0.48
D_MARKET	Dummy variable related to the presence of a market near the respondent's house	0.65	0.48
D_POST	Dummy variable related to the presence of a post office near the respondent's house	0.71	0.46
D_PHARM	Dummy variable related to the presence of a pharmacy near the respondent's house	0.80	0.40
D_GARD	Dummy variable related to the presence of a garden near the respondent's house	0.45	0.50
D_BUSST	Dummy variable related to the presence of bus stops near the respondent's house	0.79	0.41
D_QUIET	Dummy variable related to the perceived tranquility of the location where the respondent lives (1 if it is a calm place, 0 otherwise)	0.71	0.46
D_RELAT	Dummy variable related to the presence of respondent's resident relatives in the historic center (1 if there are relatives, 0 otherwise)	0.35	0.48
D_PARK	Dummy variable related to the absence of parking spaces in the neighborhood of the respondent's house	0.83	0.38
D_STRLIGHT	Dummy variable related to the presence of a deficient street lighting in the neighborhood of the respondent's house	0.14	0.35
D_CRIME	Dummy variable related to the presence of criminal activity in the neighborhood of the respondent's house	0.16	0.36
D_REFUS	Dummy variable related to the presence of problems of refuse collection in the neighborhood of the respondent's house	0.44	0.50
D_TRAFF	Dummy variable related to the presence of traffic in the neighborhood of the respondent's house	0.36	0.48
D_WATLOS	Dummy variable related to the presence of water losses in the neighborhood of the respondent's house	0.10	0.30
D_NOISE	Dummy variable related to the presence of noise in the neighborhood of the respondent's house	0.42	0.49
D_PAV	Dummy variable related to the presence of incoherent paving in the neighborhood of the respondent's house	0.07	0.26
	Respondent-related control variables		
D_AGE	Dummy variable that represents the age of the respondent (1 if the age is less than 40, 0 otherwise)	0.13	0.33
D_GEN	Dummy variable related to the gender of the respondent (1 for female and 0 for male)	0.63	0.48
EDUC_LEV	Dummy variable related to the respondnet's education level (1 if the respondent has a university degree or a diploma, 0 otherwise)	0.14	0.35
JOB	Set of dummy variables related to the respondet's job (JOB2 is 1 if the respondent is a practitioner, 0 if the respondent is a public employee; JOB3 is 1 if the respondent is a student or an unemployed person, a retiree or a housewife, 0 if the respondent is a public employee)	0.13 0.56	0.34 0.50
D_RELATION	Dummy variable related to the goodness level of the relationships between the respondent and his neighbors (1 if good or excellent, 0 otherwise)	0.77	0.42
D_HOU_SAT	Dummy variable related to the respondent's satisfaction concerning the house where he/she lives (1 if the satisfaction degree is medium-high or high, 0 otherwise)	0.84	0.36
DUR_RES	Ratio between the number of years the respondent has been living in the house and his/her age (percentage of lifetime the respondent has spent in the house)	0.57	0.33

Table 1: Variables and descriptive statistics

5.2 Results

The results of the implementation of the OLM are described in the sub-subsections that follow. We present the estimates concerning the control variables in the first place, and afterwards we report the outcomes related to the influence of neighborhood characteristics on residential satisfaction. The detail of the estimates is reported in Table 2. The table shows the OLM's estimated odds ratios. As we stated in (8), the odds ratio is the ratio of the probability of higher level of residential satisfaction with the neighborhood where a house is located (variable "NEIG_SAT" in Tables 1-2) in case of the event related to the value "1" of a dummy variable to the probability of the event related to the value "0". A change of the level of residential satisfaction can occur as follows:

(1) from low (y = 1) to a higher level (y = 2, 3, 4 or 5);

(2) either from low or from medium-low (y = 1 or 2) to a higher level (y = 3, 4 or 5);

(3) either from low or from medium-low or from medium (y = 1, 2 or 3) to a higher level (y = 4 or 5);

(4) either from low or from medium-low or from medium or from medium-high (y = 1, 2, 3 or 4) to high (y = 5).

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Ordered Logit model (Dependent variable NEIG_SAT)				
Variable	**Odds ratio**	**Stand.error**	**t-statistic**	**Hypothesis test: coefficient=0**
Respondent-related control variables				
D_AGE	1.8558	1.0110	1.14	0.256
D_GEN	1.2165	0.4175	0.57	0.568
D_RELATION	4.8451	2.0846	3.67	0.000
EDUC_LEV	0.8550	0.5763	-0.27	0.788
JOB2	0.6431	0.3648	-0.78	0.436
JOB3	0.6324	0.2512	-1.15	0.249
D_HOU_SAT	2.5904	1.1824	2.09	0.037
DUR_RES	1.2638	0.4083	0.55	0.581
Neighborhood-related variables				
D_QUIET	2.0624	0.9069	1.65	0.100
D_RELAT	1.3349	0.4767	0.81	0.419
D_SCHOOL	1.4088	0.6374	0.76	0.449
D_MARKET	0.5028	0.2679	-1.29	0.197
D_POST	1.4236	0.7920	0.63	0.526
D_PHARM	1.7580	1.5070	0.66	0.510
D_GARD	0.9126	0.3610	-0.23	0.817
D_BUSST	2.8139	1.9434	1.50	0.134
D_PARK	1.0284	0.4884	0.06	0.953
D_STRLIGHT	1.0469	0.5103	0.09	0.925
D_CRIME	0.4026	0.2437	-1.50	0.133
D_REFUS	0.4098	0.1542	-2.37	0.018
D_TRAFF	0.5714	0.2078	-1.54	0.124
D_WATLOS	0.6978	1.2838	-1.50	0.135
D_NOISE	0.2973	0.1128	-3.20	0.001
D_PAV	0.9406	0.6336	-0.09	0.928
Pseudo R-squared= 0,1886				

Table 2: OLM's estimated odds ratios, dependent variable NEIG_SAT. The odds ratio is the ratio of the probability of higher level of residential satisfaction with the neighbourhood where a house is located in case of the event related to the value "1" of a dummy variable to the probability of the event related to the value "0": the model includes the covariates of Table 1.

5.2.1 Respondent-related control variables

The signs of the estimated odds ratios of the respondent-related control variables are always consistent with expectations discussed in the previous subsection.

The variable related to the quality of relationships with neighbors, D_RELATION, showsa positive odds ratio, 4.86, as expected.

The model's results show that respondents older than 40 express a higher satisfaction degree than younger people, which can be related to expectations' and needs' change during lifetime. The results concerning variable D_AGE's odds ratio indicate that if the respondent is older than 40, the probability of having a higher satisfaction degree increases by a 0.86 factor. With reference to the gender-related variable D_GEN, women express a level of satisfaction higher than men's, which can be explained through comparatively higher emotional connection with the residential location-related relationships. The model's results show that in case of a female respondent the probability of having a higher level of satisfaction increases by a 0.22 factor, with a low significance level.

As expected, the presence of relatives in the neighborhood has a positive influence.

The variable related to the quality of relationships with neighbors, D_RELATION, shows a positive odds ratio, 4.85, as expected.

Respondents with a low education level reveal a higher satisfaction degree than graduate's (variable EDUC_LEV, odds ratio equal to 0.86), as expected.

Practitioners show a residential satisfaction level lower than employees, as well as students, unemployed and retiree people (variables JOB2 and JOB3, odds ratio equal to 0.64 and 0.63 respectively).

Finally, the variables related to the number of years the respondent has been living in the house (DUR_RES) and to the level of satisfaction related to the house (D_HOU_SAT) exhibitpositive odds ratios (1.26 and 2.59).

5.2.2 Neighborhood-related control variables

The signs of the estimated odds ratios of the neighborhood-related variables are mostly consistent with expectations discussed in the previous subsection.

The variable related to the tranquillity of the respondent’s house location, D_QUIET, showsa positive odds ratio, 2.06, as expected.

Variables related to the presence of schools (D_SCHOOL), post offices (D_POST) and bus stops (D_BUSST) have a positive influence on the satisfaction related to the neighborhood of the respondent’s house, as expected. Odd ratios are 1.41, 1.42 and 2.81. The availability of public bus services nearby the house’s location is perceived as comparatively more important in terms of residential satisfaction.

Variables related to the presence of markets (D_MARKET) and gardens (D_GARD) have negative effects, which is not consistent with expectations. A possible reason could be that the supply of these services is higher than the demand expressed by the residents of the historic center, so the marginal value of these services is negative, in terms of the cost-opportunity of losing the availability of other services perceived as underendowed.

The presence of pharmacies (D_PHARM) has a positive effect on the level of satisfaction. Odds ratio is 1.76.

The absence of parking spaces (D_PARK) and the lack of sufficient street lighting (D_STRLIGHT) show no evidence of any impact on residential satisfaction since the corresponding p-values are more than 90 percent.

The presence of crime in the neighborhood and problems connected to refuse collection, that is variables D_CRIME and D_REFUS, exhibit less-than-one odds ratios (0.40 and 0.41), as expected.

The traffic-related variable D_TRAFF has a negative influence as expected, and it shows an odds ratio nearly equal to 0.57.

The variable related to water losses, D_WATLOS, has a negative effect, and it exhibits a 0.69 odds ratio.

Finally, noise-related and paving-related variables, that is D_NOISE and D_PAV, show negative effects as well (0.30 and 0.94).

6 DISCUSSION AND CONCLUSION

The outcomes of the DCM-based model entail important implications for future planning policies. The restricted availability of public services and infrastructure is a very influencing factor in determining low satisfaction. As a consequence, it could very possibly be effective to provide the historic center with important services such as schools, public gardens, parking lots, bus stops, groceries and retail shops and pharmacies.

Moreover, crime control, effective refuse collection, thoughtful noise mitigation strategy, improved street lighting and paving, and traffic control are other factors which could increase the perceived satisfaction by the residents.

These outcomes provide local decision makers and public officials with important information on the historic center’s residents’ expectations related to urban planning policies.

For instance, a very effective policy to enhance residential satisfaction with the neighborhood could be to improve the public transportation network in order to make it easier for the residents to commute from the historic center to other urban destinations.

Another proposal could be the implementation of a demand-responsive transport service, characterized by flexible routing and scheduling of small vehicles operating in shared-ride mode, according to passengers’ needs. This would be useful and a sustainable, since it would reduce the overall cost of the public transport system.

With reference to traffic problems, which is another negative factor, it seems that policies that entail an increase and a more effective management of parking space very close to the historic center boundary could generate a positive effect on residential satisfaction related to neighborhood, which may possibly imply the pedestrianization of the most part of Cagliari’s inner-city as well.Moreover, a more effective refuse collection system could be based on the project of locating dustbins underground, which could possibly improve the urban cleanliness perception.

Considering relationships with neighbors, the outcomes of the model's implementation show that good relationships have a positive effect on residential satisfaction. So, it is reasonable to propose a policy that contributes to improve relationships between neighbors, such as, for instance, making available public facilities where residents can implement social activities and build a sense of community. These facilities could also improve participation related to planning decisions, since residents and city users could feel at ease with a familiar environment for public discussion.

Finally, since, as we put in evidence in the previous section, residential satisfaction is positively related to residents' satisfaction concerning the house where they live, a decisive role to improve perceived quality of the neighborhood is played by public planning policies for residential reuse and renewal, which is the core of the implementation plans of the historic centers (IPHCs) defined by the Regional Landscape Plan of Sardinia (RLP). Following the RLP's approval, the Sardinian regional administration provided municipalities and practitioners with a wide range of technical guidelines and documentation that are significantly influencing the implementation of the planning processes of IPHCs.As a consequence, in the planning processes of the IPHCs, heavily influenced by the control of the technical staff of the regional offices, a strong consistency and implied uniformity do show up as: i. a strong attention to historical, typological and morphological characteristics in terms of the territorial analysis of historic urban settlement systems, which are identified by the RLP as "Centers of antique and primary development"; ii. A strong prescriptive ruling framework characterized by a markedly-conservative attitude (Leone and Zoppi, 2014). In this context, it would reasonable a urban-renewal policy that entails the transformation of private buildings into public housing, in order to revitalize the historic center through the integration of public and private financial efforts.

Since more liveable houses and neighborhoods endowed with high-quality public services and infrastructure make peripheral and outbound locations more attractive than the historic centers', a key element to rebalance the historic centers' displacement is to increase the quality of inner cities' houses and neighborhoods. As an example, in the case of Cagliari, the model's implementation shows that attractiveness of the historic center could improve substantially if the availability of post offices, bus stops and retail shops is increased. Moreover, the model's outcomes indicate that a comprehensive planning approach to public transportation, parking, and pedestrian paths would help making the historic center comparatively more attractive, since these issues are much more important for the historic center than for other urban neighborhoods.Furthermore, the establishment of one or more restricted-traffic areas could increase the tranquillity of the historic center's neighborhoods, and, by doing so, determine a rise in the level of satisfaction of the residents.

This paper has employed an OLM-based approach to analyze questionnaires delivered to the residents of the historic center of Cagliari in order to investigate the determinants of their satisfaction with the neighborhood where they are living. Moreover, the application of this method allows for an integration of the results of the questionnaire analysis and DCM-based approaches, which can be used by city planners in the development of policy-making processes concerning city residential areas. In this respect, the paper makes an important methodological contribution.

The optimal choice of the attributes to be included in the OLMs includes as many variables as necessary to describe the residential satisfaction with the neighborhoods where people are living. Of course, this choice is heavily influenced by available information. The analysis here implemented is based on a set of variables representing the best choice given the information available, rather than the optimal choice. These variables should be considered as a subset of the optimal variable choice. Nevertheless, they give us an interesting picture of the phenomenon.

Regarding this point, it must be stated that there are a number of variables that should have been included in the OLM model and were not included since no information is available. One is the household income, which could be very important in determining the income effect on the investment. Moreover, data on capacity of the system of public infrastructure and services would be very helpful.

The method developed in this paper could be easily exported to assess residential satisfaction related to the neighborhood on behalf of residents living in other urban contexts, in particular of people living in residential peripheries, by adapting the questionnaire to the different situations at stake.

The results obtained with reference to Cagliari's historic center allow generalization for two reasons. On the one hand, no similar empirical studies have been implemented to analyze the determinants of residential satisfaction related to neighborhood in other Italian conurbations by means of a DCM-based approach. On the other hand, it is not possible to compare the situation of the urban area of Cagliari to a situation in which a more flexible, participatory, faster and bottom-up planning process was implemented. This kind of situation would have probably encouraged people to lobby in favor of effective planning policies concerning the historic center, since the established planning process has been developed quite homogeneously in all of Italy, and counter-examples are very rare.

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reviewed paper

I Am My City: Rethinking Cairo As A Contented City

Heba Safey Eldeen

(Heba Safey Eldeen, Associate Professor of Architecture, Misr Intrnational University (MIU), hebasafieldin@miuegypt.edu.eg)

1 ABSTRACT

Cairo: the urban legend, is one of the most ancient, colourful, multifaceted of cities. Seat of pharaohs, sultans and kings, prize of conquerors from Alexander to Saladin to Napoleon, "the city Victorious" has never stopped reinventing herself. The very nature of Cairo has ever reflected polycentric ensembles of urbanism that belonged to different user group, with different perspectives, conceptions and aspirations towards their city life. Sorrowfully over the past few decades, the city has lost most of its acquired identities for reasons beyond the scope of this paper. It is argued that the city has undergone, and still undergoing- a process of expansion and extension for its physical measures on the expenses of its societal, heritage and cultural identity to the extent that is considered as “a city out of control”. Where is Cairo going? Who defines its directions? Whose visions does it follow? Is planning still possible for contemporary Cairo? Can the quality of life be improved by improving the city’s resilience?

With Egyptian history instantly being rewritten, I am dreaming of a Cairo reborn. Hence, imaging the future of Cairo for any planning, design or governance intention requires understanding and inferring the functional aspects of the socio-cultural patterns in the city. Hence determining the what, why and how of planning and design. This further requires reviewing theoretical conceptualisations and evaluating examples of other cities and regions that are agreed upon as vibrant, resilient, liveable, smart and most importantly: happy.

The paper at hand serves as a theoretical approach towards understanding contemporary Cairo identity as a prologue for its urban reform as a vibrant city. My objective is to introduce a model for understanding Cairo through correlating urbanism to its political, economic, legislative, and socio-cultural attributes. Therefor hypothesise visions for its transformation into a vibrant city. The methodology is based on a quick review of the modern urban history of Cairo; identifying its districts types, their local characteristics of user groups, behavioural patterns and physical settings, and then discussing Cairo’s overall contemporary political, economic, legislative, and socio-cultural attributes that altogether designate its overall cultural identity. Based on the works of Stewart-Hakky-Hemdan, Abu-Loghod, Giraud, Raymond, Sims, Singerman, Amar et al, further talk about Cairo argues its actuality as a collective/integrated capital, or interrelated/intertwined entities of substantial districts. Thus identifying its urbanism lacks and shortcomings. Based on the works of Jacobs, Alexander, Lynch, Gosling, Maitland, Wiedenhoeft, Geddes, Low, Patsy, Montgomery and others, theoretical debates then discern contextual definitions and conflicts of “vibrant”, “resilient”, “smart”, “liveable”, “sustainable”and “happy”city concepts. Through an exploratory grounded observation in the various, multi-faceted districts of the city, in addition to a random exploratory investigation with a number of residents, an attempt was to give Cairo an urban description was undergone. Questions are thenceforth evoked about the values, visions and practices explores the possibilities and suitability of approaches that profile a theory towards the transformation of our Cairo Victorious into a liveable, sustainable, smart, and a happy city. Such discussion is also expected to provide insights for planners, designers, decision makers for the betterment of both practice and education fields.

2 CAIRO YESTERDAY: A CITY RESILIENT

The legend says that the eighth descendant of king Osymandias founded Memphis, the most illustrious city in Egypt. For he sought out the most fitting site in the land, the place where the Nile divides the Delta, situated, as it were, at the gateway to Egypt, was master of all the commerce passing upstream to the country above. On “Heliopolis”was later founded, and eventually both were connected. The route from Memphis to On “Heliopolis“, slashing upwards from south-west to north-east, remains the major traffic axis of twenty first century Cairo. The date groves enfold the few stubs and chunks of Memphis that have not subsided into the quick silt of the valley floor.

Even these scant remains threaten to vanish now, not into the ground but under the brick and reinforced concrete of expanding Cairo.

A thousand years ago the Persian geographer Huduh al-Alam described Misr El-Fustat as “the wealthiest city in the world”. An Arab contemporary, the Jerusalemite al-Muqaddasi, wrote that “its citizens thronged as thick as locusts". As centuries passed, however, the rich and powerful sought more spacious, quarters further north in the open plain stretching towards the ruins of the ancient On. By the time Columbus sailed for Indies –hoping, like his Portuguese competitors, to find a new route to the east and this break the spice monopoly of the sultans who reigned from our very citadel- Misr Al Fustat was nothing but a rubbish tip fort he great and prosperous city of Cairo.

Figure#1 Memphis and On on contemporary Cairo's map

Fabled medieval Cairo of bazaars, domes, and minarets; the spiral ninth century Mosque of Ahmad Ibn Tulun, the elegant tiers of Sultan Hassan's fourteenth century madrassa, the sharp, pencil pointed towers of the Ottoman period, the twin bulbs a-top of Bab Zuwayla –the eleventh-century gate where long ago the heads of criminals were hung and a troll was said to lurk behind the massive door. Splendid mosques still survive by the dozen, evoking the long summer from the tenth to sixteenth centuries when Cairo was the biggest and richest city west of India. When Ibn Battuta first arrived in the year AD 1326, Cairo was indeed at the peak of its fortunes. For three centuries it had been the greatest of Muslim cities. But this town was already ancient long before the coming of Islam. Successive cities have grown, flourished, decayed and been reborn on this site beginning no less than 4,000 years before. The town was so old that its inhabitants even at the start of the barely conceivable antiquity believed that this was where Creation itself had taken place.

Tall buildings are no novelty to Cairo. Its loftiest medieval minarets are 250 feet high, and even the apartment houses of a thousand years ago were commonly seven or, by one account up to fourteen storeys tall. "We arrived in Cairo on Sunday, June 18, 1481. I had come to see the Cairenes and their deeds. However, if I were to write about its wealth and its people, all of this book would not be sufficient. I swear that I fit were possible to put Rome, Venice, Milan, Padua. Florence and four more cities together, they would not equal in wealth and population half that of Cairo".

The classic panorama of Cairo remains the one that enchanted Orientalists painters two centuries ago. On snogless days, the vista from the esplanade at the citadel, Cairo's mammoth crusader-era fortress, is stunning. It is from here that centuries of rulers surveyed the city at their feet (and occasionally, in times of trouble, from where they fired cannon shots to subdue its unruly people). The first thing that astonishes a stranger to Cairo is the squalid wretchedness of the Arabs and the external splendour of the Turks. "With the polo, the

balls, the racing and the riding, Cairo begins to impress itself upon you as an English town in which any quantity of Oriental sights are kept for the aesthetic satisfaction of the inhabitants, much as the proprietor of a country keeps a game preserve or deer park for his amusement".

The city's dominance echoes in the language itself. Misr- the word derived from the same roots as the biblical Mizraim, or Egyptians –is still the common Arabic name fort he city, and just as Memphis was once confused with Egypt as a whole, to this day the name for Egypt in Arabic, Hebrew, Turkish, Persian, Urdu, or Hindi is also Misr. To 250 million Arabic speakers and I billion Muslims, Cairo retains a mystique, a stature, and a reassuring gravity that no other city can match.

German, Austro-Hungarian, French and Italian architects had given much of this new city a belle époque veneer, with a twist here and there of Islamic decor to maintain the oriental atmosphere. A sort of French municipal dream progressed steadily from Opera square to nearby Ataba square- the hub of Cairo's rapidly expanding tramway network. A statue of Ibrahim guarded the Azbakiyya Gardens, with their winding paths and fountains, their banyan trees and bandstand, and the Italianate quarters of the Khedivial fencing club. Behind Ibrahim and to his left stood the domed main post office and the fire department, with its shiny red engines pulled by thirteen specially imported English carthorses. Nearby, Oscar Horowitx had capped a five story department of Victor Tiring et frères with a glass globe illuminated from inside and held aloft by four cast iron strong men. Here East meets the West, and the struggle between the two elements still rages at its greatest height. To the west lives Europe, to the East the orient. Gradually the former is encroaching upon the latter, so much so that in the Mousky, a Levantine thoroughfare interlaces by Arab lanes, the huge signboard of a well-known whisky firm tops a wakf or a religious establishment.

Tongues and races mingled amid the tight ranks of tenements in Cairo's new working-class districts. They mixed happily on the whole, even if the influence was mostly one way, and even if marriage across religions remained rare. All adopting Mediterranean dress, manners, and phrasing. Fifteen miles south of Cairo, facing the ruins of Memphis across the Nile, an ancient sulphur spring had been developed into a chic spa. Aside from healing baths and luxury accommodation, Helwan-les-bains was equipped with a Japanese garden fitted with Pagodas and plaster Buddha's. The fresh air of the nearby desert made it an ideal place for pony rides and picnics. Alpine chalets abutted pillared and porticoed neo-classical mansions. Bougainvillea hedges separated Raj-style bungalows from steep-roofed manor houses. Garden competitions, Boy Scout and Brownie troops, a sporting club with a golf course and a yacht club on the Nile, churches, mosques and a thriving synagogue completed this suburban dream „Maadi".

As the time passed, apartment blocks and office buildings has supplanted the original villas of Khedive Ismail's modern city. The city centre had shifted westward away from Ataba square and towards the Nile. What was then downtown Cairo had become a dense zone of shops and offices that looked a little different from Milan or Barcelona. Glorious avenues of trees were cut down, great gardens swallowed up by enormous European buildings, and the beauty is gone!

A visitor from New York claimed he had seen no town outside America where so many large and rich looking houses were being built: "they are not just beautiful, but they are undoubtedly very costly. The roads are broad; luxurious motorcars abound; and there is a dazzle of expensive finery, which is not the less alluring because the face of the wearer is half-veiled". By that time, Cairo no longer aspired to be cosmopolitan; it already was. By that time, our Copts and Jews together with Greeks, Italians, British, French and white Russians who dominated business and finance. "to be French speaking in Cairo before 1952 revolution was to belong to a group of people who felt themselves deeply rooted in Cairo as a place, and probably believed that their lives would be spent in that city until death disseminated them to their various cemeteries, distinguished only by religion or rite. It was to think of Cairo as home, but to believe that Paris was the navel of the world".

The following table summarises Cairo's cultural importations over time:

Era	Cairo's History	Cultural Importations
Prehistoric	Ancient Egypt (Memphis, On Heliopolis))	Influences From Africa+ Ethiopia + East Early interference from hybrid identities
Classical	Ptolemaic Period 332-30 BC Roman & Byzantine (Alexandria was capital, but Misr was important port)	Early globalized amalgamate identity

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Medieval	Arab 641-969: Amr Ibn El-Ass Conquest 640 (Al fustat) Abassid Caliphate El-Ekhshidy (Al Askar) 750-868 - Ibn Tulun 837: AL Katai' (new royal city)	Amr Ibn AlAss came from the Arab peninsula, while the two following dynasty rulers came from the Kurds (Iraq now) with a Mesopotamian/Persian background
	Fatimid 969-1171 Al Qahera (Cairo) - to date	Resided in Sharqeya, and largely in upper Egypt. Fatimids originated in Tunisia, North Africa; with "Berber" back ground. They descended from Fatima el Zahraa, daughter of prophet Mohamed, Ismaili branch of Shi'ism
	Ayubid 1171-1250	Salah Eldin ElAyuubi came from Kurds (Iraq)
	Mamluk 1250-1517	Owned slaves from Circassia, Georgia, some came from Persia, India and Iraq, current Russian peripherals and Far East
Early Modern	Ottoman 1517-1867	Constantinople from Byzantine origins/backgrounds
	French Occupation 1798-1801	France, central Europe
	Mohamed Aly (1805-1882)	Balkan, Albanian, south Slavic, with Byzantine origins/backgrounds
	Khedivate (1867-1914)	-Westernization connections with France, Italy and Great Britain -Connection with Istanbul (Top Kapi) with byzantine origins
Modern	British Occupation 1882-1953	
	Sultanate 1914-1922	
	Kingdome 1922-1953	Connection with Great Britain

Table #1 Cairo's cultural importations over time

It can be therefore concluded that -evidently, Cairo has always been able to absorb any imported or hybrid features, and reflect it in a unique urban reality.

Figure #2 Scenes of yesterday's Cairo 1

Figure #3 Scenes of yesterday's Cairo 2

3 CAIRO TODAY: A CITY OUT OF CONTROL

Cairo, knowing the city too well, in the words of Naguib Mahfouz: "like meeting your beloved in old age, then was I to tell about her wrinkles, her bad breath and worse taste, and her unfortunate habit of shouting at servants?"The city is changing, and what it was changing through disturbed me. I felt increasingly estranged from what was becoming a harder, more impatient, less tolerant city of ugly new buildings –a place far removed from other Cairo's I had known. Crowding squeezes Cairenes out of their homes. There are precious few garden spaces, until a recent study of the city stated there were only five square inches of parkland per inhabitants, which is to say less than the area covered by the sole of one . The pressure of people touches every aspect of life in Cairo. It drives the price of land as high as $500 a spare foot, making millionaires out of speculators while stifling youthful dreams of independence. It overburdens public services and so litters thoroughfares with uncollected waste, but it also limits crime by cluttering getaway routes. Crowds draw in business, creating a rich and varied market that generating more money to embellish the city with the facilities and monuments, which sustain its sense of greatness. But this forces compromises: to relieve traffic, concrete flyovers brush past medieval walls; to provide housing, apartment buildings supplant gardens. Rather than standing live flamingos, Cairenes take themselves out to the streets. They turn sidewalks and roadways into zones of commerce and entertainment, converting them piecemeal into playgrounds and restaurants and open-air mosques. The street is where some two million homeless (or more) sleep, and where all the people of Cairo engage in combat with the city's millions motor vehicles and thousands of donkey carts, microbuses and toktoks. The crowding makes for noise and stress, pollution and social tension. We Cairenes complain, yet secretly, complicitously, we are by and large addicted to living cheek by jowl with a never-ending spectacle.

Combined with the dust that blows off the desert, heavy use gives the city a cosy patina of age. It burnished knobs and handrails to greasy smoothness, cracked tiles into shards, and tint walls into a uniform dun colour that ignites into gold in the soft, slanting light of late afternoon. Sidewalks buckle under the weight of feet.

Staircases in grand beaux-arts building sag, their marble steps eroded into slippery hollows. Advertising tattoos every surface with Arabic's elegant squiggle. Neon spangles rooftops, mingling with antennae and the upturned domes of satellite dishes. The air itself is saturated with the things of man. Deep-frying oil and fresh mint overlie the musk of freshly slaked dust. The human urge to be noticed floods the completely sound spectrum noise, from "Allah Akbar"blasting off every mosque megaphone to insults hurled from the other end of the Arabic alphabet. The noonday in Cairo is a rock-concert-equivalent to over one hundred decibels.

However though, when Arabs think of Cairo, they still think of it as a repository of Arabness: the seat of the greatest universities, the largest libraries, the biggest-circulation newspapers, the most vibrant pop culture – and even of the busiest camel market in the Arab world. The more than million Arab tourists who come every year rarely bother with Cairo's antiquities. They head instead to theatres, to cinemas and literary watering holes, to swank gambling casinos and glitzy nightclubs. They go to cafes to soak up the sounds of Cairene slang and eavesdrop on the latest jokes. They flock to concert halls for the toniest in classical oriental music and swarm street kiosks blaring the sassiest Arabic rap. They come because, worn as she is, Cairo still draws the best talent in Arab arts.

Figure #4 Scenes of today's Cairo

Hence, it can be concluded that the modern history of Cairo's urban milestone comprises:

- The phase of La Belle Epoch (1850-1950) that included the birth of modern Cairo, and several political and cultural upheavals, including WWI, 1919 Revolution, WWII and after.
- The 1952 Revolution and beyond phase, with the 1950's and 1960's Centralisation and Nationalisation, 1967 War, 1973 War, and the Open-door policy 1974. This phase was the remarkable beginning of the urban decline.
- With the 1980's and 1990's Privatisation, then the reign of Globalisation and the turn of the millennium, Cairo's urban and architectural enigma (2000+) has started, reaching its peak after the Jan 2011 revolution, where the city went was totally out of control, and still is till the writing of these lines. Cairene urban status can now be described as spontaneous, "improvised", or "ad-hoc". As a result, an unexpected deficiency occurred in the entire number and classification for all inhabitants' social classes. This deficiency is paralleled with a large speedy construction movement all over Cairo like nowhere else in the world.

It is evident-also, that the continuous social flux in contemporary Cairo has made it a fascinating example of urban change. Witnessing the struggle between politics, history, and place making since the fifties of the twentieth century has caused erasing and demolishing parts of its past. The intense city has become a self-destructive character, culminating the question of a Cairene identity. Efforts dedicated/exerted to respond to Cairo's chaotic urban identity are numerous and various in approaches; national or individual or limited-scale sized projects are implemented. Some of them are dedicated to conservation and preservation of historical areas, and some are dedicated to partial development or beautification of city districts. However, something is still missing or troublesome. For what we find day after day is more law breaking, vandalism, demolishing of historic buildings or buildings of value and an overall deterioration of the city. In addition to the reign of informality and its merging/blending with all formal city districts, Cairo today possesses a confused urban identity.

A quick review of Cairo's profile –or the Egyptian capital history- reveals the fact of the multiple-layered embedded identities. The socio-urban topography of contemporary Cairo can be summarised in the following description of each district-category, based on location, dominant activities, type of residents, and status:

- The Historical Districts: User groups: the troops of the "balady" locals and workers in the nearby downtown. Naturally deteriorated due to age, lack of maintenance and urban governance. Most of the historic buildings currently suffer from collapse-threats that might lead to their total loss.
- The Nineteenth Century Districts: User groups: low-middle class. Mostly governmental employers and some tradesmen.
- Turn of the Century Districts: Each was dedicated to a user group, ethnicity, or nationality. Either in villas with gardens, or apartment buildings, all districts were elegantly designed with different European. With the social mobility that accompanied the nationalisation and centralisation, the user groups, the land uses, and the urban fabrics have changed dramatically. Many of the old buildings are destroyed to accommodate high-rise ones. Densities have exploded. Most of these districts have repelled their original residences and their current social structure cannot be categorised.
- Twentieth Century (Modern) Districts: Built on the new town-planning schemes, models of modernism are dominant in gridiron urban fabrics and high-rise buildings, and newly building types. Home for the newly centralised governmental institutions, with modern architecture. Included modern activities required by the emerging user groups, clubs, shopping centres, parks, schools, day-care centres, etc.
- New Urban Settlements and Gated Compounds: Divided into two categories; satellite cities and attached cities, and gated compounds. After 1973's victory, a decision to decentralize the economy and industry was intended to protect the city from the overpopulation as well as to protect the left agricultural plots of the city from the crawling of urbanism. Linked with ring roads and/or highways. Built on planned infra structure and services, to house low-income residents of the big city, as well as newly-weds. Mostly designed as workers cities for the low-middle and low income. A second type of urban settlements (gated compounds) was started in the nineties, after the original districts of the city became repellent. Including all types of luxurious aspirations of entertainments. Buildings are with very low density and highest percentages of areas are left for greenery and public spaces. Types of users of this type are mainly the businessmen and the newly crème of society.
- Squatter Settlements: Capitalised over the past three decades, scattered within and outside the city peripherals, covering more that 50% of Cairo’s face, are considered as the instant solution for the homeless. They house very high densities, reaching 90% building densities, up to five floors. Mostly deprived of infra structures and services, as well as public spaces. The user groups of those settlements are the socially marginalised and the least-income inhabitants of the big city.

The fact is that Cairo has never been entirely expressive of one culture. Perhaps some dominant culture –now or then has reigned, and then was subject to change with the alterations of its influences/dictates. From its naissance, Cairo was built where there were already subcultures presenting the subgroups of the Egyptian capital (Madinet Masr). While the historical part of the capital amalgamation of history, nationalities, and therefore, cultures, fall beyond the scope of this paper, yet, it is worth reminding. Cairo’s particular single urban identity is indeed a true fallacy.

Era	Cairo’s History	Cultural Importations
Late Modern	Republic: - 1953-1970 - 1970-1981 - 1981-turn of the millennium	Connection with former USSR Connection with the USA Globalisation and Communication Rebellion
Contemporary	2000-2011 2011- 2015 2015-	Urban Collapse & Launch of New ”Globalised” Capital Project

Table#2 late modern and contemporary Cairo’s cultural importations

However, with the highly politicised cityscape of modern and contemporary Cairo, it has reached a perplexed state that made her face major political, economic, social and cultural challenges. This has resulted in a lack of identity at all; bearing in mind that the city's loss of urban identity is a reflection of the entire Egyptian cultural hesitation and search for meaning.

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Walking down Cairo streets today puts me in such a complexed state. People seem to be unhappy. They look stressed, hopeless and reckless. What I read in the books and see in the old movies seem to me like a fairy tale. According to the United Nations, Cairo is the most densely populated large urban area in the world. Overall, this city packs 70,000 people into each of its 200 square miles, confining its citizens more tightly than does the bristling little island of Manhattan. In central districts the density is 300, 000 per square mole, a figure that soars in some throng not tower blocks but alleys full of low-rise tenements, that differ little from the housing stock of, say a thousand years ago. In such conditions, with three and sometimes five people in a tiny room, families take turns to eat and sleep. Schools operate in up to three shifts, and still have to squeeze fifty, sixty, or sometimes eighty students in a class.

Something must be done for our mother city. Both the mother and all her children are aching under the political unrest, worsening economy, deteriorated health conditions. Tons of garbage are piled around many corners of her streets, pavements are not more for pedestrians. Even the streets, many of which have no room for cars! Public spaces are not for the public. Fast food restaurants and enclosed malls top the destinations for family outings, instead of public areas and piazzas. Kids can not walk on their own, can not bike, mothers fear their babies get sick, special-needs residents can not stroll on their own, senior citizens almost have no where to go in many districts and streets. The urban environment has gone ugly enduring all aspects of pollution. In my viewpoint, such built environment has also affected the values and manners of many Cairenes, in addition to the very fact of the rivalry and turmoil of sub-cultures. This has become a threat to many conservative families. This urban buzz is a product of 22-or-so million inhabitants simultaneously crushing the city's infrastructure under their collective weight, yet lifting its spirit up with their exceptional charm and humour.

Based on the preceding, Cairo and the Cairenes possess two striking facts; being of numerous origins; an amalgam of cultural backgrounds, and being of different urban settings; various subcultures. A plan for Cairo is therefor not only confined to planning, urban and housing design. Rather, it is political, economic, educational, and primarily cultural. If we are targeting a better Egypt, it is my belief that a decent quality of life should be the core and pivot of our entire strategic and action plans. It is my belief that the Cairo urban conundrum would only be solved through urban sociology.

4 CAIRO'S URBAN IDENTITY: A CITY CONTENTED?

As revised in the previous sections of the paper, Cairo today is a huge-over populated city of multiple urban settlements, described as the largest urban mass in the contemporary world. Physically, some parts are really attractive, others are really secure, others are really vibrant, others are really liveable. But, can Cairo be collectively described to have a particular urban identity?

The fact is that the failure of ”well-physically-measured”planned cities has resulted in tackling urbanism from different perspectives.

Urban planning and design theories over the last three decades have emphasised the social and behavioural measures in the design of the built environment as means for urban success. Many concepts and terms were then introduced in which responses of city dwellers to their quality of life are the major determinants of urban accomplishment. Based on the works of Jacobs, Alexander, Lynch, Appleyard, Gosling, Maitland, Wiedenhoeft, Geddes, Low, Patsy, Montgomery, Gehl, and others, theoretical debates then discern contextual definitions of “vibrant”, “resilient”, “smart”, “liveable”, “sustainable”and “happy”city concepts. In this part of the paper, and with the help of such theories, an exploratory grounded approach is employed together a random investigation with residents of the different Cairo district types. The aim was to identify the conflicting nature of Cairo in the eyes of its people: „us“; inferring Cairo's urban status from a socio-behavioural perspective so that we are able to identify its urbanism lacks and shortcomings, thus determining possibilities and suitability of approaches to profile a theory towards the transformation of Cairo, and hence determining values, visions and strategies for its future development.

Definitions and descriptions of vibrant, liveable, sustainable, resilient and happy cities were devised as a checklist, as basis for an exploratory grounded observation in the different districts of the cities. This helped formulate an argumentative approach. Based on the works of Canter, Zeisel, Groat and others, the observation techniques depended on ground-base-maps, checklists and photography. The following table gives a glimpse of the undertaken process:

Concept	Features/Qualities	Yes	No	Conditioned
Vibrant	throbbing with energy or activity, vigorous, lively, vital	Yes		
	active, people talking, lots of facilities, tourist destinations, lots of things to do/show/see	Yes		
	continuos economic development (resulting in prosperity), technological innovation, economic entrepreneurship, offering its inhabitants a multiple experiences			Conditioned
Liveable	attractive & secure environments for people to live/work/play in			Conditioned
	good governance, competitive economy, high quality of living, environmental sustainability		No	
	place is easy to use and feels safe, creating and maintaining a sense of enjoyable place			Conditioned
	combination of amenity values, open spaces, special design features, historic and cultural heritage, location, intangibles	Yes		
	Character landscape sense of place	Yes		
Sustainable	enables citizens to meet their own needs and enhance their wellbeing without degrading natural world ot lives of other people or species - now or in the future		***No***	
	patterns of production consumption-transportation systems		***No***	
	pollution prevention, respect for the carrying capacity of the eco-system		***No***	
	preservation of opportunities for future generation, enhancing the quality of life			***Conditioned***
	managing urban growth		***No***	
	policies, mixed-use city			***Conditioned***
	efficient public transportation systems and measures		***No***	
	encouraging walking and cycling			***Conditioned***
Resilient	a city that has developed capacities to help absorb future shocks and stresses to its social,economic and technical systems and infra structure	***Yes***		
	ability to maintain essentially the same functions, structures and individual identity			***Conditioned***
Smart	digitally networked and technology-advanced spearheaded by software and hardware companies		***No***	
	organic integration of social and environmental systems		***No***	
Happy	offers walking exposure to different city areas			***Conditioned***

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Happy	experimentation of form and long day time span	***Yes***		
	Greenery, redbrick houses, public gardens, pedestrian plazas, bike lanes, spaces for public art installations and recreation			***Conditioned***

Table #3: observation checklist

Based on the observation, and according to the theoretical stances, Cairo is a vibrant city, providing its inhabitants a multitude of experience. Indeed, Cairo is impulsing or throbbing with energy or activity. It is vigorous, lively, and vital. It is characterised by rapid, rhythmic movement back and forth or to and from; vibrating. Cairo is a very active city; where people talking all day long, and where there are lots of activities and tourist destinations. Heavily populated cities are vibrant cities, and Cairo is one marked by much life, movement, and activity. It indeed has lots of things to do, to show, see, and where there's a lot of activity. From retrospection, a vibrant city is also described as the city having continuous economic development; resulting in prosperity. Cairo for Egypt is the engine of economic growth, it consumes almost or above 70% of Egypt's energy, mainly contribute to urbanisation rates, energy consumption and climate change.

Literature on vibrant cities also affirms that a vibrant city provides a good physical environment, together with an image and local identity, and that it is an orderly city. It also provides technological innovation and economic entrepreneurship as well as artistic and cultural activities. For Cairo, those last few aspects are debatable.

From retrospection, observations detecting the liveability witnessed that Cairo comprises a unique combination of amenity values open space and special design features, historic and cultural heritage, location, intangibles such as character, landscape and sense of place. Hence, in that sense, Cairo is a liveable city. However, some other measures are debatable or, let's say-conditioned in Cairo, such as the good planning, the provision of vibrant attractive and secure environment for people to live, work and play. Encompassing good governance, a competitive economy, high quality of living and environmental sustainability are also conditional in Cairo. Therefore, and concerning such measures, Cairo is a conditioned liveable city. More criteria components measures place excludes Cairo of the liveable city list.

Such as: protection of the environment, maintenance of a diverse economy, provision of accessibility through land use, housing choices, balanced city budgets, the involvement of people in planning, public safety, a clean city with healthy environment, integrated public transport system, self-sufficient communities, barrier free, accessible for all, social wellbeing of its citizens, activity with greater transparency and good governance by all. In that sense, Cairo is not a liveable city.

Like wise, regarding Cairo as a happy city is conditioned. It fulfils some criteria and misses some. offerswalking exposure to different city areas, experimentation with form and long daytime span. Despite the fact that the percentage of greenery is rocketing in Cairo peripheral compounds, yet, it can never be described as green. However, some green locations do create sub-meanings of beautiful and quite, and consequently, urban happiness. Literature on happy cities includesredbrick houses, public gardens, pedestrian piazzas, bike-lanes, spaces for public art installations and recreation as other causes of urban happiness. While tall buildings and car areas were associated with sadness according to some investigations. Based on that logic, Cairo offers piecemeal happiness for its residences. According to the recent urban literature, city dwellers'happiness is the most countable dimension to measure urban achievement.

Indeed Cairo's history is an ever changing state of continuous flux, victoriously struggling to adapt itself against all its imposed circumstances and never failing to surprise us; reinventing itself despite its own flaws.

Investigating People Standpoints About Their Districts And Their City:

Moving to this part of the paper, and to support the argument, an investigation was conducted, through semi-structured questionnaires and interviews with a number of residents from the different district types. The design of the investigation depended/relied primarily on the examples provided by Canter, Zeisel, Groat, and others. Locations for meeting people were randomly chosen in public spaces; piazzas, parks, streets and cafes of the different Cairene district-types hypothesised earlier in the paper. The sample comprised different gender and age groups. The questions were designed/based on examining people's perceptions regarding the definitions and features of the vibrant, liveable, sustainable, smart and happy cities explored earlier in the paper. They alsorevolved around three pivots; physical measures (including distances, densities, population, scale, activity locations, accessibility, diversity and proximity, trips and routes to and from activities, walkability bike ability, public transpiration systems), socio-cultural measures (including meanings, opinions, values, social interactions, privacy, security and safety, social isolation, inclusion versus segregation, sense of community and sense of belonging), built environment significance (including sense of place, place identity, design features and formal qualities, style, and imageability, landmarks, attractiveness and appeal). Further questions on ranking favourite spaces and places in both their near environment and in the entire city, inquiries if some buildings did more than their functional structure, neighbourhood satisfaction and homogeneity were also proposed, with responses that gave deeper insights. In addition to further open ended questions and elaborations/suggestions of respondents to develop their city to their most convenience. An ending ”yes/no”question was directly measuring their satisfaction with their city’s overall urbanism.

Negative responses were basically on the high population, congestion, pollution, lack of cleanliness, loss of amenity spaces, reduction of privacy, social segregation between societal classes, high cost of accommodation in the city centre and in the more privileged suburbs. More negative responses referred to the high dependency on the car, insufficiency of the public transportation systems, lack of many public spaces and greenery, disappearance of many public free activities for different genders and age groups.

Most of what were expected responses. However, and with all demographic variables of the respondents, statistics revealed that- and with all the expected negative responses, yet and very consistently 30% of the sample investigated was very satisfied with Cairo as it is! 48% was satisfied with conservations, 13% was dissatisfied and only 9% was very dissatisfied.

This has led me to wonder a little more if–in Cairo’s case- there was a synonym for urban satisfaction? Contentmentseemed the appropriate term to describe how the Cairenes perceived their city. Contented denote the feeling or expressing acceptance of status or situation, it signified gratification and satisfaction. It seemed to me that we “Cairenes”were destined to pursuit contentment in our city. The only aspect that has influenced our collective wellbeing and made us endure the everlasting changes enforced on us and mirrored on our city. Where is Cairo going? Is planning still possible for contemporary Cairo? Can Cairo ever be located on the liveable or sustainable or smart or happy cities map?

5 CAIRO TOMORROW: VALUES, VISIONS AND STRATEGIES

Locating Cairo on the liveable or sustainable or smart or happy cities map is mainly concerned with the

enhancement of quality of life of the residents rather that its urban form, size or area. According to Jan Gehl: ”life of people come first, then comes spaces, then comes buildings, the other way around never works”. This means that some values and ethics should be implanted for any planning or design of our city contented.

Values and ethics that revolve around the human, such that human life of the Cairenes can continue indefinitely, humans of Cairo can flourish, Cairene multiple/various cultures can develop.This calls for a vision based on the following considerations:

- A strict connection with the social dimension should be enforced, namely to the relationships among the different groups and cultures.
- These relationships are based on the idea that the welfare of the individual in the community is linked to the welfare of the system itself.
- Multiplicity and differentiation should not build invisible walls in human life. Meanwhile conflicts, individuality, isolation, and plurality should be replaced by concepts of cooperation, and participation.

The vision for the future Cairo contented would then be pivoted around the enhancement of the quality of life of its humans; bringing together different people in self-sufficient settings, with variety of activities and amenities that guarantees safety, proximity, accessibility and interest for all. This vision requires some performance measures/indicators, these are: stability indicators, health-care indicators, cultural and environmental indicators, educational indicators, and infra-structural indicators. The solution to Cairo’s urban challenges therefore needs a humanistic urbanisation manifesto that advises some strategies for

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achieving its urban calmness. On top of such strategies is to break down bigness. A focus on the present is to prioritise particular areas, spots or locals, rather then targeting wider geographical areas, scale of homogeneous areas –small enough to allow people to be aware of others. Telling the truth about politics and economy, and their consequences on the cultural attributes and social implications should be discussed with city dwellers Learning to listen to people would thus prioritise feelings over forms (form follows feeling) and would guarantee social inclusion, neighbourhood scale-suitability and a strengthened sense of community; and hence a strategy of people empowerment would be endowed. Fighting for environmental justice is yet another determinant component of this manifesto. Endorsement of public transportation and freeing pedestrians, together with sufficient connected public spaces are strategies that will have positive outcomes for social cohesion, lessening the behavioural gaps between Cairo subcultures, reducing environmental pollution, and helps noise alleviation.

That is to say, most strategies are centred on extending the design process, and abolishing physical monopolies over values and ethics.

For the case of my city victorious, drawing-up any values or visions for its contented future highlights an emphasis on its heritage conservation. By heritage I mean both tangible and intangible for what both hold of values. On the one hand, intangible heritage is defined as embracing all forms of traditional and popular culture, i.e. collective works created in a given community and based on traditions. It is transmitted from one generation to the next, constantly recreated by communities and groups in response to their environment, their interaction with nature and their history and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity. It remarks mental and emotional values, including historical values (memorable and pride), aesthetic values and social values.

On the other hand, tangible heritage is all the surviving physical traces of human achievements through time from the ancient archaeological ruins to the hydraulic lifts, from simple country cottage to vast urban zones. It is everything created by human beings as the product of human intelligence and creativity, which allows knowledge and skills to be enhanced and passed on from one person to another and from one generation to the next. It remarks usage and societal needs for life, including economic values, urban values and function values. In that sense, drawing-up Cairo's developmental objectives are to include community renewal, revitalisation and continuity, education, identity, nationalism and appreciation of the past, pleasure, recreation and increased quality of life, diversity tourism, profit and economic development.

Analysing the results of the empirical study (based on both the observation and the suggestions provided and prioritised by Cairene residents interviewed), and supported by available literature, pivots of Cairo Contented Strategies are sought to transform it into a liveable, a sustainable, a happy and a smart city, as follows:

Cairo Tomorrow	Liveable [referring to the people]	Sustainable [referring to the place]	Happy [referring to the social context]	Smart [referring to the governance system]
Planning and Design Issues to be addressed	comfort, health, safety, well-being, walkability, provision of recreational facilities, accessibility, …	environmental- responsibility, connectivity, diversity, access to employment, productivity, resilience, …	community engagement, custodiaship, living-affordability, cooperation, inclusion, …	leadership, participation, productivity, planning, management, monitoring, …

Table #4: pivots of Cairo contented strategies

From a different perspective, COAG's review of capital city strategic planning systems suggest the following ranking of priorities:

(1) National Urban Policy Objectives.

(2) Urban Design Protocal (principles).

(3) Engagement (developing vision – reviewing design options - providing feedback during public exhibition).

(4) Excellence (leadership - collaboration and team work).

(5) Objective Quality Measures of Well Being.

Hence, values, visions and strategies for tomorrow’s contented Cairo can be formulated what I describe as the humanistic urbanisation manifestofor tomorrow’s Cairo contented.

6 CONCLUSION

Along this paper, a review of Cairo’s history from its birth as the Egyptian capital of Memphis and On Heliopolis until to date was conducted through a literature review. It revealed the fact that we Cairenes are an amalgam of origins and sub-cultures; theoretically divided Cairo into a six different „urban“types of districts. A content analysis of available literature from travellers and historians-journals was accomplished to identify the nature of „Cairo“. A methodic grounded theory based on personal interpretation was then employed to explain the term and concepts of viable, liveable, resilient, sustainable, smart and happy. In addition to a random investigation with a number of residents in each of the Cairene districts proved that Cairo indeed is a viable, very resilient city. Reading through the results introduced another term that can be added to the urban description of Cairo, as a “contented”city. A quick review of global city programs together with discussion of the findings of the empirical studies helped in framing major values for developing a vision, strategies, objectives and measures that would guarantee an overall quality of life in all districts for all subcultures, developing Cairo from a„contented“to a„happy“ city.

With all the challenges confronting it, rendering a Happy Cairo seems like mission impossible. However, long time ago Plato has asserted: “the city is what it is because our citizens are what they are”. Hence, my city is a shared project; its greatest challenge for being happy depends on our willingness to make choices that benefit complete strangers. This means that imaging the future of Cairo for any planning, design or governance intention requires understanding and inferring the functional aspects of the socio-cultural patterns in the city. Hence determining the what, why and how of planning and designing a happy city.

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🏆 *reviewed paper*

Integrated Information System for Sustainable Urban Regeneration

Irina Angelova, Yu Mi Song, Sung-Ah Kim

(Irina Angelova, Ph.D. Student, University of Architecture Civil Engineering and Geodesy, Faculty of Architecture, Department of Urban Planning, 1 Hristo Smirnenski Blvd, Sofia, Bulgaria, irinkaangelova@gmail.com)

(Yu Mi Song, Ph.D. Student, Sungkyunkwan University, Department of Convergence Engineering for Future City, Engineering Hall 1 Suwon 440-746, Republic of Korea, hanimyu@skku.edu)

(Prof. Sung-Ah Kim, Sungkyunkwan University, Department of Architecture, Department of Convergence Engineering for Future City, Engineering Hall 1 Suwon 440-746, Republic of Korea, sakim@skku.edu, Corresponding Author)

1 ABSTRACT

Information systems are widely used in urban planning process for communication between different side actors. However, most of them have been implemented without providing possibilities for decision makers to participate together with urban planners in the process. This research aims to outline a framework where an interactive model for decision making plays a key role in creating a collaborative environment. The proposal regards the information representation as the main instrument for encouraging a constructive dialog between different actors. The focus is on the relationship between three elements of information representation: level of detail, type of visualization and interaction. Combining these elements, information can be provided in a dynamic way enabling more effective exploration and understanding. The proposed strategy implements a digital model that operates on different scales and levels in order to support the key stages of the planning process for sustainable urban regeneration in Bulgaria. Positional approach is used to define the functionality and decision making operation for the selected process. As a result research ideas about the use of the digital model are presented.

2 BACKGROUND

Today's planning process for sustainable urban regeneration can be described as a strategic approach, whose main element is the mind-set for action and implementation through links between budgets, projects, citywide and regional infrastructure. The quality and effectiveness of the plans can be greatly enhanced through the integration of multidisciplinary and multi-actor insights, intelligence and perspectives that are usually not considered within the formal planning process (Kunze, A. et al. 2012). In order to support and manage this process urban planners create urban information systems which are the main instrument for work and communication between experts and nonprofessionals.

Most of the urban information systems consist of three main cores – Urban and Regional Information Infrastructure, Digital Environmental Model and Platform (fig. 1). The first one represents the datascape in which data from agencies, periodically refreshed sources and real time data is collected (Laurini, 2001). Data acquisition is not limited to the basic city planning surveys but includes data about all social, economic and environmental issues, concerning the concrete planning process. All this variety of files is classified in spatial and non-spatial data. The first one consists of location and attribute information whereas the second contains only attribute information. Both of them during the data preparation are collected and combined in common database and handled on an unified base map in a Geographic Information System (GIS) (Asami, 2008).

The management of this huge datascape for the purposes of sustainable urban regeneration requires creating a Digital Environmental Model. Essentially, it includes all the information organization and analysis that professionals are doing in all stages of the planning process. Supported by the necessary handling systems it defines the Analysis Module of the urban information system. The third project's core, the Platform, generates diverse range of traditional output materials, that are the main instrument for communication between the planners, decision makers and representatives of the interested parties. Usually web-based in GIS, it is used by limited actors and represents the information system's Decision Module.

The connection between the Digital Environmental Model and the Platform uses the means of geovisualization. This traditional visualization of urban spatial models has been rather abstract and not easy to read and consists mostly of information associated with 2D maps (Kunze, A. et al. 2012). Professionals produce maps and other conventional output materials in the end of each stage with an intention to communicate with different side actors in the planning. This way of work creates one direction

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communication and do not provide any possibilities for decision makers to participate together with urban planners in the process.

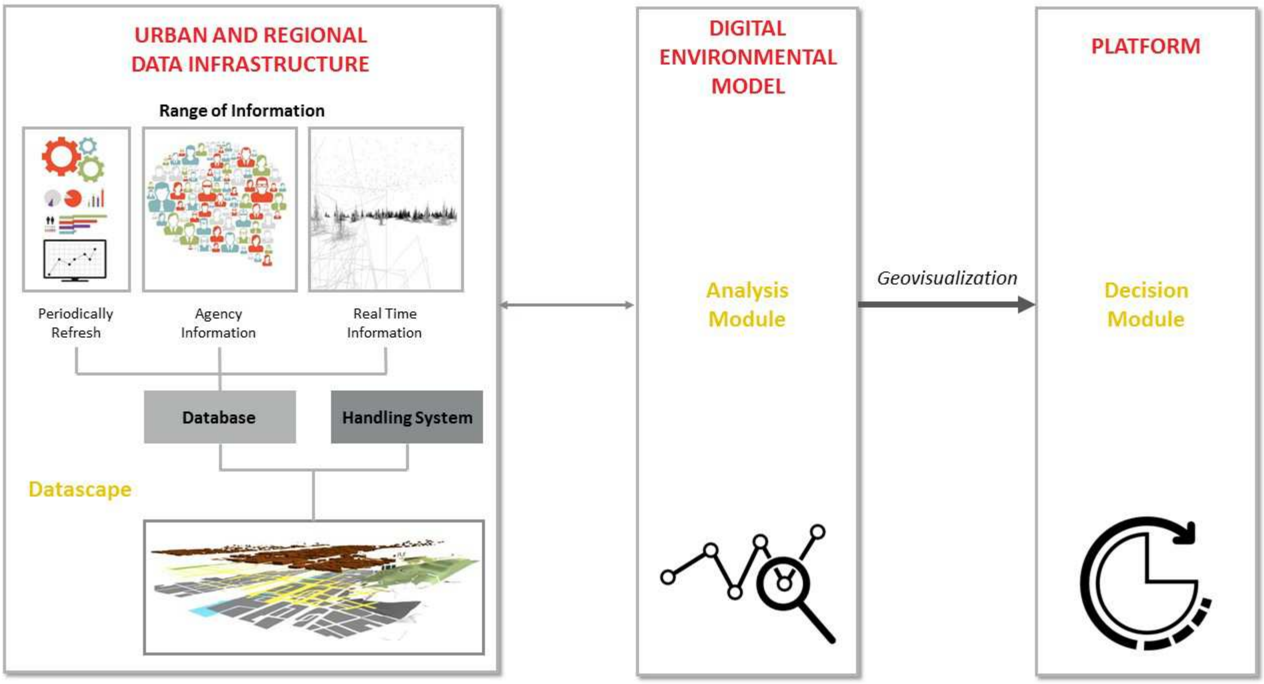

Fig. 1: The three parts of the Urban Information System

The urban information systems still have limited capabilities mainly designed for professionals who stay their only users. Kunze argues that when expert tools become more interactive they will be able to be used by non-experts. He envisions the use of Decision Support Tools together with collaborative environments in planning agencies of the cities and regional administrations. However, the current lack of integrated instruments for creating urban plans does not allow the professionals and decision makers to combine efforts and work together from the beginning of the planning process. This predetermines the planning process and reduces the quality of response plans.

3 RESEARCH OBJECTIVES AND METHODOLOGY

The initial question comes from the observation that most urban information systems fail to create conditions for communication and constructive dialog between professionals and decision makers in the planning process. As they are primarily designed to perform certain actions, but not the different participants execute this actions together, systems remain to serve only experts in long-term. This aspect requires rethinking how current information systems can be improved and how to involve decision makers more actively in the planning process.

The main objective of this research is to propose an interactive model for decision-making in a collaborative environment. The suggestion presents a framework that operates on different scales and levels in order to share and use understandings. It can also serves as a strategic instrument for the formal planning process so it could reach the standards of sustainable urban regeneration. In order to structure the strategy of the system it is necessary to:

First of all, understand and analyze the actors in the planning process for sustainable urban regeneration, research their formal relations and tasks to be performed during each stage of the process. Regarding the crucial actors, their resources and interdependencies current relations in co-operative work are identified and present in the form of graphics. This analysis is based on the experience in integrated urban regeneration in Bulgaria and the production of the first kinds of such plans in the country, aiming at integration of resources, participants, projects and financial sources, as well as the economic, social, environmental and aesthetic objectives.

Second, examine the opportunities that current urban information systems provide for communication and decision-making on the different stages for the selected planning process. Research how the means of information representation can improve the collaboration between urban planners and decision makers in key stages where mutual commitment is essential for consensus building (fig. 2). The rate of information is considered for each stage of the planning process regarding the type of visualization, level of detail and provided possibilities for interaction.

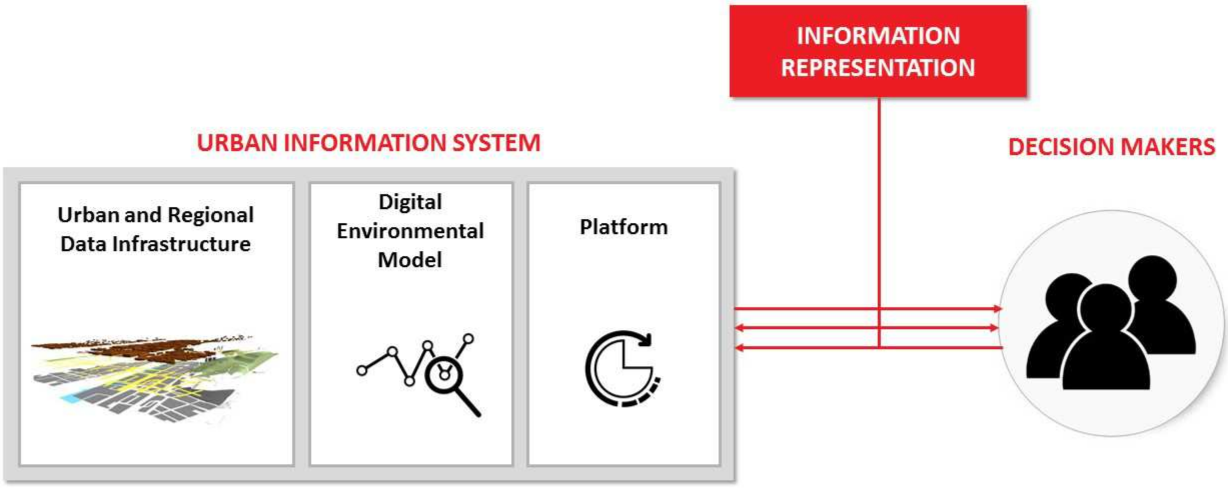

Fig. 2: Information representation as a link between urban information system and decision makers

Finally, suggest a framework for integrated information system. The proposal gives a general idea how this system operates and what kind of opportunities it provides to enrich the connectivity between urban planners and decision makers. Relation between the system's structure and the level of information technology is modeled on conceptual level in order to reach the strategy for co-operative dialog.

4 ACTOR ACTION TIME ANALYSIS

The implemented research methodology involves actors action time analysis in context of the stages in the statutory planning in Bulgaria. The latter is divided into urban planning system and urban monitoring system (fig. 3). The first one includes the plan preparation and approval procedure, having four stages: target analysis, strategic planning, detailed planning and design, programming and budgeting. Each stage contains fixed tasks and combines concrete actors to complete it. Second system continues during plan performance and includes implementation and management, monitoring and control. In this paper under the term planning process is accepted urban planning system or the focus is on the first four stages. In the case of Sofia city, this was a consecutive process with small overlaps continuing a total in 17 months until June 2013.

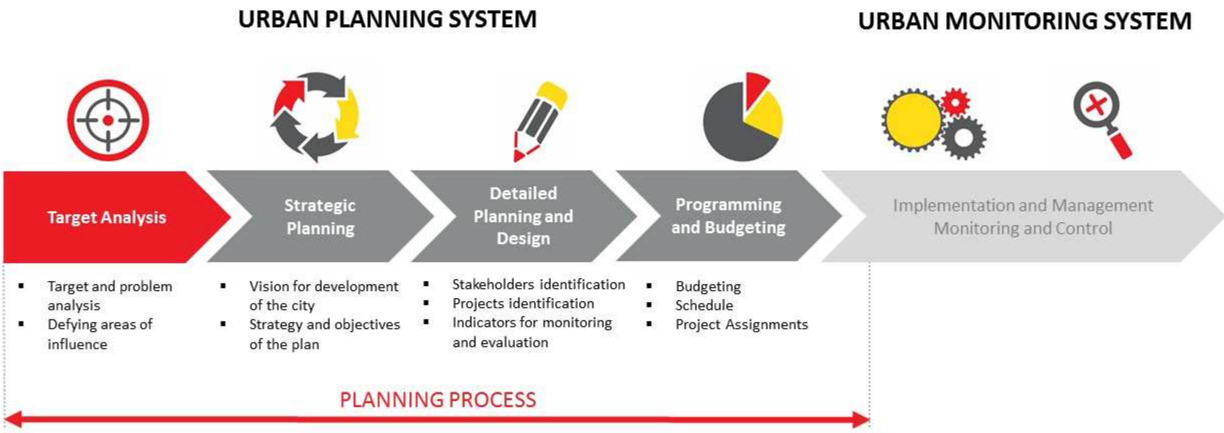

Fig. 3: The stages of the planning process in Bulgaria

In the planning process for sustainable urban regeneration, the operation is formatted through a specific set of procedures and control under the legislation of each country. Usually, this framework is organizing the government, the technical team and the public. Ding proposed a segmentation of decision-making operation process dividing all actors in four paths: operating path, guide path, creative path and participative path. In the case of Sofia city plan operating and guide paths are represented by ministry and municipality

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departments, which are responsible for finances, guidance and realization of the plan and control. Creative path is presented by design team which is a consortium, independent from municipality, combining wide range of professionals and technicals. In the last one are included all groups that are not part from of the first three and have a regard to the plan preparation.

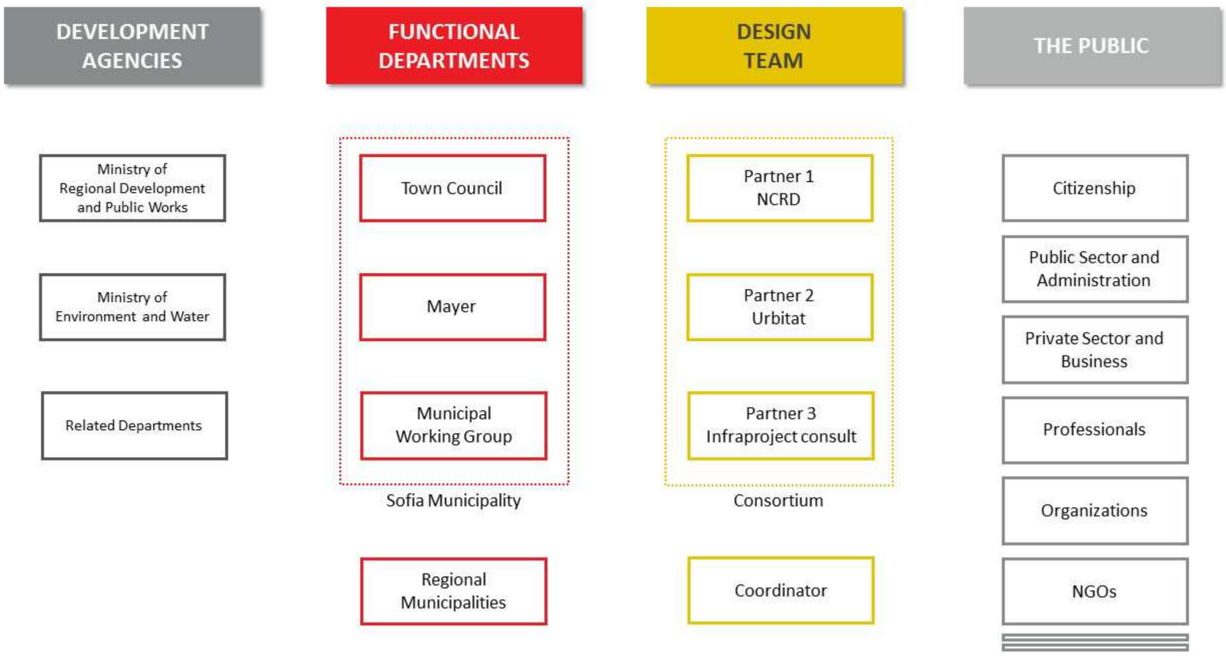

Fig. 4: The four paths in Bulgarian planning process for sustainable urban regeneration

To structure the characteristics of the actor network and the inventory of all involved actors was used positional approach. The study showed that two actors participate with more than one of their parts in the planning process. First composite actor is Sofia municipality presented by three actors that take different roles in each planning stage and have interdependent relations. The second one, the consortium, combine three separate partners with many independent experts and during the planning process is participating with more than one part. All other actors, even if they represent a group of participants are regarded as separated actors (fig. 4).

Stakeholder analysis gained insight into the roles and positions that actors take during tha planning process. For each process stage the formal positions of actors were characterized, their tasks and responsibilities as well. This step required a review of the laws and legislation procedures under plan was performed. Figure 5 below shows the formal relations between actors in the first stage: target analysis. One side arrows show hyerarchical relations whereas two side arrows indicatie relation between key actors.

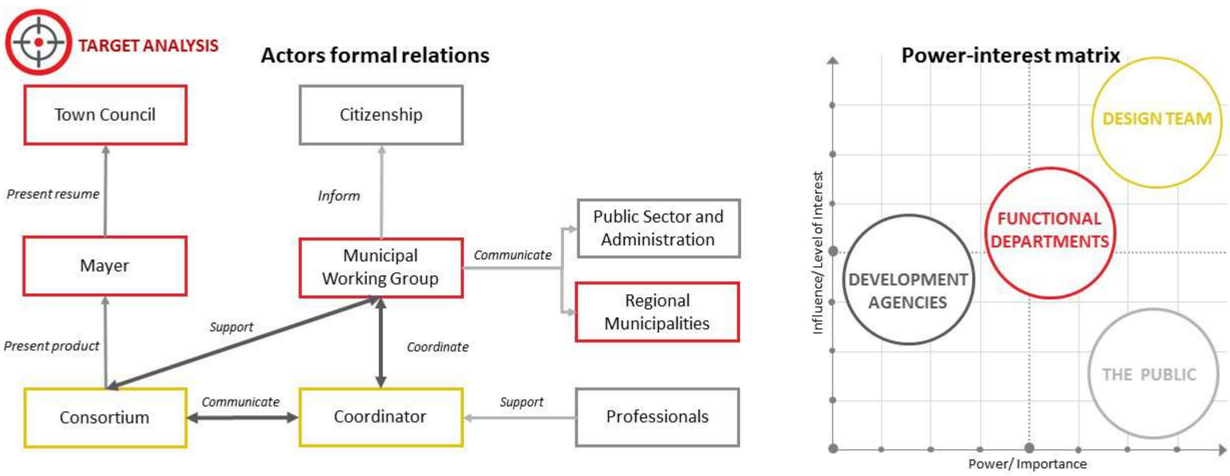

Fig. 5: Stakeholder analysis for the first stage of the planning process

Identifying the key actors and decisions to take in each stage is essential for reaching adequate form of collaboration. Inventory of the resources of the key actors showed the similarities and differences, common objectives, interests and conflicts among them. Every path of actors was positioned on power-interest matrix estimating its resources: knowledge and skills, man power, financial, authority and organisation (fig. 5). Under this circumstances the functionality of actor network was investigated in decision-making context of overall planning process. Depending on the actors' positions and tasks they perform decision-making operation is separated in four types: discovering and understanding problems, identifying various solutions, choosing among solution alternatives and monitoring how the selected alternatives are working. In the modeling of the network and its context actors communication was estimated through graphic display materials and information management. Analysing actors in the planning process, their relations in a network and used information is crucial for creating functuonality of an integrated system for collaboration.

5 INFORMATION REPRESENTATION

Presently, the Platform of urban information systems displays results from the planning process in the form of digitalized maps providing knowledge about concrete geographic areas. This form of presentation in graphical form cannot always help users to see patterns and relationships in large datascape standing behind. Representation of the information provides clues that affect the amount of effort to explore the information for solving the problem, so that effect on the people's information recognition, implementation, and satisfaction (Adnan et al., 2008). Consequently, information representation will take more and more critical place in planning process for sustainable urban regeneration and diverse ways of visualization need to be explored for helping actors to make decisions more effectively.

There are various techniques for information representation. The complehension depends on the knowledge of the recipient, the intended use of the information, individual inclination and etc. In this paper, diverse methods for information representation are explored in accordance with the type and magnitude of information for different stages. Current research consider three elements as most important in terms of organizing information presentation for the selected planning process: level of detail (LoD), type of visualization and interaction. According to the planning stage, required information is provided in the most appropriate way as a result of combination of these three elements and can help different actors to participate more activily.

5.1 Level of displayed model

Urban planners investigate from overall status of a city to a particular building in the planning process. According to the context, the required information can concern neighbourhood structure or detail building façade. Therefore, each planning stage needs different model representation. Commonly, CityGML's LOD is the most used and accepted worldwide. There are five phases from level 0 to level 4. LOD 0 is a digital terrain model that include an aerial image or a map and covers the city territory together with the metropolitan area. LOD 1 is well known as a block model with flat appearance of roof and prismatic buildings. LOD 2 provides more detailed information on level to the roof structure and buildings' surfaces. LOD 3 represents the architectural model. LOD 4 is up to interior level (Open Geospatial Consortium, 2006). The model used in this research for the purposes of the planning process does not use the last LOD (fig. 6).

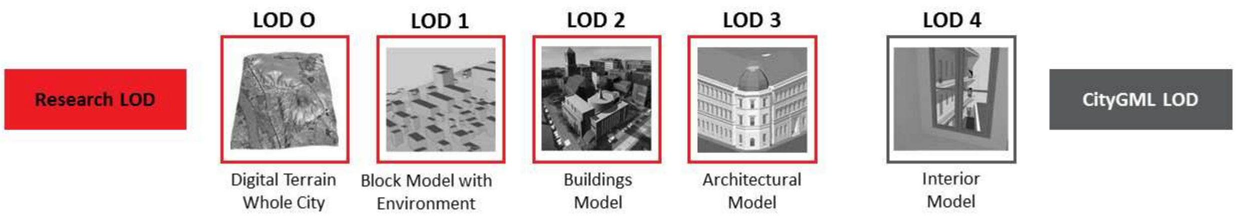

Fig. 6: Setting the range of LOD for urban planning.

5.2 Type of visualisation and interaction

The information can be represented in visual, acoustic, osmatic, tactual or other way. Among them, the visual which people are most experienced in, has the biggest effect and can be provided in any suitable manner. Furthermore, it is the most used technique that helps quickly analyse the large data set (Keim et al., 2002). In this paper, the methods of visual information representation are classified in analog and digital

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model on whole. The digital visualization is divided on text, 2D image, 3D model, 4D model and multi-dimensional model (fig. 7)

Text as the most basic way to represent information has the advantage to give detail descriptions, but it can also deliver key messages. Here, this classification proposes five different ways of use: simply a list of words, sentence, table, tree and net. The first three ways give possibilities to provide detailed information. Tree structure can be used to present words in a one-way relation, whereas the net structure presents complex connections of words. These five types of text representation can be diversely combined with other means of information in different stages of planning process.

Depending on the type of expressed information, the 2D image exposes much better methods to deliver information than text, and it is easier to understand. Here are included map, symbol, graph, net and mixed form and all of them provide static information. A more powerful way to transfer dynamic visualisation is by using 3D model. In the same way as 2D image, the 3D model uses the same techniques as map, symbol, graph, net and mixed form. 4D model combines 3D model with the time and creates simulations of urban data in different time periods.

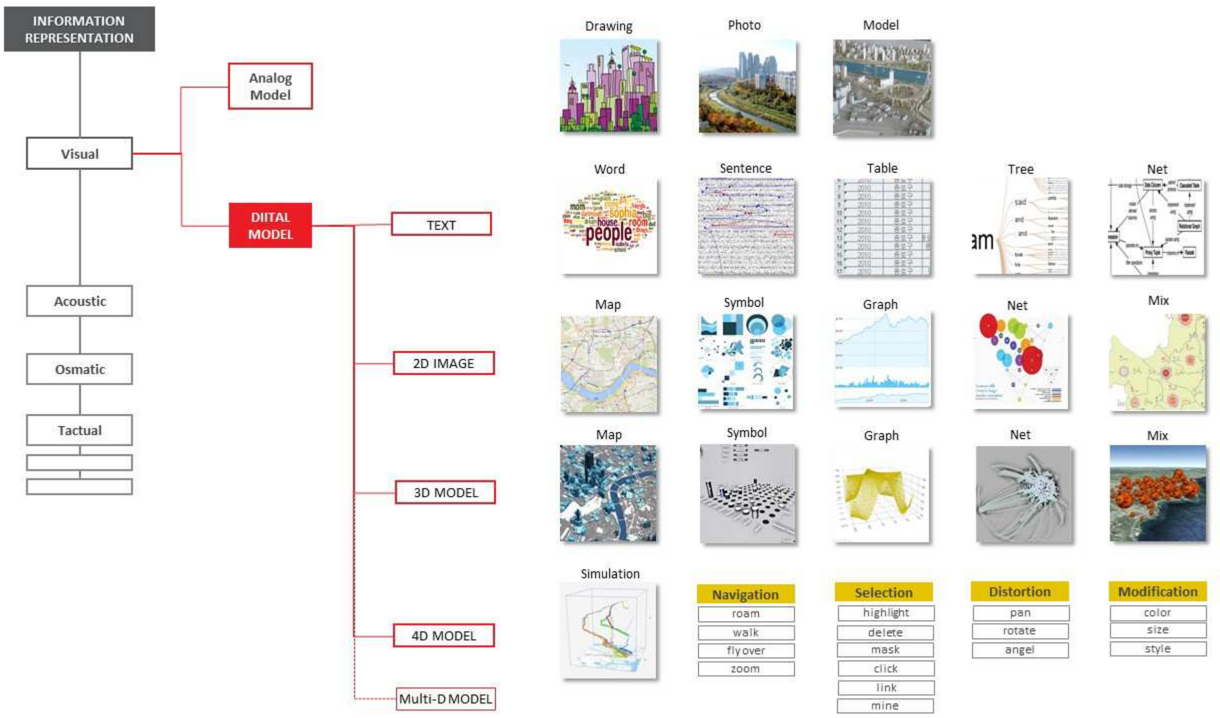

Fig. 7: Means of information representation: visualization type and interaction

Mixed visualization method creates many abounding combinations using techniques from one dimension, or brings together different visual representation forms from more dimensions. The result is presenting the content in a more specific way unifying different techniques. In the planning process for sustainable urban regeneration, the examples of mixed forms in 2D image and 3D model express summarized results additing maps with symbol, graph and net.

According to the Ward and Yang interaction is the mechanism that modifies the information visualization in what and how users see it. If there is no function of interaction, the information visualization becomes a static image or autonomously animated images (Yi et al., 2007). Main factors that influence the use of interaction are express the data, the type of data and location of the representation. Although information technologies providing different forms of interaction are developing rapidly, the main functions used in urban planning models are divided into four groups depending on their characteristics: navigation, selection, distortion and modification.

Navigation (roam, walk, fly over, zoom) allows the user go around the 3D model stimulating free movement anywhere or leading to a particular area. Concrete information singles out or emphasizes by selection functions like highlight, delete, mask, click or mine. Moreover, link automatically makes connection to another information. Distortion functions (pan, rotate, angel) provide various change to the viewpoint using multi-rotation axis. It is used for more detailed and deeper exploration of the 3D model. Modification for interaction finds application in all forms of digital model. Changing the size, colour or style of the represented information can help users discover the necessary information more quickly among huge amounts available at the same time. Simulation indicates the passage of time. In urban planning process, 4D models present 3D spatial information changing in a concrete period.

Information visualization helps to understand the complex raw data easily even by non-experts. As interaction is the method to control the information space (Adnan et al., 2008), the interaction functions make dynamic exploration and acquisition more efficient than static information visualization. That emphasizes on the necessity for automatically and relevant information presentation. In addition, the level of information is adjusted in accordance with the level of detail of the models. Therefore, it will be able to help the decision makers involved in urban planning process who are necessary to confirm a lot of information.

5.3 Matching with urban planning process

Combining the three elements LOD, type of visualization and interaction, proper information representation is connected to the different stages of the planning process and urban monitoring system.

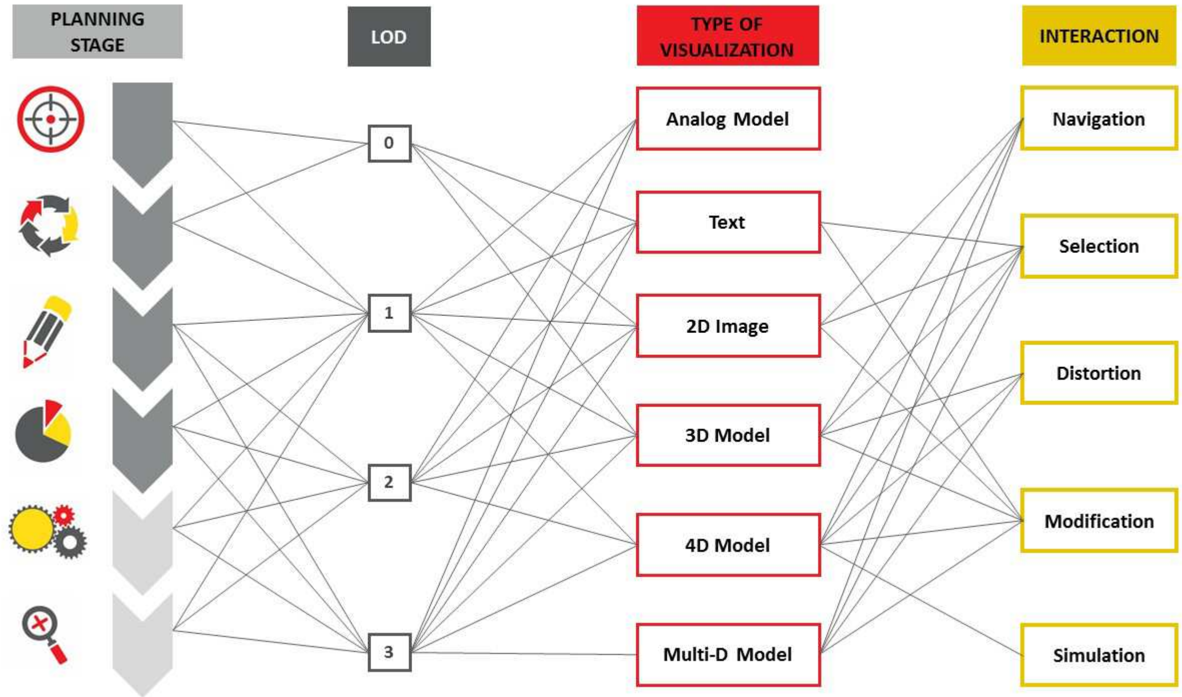

Fig. 8: Matching urban planning process with three elements: LOD, Visualization type and Interaction

In the early stages of the planning process, the actors' purpose is to grasp the situation of the whole city and select concrete targets. Therefore, detailed representation is not required and LOD is lower. As the planning process progresses, the city model needs higher LOD and more information is necessary. In the stages of urban monitoring system, the LOD depends on the detail planning and design stage. For instance, it is possible to use model with LOD 1 for checking the improvements in the environment of a neighborhood or use model with LOD 3 when it concerns a building renovation project.

Using the model with different LOD is limiting the possible types of visualization. Higher LOD allows wider range of visualization types and gives more freedom to express the required information. As much as analog model provides only static form of visualization, it cannot represent detailed shape or change in time. So in the case of planning process for sure the use range of analog model is severely limited. The dynamic information representation is more effective providing bound interaction for different side actors. Digital model covers all kinds of interaction functions. Models from three to multi-dimensions are able to connect with all interaction functions and provide various use of the model representation.

6 FRAMEWORK FOR INFORMATION DELIVERY TO DECISION-MAKING

This research aims to outline a framework for an interactive model for decision making in a collaborative environment. The proposed strategy implements information representation through a suitable screen basis

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for different actors. The system encourages collaboration between urban planners and decision makers improving mutual trust, respect, participation and commitment.

Successful collaboration between different actors should relay on both working together in a common space and doing it separately anywhere. Digital model has no constraints of on the location and has the greatest advantage to be shared with infinite number of people. Based on its potential, this framework is targeting the two main parts of decision making procedure in the planning process – functional departments and design team.

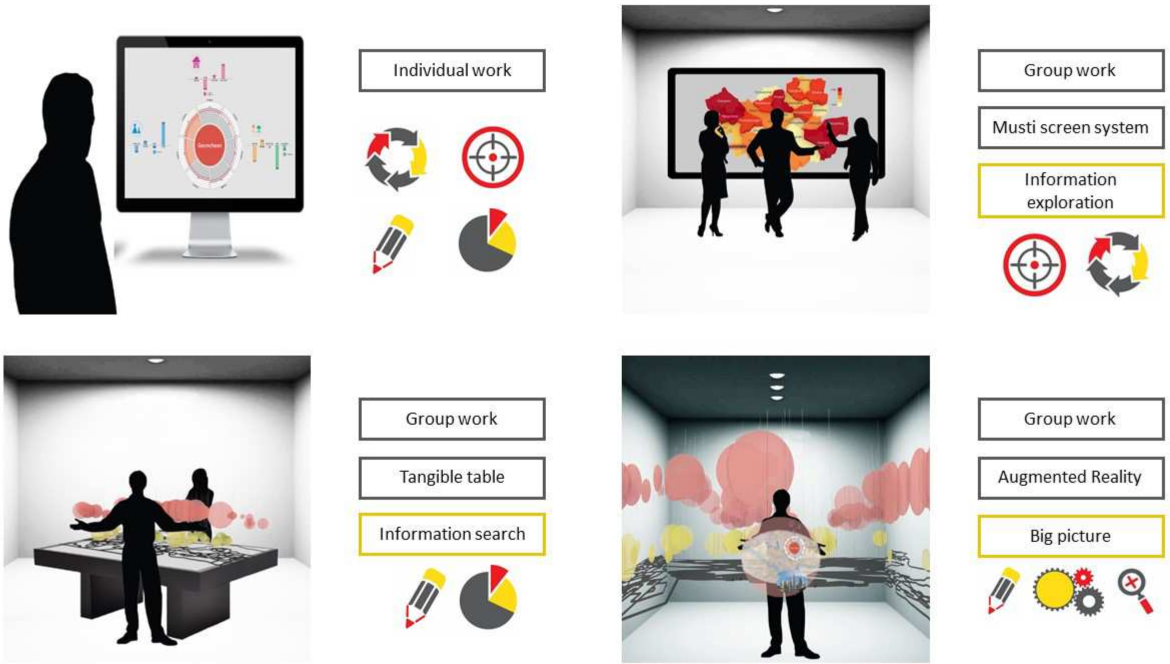

Fig. 9: Level of operation of the integrated information system s

Suggested digital model for information representation supports individual and group work. First level of the framework includes computers and portable devices typically used from urban planners in their individual work. Next levels propose digital environment for group work during all stages of the planning process. Second level includes multiscreen system which gives opportunity to explore plurality of information at at the same time and share understanding between actors. Its main application is found during the first two stages target analysis and strategic planning when most decisions concerning discovering and understanding problems about the city are made. Third level provokes actors' interest in information search using tangible table. The unified GIS based map is positioned on the basic and different layers of information are presented using multiple spheres. This way of representation presents diverse options for easy comparison between different elements or exploring details for a particular area supporting decisons concerning chose among solution alternatives or identification of various solutions, typical for detail planning and design, and programming and budgeting. This two stages of the planning process demand more detail understanding and the digital model in tangible table is the main instrument inducing interest in actors' information search and serves as a pillar for co-operative dialog. Last level, using augmented reality, is strengthened by most interaction functions and creates full comprehension of the situation. An actor can take the sphere which contains information about a concrete area surrondinng him and look at it. This form of interaction transform the actor into a real participant in the process.

7 CONCLUSION

The proposed framework for integrated information system aims to support the Bulgarian urban planning process and consider an underresearched area. The model for interactive collaborative environment contributes to the curren process and aims to transform the group work from one way to multiple ways. The main potential comes from the system's scope and used information technology. During model construction main actors of the process were organised in a network using snapshots of the different process stages. Their relations helped to understand the decision-making operation and serve as a basis for proposing solutions. In the design of the framework the means of visual information representation were matched to the planning process depending on three variables: LOD, type of visualisation and interaction. The project is targeting the decision makers and urban planners at planning scale and the goal is to promote the generation of better collaborative environment for the early planning stages. Future development and implementation of this model would make discussions during plan preparation more constructive and decision-making process more transperant.

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Land Transactions and Rezoning Strategies in the Peri Urban Communal Area of Domboshava, Zimbabwe: Challenges and Pitfalls

Emaculate Ingwani

(Dr Emaculate Ingwani, University of Venda, Private Bag X5050, Thohoyandou, South Africa, ingwani@gmail.com)

1 ABSTRACT

Urbanization in sub-Saharan Africa has led to the proliferation of peri-urban settlements close to cities. Residents who have local tribal as well as migrant backgrounds in these spaces often take land matters into their own hands leading to diverse land transactions. This paper is based on field research on Domboshava, a peri-urban communal area located 20km northeast of Harare, the capital city of Zimbabwe. In this peri-urban communal area, land transactions are shifting from customary inheritance in the tribal line to individualized land transactions such as direct land sales and renting – prompting the local authority (Goromonzi Rural District Council) to propose rezoning as a solution to increased land transactions in in this peri-urban communal area. This strategy has however become part of the problem as land transactions proliferated ahead of the implementation of the rezoning strategy. Forty-one local residents, as well as a number of key informants such as Traditional Leaders and local government officials were sampled for the study. Qualitative and quantitative data were collected through structured interviews, review of pertinent documents, as well as observation. I used Hirschman (1970)'s voice, exit, and loyalty model to reveal the reactions of community residents to the local authority's rezoning strategy (as a solution to proliferation of land transactions), as well as to demonstrate the community residents' criticism or disregard of, or compliance with this strategy. My findings reveal that when community residents find themselves stuck within planning strategies they perceive as dysfunctional, they react differently to their situation. Often, this compounds the problems. Appropriate planning strategies that address the challenges in Domboshava are sorely needed.

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2 INTRODUCTION

Urbanization in sub-Saharan Africa has led to the proliferation of peri-urban settlements close to cities. Land transactions in these spaces are on the increase. In Zimbabwe, a number of communal areas are located on the periphery of cities - the peri-urban. Over the years, the influence of urban development has shifted into these zones. These peri-urban communal areas signal the outward movement of the edges of cities (see Mabin, 2012; Watson, 2012). As cities spread and expand further into the countryside, they always absorb farmland and villages (Tacoli, 2002; Berry, 2011; Mabin, 2012). Local administrative authorities often lack the capacity to deal with challenges in peri-urban areas (Tacoli, 2008). Peri-urban areas also experience various kinds of land transactions because of unclear physical and institutional boundaries that regulate conditions of access to common property resources and land use in these areas (Tacoli, 2002). Land transactions entail the different kinds of land rights exchanges within and outside the procedures of land tenure systems (Benjaminsen & Lund, 2003; Chimhowu & Woodhouse, 2010; Colin & Woodhouse, 2010). This entails individualization and privatization of access to land by locals and even strangers (Owusu, 2008; Maxwell et al., 1998; Peters; 2007). Chauveau & Colin (2010) refer to land transactions as customary land transfers framed outside the legal procedures. In many instances, these land exchanges include selling, renting, inheriting, and in some instances land grabs.

The notion of communal land rights and access to land under the communal system of land tenure in sub-Saharan Africa is however variable, contingent, and relevant to social and political contexts in which it is applied (Sjaastad & Cousins 2008). For example in West Africa, several systems of land tenure co-exist with none completely dominating the other, and there are no legal land holding rights that exist among community residents (Delville, 2000). In South Africa communal land tenure is defined in Chapter 1 of the Communal Lands Rights Act (CLRA) 11 of 2004 of South Africa as, "land occupied or used by members of a community subject to the rules or custom of the community" (Cousins, 2008b:109). In Zimbabwe, communal land is administered through a plethora of Acts including the Communal Lands Act (CLA) Chapter 20:04 of 2002, TLs Act (TLA) Chapter 29:17 of 2001, the Regional Town and Country Planning

Act (RTCPA) Chapter 29:12 of 2001, and the Rural District Council Act (RDCA) Chapter 29:13 of 2002. The Constitution of Zimbabwe Amendment Number 20 Act of 2013 section 332 (b) (iii) defines communal land as "land set aside under an Act of Parliament and held in accordance with customary law by members of a community under the leadership of a Chief". The CLA Chapter 20:04 of 2002 defines communal land as, "land which immediately before the 1st of February 1983 was Tribal Trust land ... vested in the President who shall permit it to be occupied and be used." The administration of communal land is thus enabled through the Constitution of Zimbabwe and the Acts of Parliament (statutes). The Rural District Councils (RDCs) as the local authorities administer these Acts on behalf of the state on one hand, together with traditional authorities (Chiefs, Headmen, and Village Heads (VHs)) on the other hand. Both the state and traditional authorities hold important roles in administration of communal land in Zimbabwe.

Communal land tenure in Zimbabwe provides for access and use of land parcels to residents in communal areas as individuals and as collectives. Communal land in Zimbabwe like in most sub-Saharan Africa belongs to the state, and individuals lack rights to dispose of land at will since 'communal' implies some form of collectivity (Cousins, 1990; Nyambara, 2001; Cousins, 2000; Bennett, 2008). This system of land tenure therefore represents sets of elusive relations often overlapping and nested with regards the rights to access land and other resources (Cousins, 2000; Cousins, 2007; Cousins, 2008b; Sjaastad & Cousins, 2008). This context in Zimbabwe like in most African countries does not only demonstrate pluralism of the communal land tenure system in terms of its content, but the legal pluralism in terms of statutory provisions that also regulate communal rights to land (Delville, 2000; Nyambara, 2001; Berry, 2002; Wehrmann, 2008; Cousins, 2009). However, in the minds of many land users in Zimbabwe and generally in most sub-Saharan Africa, "communal land belongs not to single individuals, but to a vast family of which many are dead, few are living and countless numbers are still unborn" (Berry, 1992:342; Chimhowu & Woodhouse 2006:349). This also shows polarization and overlapping of rights and institutions that regulate land with the state as the sole owner of the land on one hand, and community user groups on the other (Nyambara, 2001; Wehrmann, 2008; Cousins, 2009).

3 THE STUDY AREA

This paper is based on case study of Domboshava, a peri-urban communal area. The peri-urban communal area of Domboshava is situated twenty kilometres northeast of Harare. In terms of local governance, Domboshava is considered a rural area, and falls under traditional authority, and Goromonzi Rural District Council (GRDC) as the local authority. Land in Domboshava falls under communal land tenure system, and is administered under the system of customary land tenure. A combination of statutes on land and settlement, and local customs and tradition legally constitute the structure that regulates access to land in this peri-urban communal area. The legal instruments include the CLA Chapter 20:04 of 2002, the TLA Chapter 29:17 of 2001, the RTCPA Chapter 29:12 of 2001, and the RDCA Chapter 29:13 of 2002. The prevalence of land transactions in Domboshava presents complex institutional challenges on this structure prompting the local authority to propose rezoning as a solution to increased land exchanges.

Two important kinds of households were identified in Domboshava. These are tribal and migrant households. Tribal households are those with historically sanctioned rights to communal land under the system of customary land tenure. Tribal members comprise individuals born and bred in Domboshava often with a lengthy lineage history to this area. Tribal households and their members are presumed to 'own' land (in communal areas) that supposedly belongs to their ancestors (Holleman, 1952; Bullock, 1972; Bourdillon; 1976). The tribal status is therefore associated with individuals' long-term autochthonous relationship with particular land parcels, belonging, as well as 'ownership' of land in this rural area (cf. Berry, 2011). By virtue of their tribal identity and land claims through descent from the original inhabitants and 'owners' of land in Domboshava, tribal households and their members practice peasant farming if they so wish, and are able to bequeath land. On the other hand, migrants are outsiders without legitimate lineage land rights in Domboshava. Migrants constitute a diverse group of strangers in terms of aspects such as place of origin, language, culture, and ethnicities. Migrant households migrated from elsewhere to live in this communal area. Migrants nevertheless acquired land sometimes within the system of customary land tenure.

4 THE PROBLEM

The unprecedented level of land transactions experienced in the peri-urban communal area of Domboshava has prompted Goromonzi Rural District Council as a local authority to propose rezoning as solution to this peri-urban challenge. This approach was meant to curb land transactions such as direct land sales and land grabs through upgrading rural land to urban land with title. However, the rezoning strategy became part of the problem as land transactions proliferated ahead of the implementation of the rezoning strategy.

4.1 The aim of the study

This paper seeks to highlight the reactions of the peri-urban community residents of Domboshava when they found out that the local authority, Goromonzi Rural District Council (GRDC) sought to implement rezoning strategies as a way of curbing land transactions. This aim was guided by the following sub-problem questions:

(1) What constitutes the rezoning strategy in Domboshava?

(2) How did the community residents react to the rezoning strategy?

(3) Why did the community residents of Domboshava reacted to the rezoning strategies?

5 THE CONCEPT CUSTOMARY LAND TENURE IN ZIMBABWE

In most sub-Saharan African countries, land rights of local community residents are often overshadowed by provisions of codified statutory laws as these are applied concurrently with customary land tenure provisions (Delville, 2000). According to Adams et al. (1999), this situation is also apparent in Zimbabwe where communal tenure is not only providing a conflation of tenure regimes, but also interchangeably refers to customary land tenure. However, communal and customary land tenure systems do not necessarily mean the same (Cousins, 2009). They represent a dualism (Mamdani, 2000). The provisions and conditions for land use under communal and customary land tenure systems overlap. Customary land tenure like the communal tenure system defines the conditions on which land can be accessed, held, and used in most rural areas of sub-Saharan Africa. Peters (2004) views customary land tenure as a pre-colonial oral system on land rights merely put into writing through the land law. Customary land tenure is governed by land relations among the community members, and is viewed as tribal law or simply custom, and "its claim was not to guarantee rights but to enforce tradition" (Mamdani, 2000:101). Delville (2000:98) describes customary land tenure as "'procedural' and not codified". Written procedures on the practice of customary land tenure unlike communal land tenure are absent. Customary land tenure systems are largely shaped by local interests and institutions (O'Flaherty, 1998). Customary land tenure features cultural and religious symbolisms rooted in local customs and tradition of community residents as land 'ownership' is vested in local traditional authorities (Christodoulou, 1990; Delville, 2000; Mamdani, 2000; Mathieu et al., 2003; Wehrmann, 2008). These local traditions and customs define the context in which people "live their lives" (Giddens, 2001:643).

Individuals and collectives under customary land tenure assume rights to hold and use land without title (Moyo, 1995; Cousins, 2009). Customary land tenure systems do not define each person's rights by which they access and obtain resources (Chauveau, 1998 in Delville, 2000:98). Customary land tenure implies collective rights to land, as well as other natural resources in communal areas (Cousins, 2009). Under customary land tenure, communal residents hold kinship rights to land, and they can always claim such rights even after their long absence from their communities (Christodoulou, 1990). The tenets of customary land tenure lie within the norms, beliefs, and values of communities often connected to ancestral spirits (Ibid). These principles of customary land tenure continue to apply in most rural sub-Saharan Africa even though the circumstances in terms of traditional authority, socio-economic conditions, and rights themselves are not universal, homogenous, and evolve over time (Delville, 2000). Customary land tenure in Zimbabwe is defined through the custom of communities where it is applied, and in turn, these communities are definable and identifiable through such custom. Traditional Leaders remain the custodians of customary land tenure.

5.1 Administration of customary land tenure in Zimbabwe

Administration of land and property rights under customary land tenure in communal areas in most sub-Saharan Africa is through both statutes (laws) and traditional system of authority. Under these circumstances, TLs have limited authority to administer land rights under customary land tenure. For example, in South Africa and the post-independence era in Zimbabwe pursued changes on the colonial version of the role of TLs on land, as well as the land tenure in most rural areas commonly referred to as native reserves (Cliffe et al., 2011). However, in the post-apartheid era in South Africa many TLs still derive their powers not only from tradition and custom, but also "from colonial and apartheid constructs embodied in previous laws" (Claassens, 2008:361). In Zimbabwe, the post-independence era also witnessed changes in the administrative role of traditional authorities on land as these roles were transferred to local authorities referred to as RDCs by the government (Cliffe et al., 2011). Although these changes were institutionalized, the presence and the current roles of TLs as part of the state remain. For example, the Chiefs retain their legislative, judicial, executive, and administrative roles which they enmesh with tradition (cf. Mamdani, 2000). Chapter 15 of the Constitution of Zimbabwe institutionalizes these roles of TLs. However, the Constitution of Zimbabwe neither elaborates nor provides clear guidelines on how the traditional authorities and local authorities such as RDCs complement their roles particularly on land administration in communal areas.

In Zimbabwe, traditional authorities comprise Chiefs, Headmen, and VHs. Institutionalization of traditional authority and traditional leadership varies from country to country in sub-Saharan Africa, and is done in line with local tradition and custom. These traditional authorities do not necessarily derive their power from laws (statutes) per se, but from local tradition and custom, and are expected to observe the laws in the discharge of their duties (O'Flaherty, 1998). For example, in South Africa, TLs administer land rights under the Traditional Leadership and Governance Framework Act (TLGFA) 41 of 2003 (Claassens, 2008; Love, 2008). In Ghana, the 'non-interference in chieftaincy affairs' policy is one of the important legal instruments used in the administration of communal land (Ubink, 2008 in Peters, 2010). The policy on 'non-interference in chieftaincy affairs' empowers TLs to act as they please, discharge political power, act as government 'voter-brokers', and thus the "fallacy of a strict division between 'traditional' leaders and modern government and party politics is clear" (Ubink, 2008 in Peters, 2010:606). In Ghana, Chiefs have more power to adjudicate on land issues (Crook, 2008 in Peters, 2010). In Zimbabwe, TLs perform their roles under the guidance of the TLA Chapter 29:17 of 2001. In most African countries, it is the role of local authorities to administer the statutes on land on behalf of the state. In Zimbabwe, it is the role of RDCs to administer communal land under customary land tenure on behalf of the state. In this regard, it is therefore unlawful to allocate land without the collective consent of both the RDCs and TLs as the custodians of land on behalf of the state.

The relationships between the state and TLs on land administration under customary land tenure in sub-Saharan Africa vary from country to country. These relationships are localized, and are never homogeneous. Different countries vest different degrees of power and authority on TLs since African traditions, cultures, norms, values, and rituals are themselves divergent. The influence of statutory regulation on traditional authorities in most sub-Saharan Africa is never neutral (Claassens, 2008). Although the role of traditional authority is obscured by the role of the state through laws, their influence in land administration cannot be underestimated (Okoth-Ogendo; 2008). Struggles on land administration in communal areas clearly exist. Under these circumstances, the critical question that needs clarity is on 'who' has authority over land (Cousins, 2008a). Love (2008) views these struggles in terms of whose voices are heard, and whose are silenced. Berry (2002) relates the struggles to who should have access to land rights and the terms of reference on which the rights are exercised. I therefore conceptualize traditional authority as an institution that regulates access and allocation of land rights under customary land tenure comprising the VHs, Headmen, and the Chief.

5.2 Strategies for rezoning communal land in Zimbabwe

Rezoning strategies in urban and regional planning discourses take a variety of forms. In Zimbabwe, rezoning strategies involve government programmes that seek to correct colonial imbalances. For example, the villagization programmes that dominated development initiatives soon after independence (see Potts & Mutambirwa, 1990; Nyambara, 2001; Spierenburg, 2004; Thebe, 2010). This entails integration and application of regulations to support effective land use and land use planning. Rezoning originates from Zimbabwe's post-independence decentralization programmes when local authorities sought to create small rural towns called growth-points in an endeavor to modernize the rural areas. Small rural towns were expected to develop in a linear hierarchy to become fully urbanized (Helmsing et al., 1991; Munzwa, &

Jonga, 2010). The settlement hierarchy proceeds from what are known as business centres, rural service centres, growth points, towns, and ultimately to cities (Helmsing et al., 1991; Munzwa & Jonga, 2010). The purpose of the settlement hierarchy was to curb rural-urban migration by bringing similar urban services closer to the people living in the rural areas (Tacoli, 1998; Helmsing et al., 1991). The approach was meant to harmonize urban spread into rural areas (Munzwa & Jonga, 2010). In this regard, rezoning simply implies conversion of rural spaces to urban. Thus, rezoning is transit oriented as it seeks to apply strategies that create easthetic city peripheries that will eventaully merge with the greater urban zone.

6 METHODS

In this study, forty-one local residents as well as a number of key informants such as Traditional Leaders and local government officials were sampled Qualitative and quantitative data were collected through structured interviews, review of pertinent documents, as well as observation. The mixed methods approach that combines qualitative and quantitative approaches was thus employed in this case study. In order to highlight the reactions of community residents to rezoning of Domboshava, Hirschman (1970)'s voice, exit, and loyalty model was used in data analysis. This model addresses the different responses consumers are able to make when faced with poor and declining markets. Exit means quitting (Bekker & Leilde, 2003), or simply leaving (Hirschman, 1970; Barry, 1974; Laver, 1976). Voice means speaking out (Hirschman, 1970; Barry, 1974) or "staying put and shouting" (Laver, 1976:464). Loyalty means 'stay and be silent' (Hirschman, 1970; Barry, 1974). Loyalty also entails to 'simply stick it out' or 'grin and bear it' (Hirschman, 1970; Barry, 1974; Bekker & Leilde, 2003). Through Hirschman's model, I was able not only to reveal the reaction of community residents to the local authority's rezoning strategy, but to demonstrate their criticism or disregard of, or compliance with this strategy.

7 DISCUSSION OF FINDINGS: THE REACTION OF COMMUNITY RESIDENTS TO REZONING STRATEGIES IN DOMBOSHAVA

In Domboshava, land transactions are shifting from customary inheritance in the tribal line to individualized land transactions such as direct land sales and renting - leading to changes in land use, settlement patterns, and increased population densities – prompting the GRDC to implement rezoning as a solution to land transactions. In this section, I explain the nature of the rezoning strategies proposed for Domboshava, the reaction of community residents to these strategies, and the reasons why they community residents reacted the way they did.

7.1 Rezoning strategies in Domboshava

From the perspective of Local Government Officers at GRDC, rezoning constitutes settlement upgrading from rural to urban. This strategy is guided by statutes on land and settlement, as well as a master plan for Domboshava. These statutes include the CLA Chapter 20:04 of 2002, TLA Chapter 29:17 of 2001, the RTCPA Chapter 29:12 of 2001, and the RDCA Chapter 29:13 of 2002. The master plan for Domboshava was prepared in line with the GRDC's proposal to upgrade the communal area from rural to urban. The master plan provides for the orderly and planned layout of physical structures in this communal area concomitant with urban spaces. The practice of upgrading settlements from rural to urban is however not a new phenomenon in Zimbabwe. The strategy aims at urbanizing communal areas in line with the provisions of section three of the RDCA Chapter 29:13 of 2002. In this case rezoning translates to spatial issues reflected on master plans.

From the perspective of Local Government Officers, the mixed and unplanned settlement pattern emerging from villages of Domboshava as a result of migrants settling in this communal area conflicted with the principles of planning on conviviality, city imaging, and the beauty concomitant with international destinations such as Harare. As such, beautification of Domboshava was inescapable because of the location of this communal area in the periphery of the capital city. The Local Government Officers regarded Domboshava as one of Harare's frontiers because "we approach cities from their rear" (Mabin, 2012). Thus, settlement upgrading as a rezoning strategy was justifiable as a response to settlement growth of Domboshava, and the urban expansion of Harare into its periphery because of increased land transactions. This justification however ordinarily seeks to preserve the image of Harare, and not necessarily that of Domboshava. On the other hand, by trying to beautify Domboshava and to avoid 'another Epworth in the making' as highlighted by some of the Local Government Officers at GRDC, these land use planners sought to restructure the traditional system of customary land tenure through the proposed master plan since Domboshava was 'degenerating' into an 'informal settlement' like Epworth located in the eastern side of Harare.

The GRDC as an agent of the state has the power to propose and impose the settlement upgrading strategy for purposes of the beautification of rural settlements. In the event of resistance by community residents, section thirty seven of the RTCPA Chapter 29:13 of 2002 authorizes the GRDC to use necessary force in order to achieve the planning ideals.

Since the situation in Domboshava presents uncoordinated and overcrowded residential structures from the perspective of GRDC, this meant application of clean-up measures akin to Operation Murambatsvina/Operation Restore Order (OM/ORO) experienced in Zimbabwe in 2005. This strategy involves the demolition of structures perceived as discordant, illegal, and substandard in physical and planning terms. Ironically, the situation in Domboshava emanates from previous displacements of households through the Fast Track Land Reform Programme (FTLRP of 2002) and OM/ORO of 2005 (see Tibaijuka, 2005; Kamete & Lindell, 2010; Kamete, 2011; Kamete, 2012). Forced eviction of households and the destruction of dwellings has been the general response to substandard and informal structures by local authorities in Zimbabwe (Kamete & Lindell, 2010). Clean-up measures were also applied in Gutu in Masvingo on households that settled themselves on ungazetted land (see Mujere, 2011). Police destroyed houses and burnt down crops to force people to return to their original places (Ibid). Thus, the proposed rezoning strategy by the Local Government Officers for Domboshava could possibly resuscitate a vicious cycle of displacement in this peri-urban communal area. Quan & Payne (2008:4) also point out that, evictions "lead to the creation of new unauthorized settlements elsewhere, only moving the problem from one location to another at great social, economic, and occasionally political cost". In this regard, GRDC's understanding of rezoning does not take cognisance of the causes behind the status quo, and is rather divorced from the lived experiences, as well as polarized expectations of community residents from rezoning.

7.2 Tribal members' reactions to rezoning strategies, and the reasons for their actions

The reactions of tribal and migrant members of Domboshava to rezoning strategies were different. Tribal members in Domboshava perceived the rezoning strategy through settlement upgrading as a hidden agenda by the GRDC to dispossess them of their tribal land rights. In their minds, the proposal was meant to generate revenue to the benefit of the GRDC. Yet, from the perspective of Local Government Officers, land in rural areas or reserves is simply 'reserved' for future development. As a result, tribal members sold 'their' land to migrants ahead of the implementation of the rezoning strategy - to frustrate the local authority. By selling land directly to migrants, tribal members also sought to benefit somehow (perhaps in monetary terms) from their customary land rights. As these tribal members sold their land to migrants, in essence they simply transferred their land rights, and not necessarily land because communal land in Zimbabwe belongs to the state. According to Toulmin & Quan (2000), such circumstances are very tricky because the state continues to 'own' land despite local changes. Yet, tribal members perceived their customary land rights as unchallengeable in Domboshava. The problem lies within the levels of decision-making between the traditional authorities and the GRDC who both claim to have power to allocate land to migrants, yet in legal terms the GRDC on behalf of the state overrides the powers of localized structures (see Cousins, 2008a). However, rules under the tradition and customs of tribal members of Domboshava remain authoritative and provide a sense of legitimacy in regulating individual behaviour in land transactions although these rules are largely unwritten and unspoken (cf. Cousins, 2008b). The reactions of tribal members to proposed implementation of rezoning strategies in Domboshava were largely shaped by familiar experiences that happened elsewhere, for example, the case of Seke communal area in Zimbabwe. From Hirschman (1970)'s perspective, other consumers' behaviour as well as the market experiences from elsewhere influence the decision and choices made on the market.

Tribal members collectively voiced their concerns and disapproval of the settlement upgrading strategy through organizing themselves and sending village representatives to negotiate with the GRDC. By voicing to the GRDC, tribal members sought redress on a rezoning proposal they regarded as disruptive and undesirable. Although, settlement upgrading paves way to planned activities on the master plan, the layout for residential, commercial, industrial, and institutional spaces on the master plan are inadequate to cover the ever-increasing population of Domboshava. For example, the master plan covers only two hundred and eleven residential units. According to Local Government Officers, residential structures deemed substandard are likely to be excluded from the new layout. This means possible exclusion of residential structures of some tribal members whose residences are old and dilapidated. Yet, residential structures in rural areas of Zimbabwe are never built according to plans. There exists no layouts for rural settlements in Zimbabwe. In the minds of tribal members, creating order and beautification in Domboshava through rezoning is a false justification for imaging Domboshava. Thus, Walker (2009:474) notes that,

"Laws and policy prescriptions that underestimate the distinction between the economic and the social values of land run the risk of being implementable. What is important here is that the social meanings of land are constructed differently at different levels - individual, household, community, nation - and the interplay among these different levels is significant for determining how rights-based claims to land get framed by ordinary women and men".

Reactions of tribal members also reveal the multiple meanings, and the symbolic relationship they derive from land. As in Ghana and Cote d'Ivoire, tribal members of Domboshava base their rights to land on history and indigeneity (cf. Peters, 2010). In Domboshava, customary land rights and attachment to the community characterizes the belonging of tribal members. Belonging is embedded not only in the structure on the system of customary land tenure, but also in the social system. Thus, the meaning of land goes beyond its use value, to a linkage between generations, and as "a potent element for social identity" (Walker, 2003:116). Thus, the symbolic relevance of land is associated with the lived experiences of tribal members. For tribal members of Domboshava, land is a critical source of community cohesion that carries both communal and individual interests of the users (cf. Mathieu et al., 2003; Cousin, 2008b). Land is an important productive resource, as well as a potent symbol of their past (Cousins, 2008b). Clearly, land in Domboshava is not only a spatial entity that defines the territorial boundaries of the communal area, but a physical asset and entitlement used by community residents and passed to the next generations. Land is rather a determinant of "socio-physical realities that are significant to human well-being" (cf. Walker, 2009: 467).

The major concern of tribal households of Domboshava about the rezoning strategy was the risk of possible relocation to an unspecified place elsewhere - possibly to Gokwe - a dry and tsetsefly infested communal area located almost 350kilometres northwest of Harare. The recurrent question asked by tribal members particularly those advanced in age and those with ailing health was - where do we go from here? However, possible relocation of households to new places shows that the individual and collective land rights of community residents of Domboshava were rather insecure. According to Cousins (2008b), displacement of communities affects individuals' land rights in many ways. In Domboshava, forced eviction and relocation of tribal households implies displacement of these people from their homeland. Through rezoning, tribal members risk being 'pushed out' of their community through clean-up measures akin to ORO/OM of 2005 - a complete departure from the rational comprehensive models in planning to politics of muddling through (Lindblom, 1959; McLaughlin, 1987). Direct land sales by tribal members of Domboshava are therefore a voice to the GRDC and an expression of discontent and non-approval of what they viewed as unwarranted clean-ups and possible relocation. It is an attempt to solicit attention from the GRDC as well as the state.

From the GRDC's perspective, policy processes on rezoning aim at improving access to services such as water, electricity, and sanitation - largely expected by residents in most communal areas of Zimbabwe. However, tribal members from Domboshava perceived services initiated by the GRDC as inferior, and were thus not excited about services accompanied by clean-up measures. Effectiveness of the tribal members' voice to bring the desired change also depends upon the GRDC's willingness to listen and to respond to community concerns. This impasse emanates from accompanying rezoning with laws on land and settlement. These laws grant the GRDC more power to control the practice of rezoning particularly through settlement upgrading.

Voice and exit strategies by tribal household members in Domboshava did not bring the desired change therefore loyalty naturally took precedence. According to Hirschman (1970), the loyalty strategy entails keeping exit at bay, while activating voice and continuing to campaign for change from within. Loyalty also entails to 'simply stick it out' or 'grin and bear it' while advocating for redress (Hirschman, 1970; Barry, 1974; Bekker & Leilde, 2003). Tribal members advanced in age with little ability to build new homesteads

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from scratch elsewhere demonstrated loyalty. The elderly argued that their roots and tribal identity belong to Domboshava, and that they invested social capital and networks in this communal area (cf. Chambers & Conway, 1991; Ellis & Biggs, 2001; Cahn, 2002; Cousins, 2007; Scoones, 2009). Leaving Domboshava for other places elsewhere was inconceivable since their ancestors were buried in this communal area. In this regard, loyalty entails vigilance while waiting and adapting to the deteriorating conditions in anticipation of uncertainties, and not necessarily change for the better.

Tribal members of Domboshava also reacted to rezoning through resisting projects from GRDC they perceived as suspicious. According to Hirschman (1970), when people are suspicious of new products, they are likely to resist or boycott the products by simply not buying them. The GRDC intended to install piped water in Zimbiru Village. As much as tribal members in Domboshava looked forward to sources of clean water closer to their homesteads, the piped water project was perceived as a deceptive precursor for a rezoning strategy that needed to be resisted, rejected, and boycotted. Tribal members from Domboshava were not excited about the water project. They viewed the project as a form of interference with their rural life. They believed in rezoning strategies that valued their communal status even though they were fully aware that the communal area was situated in a peri-urban zone that is likely to turn urban. These tribal members therefore campaigned against the piped water project from within through collective resistance and direct confrontation with Local Government Officers from the GRDC.

Chasing away Local Government Officers and removing land surveyors' pegs not only demonstrates defiance and confrontation, but loyalty to the structure that defines the system of customary land tenure. Similarly, community residents of Gokwe demonstrated resistance and anger by attacking officials from the local authority when the government introduced a villagization programme in this communal area (Nyambara 2001). Villagization programmes involve relocation and reorganization of land use of rural households in terms of arable, grazing, and residential (Potts & Mutambirwa, 1990). Elsewhere in northern Zimbabwe, residents of Dande communal area resisted a development project that aimed at land redistribution (Spierenburg, 2004). In another case, the community residents of Binga sabotaged a project by the RDC through selling communal land to migrants (Dzingirai, 2003). These reactions are similar to those of Kgatleng residents of Botswana against the imposition of legal rights on boreholes when the land administration authority failed to convince people about the project, and the residents were generally skeptical about the project (Peters, 1994). In Kenya, the Luo tribe clashed with government over the land titling programme because the Luo perceived the programme as a threat to their belonging and ancestral land rights (Shipton, 2004 in Mujere, 2011). According to Robins (1995) in Nyambara (2001:278), peasants have always resisted relocation of homesteads and consolidation of villages, and this took form of "attacks on state officials who come to peg new homes, the removal of pegs from home fields and yards, making the officials object of witchcraft, boycotting meetings, and so on". In these cases, projects from the local authorities "caused a great deal of anger" since these were literally after land dispossession and displacement of people from their ancestral 'soil' (Peters, 1994:21).

The perceptions of tribal members of Domboshava were thus shaped by possible dispossession, loss of land rights, and many freedoms (cf. Cousins, 2008a). The 'freedoms' of tribal members entail autochthonous land rights, choices to bequeath land and other property rights through inheritance, choices to exchange land, choices to access the commons, and above all the right to belong to this communal area. Loyalty to customary land tenure by tribal members of Domboshava is rather a forced alternative and not necessarily a rational initiative in order to preserve their freedoms as well as belonging (cf. Hirschman, 1970).

7.3 Migrant members' reactions to rezoning strategies, and the reasons for their actions

On the other hand, the reactions of migrants were different. Migrants perceived rezoning and provision of services through the water project from GRDC as worthwhile. In their minds, rezoning could lead to improved living conditions concomitant with urban spaces. Migrants thus looked forward to upgrading of Domboshava from rural to urban. Many migrants were rather uncomfortable with and uncertain of their migrant status associated with squatters by the GRDC since they were unregistered through the formal procedures. Migrants that bought land through individualized land transactions such as direct land sales and land grabs were legally categorized as squatters (CLA Chapter 20:04 of 2002; TLA Chapter 29:17 of 2001). In the minds of migrants, rezoning would secure their land rights since in most cases these migrants were victims of displacement through the FTLRP and OM/ORO. If Domboshava turns urban, the context allows for formal registration of individual land parcels with the GRDC, and land would be considered as urban with title. Land titles are "preemptive", that is, they prevent the state from allocating the same pieces of land to others (Migot-Adholla, 1994:25). As such, land titles confer absolute and legal private property land ownership rights to migrants. Migrants of Domboshava therefore expected to obtain land titles through rezoning.

Migrants regard Domboshava as urban due to its proximity with Harare. However, Domboshava is rural since the peri-urban area is categorized under communal areas in policy terms (CLA Chapter 20:04 of 2002). Some migrants however support settlement upgrading from rural to urban because they retain their tribal status in their homelands. Such land rights legitimize their land claims even after migrants' long absence. Migrants had nothing to lose in terms of autochthonous land rights in Domboshava through land dispossession by the GRDC, but probably could gain titled and private land rights through rezoning. According to Hirschman (1970), migrants' perceptions typify neither voice nor exit, but rather loyalty to rezoning. Loyalty in this regard, translates to waiting in anticipation for an improvement. Being loyal also entails patience (Hirschman, 1970; Ayes, 1971; Barry, 1974; Dowding et al., 2000). For migrants, waiting patiently for transformation from rural to urban is a significant and a calculated alternative rather than to use overt strategies such as voice or to exit. Engaging voice was somewhat tricky and difficult for some unregistered migrants because of their 'illegal' migrant status in Domboshava. Migrants were simply sticking with the status quo while waiting for change come. Loyalty also provides an explanation to the standard and state of the art houses constructed by migrants in Domboshava. Such modern and often gated structures are unlikely to be demolished during clean-up exercises. These residential structures stand a better chance of being integrated into the GRDC's master plan for Domboshava. Demolition of physical structures involves compensation to the owners (RTCPA Chapter 29:12 of 2001). This is often an insurmountable task for local authorities in Zimbabwe as they struggle financially to meet most of their budgetary requirements. Construction of permanent and modern structures by migrants is however a way of securing land rights, and to remain safe from the GRDC's non-planning interventions akin to ORO/OM associated with the rezoning strategy on settlement upgrading.

8 CONCLUSION

Findings from the case of Domboshava clearly show that the rezoning strategy does not necessarily focus on what community residents expect, but on what laws expect in terms of land and settlement in this peri-urban communal area. The behaviour of tribal members also demonstrates resistance not only to the rezoning strategy they regarded as undesirable, but also to the structure on customary land tenure they regarded as confusing. As a result, tribal members were simply exiting the structure or rules that regulate customary land tenure as described in statutes on land and settlement through unsanctioned land transactions. Statutes capacitate and constrain (at the same time) individual freedom of tribal members to exercise their land rights. In the minds of tribal members of Domboshava, exiting these institutions is a worthy cause because the structure failed to protect their customary land rights against possible dispossession by the GRDC. Tribal members are content with their rural and tribal status that allows them to practice inheritance for their descendants.

Clearly, a conflict of values exists between tribal members and migrants in terms of gains and losses attached to rezoning. Among tribal members, settlement upgrading is associated with loss of land rights, whereas migrants equate the programme with access as well as secure land rights through land titles. Future scenarios however predict a complex combination of resistance to rezoning by tribal members that preserved their land parcels for their future generations against those that resigned and totally exit the system of customary land tenure through land sales to migrants. The latter group of tribal members is likely to support rezoning through settlement upgrading. On the other hand, migrants are likely to team up with tribal members that hold small residential land parcels in support of rezoning through settlement upgrading. Appropriate planning strategies that address the challenges in Domboshava are sorely needed.

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reviewed paper

Land Use Plans: Long Live the Crocodiles

Marjolijn Claeys, Hans Leinfelder

(Marjolijn Claeys, Voorland, Ledebergstraat 94, 9050 Gent-Ledeberg, Belgium, marjolijn@voorland.be)
(Prof. dr. ir. Hans Leinfelder, KU Leuven-Faculty of Architecture-campus Ghent, Hoogstraat 51, 9000 Gent, Belgium, hans.leinfelder@kuleuven.be)

1 ABSTRACT

Some would say that land use plans are the dinosaurs of planning policy. And indeed, in almost every country in continental Europe land use plans emerged as main instruments in the earliest/almost prehistoric periods of organic planning legislation. But unlike the dinosaurs, land use plans have managed to survive in most of these countries and they have adapted successfully until now as some kind of living fossils. That is why we prefer to see them as crocodiles. Like crocodiles, land use plans appear quite frightening because of their non contemporary unattractive look and their lethal/legal power. Unfortunately, similar to the gradual extinction of crocodiles because of climate change, land use plans seem to become endangered and mainly too because of drastic changes in contextual factors.

Since their features seem rather unappealing at first sight, acolytes of crocodiles as well as land use plans rarely raise their voices in the debate about their survival. However, this contribution wants to change strategy. It consciously ignores the characteristics of land use plans that might make them vulnerable. Instead, it addresses three main contextual aspects of its questionable survival. In other words it focuses on the destructive ways in which planners, policy makers and citizens more and more position land use plans as planning instruments.

First, planners and policy makers seem to have almost blind faith in the power of land use plans. The latter are still too often considered, by planners as well as policy makers, as the universal solution of each planning process. This dogmatic belief burdens land use plans with impossible expectations since it ignores the original ambition of land use plans, namely offering a framework for the assessment of building permits. It also neglects the role and position of other policy instruments in consolidating the outcomes of a planning process.

Secondly, convinced of the robustness of land use plans, in the last two decades policy makers in closely related policy domains such as for instance environmental, nature conservation and cultural heritage policy, have legally linked their own sectoral assessment tools to the approval process of land use plans. Despite the integrating character of planning, this strategy has led primarily to a formal overload of land use plans with sectoral policy goals what makes them obese and vulnerable.

Finally, the sensitivity of individual citizens for interference of government in their private property rights has grown tremendously, even when this interference is inspired by public interests. The combination of government's preference for land use plans as a tool to limit these rights on the one hand and the vulnerability of these plans because of the lethal amount of linked sectoral policies on the other hand, make land use plans ideal subjects for judicial procedures. Already weakened because of the combination of the first two aspects, land use plans are easy preys.

Before officially declaring land use plans extinct, this contribution pleads for a drastic sanitation of the societal and political context in which land use plans have to function. We want to prevent these crocodiles from extinction because, in our opinion, land use plans still have an optimistic and meaningful life expectancy. But as crocodiles have adapted to and need a specific climate, land use plans need to be strictly used for the purposes they were generated for originally.

2 WHY WORRY ABOUT THE SURVIVAL OF LAND USE PLANS?

The authors of this paper are involved in a ‚comparative‘ research project in Flanders (Belgium) on potential concepts for framing and tuning various policy instruments when a (spatial) planning process turns from visioning and decison making into realizing. The research project is commissioned by the Spatial Planning Department (Ruimte Vlaanderen) of the Flemish Government and is conducted by a consortium of private consulty agencies (Voorland, ProFlow and LDR advocates) with the support of another private consulty agency (Intoe) and KU Leuven-Faculty of Architecture.

2.1 Introductory observations on the current position of land use plans

In the call for the research project, the Spatial Planning Department describes how spatial planning processes in Flanders have recently evolved towards processes that not merely cope with changes in land use (as defined in land use plans) but also with a broad package of spatial as well as non-spatial measures. Attempts to keep this combination of measures as transparant as possible and to embed these measures in obvious political decisions have appeared to be inadequate. They are certainly no guarantee that land use plans survive the judgement of the highest administrative court in Flanders/Belgium, the Council of State. Existing jurisprudence points out for instance that the framing and tuning of the measures taken in land use plans and these taken in flanking and supporting policy instruments, such as strategic environmental impact assessments, is insufficiently visible. Frustrating experiences bring the Spatial Planning Department to three observations which also question the general relevance of land use plans.

First, the transparency and legal status of overall decisions in planning processes has decreased remarkably. The outcome of processes is not only translated into traditional land use plans, but also into programs of action, flanking policy measures or mitigating measures. The land use plan and the amalgama of instruments form an overall package of measures. These packages can be quite small or very extensive as they consist of these measures actors have considered necessary or very important throughout the planning process. However, not every measure can be translated into land use plans because a social measure for instance is not considered a spatial planning policy issue or because some measures are insufficiently strategic but instead very technical aspects which should not be taken care of in the land use plan but be elaborated on in the building permit. As a consequence, these measures are politically decided upon parallel to the political decison on the land use plan. Often, both types of decisions are linked. However, the overall package of measures misses a clear status. Therefore, decisions about spatial as well as non-spatial issues that are embedded in the overall package have to be justified each time specific instruments are brought into action to implement a part of the program of actions.

Second observation of the Spatial Planning Department is that land use plans get a disproportional part of the attention while they are only one instrument in the complex combination of various policy instruments and measures. The public debate and legal procedures often shed insufficient light on instruments and measures other than the land use plan. The fact that land use plans are increasingly used to regulate the most diverse issues, also non-spatial issues, is the result of two societal trends. First, the legal system in Flanders highlights the written rule, i.e. legislation; the enacting force of their urbanistic rules empowers land use plans dramatically. And as land uses directly interfere with individual property rights, urbanistic rules are considered very relevant by citizens. Second, courts, and in particular the Council of State, have become increasingly demanding when it comes to the level of degree and the range of urbanistic rules of land use plans. This attitude is prompted by a specific interpretation and implementation of the principles of legal certainty and protection of legitimate expectations. Leaving development perspectives open becomes more and more difficult which leads to very static land use plans at the very moment where the need for flexibility grows. Plus, since other legally binding instruments are lacking, the pressure to embed non-spatial measures in land use plans continues to rise; land use plans are perceived as the instruments bringing universal happiness. The overwhelming focus on land use plans can also be noticed in the large number of legal procedures fighting decisions on land use plans. When one is unsatisfied with (certain aspects) of an overall package of measures, only the land use plan is challenged since flanking policy instruments are not taken into consideration by the Council of State.

Finally, an aspect that is often denied is the tiering mechanism in political decision making. A land use plan is only one link in a (tiered) chain of decisions which are taken at a strategic or plan level and are being followed by decisions with a higher degree of detail, for instance the realization of projects through building permits. Also non-spatial measures have to be positioned within this mechanism. For instance, mitigating measures from a strategic environmental impact assessment that can not be embedded in a land use plan should be specified in a building permit.

2.2 Outline of the paper

This summary of observations and concerns from the Flemish Spatial Planning Department is the starting point of this paper. A brief description of the genesis of Flanders' breed of land use plans offers some insight in its characteristics, strengths and weaknesses. Next, the three main contextual aspects that question the survival of land use plans in Flanders are addressed. They coincide roughly with the concerns described above: the almost blind faith of planners and policy makers in the power of land use plans, the legal linking of sectoral assessment tools to the approval process of land use plans and, finally, the sensitivity of individuals for interference of government with their private property rights. The paper ends with a plea for a drastic sanitation of these contextual aspects since land use plans definitely have a meaning in planning policy and thus have a reason to survive.

3 BRIEF GENESIS OF FLANDERS' BREED OF LAND USE PLANS

Compared to other countries in continental Europe, Belgium was quite late in adopting an organic planning policy legislation. The approval of its first organic Planning Policy Act goes back to 1962. The Act offers a legal framework on the content and procedures of planning policy, building permit policy and enforcement policy. Although planning policy has become a regional policy matter in 1980 as a consequence of Belgium turning into a federal state, it is only in 1999 that the Flemish government adopts its own organic Planning Policy Decree, codified later on in 2009. Today, the Flemish government is again taking new steps in rethinking the planning system.

3.1 Subregional land use plans guaranteeing legal certainty in 1960-1970

Before the Planning Policy Act of 1962, Belgium didn't really have an adequate and systematic ensemble of instruments regulating the development of its territory and protecting its natural environment. As a consequence of this long-lasting lack of regulatory instruments, today's spatial structure in Belgium is characterized by an extensive road network, dispersed settlements and the specific (small scale) structure of agriculture (Albrechts, 1999).

The main goal of the 1962 Act was of course to stop these negative developments, providing a framework for a hierarchical planning system at four policy levels (Van den Broeck, 2005) (fig. 1). However, the national plan (‚nationaal plan') and the regional plan (‚streekplan'), conceived in the Act as visionary documents, were never developed. In practice, planning policy in Belgium was limited to general and specific municipal land use plans (‚algemeen plan van aanleg' and ‚bijzonder plan van aanleg') and, above all, subregional land use plans (‚gewestplan').

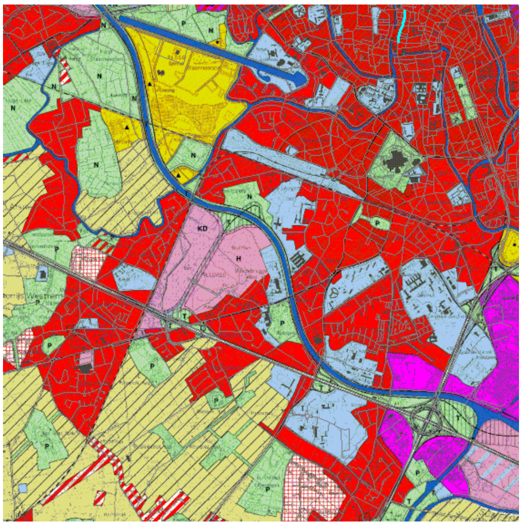

Fig. 1. Hierarchical planning system in the 1962 Act. Fig. 2. The degree of detail of subregional land use plans.

As only very few municipalities drew up their own municipal land use plans, the Belgian government decided in the 1960s and 1970s to develop 48 detailed subregional land use plans covering the whole of Belgium. On the one hand, by doing so, the subregional land use plans turned out to become the highest planning instrument in Belgium. On the other hand, because of the level of detail of these subregional land use plans in allocating land uses to individual parcels, they limited the need for municipalities to draw up their own land use plans (fig. 2).

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Albrechts (1999) summarizes, amongst others, the following characteristics of the subregional land use plans as the main planning instruments in Belgium and Flanders.

- The subregional land use plans are mostly passive plans not directed at implementation as such. The land use plan is looked upon in the first place as a criterion, into which a system of building permits can be projected. In these land use plans there is no mention of an explicit time-horizon, of action-programmes, instruments, priorities, budget making etc.
- As a result of the procedure for approval of land use plans, these plans become 'laws' which can only be altered by the approval of another land use plan in the same way.
- Adjustments to a subregional land use plan are only possible by making detailed corrections at the same policy level and by the devising of a completely new plan subject to legal approval.

These characteristics stress the legal certainty the subregional land use plans have brought to the Belgian and Flemish planning system. Not only do municipalities have these plans at their disposal to control the validity of building permits. Through the subregional land use plans, every land owner in Belgium also has a quite clear idea of the development potential of his property. Moreover, after decades of daily planning practice with and jurisprudence about these subregional land use plans, the allocation of land uses at the level of individual parcels implies a financial value that is linked to the potential to develop the individual property extensively or intensively. Parcels are sold and bought on the real estate market taking into account the colour and thus the desired land use and the potential financial value of the property (Needham, 2006).

3.2 Structure plans for visioning and implementation plans for legal certainty

In 1999, Flemish government, having become the competent authority for planning policy in 1980, adopted a new Planning Policy Decree. This Decree introduced the development of two new planning instruments at three policy levels: the 'national' level of the Flemish region, the regional level of 5 provinces and the local level of 308 municipalities (Leinfelder et al., 2010; Van den Broeck et al., 2014). The political (long term) vision on the future development of the territory involved is written down in a structure plan ('ruimtelijk structuurplan'), the implementation of this vision through the allocation of land uses and rules on development and management of these land uses is defined in an implementation plan ('ruimtelijk uitvoeringsplan') (Albrechts, 2001) (fig. 3).

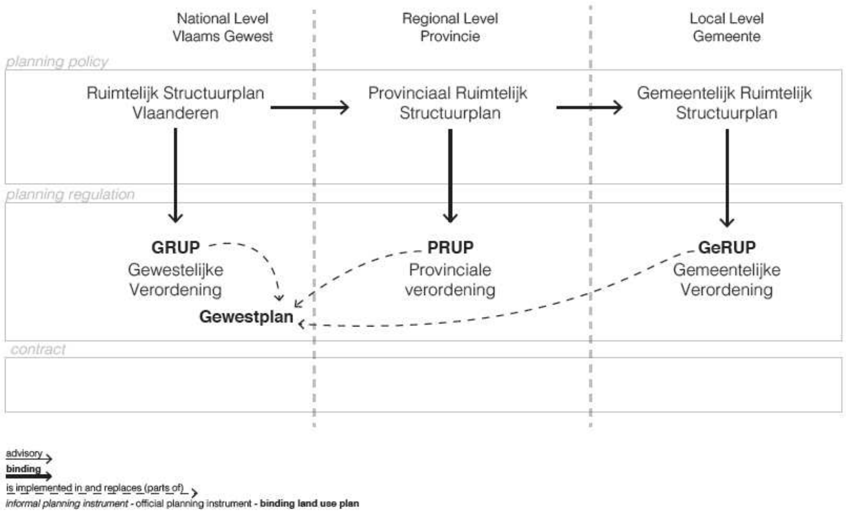

Fig. 3. The planning system with structure plans and implementation plans.

While the original ambition of the implementation plans was to have a more active character than the subregional land use plans, planning practice has shown that the resemblance with the land use plans is huge. Path dependency within the group of planning practicioners and jurisprudence by the Council of State have resulted again in very detailed 'law'-like implementation plans, both at the municipal level and at the provincial and Flemish level (fig. 4) (Albrechts et al., 2010). Despite some innovations, for instance the additional possibility to use symbolic indications on the graphic allocation plan, implementation plans are very similar to land use plans.

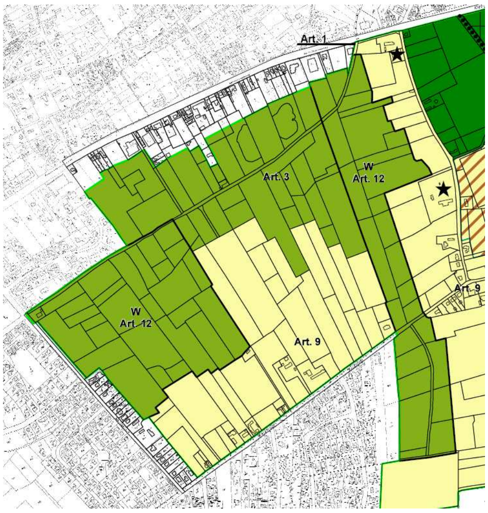

Fig. 4. The degree of detail of a 'national' implementation plan.

Very important to mention is that the original subregional land use plans, introduced by the 1962 Act, keep their legal status for individual parcels for as long as they are not replaced, for these parcels, by an implementation plan. Knowing that the drawing up of implementation plans takes years and is only done when necessary for the realization of a project or the optimalization of a functional spatial configuration, the use of the majority of the land in Flanders today is still defined by subregional land use plans. It is expected that this situation will last for many more years.

3.3 Shift in visionary planning instruments but preservation of legally certain implementation plans

Today, almost 20 years after the Flemish Spatial Structure Plan of 1997 (Ministerie van de Vlaamse Gemeenschap, 1997) initiated an overwhelming visioning activity at various policy levels in Flanders, the Flemish government is again taking new steps in rethinking the planning system. Its ambition is, amongst others, to reorganize the system of structure planning to a system of strategic policy planning that is more focused on key issues and key regions, that is more flexible and more action-oriented. It is impossible to elaborate on this shift in planning system in this paper (see: Departement RWO, 2012). What is striking however, is that the role and position of the implementation plan in the planning system, and as a consequence of the subregional land use plans, remains unchanged at first sight!

3.4 Land use plans are the dinosaurs of planning policy

Based on this brief description of the genesis of the specific breed of land use plans in Flanders/Belgium, one can certainly say that these plans are the dinosaurs of planning policy. This is not unique. Indeed, in almost every country in continental Europe land use plans emerged as main instruments in the earliest/almost prehistoric periods of organic planning legislation. However, where most of European countries have land use plans at local level - the Dutch ‚bestemmingsplan', the French ‚plan local d'urbanisme' and the German ‚Bebauungsplan' – the Flemish region has land use plans at national/Flemish, provincial and municipal level.

Unlike the dinosaurs, however, the genesis shows that land use plans seem to have survived and adapted successfully until now as some kind of living fossils. That is why it is better to see them as crocodiles. And, like crocodiles, land use plans, also today, appear quite frightening because of their old-fashioned unattractive look and their lethal/legal power.

4 CONTEXTUAL ASPECTS QUESTIONING TODAY'S SURVIVAL OF LAND USE PLANS IN FLANDERS

Unfortunately, similar to the gradual extinction of crocodiles because of climate change, land use plans seem to become endangered and also mainly because of drastic changes in contextual factors. Three contextual factors will be addressed in this paragraph: the almost blind faith of planners and policy makers in the power of land use plans, the legal linking of sectoral assessment tools to the approval process of land use plans and, finally, the sensitivity of individuals for governmental interference in their property rights.

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4.1 Almost blind faith in power of land use plans

Until the rise of strategic structure planning in Flanders in the 1990s, the one and only possible outcome of a planning process seemed the drawing up of a new land use plan and, later, a change of the existing land use plans. The ambition of these land use plans was and still is merely to command and control the development of activities in space through granting or refusing building permits. Plans formally state ‚what is allowed' and ‚what is not allowed'. Urbanistic rules in land use plans list positively the sort and number of activities that can be developed by private or public persons or they enumerate negatively the activities that can not be developed at a specific spot. Land use plans grant an overwhelming power to public authorities to control new developments passively without necessarily interfering in an active way on the real estate market. More generally, the typical command-and-control characteristics of land use plans is very familiar to politicians and policy makers as, already for centuries, they are used to write laws and other legislation to regulate private and public interventions in society.

The development of ideas on strategic structure planning in the 1990s initially widened planners' perspective on their professional activity. Strategic structure planning emphasizes the role of the planner as a story teller combining the ideas of a coalition of various actors in an attractive story line about the future development of a territory. Through this story line and the growth of a coalition of actors supporting this story line, the planner hopes to raise the societal acceptance for institutionalizing this so-called policy discourse (Hajer, 1995; Van Tatenhove et al., 2000). This institutionalisation can take the form of restructuring governmental organization, writing policy documents and legislation or developing policy instruments for the translation of the story line in practice. The new story line was actually written down in the new Spatial Structure Plan for Flanders in 1997, this with the support of various stakeholders, interest groups as well as government administrations at all policy levels (Albrecht, 1999). It was however the process of institutionalisation, especially within the planning policy field itself, that failed to come up with new ideas on how to consolidate the outcomes of planning processes. The 1999 Decree for instance neglected or failed to define new instruments besides the land-use-plan-like implementation plans. While, at the same moment, an enormous source of international and even Flemish literature on ‚collaborative' planning referred to ‚agreements' and ‚contracts' between private and public actors to consolidate the planning process outcomes (for instance: Healey, 1997; Healey et al., 1997; Vermeersch, 1994). However, the Flemish planning society decided to stick to the traditional land use plan as the most appropriate ‚contract form', beit that land use plans should be considered as predominantly unilateral contracts without any commitment, for instance, of private actors to realize the plan in reality. The best and perhaps most disappointing illustration that the institutionalisation of strategic structure planning in Flanders already went wrong in the Spatial Structure Plan for Flanders itself, was the explicit desire of the ministers in the Flemish government that the plan would include a so-called ‚spatial accounting' table (fig. 5). The table shows ‚schizophrenically' (Van den Broeck in Renard, 2009) the implications of the new story line on the acreages for the various land use categories in the subregional land use plans. By including the table in the Spatial Structure Plan, the tone was irreversibly set to focus on drawing up implementation plans for the realization of the vision.

Bestemming	Huidige gewest-plannen (ha)	Gewestplannen in 2007 (ha)	Natuurverwevings gebied
Wonen	227.500	227.500	
Industrie	55.000	62.000	
Recreatie	17.500	18.500	10.000
Overige bestemmingen	57.000	57.000	
Landbouw	806.000	750.000	70.000
Bosbouw	43.000	53.000	40.000
Reservaat en Natuur	112.000	150.000	
Overig groen	34.000	34.000	30.000
Totaal	1.352.000	1.352.000	150.000

Fig. 5. 'Spatial accounting' table of the Spatial Structure Plan for Flanders. (Ministerie van de Vlaamse Gemeenschap, 1997)

Concerning the importance of land use plans in Flemish planning policy, Claeys (2012) makes a relevant distinction between project-driven and vision-driven implementation plans (fig. 6). In the first type, the implementation plan is situated at the end of the visioning process and nearly coincides with the assessment of the building permit as final step to realization. The implementation plan is administratively and legally necessary to grant the building permit for a specific project. In the second type of implementation plans, the approval of the plan is situated at a moment in the visioning process when realization is still far away in time. But also in this type, the plan defines the urbanistic frame for the assessment of building permits for yet unknown initiatives that might contribute to the future development of a territory.

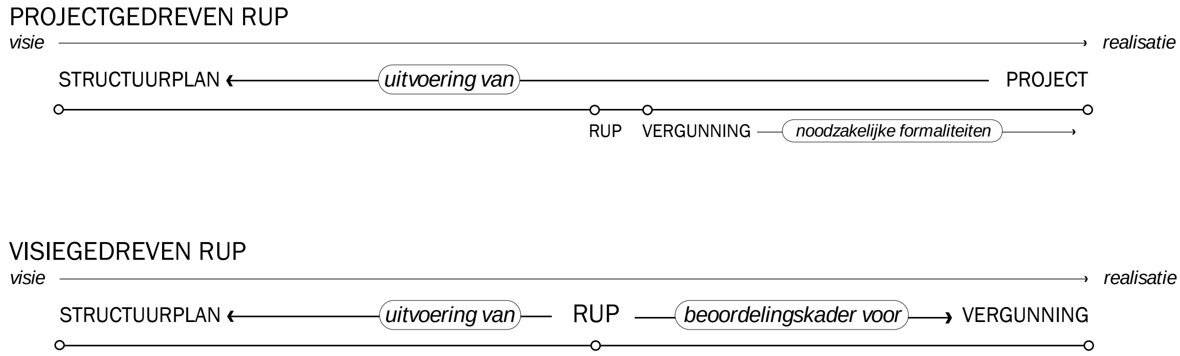

Fig. 6. Project-driven and vision-driven implementation plans. (Claeys, 2012: 45)

Offering such a framework for the assessment of building permits is of course exactly the role of land use plans that was set by the 1962 Act (Albrechts et al., 2010). It is a pity that today’s politicians and policy makers often ignore this role and ask for a land use plan even when the outcomes of a planning process don’t need the drawing up of another often annoying and limitative legally binding land use plan. They seem to have an almost blind faith in the power of land use plans. However, this dogmatic belief burdens land use plans with impossible expectations. It also neglects the role and position of other policy instruments in consolidating the outcomes of a planning process.

4.2 Legal linking of sectoral assessment tools to the approval process of land use plans

Already in the early 1990s, when Flemish environmental policy was scarcely out of its egg, environmental legal norms and standards were linked to land use categories in planning policy. The legal link between environmental and planning policy culminated drastically when various European directives obliged the preliminary assessment of the impact of projects, plans and programs on the environment as a whole and on the natural environment in specific. The European directives on environmental impact assessment as well as the Habitats, Birds and Water Framework Directive all come down to the same idea that planning processes should assess every reasonable development alternative on its environmental impact before approving a policy plan for one single alternative. Furthermore, the necessary mitigating measures resulting from the assessment procedure should be integrated at the most in the final plan. Each EU member state decided how to translate these directives in its own legislation and policies. This integration seems problematic in many member states as assessment procedures and the attitude of the European Court of Justice towards these procedures are generally considered excessive and dramatic at the expense of economic and infrastructure development (Buijs et al., 2014 and Kistenkas, 2014).

When an implementation plan in Flanders deals with a spatial development issue that should be assessed accorrding to any of the European directives, a table is drawn up and integrated in the planning document. This table shows the mitigating environmental measures and the related goals, the decision whether or not the measure is integrated in the plan, and how it is integrated (fig. 7). The informative value of the table is important since it also indicates why an environmental measure is not integrated in the implementation plan: because it is considered as a non-spatial issue or because it is so technical or specific that it can not be dealt with in the implementation plan and should be integrated in the building permit procedure. In this case, this type of measures is integrated in parallel political decisions on what is called ‚flanking‘ policy measures.

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Milderende maatregel	Doelstelling	GRUP (plan)	Ruimtelijke vertaling
		betreffende 'Ruimtelijk beleid binnen de agrarische gebieden waarvoor de bestaande plannen van aanleg en ruimtelijke uitvoeringsplannen herbevestigd zijn')	
Mitigerende maatregelen voor Mens-gezondheidsaspecten			
Effecten op externe veiligheid	Verminderen van de grote snelheidsverschillen tussen vrachtwagens en auto's (zorgvuldig ontwerp, kruipstroken, …)	x (voorzien van ruimte voor dwarsprofiel met kruipstrook)	Het gebied voor wegeninfrastructuur voorziet de ruimte voor dwarsprofiel met kruipstrook. In de toelichtingsnota wordt de afbakening hiervan verder verduidelijkt.
Mitigerende maatregelen voor verkeer			
Effecten op verkeersveiligheid	Dwarsprofiel (integreren kruipstrook)	x (voorzien van ruimte voor dwarsprofiel met kruipstrook)	Het gebied voor wegeninfrastructuur voorziet de ruimte voor dwarsprofiel met kruipstrook. In de toelichtingsnota wordt de afbakening hiervan verder verduidelijkt.
Effecten op doorstroming	Ontsluiting Pontstraat-West	x (voorzien bufferzone tussen Pontstraat-Oost en N60)	Voor de realisatie van de N60, zijnde de wegeninstrastructuur en aanhorigheden (weg, bermen, grachten, geluidsreducerende maatregelen,…) worden verschillende bestemmingsgebieden voorzien in het

Fig. 7. Table with mitigating measures (‚milderende maatregel') and related goals (‚doelstelling'), the decision to integrate it in the implementation plan (‚GRUP (plan)') and how it is done (‚ruimtelijke vertaling').

Despite this detailed information on the integration of environmental measures in the implementation plan and the parallel political decision making on flanking policy measures, the Council of State is and remains convinced that the majority of measures, even when not clearly spatial, should be integrated in the implementation plan. As a consequence, the divergence in interpretation between government administration and the Council of State on the integration of measures in land use plans results repeatedly in the annulment of implementation plans by the Council of State.

Inspired by the success of environmental EU directives to link environmental policy goals intensively to planning policy, other sectoral policy domains have also developed legislation or even informal procedures to embed qualitative objectives in the assessment of the impact of new land use plans. Cultural heritage policy for instance succesfully introduced similar preliminary assessments referring to conventions of the Council of Europe. The agricultural policy domain doesn't have such a European big stick but often demands in planning processes, without having any legal basis to do so, to conduct a more general agricultural impact study or a more detailed agricultural impact assessment.

Implementation plans or land use plans seem to have gathered a unique glance of robustness in the eyes of closely related policy domains. Instead of developing an own territorial policy, their strategy is focussed on linking their own policy to planning policy. This has led primarily to a formal overload of land use plans with sectoral policy goals. It makes the crocodiles obese and vulnerable instead of robust.

4.3 Sensitivity of individuals for interference of government with their private property rights

As already described in 3.1, the subregional land use plans of the 1970s defined a land use for every individual parcel in Belgium. Through this operation, every land owner in Belgium got a quite clear idea of the development potential of his property.

The introduction of new implementation plans at the end of the 1990s might have gone hand in hand with an operation to transform this property-led allocation of land uses into a more development-led allocation. Similar to larger countries, the definition of development rights of 'unused' – non prior – land might have taken the form of more general legislation while the precise allocation of land uses in land use plans might have been preserved for guaranteeing a qualitative urban or economic expansion or for the conservation of natural areas and landscapes. However, such a kind of operation appeared to be too complex and probably too costly. Indeed, after decades of daily planning practice with and jurisprudence about subregional land use plans, the allocation of land uses at the level of individual parcels had resulted in a financial valuation of individual property that is linked to the potential to develop it extensively or intensively.

This financial value of individual property as a result of the allocation of land uses in land use plans and implementation plans makes individual citizens very sensitive for government's decisions on planning, even when these decisions are inspired by public interests. Already in the 1962 Act, the Belgian Parliament has introduced mechanisms, still existing today, dealing with this sensitivity: the possibility to reconsider land use allocation options as a result of objections during citizen's participation, expropriation and preemption rights, the possibility to compensate individuals for the loss of property value and, much less implemented, the possibility to claim from individuals the increase in property value because of changes in land use plans. Only recently, since 2014, a legislative initiative provides in the mechanism to exchange land uses and consequently exchange properties between two different areas.

In the mind of indivduals, changes in land use plans are immediately linked to the loss or increase of individual property value. This is the result of the fact that a specific land use, and thus a development potential, has been allocated to every square meter in Flanders. Furthermore, changes in land use do not necessarily have to concern the individual property itself, also changes concerning neighbouring properties or even the larger surroundings of a property can have a positive or negative effect on the property value.

Knowing this, it is quite easy to realize that people often don't agree with the ambitions of an implementation plan. As these land use plans have become formally very vulnerable because of the lethal amount of linked sectoral policies, the chance of success through legal procedures, not on content but on formal and procedural aspects, is considerable. One can say that ‚the implementation plan-crocodiles', already weakened because of the combination of the first two contextual aspects, have become easy preys for a lot of individuals.

5 CONCLUSION – DRASTIC SANITATION OF CONTEXTUAL ASPECTS

Instead of inventing a contemporary alternative for land use plans, this paper pleads, first, for a drastic sanitation of the societal and political context in which land use plans are expected to operate. The ambition is to prevent these ‚crocodiles' from extinction because land use plans still have an optimistic and meaningful life expectancy. But, as crocodiles have adapted to and need a specific climate, we are convinced that land use plans can only survive when strictly used for the purposes they were conceived for originally.

Albrechts et al. (2010) stress the substantive and formal difference between the more visionary documents and the more legal documents in planning policy. This observation is very important. On the one hand, strategic plans, formulating a vision on the qualitative development of a territory, are built on a story line around which stakeholders are gathered in a supportive coalition. The outcome of the decision making process about these plans is formalized in agreement packages between the various stakeholders on measures to be taken. On the other hand, land use plans, being the legal documents in planning policy, were conceived solely as a framework for assessing the validity of building permits, nothing more and nothing less. In other words, they are the judicial means for civil servants at different policy levels to evaluate whether or not a permit can be granted to build, take away or alter the spatial configuration of a construction, an infrastructure, a natural element or a topography, etc. The land use plans and their successors, the implementation plans, should be recognised as legal documents. Their role was and still remains to offer a legally certain framework for building permits. They are not visionary documents or strategic instruments and shouldn't be expected to be so. Instead of burdening the implementation plans with impossible expectations we should leave these old crocodiles to focus on the role they were designed for. Only by doing so, these crocodiles can survive and remain their robustness.

The ambition to draw up a land use plan can be one of the actors' agreements in a strategic planning process. But often other instruments are more suited to guarantee a qualitative realization and are much more compatible with the informal way of decision making in contemporary network society. These instruments can eventually also address spatial aspects: there are more informal ‚landscape (quality) plans' or there are very strict and legal instruments such as the ‚classification' of valuable landscapes. Other instruments can help managing the land use in the most appropriate way through land exchange, expropriation or preemption. And finally, there are legal means to reach non-spatial goals in an appropriate way, such as water level management, nature development plans, social housing objectives, etc. Instead of automatically opting for a

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land use plan, the stakeholders of a strategic planning process should consider this wide range of instruments and implement the most appropriate planning instrument. Instead of using the land use plan to achieve sectoral policy goals, the stakeholders should develop their own territorial policy instruments. Having a clear perspective on the wide spectrum of available instruments and their appropriate use should help directing the use of land use plans to the most relevant situations. Knowledge and a more common/appropriate use of other (planning) instruments should contribute to assess the surplus value of the land use and implementations plans in institutionalizing the outcome of the planning process.

A third necessary change in the contextual factors is a more explicit (legal) status for the overall package of measures at the end of a planning process. This package should become the nexus in tuning planning policy goals with other (sectoral) policy goals. By doing so, it is no longer the land use plan itself that should be assessed on its impact on for instance environment and natural environment. A clearer identity of the various elements in the package, including the land use plan, should allow citizens to focus their participation and legal procedures on the right policy instrument: the overal package of measures, the land use plan or another policy instrument. As a consequence, a legal procedure against a land use plan should be limited to the spatial aspects and especially the spatial aspects for the realization of which a building permit is necessary. Disagreement about non-spatial aspects or about spatial aspects that don’t need a building permit should not be ventilated in procedurs about land use plans.

When providing the right societal and political climate, the ‚implementation and land use plan-crocodiles’ will certainly survive. But, just like all living creatures, also land use plans themselves should adapt a little to the climate to survive. The following months, the research project in progress (mentioned in paragraph 2) will tackle this question by comparing the situation in Flanders with the way in which other European regions deal with the relation between land use plans and other (sectoral) policy ambitions: the Brussels Capital Region in Belgium, the Netherlands, Germany, France and Finland. Except for Brussels, the drawing up of land use plans is for instance limited to the local, municipal level what makes land use plans less prominent as a planning instrument. In that case, instruments and decisions at a more strategic level come to the fore for ‚institutionalizing‘ the outcome of planning processes in a way that is perhaps more compatible with the contemporary societal and political climate characterized by networking, process management, mediation and participation.

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reviewed paper

Living Heritage Protection in China Urban Renewal Planning: A Case Study of Quanzhou West Street

Wen Luo, Yecheng Liu, Ying Jiang

(Research Fellow Luo Wen, Beijing Tstinghua Tongheng Urban Planning & Design Institute, Research Center for Historic and Cultural Cities of National Importance, Beijing, China, luona9706@126.com)
(Project Manager Liu Ye Cheng, Beijing Tstinghua Tongheng Urban Planning & Design Institute, Research Center for Historic and Cultural Cities of National Importance, Beijing, China, liuyecheng@thupdi.com)
(Project Manager Ying Jiang, Beijing Tstinghua Tongheng Urban Planning & Design Institute, Research Center for Historic and Cultural Cities of National Importance, Beijing, China, 82416948@qq.com)

1 ABSTRACT

Living Heritage which is delivering the city's character gene, also plays an important role in maintaining the vitality of the city. However, in the old towns of china, Living Heritage is always associated with aging population, bad infrastructure, complicity of property ownership and poor residents. The urban renewal planning in most cases of China was material-based planning, which focus on increasing the quality of infrastructure and local wealth. Living Heritage hasn't received enough attention in the process and it was gradually dying. As a result, renewed cities always have an obvious reduction of vitality, personality and humane.

The complicated situation in Quanzhou West Street is a microcosm of the old towns in China. A sociological research has already been conducted to evaluate the situation of Living Heritage there both qualitatively and quantitatively. With reference to several related cases, we offered a set of innovative strategy combinations to keep Living Heritage living in urban renewal.

2 LIVING HERITAGE: THEORY AND PRACTICE IN CHINA

2.1 Definition of Living Heritage

Living Heritage hasn't got a clear definition in academic circles. In some article, it means a heritage site which was still in use and matainning its initial function.[1] It's the opposite of the heritage sites which was dead or becoming an empty shell. But we consider Living Heritage a much more integrated concept. It is the embodiment of a variety of traditional culture in modern life, including both tangible and intangible culture heritage. And in most cases, the way of its existence is the intangible cultural heritage.

Early in the heritage protection area, people only pay attention to material heritage. In 1982, the initial concept of Living Heritage firstly appeared in the international charter.[2] Then in the declaration of San Antonio (1996)[3], heritage is divided into static heritage and Living Heritage,which definitely called attentions to the heritage that still in use and matainning its initial function.

By far, the concept of heritage conservation has been greatly expanded. Living Heritage and its similar concept like cultural heritage, intangible heritage often appears in modern heritage conservation concepts. However, Living Heritage still hasn't got a clear definition in academic circles. A well-known concept called 'intangible cultural heritage' is a typical Living Heritage, but they have diffrences.

According to the Convention for the Safeguarding of the Intangible Cultural Heritage (UNESCO 2003), the "intangible cultural heritage" means the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage.[4] In short, intangible cultural heritage is in the form of projects, while Living Heritage is in the form of cultures.

[1] For example, Miura, Keiko: Conservation of a "living heritage site" – a contradiction in terms? A case study of Angkor world heritage site in: Conservation and Management of Archaeological Sites, Vol. 7 Issue 1, pp. 3-18, 2006.
[2] Historic Gardens(The Florence charter 1981), adopted by ICOMOS in December 1982, cited from http:// www.international.icomos.org/charters/gardens_e.pdf
[3] Inter-American Symposium. The Declaration of San Antonio, adopted at the Inter-American Symposium on Authenticity in the Conservation and Management of the Cultural Heritage, March 27 - 30 1996, hold by The ICOMOS National Committees of the Americas
[4] Cited from http://portal.unesco.org/en/ev.php-URL_ID=17716&URL_DO=DO_TOPIC&URL_SECTION=201.html

In addition, Living Heritage is a much broader concept. It not only cares about the intangible cultural heritage with outstanding value, but also cares about the traditional culture, the traditional life style, the conventional wisdom which still alive in our lives.

2.2 Living Heritage conservation in China

As mentioned above, Living Heritage includs both tangible and intangible culture heritage. In China, The protection of cultural heritage is a very fashionable concept now. However in most cases it only refers to the tangible culture heritage and the intangible cultural heritage as projects.

The conservation of intangible cultural heritage began very early in China. In 2001, Kunqu was included in the "representative list of oral and intangible cultural heritage of humanity". From then on, there are 37 projects included in that list in total. Now China has built up a three-tiered conservation system, from national level to city level, to protect intangible cultural heritage. In 2011, the Law on Intangible Cultural Heritage Protection was put into effect.

Under the advocacy of the central authority, and government at all levels, the value of intangible cultural heritage was widely accepted by people. However, other intangible living heritages which haven't got enuogh good luck to be included in the three-tiered protection list was in danger.

Living Heritage often exist in symbiosis with the old town, delivering the city's character gene. It also plays an important role in maintaining the vitality of the city. However, in the old towns of china, Living Heritage is always associated with aging population, bad infrastructure, complicity of property ownership and poor residents.

2.3 Living Heritage Conservation in China urban renewal planning

Similar with the world, city planning in China has also born out of architecture. So city planning early in China was totally material-base planning which focus on buildings and municipal infrastructure. Now most of the new city plan are still material- base plan and that is enough in a way. However when things goes to urban renewal planning, there is not so simple.

Most Chinese old cities have a long history. All kinds of heritage could be seen here and there, some of which are still living. An urban renewal plan often has to be a conservation plan first to conserve heritages. In the world, approaches to heritage conservation have gone through three stages.[5] They are material-based approach, values-base approach and Living Heritage approach. Now urban renewal plan in China always contains a conservation plan using values-base approach. Under a value assessment, tangible and intangible cultural heritage which form the values are both involved in the conservation plan. However, they are extremely unequal. The intangible cultural heritage is the tangible heritage's supplement. The approach to conserve intangible heritage is material-based, focusing on conserving the place where intangible cultural heritage taken place. And in most cases, intangible heritage only means the projectized intangible cultural heritage, not all living heritages.

In short, China urban renewal planning in a whole is still a material-base plan. Intangible Living Heritage hasn't received enough attention in the process and it was gradually dying. As a result, renewed cities always have an obvious reduction of vitality, personality and humane.

3 QUANZHOU WEST STREET: CURRENT SITUATION AND PROBLEMS

3.1 A brief introduction on Quanzhou West Street

Quanzhou is one of the starting points of ancient maritime Silk Road. The old town's history can be traced back to the Tang Dynasty. However along with the development of modern city, the traditional landscape of the old city was almost disappeared. Now it's West Street area has become the only place where we could appreciate the city's traditional landscape.

West Street is the local culture core zone of the old town. A magnificent temple called Kaiyuan Temple is located in the middle of west street. Along the street is bustling with commercial shops, some of those are traditional clinics, snack shops, and shops selling goods for religious activities.

[5] Ioannis Poulios , (2014),"Discussing strategy in heritage conservation", Journal of Cultural Heritage Management and Sustainable Development, Vol. 4 Iss 1 pp. 16 - 34

Beautiful buildings are also a major feature of the West Street. Most of the buildings along the street are two layers stone houses, dotting with some beautiful western style buildings with a history of nearly one hundred years.

Fig. 1: A glimpse of Quanzhou West Street. The left photo was taken by Qilin Wu; the right photo was taken by Ning Jia

3.2 Living Heritage in West Street: a brief impression

The most notable feature of West Street is its Living Heritage. Due to a large number of aboriginal life, West Street has retained a large number of living heritages. Simply walking around the street, you will feel a strong traditional cultural atmosphere. What’s more, West Street is the living space of 10 intangible cultural heritage.

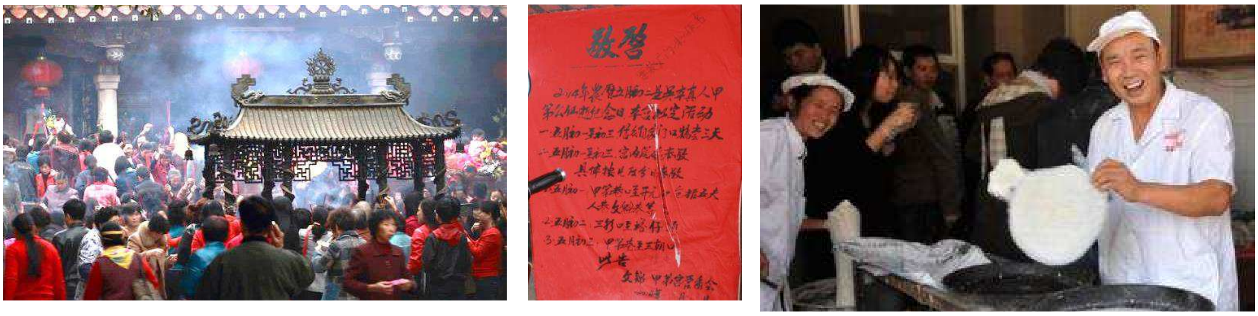

Fig. 2: Living Heritage in West Street. Photo in the middle was taken by Ning Jia; the other two were downloaded from internet.

Many famous people were born at West Street, as well as many overseas Chinese. Although no longer lived in the street, they still care about their hometown. They donated a large amount of money to repair the family ancestral temple, participated in the annual worship activities, becoming a powerful force in the continuation of living culture of the West Street.

Fig. 3: Bad infrastructure and chaotic traffic in West Street. Photos were taken by Ning Jia.

On the other hand, West Street is one of the poorest communities in Quanzhou. Aging population, bad infrastructure, complicity of property ownership seriously hindered the development of community. Young people are gradually moved away from the street, Living Heritage be threatened.

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How many living heritages are there in the street? How about their current situation? A sociological research has conducted to evaluate the situation of Living Heritage there both qualitatively and quantitatively.

3.3 Sociological research Part 1: participant observation and interview survey[6]

We conducted a participant observation and an interview survey to feel living heritages in West Street qualitatively.

In interview survey, we talked with different identities people such as indigenous people, cultural workers, monks, shops owners and so on, feeling the history, customs and even personal emotion of West Street. 30 households were chosen to conduct in-depth interviews for our further study.

In participant observation, we follow the aboriginal rhythm of life, paticipate the daily life in different times in a day, closely observe the aboriginal life, such as drinking tea, doing morning exercises, enjoying Nanyin, strolling through the market etc.

As a conclusion,we summarize twelve most prominent living heritages in the West Street.

3.3.1 Family Culture Heritage

Quanzhou is the core area of Minnan, which including southern Fujian and Taiwan. People in Quanzhou give great importance to the family. The living room is often dedicated to ancestral shrine. people worship their ancestors on traditional festivals. There are several ancestral halls on the street, where large family held grand sacrifice activities.

3.3.2 Religious Culture Heritage

There is a Buddhist temple, a Christ Church and many local belief temples in West Street. All the temples are still in use. Especially in the Kaiyuan Temple festivals, people from whole Quanzhou area will come to the West Street to participate in worship activities.

3.3.3 Pujing Culture Heritage

The West Street area was divided into a number of communities before, which were called Pujing system. Every community has a Pujing temple. The Pujing temples were once community centers. Now gods in Pujing temples were still community faith for the people.

3.3.4 Funeral Culture Heritage

Minnan people also give great importance to the funeral culture. The funeral is often held on the streets. The deceased relatives and friends composited a large funeral procession, even causing traffic jams.

3.3.5 Opera Culture Heritage

Previously, drama and ritual activities are inseparable. In front of the temple there was often a stage, where people dedicated drama to the god in traditional festivals. Nanyin, Liyuan Opera, Gaojia drama and Puppet show were the most popular dramas. Communities often have regular activities of dramatic interest group.

3.3.6 Food Culture Heritage

There are many traditional snack shop in West Street, some of which are famous throughout the country. Moist cake skin is a very popular special snack. A famous Food documentary also reported it. A lot of snacks on the street are also dedicated to the gods. But people could eat after the ceremony, which is thought to be lucky.

3.3.7 Dress Culture Heritage

On the street, women wearing flowers could often be seen. These women are residents from a village called Xunpu which is a fishing village. Their clothing is very unique. West Street residents' daily consumption of seafood are by their supplies. At the same time, their beautiful costumes are a decoration of the West Street.

[6] The social survey that was conducted in the research of the West Street was under the instruction of "Social Research Methods", Fang Yuan, (2014), Peking University Press.

3.3.8 Handicraft Culture Heritage

Some west street people are very skilled craftsmen. Even after retirement, many old people like making some handicrafts at home. Some are family inherited craft, even on the list of local intangible cultural heritage.

3.3.9 Wu Culture Heritage

Overseas Chinese have left people with the impression of martial arts master. Wu culture at West Street was used to be very active. As old people recalled once there were many martial art classrooms on the street. Many people liked to practice martial arts to keep their healthies.

3.3.10 Medical Culture Heritage

As Buddhism has the merciful doctrine, on the street espacially around the Kaiyuan temple there were many Chinese madicine clinics. Some medicinal herbs in the clinics have a long history, some even have myths and legends. However most of these traditional diagnosis has been mergers into the modern hospital.

3.3.11 The overseas Chinese Culture Heritage

Many people in the West Street have a history of overseas life, especilly the old people. This is also the reason why there are many western style buildings and a church on the street. But most of the western architecture's situation is very bad, for a lot of the owners of these western architectures had died. Their offspring also moved out long ago, leaving only the buildings on the street.

3.3.12 Architectural Culture Heritage

Buildings in West Street are very special. Their construction is very different from the modern buildings. Worse is there are rare old residents can recall the traditional method for building houses. It will be very troublesome when the old houses needed of repair. Unfortunately they really need now.

3.4 Sociological research Part 2: questionnaire investigation

On the basis of participant observation and interview survey, we designed the questionnaire to grasp the current situation of quantization. For there were about 2300 households in West Street, we made a total of 260 questionnaires, recovering 224 valid questionnaires.

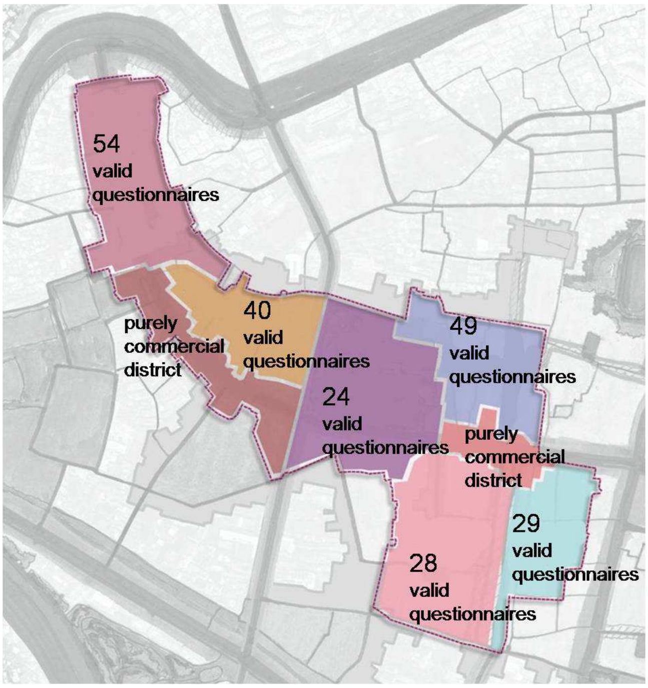

Fig. 3: Sampling distribution of the questionnaire survey in West Street

We used random sampling method. It is worth mentioning that in order to ensure uniform sampling, we divided the research area into eight smaller areas according to their slightly different characteristics. Among

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them, 2 areas are purely commercial district so that removed from our survey. In other 6 smaller areas, we extracted sample in the same proportion (10 %).

The statistical results of the questionnaire is not optimistic. Data shows that though Living Heritage in the West Street had a deep inside, they are rapidly disappearing in recent years. According to the result of the investigation observation, depth interviews and the questionnaire investigation, among the twelve living culture mentioned above, there are two on the verge of extinction(The overseas Chinese Culture/Wu Culture), seven Moderately active(Pujing Culture/Opera Culture/Food Culture/Dress Culture/Handicraft Culture/Medical Culture/Architectural Culture), only three still in the active state(Family Culture/Religious Culture/Funeral Culture).

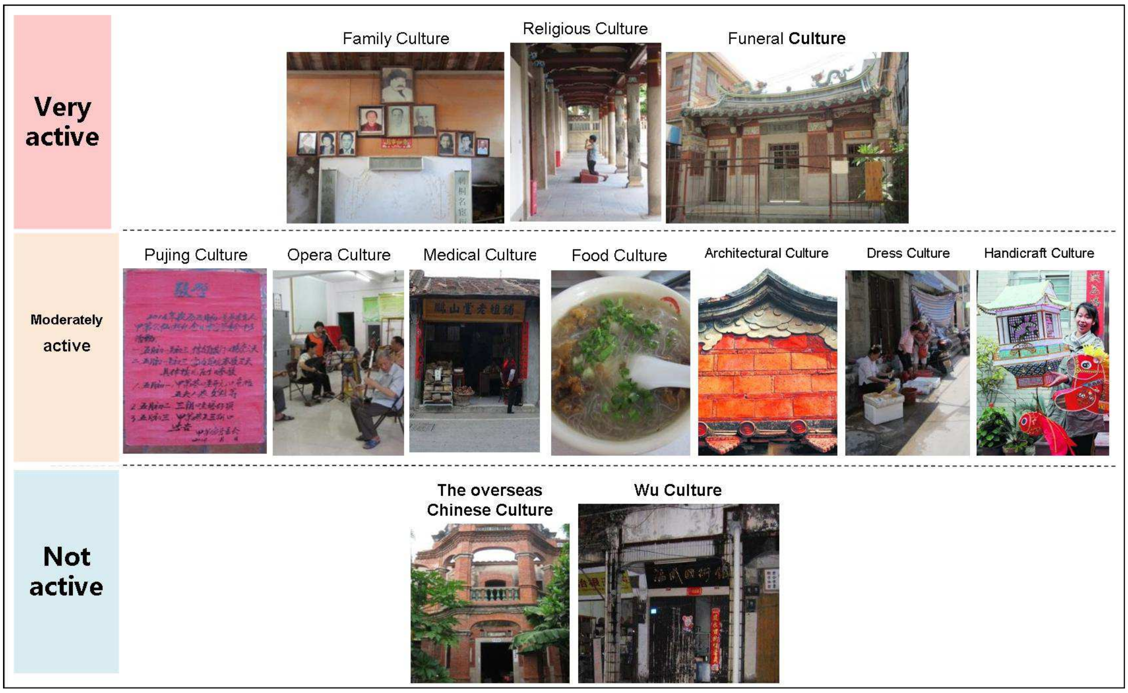

Fig. 4: Three categeris acordding to their present situation. All the photos except the “Handcraft Culture” one(which was downloaded from the internet) were taken by Wen Luo and Ning Jia during the survey.

Although we devided living heritages into three categeris and some of those we called “very active”, they are all in not optimistic situation in fact. For example, every family in Minnan before gave great importance to ancestor worship. But in our investigation, only 20.77% families still held the traditional ritual activities in their living rooms. However, the Family Culture Heritage is more active than the heritages those in the moderately active category and the not active category.

The lack of activity space and the loss of aboriginals are both important factors restricting the living state of cultural heritage. But in our observation, modernization is the most tricky factor threatening the Living Heritage. More than one of the respondents told us that there were no televisions before so local opera was the mian recreational activities. Our survey also shows that jogging and public square dancing become the main leisure activity instead of traditional cultural activities such as Nanquan. Young people lost their interests in traditional culture, some of them even couldn’t come into contact with traditional culture.

4 “4P” STRATEGY: KEEP LIVING HERITAGE LIVING IN URBAN RENEWAL

4.1 Living Heritage conservation: A group of composite strategies

According to our practical experience and case study, Living Heritage conservation needs a group of composite strategies, which we called the 4P Strategy.

4.1.1 <u>People</u>

The generation and continuation of Living Heritage are closely related with aboriginal life. Indigenous people is the soul of West Street. But because of the population growth and bad infrastructure, lots of indigenous people choose to move away from the West Street.

We propose to improve the infrastructure of West Street, meeting the equirements of modern life in the premise of not affecting the block style.

4.1.2 Place

Place is the material basis for Living Heritage's continuation. The disapperance of Living Heritage is often accompanied by the disapperance of specific place. For example, there were stages in front of the temples in West Street, where local opera was always performed. But with the development of the city, the stages was removed. People no longer have the place to perform and watch local opera, making the opera culture gradually disappear.

We propose to restore some of the traditional cultural space in the West Street, arrange some public activity space for Living Heritage, and establish several community history museums to remember the history of West Street.

4.1.3 Policy

In China, government has strong power. The policy has a significant effect on the future of a block. The urban renewal planning in most cases of China was material-based planning, without suggestions of management policy.

We propose to give a series of policy support to the conservation and development of Living Heritage in West Street. For example, give a rent relief and a tax relief to time-honored shops.

4.1.4 Presentation

Beijing Dashilan project is a good example of presentation. Through Beijing International Design Week which was held once a year, Dashilan community not only gained popularity at home and abroad, but also harvest the aboriginal self-confidence and sense of pride. The Beijing International Design Week which invited Chinese and foreign designers using the old house to do all kinds of design and display refreshed people's impression to the community. Designers' work in Dashilan told people that it was a filthy cell before but that's may only because people didn't really understand it. After the ingenious transformation of designers, the old houses has become much more convenient while keeping the poetic flavour of environment. Residents refound that their community is full of charm and potential. So they are more willing to study and inherit Living Heritage from their ancestors to keep their own characteristics.

We propose to host a series of demonstration activities and some game activities to mobilize the enthusiasm of the residents on studying and inheriting Living Heritage.

4.2 How to use the 4P Strategy: a specific example in Quanzhou West Street

In the Quanzhou West Street case, we conducted a participatory observation and in-depth interview to figure out how many living heritages there are in the street. And then, a questionnaire investigation was also conducted to evaluate their situation. After the social survey, we summarized twelve living heritages in West Street, and put them into three categories according to the current situation.

Every category of living heritage has different situation, so our 4P Strategy should also be flexible used according to the actual conditions.

For the very active living heritages, the most important thing is keeping the aboriginals. Quanzhou is the core area of Minnan, which including southern Fujian and Taiwan. In Minnan area, Family Culture, Religious Culture and Funeral Culture have very strong vitality. But they are privacies. So what we could do is listening to the needs of aboriginals, helping them improving the living conditions. Guarantee a certain number of indigenous people living in the neighborhood, you can ensure that the active degree of these three living heritages. In addition, make sure there are enough places for Living Heritage is also very important.

For the moderately active living heritages, Place and Policy are both key elements. In the social survey, we found that many previous activity places were disappeared in the process of modernization. To make matters worse, Nanyin, one of the most excellent Minnan drama, once encountered policy prohibited. People still have passions to inherit those living heritages if conditions completed.

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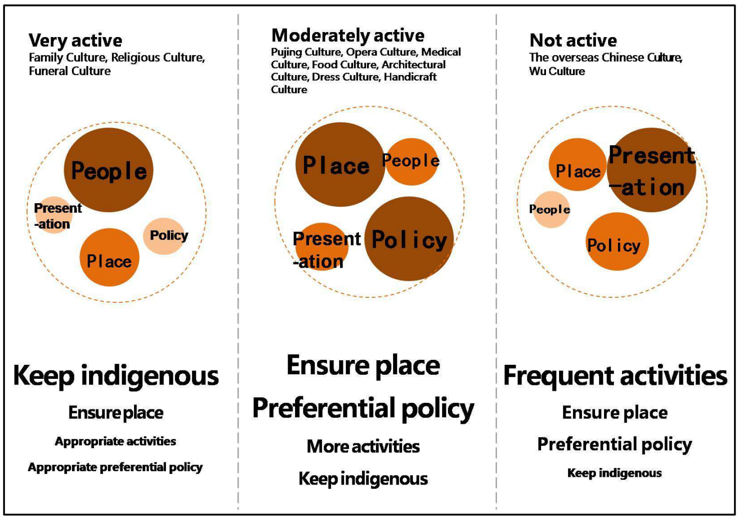

Fig. 5: Flexible 4P Strategy

Living heritages those not active are in a difficult situation. Though the development of the street and the overseas Chinese struggle are inseparable, there is no one can tell the history clearly and completely. Most overseas Chinese once promoted the modernization of West Street have already passed away or settled overseas, leaving a lot of mafnificent Weatern architectures and their offspring who hardly remember the overseas struggle history of their ancestors on the street. The suitation of Wu Culture is also bad. With the close of the last classroom for the martial arts, Wu Culture almost disappeared in West Street. So the Presentation of those living heritages is the most important. For exanple, we could collect the stories and articles on overseas Chinese to establish a regional museum, telling people the history of those beautiful building owners.

Specifically, acordding to the 4P Stragedy we should do things below in West Street:

4.2.1 People

The main method to keep the aboriginals is improving the infrastrcture which is a forte in most planning of the old city renewal in China. So here we do not discuss.

4.2.2 Place

(a) Reserve the existing space of Living Heritage, make sure the continuation of its function.

(b) Establish several community museums such as The Overseas Chinese Culture community museum, Pujing Culture community museum, and West Street Folk Culture community museum, exhibiting the history and traditional culture of the West Street.

(c) Establish community activity room for some of the living heritages such as Nanyin\ Nanquan.

(d) Restore the ancient stages for local oprea.

(e) Set aside a portion of space to the West Street old shop in the street reconstruction project.

4.2.3 Policy

(a) Give West Street old shops preferential policies or financial support, to ensure the stable operation.

(b) Give the old shops those have moved away from West Street rent concessions and policy support to attract them back.

(c) Encourage the industrialization development of the traditional handicraft, especially give the handicraft Intangible Cultural Heritage inheritance money and policy support.

(d) Give a certain policy support to the companies those with regional characteristics, attract settled.

4.2.4 Presentation

(a) Conduct further anthropology, folklore, sociology survey to the living heritages, establish archives, and record them with oral history and documentary.

(b) Organize the "East Asian Culture" exhibition once a year.

(c) Hold traditional folk festivals activities such as the Lantern Culture Festival, Mid Autumn Culture Festival to attract overseas and show the traditional culture of West Street.

(d) Organize theme activities such as medicine culture exhibition, characteristics of Taiwanese diet culture exhibition, Nanquan Wushu culture exhibition and so on.

(e) Regularly invite the puppet troupe, Gaojia troupe and other teams to perform in West Street, displaying the traditional artistic charm and creating a cultural atmosphere.

(f) Regularly organize citywide Nanyin, drama, Nanquan match, award winners, improve the enthusiasm of residents participation

(g) Carry out extracurricular activities of Nanyin, Nanquan in primary and secondary schools.

(h) Encourage other small-scale activities with the theme of Minnan culture.

5 CONCLUSION

Quanzhou West Street is a microcosm of the old towns in China. In this article, we summarized the experience from the experiment we conducted in Quanzhou West Street to conserve the living heritages. A sociological research was necessary as a basis, and we introduce a innovative strategy call 4P Strategy to protect the living heritages and solve the problems in China urban renewal practice. To protect the Living Heritage is a complex and meticulous work, we hope that the article can inspire.

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reviewed paper

Mobile Intelligent GIS Service for Vibrant Cities

Smirnova Oksana, Popovich Tatiana

(PhD, St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences (SPIIRAS), 39, 14 Linia VO, 199178, St. Petersburg, Russia, sov@oogis.ru)

(PhD student, St. Petersburg Institute for Informatics and Automation - Hi Tech Research and Development Office Ltd, 5, Galerny proezd, 199178, St. Petersburg, Russia, t.popovich@oogis.ru)

1 ABSTRACT

In this paper we would like to introduce a concept of mobile service for safe navigation through city waterways. The main technology for storing, exchanging and processing data for this project is cloud services platform. The service provides a set of essential options based on context decision making support system and geoinformation system such as: alternative route planning, calculating safe distances between vessels, suggesting evasion options to avoid collisions, supplying warning messages etc. The potential users of this service are professional and non professional sailors on various vessels navigating city waters. As a conclusion we present a case study of safe navigation through city waterways in Amsterdam, Netherlands.

2 INTRODUCTION

Main trend of any modern city is constant change. Different construction sites, restoration works are common sight for most citizens of megalopolis. Modern city can go through the course of various radical transitions in span of years. New blocks grow like mushrooms and old ones transform into vibrant social centers. Such changes lead to alterations in city's economic and social infrastructure. Considering that the term “vibrant city” lacs clear standard definition, we shall understand the term as a city undergoing an escalating economic and population growth. Such city requires resources to sustain and organize internal infrastructure and maintain the quality of life of its inhabitants without excessively wasting natural resources. Economic development and rising number of citizens result in a growing strain on transport infrastructure. Not many European cities can claim that their roads and traffic regulations were designed to sustain the number of vehicles currently owned and used by their citizens. Thus, alternative multi-purpose means of transportation are highly desired.

One of the progressive alternatives of transportation in the city is through waterways. Water transport may become full-fledged analogue of the common land transport. Vessels allow to considerably unload road traffic through the city and are more environmentally friendly. They can be utilizes as private means of transportation, public transport with fixed routes, for economic activities (shipping goods, amusement activities and etc.).

However, navigation through city waterways is not a trivial task. Any person deciding to sail through the city will need aid in navigating growing water traffic. In many large cities there is a high density of water cargo traffic. Nevertheless, associated infrastructure is underdeveloped (lac of gas stations, service stations, docks for personal vessels and etc.). In a large number of countries sailing a personal vessel requires applying for special licence.

Thus, the issue of this paper is to introduce a concept of mobile intelligent geographic information system (IGIS) application which provides means to safely navigate city waters and monitor city water situation. In part 2 of this paper we overview some works related to this concept. Part 3 describes architecture of discussed mobile IGIS application. Part 4 is a functionality overview and a case study of safe navigation in Amsterdam, Netherlands.

3 RELATED WORKS

The paper (Petit at al., 2006) introduces the principles of a multi-dimensional contextual approach for adaptive GIS applied to maritime navigation. The research presented in this work regards a contextual-based modelling approach that considers users, appliances and geographical data as the core elements of an adaptive GIS: the model identifies and characterises different elements of geographical context (user, data, process and region of interest).

Example of safe navigation system development based on GIS is given in paper (Goralski, Gold, 2007). This work pays attention the issue of navigation monitoring in vessel's location area and aspects of system functioning in real-time. It is also important to note that this paper is dedicated to the problem of shipborne system development. Integration of external intelligent navigation system with suggested solution is regarded as one of the novel directions of research.

The concept of integration GIS with maritime navigation system is described in paper (Ray at al., 2007). The concept presents a framework with several integrated modules: anti-collision function (monitoring risk of running aground and evasive ship behaviour), traffic analysis module, simulation capabilities, modules for educational and training purposes. The users' interaction with the proposed system is focused on the concept of adaptive GIS (GIS automatically adapts according to its context) which is all oriented on proposing GIS as a decision-aiding system.

In the paper (Lam at al., 2007) authors focus on the issue of integrating web-based Marine Information System (MIS), the data formats of various nautical chart and geographic information system (GIS) applications to provide conditions for safe maritime navigation, protection of onshore and offshore assets and infrastructure. This work describes advantages of combining this types of data and technologies to expand their capabilities and enhance efficiency.

Solutions listed above do not let us objectively estimate ad prognose developing water situation in the city region. In this paper we suggest new solution for mobile water navigation task based on intelligent geoinformation system (IGIS). Under the term intelligent GIS we understand geoinformation system that includes integrated tools and/or systems of artificial intelligence (AI) (Popovich, 2013).

4 MOBILE IGIS ARCHITECTURE

Mobile IGIS architecture can be divided into physical and logical. In logical architecture functional interaction between elements of mobile IGIS is depicted. Under physical architecture we understand a specific physical realization for system, which satisfies logical architecture.

In the base of mobile IGIS physical architecture lies virtualization technology. This technology is also called cloud computing. Under cloud computing we understand wide and convenient network access to computational resources (e.g. networks, servers, storing facilities, applications and services). The cloud provides software and hardware resources via the Internet. Unlike classical computational models, cloud model includes services, clients, managed content and virtual machines.

Under web-services we understand means of connecting services together. Service is a software that performs some computing functions.

Basic technical realization of mobile IGIS visualization system is represented by two-level structure. On the first level virtual machine cloud is situated, that provides technical resources of all program services. On the second level is a computational virtual cloud that provides access to developed services and software. Figure 1 represents work of mobile IGIS.

On the lower level physical servers are based, where virtual machines are launched. Managing of this virtual machines, computational resources distributing, providing new virtual machines under increasing utilization, hardware monitoring are executed through virtual machine manager (e.g. oVirt). Such solution allows to equally distribute computational resources, to prognose strain on hardware and promptly plan its replacement.

In the virtual machine cloud services' cloud is unfolded, including instances of applications that are executing users' inquiries processing. Several levels can be distinguished in services' cloud:

1 level – virtual servers processing users' inquiries;

2 level – developed application and services providing specified services;

3 level – clients' level, applications installed on clients' devices that allow to use provided services.

Application provides centralized customization of mobile devices and network access via cloud.

Thereby, cloud services are designed to support interaction between users of mobile IGIS working together towards solving common tasks. Unified application instance, launched on server, attends to number of users while solving tasks.

Application of cloud computing concept gives a set of advantages. First of all, independence from the platform: users can use any convenient mobile devices and operation systems for their work. Also, all necessary applications user receives after connecting to the cloud. Automatized scalability of the cloud is a convenient feature for expanding functional capabilities of mobile IGIS. In clouds all calculations are executed on local server and resources of users' devices are not consumed. Moreover, virtualization of calculations helps to shorten consumption of energy and associated expenditures.

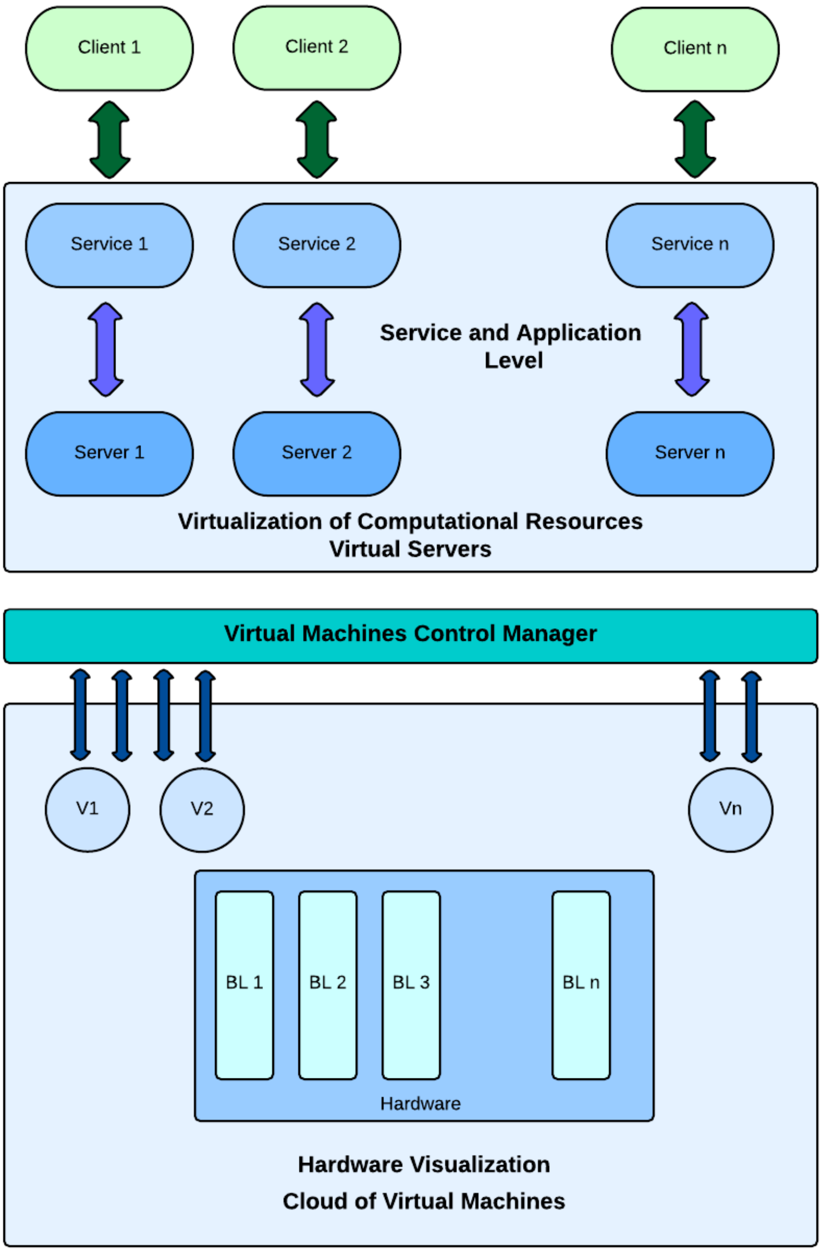

Fig. 1: Basic representation of virtualization system

Logical architecture of mobile IGIS is displayed in Figure 2. Logical architecture of mobile IGIS can be divided into 3 levels: framework services, user services and cloud services. Each of these levels contains different set of services that support functionality of the system as a whole. Cloud services are represented by a set of distributed servers, providing basic services for other units of the architecture. Cloud service level includes:

- modelling and mathematic models services – supports solution of special mathematical problems of mobile IGIS, such as maneuvering, calculation of vessels, route planning;
- external interaction server is intended for data exchange with exogenous systems and creates documents about current water situation;
- inference machine;

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- object server is assigned to support a unified object model of whole system. Main functions of the server are providing access to objects of subject area and operating them: adding objects to ontology of subject area, deleting objects, editing objects' properties;
- hydro-meteorological server provides automatic hydro-meteorological data receiving from different sources, storage and display of specific environmental parameters in given region;

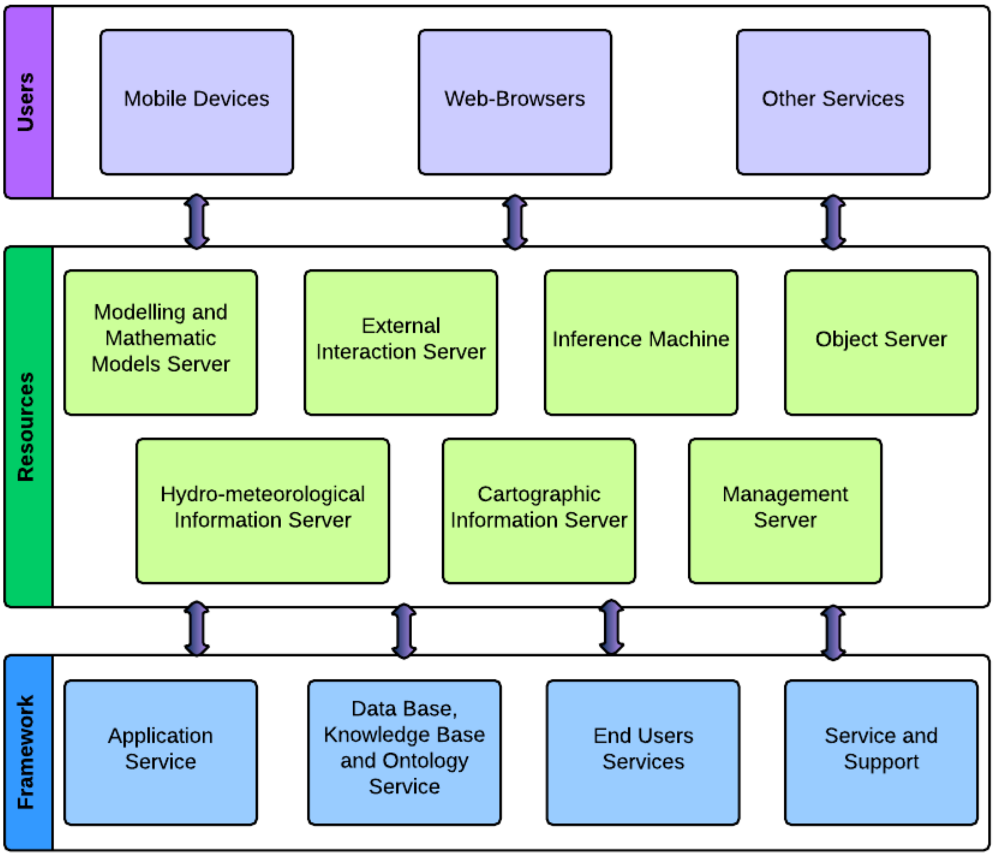

Fig. 2: Logical architecture of mobile IGIS

- cartographic information server realizes access to actual spatial data. Cartographic information server manages cartographic databases (data update, navigation, search and etc.) and batch transformation of cartographic data into given cartographic projection;
- management server supports distribution of resources, user access management, settings and operation control.

User services provide the necessary interface for connecting modules that implement required features and are installed on the mobile device. They provide access to cartographic, hydro-meteorological data, information about object's location and characteristics, and methods of mathematical modelling, allowing to solve maneuvering tasks and route planning tasks. Also, for experienced user special services are provided:

- creating and editing subject area (description of traffic infrastructure, description of city infrastructure) database (libraries, repositories);
- customization of special search engines.
- Framework services level includes the following services:
- application service;
- data base, knowledge base and ontology service;
- end users services;
- service and support.

Application service provides information and characteristics for organizing general work of applications in various layers (e.g. local network, global network).

Database is used for centralized storage, provision and selection of cartographic information. Knowledge base is designed to store techniques of solving tasks in given subject area. And ontology service represents a unified directory of data considering given subject area. Providing formulated data about concepts in knowledge domain and relations between them, it allows to sort data from exogenous sources as well.

5 CASE STUDY FOR SAFE NAVIGATION IN AMSTERDAM, NETHERLANDS

Suggested mobile IGIS allows users not only to determine their location based on GIS, GPS, AIS technologies, but to plot an optimal sailing route for their vessels, manage vessels' navigation, execute object search. Mobile GIS allows the user to solve following tasks.

5.1 Representation of main characteristics of sailing traffic participants

System's user can acquire information about water situation in any instant in any place in the world, according to data from AIS, radar, other users of mobile IGIS and other external sources of data. On the screen of mobile device main characteristics of the vessel are displayed: speed, course, vessel's category (passenger vessel, cargo vessel, yacht and etc.), and sailing route. Figure 3 demonstrates map on which the vessels' icons, it routes (blue line) and additional information are plotted.

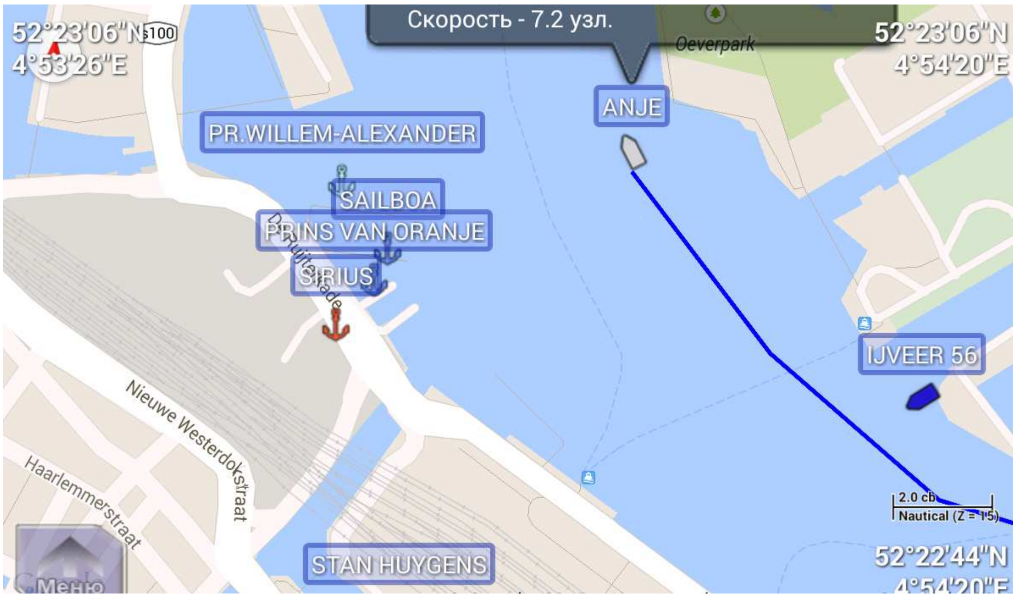

Fig. 3: Water traffic

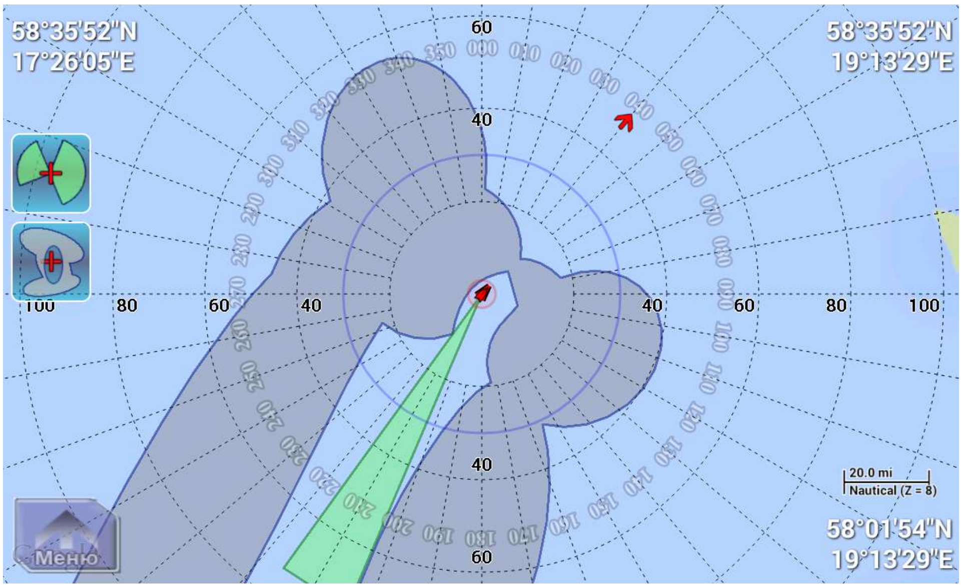

Fig. 4: Safe navigation on route

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5.2 Determination of vessels' sailing parameters

User is able to manually or automatically map sailing route's elements in the given city region, received from AIS and GPS. On device's screen sectors of recommended courses and speeds are displayed, providing safe navigation on route (in Fig. 4 are painted green), and also sectors dangerous for sailing (in Fig. 4 are painted grey).

5.3 Route plotting for vessels

Mobile IGIS allows the user to plan routes in automatic mode. While planning route, data about sailing distance for each course, sailing time, docks, gas stations and etc. is filled beforehand (Table 1). Recommended in this area routes and waterways, navigation reference points, duration of sailing and pit stops can also be marked on map.

Start point	Distance, m	Coordinates
1. Start: Hotel Plutzer Amsterdam	0	52.372837, 4.884232
2. Rijksmuseum	1730	52.360036, 4.884832
3. Museum Van Loon	890	52.363155, 4.892621
4. Hermitage Amsterdam	950	52.365343, 4.903093
5. Museum Het Rembrandtuis	640	52.369195, 4.901183
6. De Oude Kerk	1360	52.374252, 4.898184
7. Bloemenmarkt	1190	52.366777, 4.891447
8. End: Hotel Plutzer Amsterdam	1150	52.372837, 4.884232

Table 1: Route planning

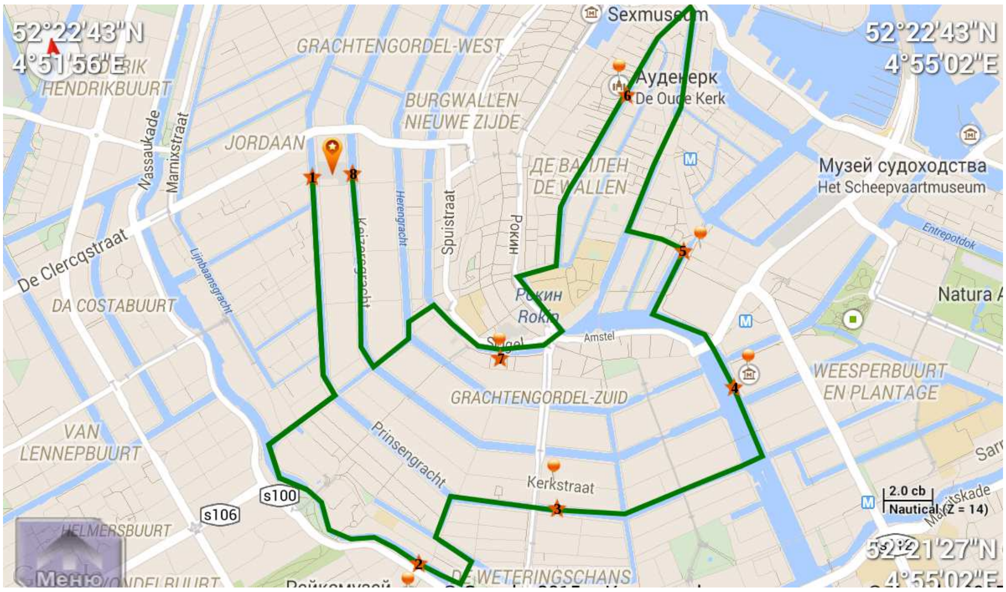

Fig. 5: Route planning

5.4 Representation and accounting of metadata

System provides display of actual and prognosed metadata (temperature, precipitations, atmospheric pressure) in given sailing region on electronic map.

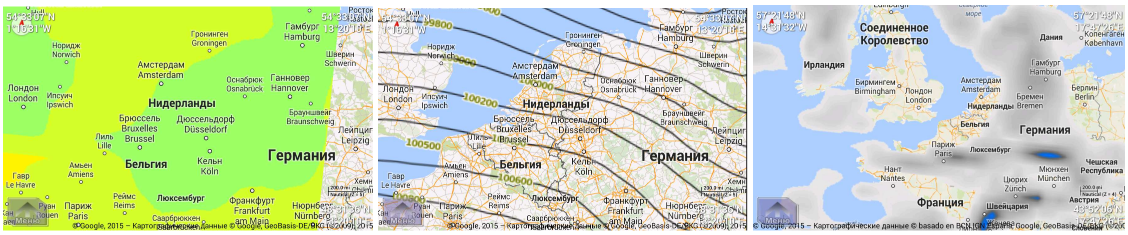

Fig. 6: Weather conditions

5.5 Notification about dangerous manoeuvres

While sailing in dangerous regions (sunken ships, dangerous climate conditions), shallow water regions or particular treatment regions (zones restricted for passenger vessels) system sends notifications to user.

6 CONCLUSION

At present, mobile GIS are one of the most perspective trends in development of geoinformation technologies. In this paper we have presented a concept of mobile intelligent geoinformation system oriented on providing means of safe navigation through city waterways. Usage of mobile IGIS will provide large city residents with opportunity to considerably simplify the process of navigating. Presented system allows to efficiently control water situation, plan sailing routes beforehand and safely navigate sailing city region.

In the future we plan to expand services and users' functions of mobile IGIS. We also plan to create an analogue of the application for small aviation and an application for disabled people.

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Multidimensional Analyses of Social Media Related Geographic Information: a Study Concerning the Urban Area of Cagliari (Sardinia, Italy)

Roberta Floris

(Roberta Floris, University of Cagliari DICAAR, roberta.floris@unica.it)

1 ABSTRACT

The widespread diffusion of tourism social media platforms is playing an increasingly important role as information source both for tourists, who gather reliable information supporting destinations' choice and services from peers, and for businesses, who can use the same information for improving their marketing strategies. The use of this type of information could also offer new opportunities for decision-support in tourism planning. By means of improved understanding of the travel motivations and by tailoring tourism service supply, decision making can be facilitated by emphasising the strengths of tourist destinations for past and potential visitors. However, information about tourists' perceptions and opinions is not always properly analysed by planners. User satisfaction depends on factors related to the location and the services quality that the local industry proposes. Moreover, its understanding may offer valuable knowledge in tourism planning at the regional and local levels.

The goal of the study of the paper is to propose an integrated approach to investigate, qualitatively and quantitatively, the relationships between tourists' satisfaction, geographic locations and tourist enterprises in supporting decision-making processes. The methodology implemented in the study includes data collection from Booking and TripAdvisor.com and their integration with authoritative territorial data. Spatial and statistical analysis techniques are applied in order to assess tourists' perceptions on success factors, which may be used as planning support tools. The case study concerns the municipality of Cagliari and demonstrates the value of social media-related data integrated by authoritative information in tourism planning. Finally, the paper proposes a critical discussion on the effectiveness of using the implemented integrated approach in order to address other planning issues. The discussion underlines the potential of the proposed approach in order to address other planning questions as well.

2 INTRODUCTION

This paper focuses on the tourism, analysing the relationships between demand, industry and location, identified as fundamental variables and it aims to understand if the use of the Social Media related Geographic Information (SMGI) may offer knowledge bases for decision making in tourism planning. The investigations are carried on exploring the potential of public volunteered comments, represented by tourists' preferences on destination and tourism supply, for providing useful knowledge about these inclinations in space and time.

For research purposes, a traditional method for collecting information about such preferences, performed via ad-hoc surveys, can be expensive and time consuming. For this reason an alternative approach is presented, by which tourist preferences are discovered by processing and analysing public available social media data. In addition, the investigation aims to demonstrate the opportunities of SMGI as support for design, analysis and decision making in tourism planning, and the consequent value to inform regional and local initiatives.

The adopted methodology deals with several questions related to tourist preferences:

(1) Which are the most popular destinations?

(2) Why people chose those destinations?

(3) What attracts tourists' attention and what do they appreciate or disregard?

(4) How this knowledge can be use in supporting tourism planning approaches?

This kind of study and the methodology adopted, which couple SMGI and A-GI from open SDI, may provide a novel kind of information, which may be integrated with the traditional knowledge, and successfully used in urban and regional planning as much as in tourist planning, for in both cases they contribute to take into account a multifaceted customers- (or citizens) –oriented view on strategic development issues. In addition, using SMGI may disclose opportunities for further analysis scenarios in urban and regional planning, and may offer useful suggestions for tourism planning strategies. In an integrated planning support framework, SMGI analytics might help to understand tourists' observations,

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preferences, interests, feelings, or needs, and possibly affect decision-making dynamics and planning processes with customer oriented strategies.

The method builds on a set of spatial analysis and statistics techniques, useful in describing and visualizing the spatial distribution and detecting patterns and hot-spots. In addition, textual analytics techniques (Campagna et al., 2013; Massa and Campagna, 2014) have been applied in order to discover the knowledge enclosed in the huge amount of qualitative social media comments. The findings could provide important insights into the Sardinia tourism industry, which could be used to develop innovative planning approaches. They could also offer a benchmark for future comparative trend analysis and directions for tourism policy design. After examining the past studies on the travel consumers' online social networks and the most popular web sites (Section 3), the paper focuses on the destination choices and judgments represented in numerical and linguistic terms (Section 4). In Section 5 the research methodology and the results of the case study, concerns the municipality of Cagliari, are summarized and briefly discussed. Section 6 concludes the paper discussing obtained findings and future research perspectives.

3 ESTINATION CHOICE, TOURISTS' PERCEPTION AND CURRENT DEVELOPMENTS IN TOURISM

Tourism is one of the largest industries all over the world and is based on multifaceted activities, which may generates both positive and negative impacts within the social, cultural and environmental domain. According to Smith (1991), as a complex activity, tourism comprises the travel to and around a destination, with the purpose of exploiting particular natural or no-natural attractions, accommodation and specialized and general services. These types of resource have been classified by Jafari (1982) into background tourism elements and facilities services. For this reason, tourism has commonly recognised both as spatial (Peroni, 2007; Cooper, 2008) and soil consumption (Boccagna, 2010) phenomenon. This fact becomes more evident when tourist activities are not adequately developed and planned. Using programmatic approaches and empathising the sense of place and identity, could help to develop more effective planning strategies for sustainable development based on tourism, in order to reach services quality goals, preserving the natural resources, the cultural heritage and life quality of the host communities (Briassoulis, 1992).

In the last decade, the fast evolution of ICTs enabled users to ubiquitous access a broad range of information services. The degree of interactivity, established by the Web 2.0 paradigm, enhanced the role of the Internet as information source, with a secondary role as opinion source (Grabner et al., 2012). Tourism is one of the sectors where the wide exploitation of ICTs leads to tourist online communities' development. Travel topics are among the most popular in on-line social networks (Buhalis and O'Connor, 2005; Baggio et al., 2008).

In the light of the above premises, this section focuses on three main topics: (1) the current developments in tourism planning and tourism destination, (2) the role and the support of customers' preferences in planning processes and (3) a review of the evolution of the e-Tourism phenomenon.

3.1 Destination choices and travel motivation

Determining the factors that influence tourists' choice for a destination is essential in developing appropriate marketing strategies and planning approaches in tourism field. Most studies of tourists' preferences address destination choices as the key element in the travel decision-making process. According to Dellaert et al. (1998) this element is combined with accommodation or activity choices. On the one hand, the investigation of decision-making processes, mostly conceptual in nature, focuses on the types of decision rules and the decision-making stages that are likely to be adopted by tourists. On the other hand, research in choice factors has been primarily addressed with empirical examinations of critical attributes, used by tourists as criteria for determining their travel alternatives (Crompton, 1979).

Knowledge of consumers' psychology is extremely important in determining the success of a destination (Rodriguez del Bosque and San Martin, 2008). The exploration of psychological concepts such as attitudes, decision-making processes, emotions, experience and satisfaction is necessary for understanding costumers choices and preferences in tourist destination. The destination consists of a well-defined geographical area, such as a country, a region or a city (Hall, 2000) that it can be referred to a product or a brand (Yoon and Uysal, 2005). Many studies on tourists' travel choice distinguish among various approaches to the definition of tourist destination. Van Raaij (1986) defined the travel destination as a product, which is partly given and partly man-made. The given part refers to the natural features of a destination, such as climate, landscapes, beaches, mountains and historic-culture buildings. The man-made part refers to physical features such as hotels, package tours, transportation facilities, sports and recreation facilities, which can be modified to satisfy customers' preferences and their budget. Ferreira (2011) claims that tourist destinations should be conceived as brands and they should be managed from a strategic point of view.

Travel motivation is a dynamic concept, that changes from one person to another and from one destination to another (Kuang Hsu et al., 2009). One of the most popular conceptual model for understanding travel motivation is the push and pull model by Crompton (1979). The push motivations are useful in order to explain the desire for travel while the pull motivations explain the actual choice of destination. Moreover, the Crompton model identifies seven socio-psychological (push) motivations (escape, self-exploration, relaxation, prestige, regression, kinship-enhancement, and social interaction) and two cultural (pull) motivations (novelty and education). Uysal and Jurowski (1994) further developed Crompton model and summarized internal (push) and external (pull) motivators to travel. Internal motivators include desire for escape, rest, relaxation, prestige, health and fitness, adventure, and social interaction. External motivators are based on attractiveness of the destination, including tangible resources (i.e. beaches, cultural attractions and recreational activities), and travellers' perceptions and expectations (novelty, benefit expectations, and marketing image). In more recent studies, researchers added shopping as a motivational factor in destination choices (Uysal and Jurowski 1994; Cooper, 2008).

3.2 Tourists' perceptions and preferences

Most studies of tourists' travel choices address tourist destination choice as the key element in travel decision-making. This process is influenced by a number of psychological (internal) and no psychological (external) variables, and consists of a number of different stages that are marked by specific actions (Uysal and Jurowski, 1994). Consumers' judgments basically depend on the strength of their beliefs or expectations about the quality of various features or attributes associated with services. Personal preferences, like motivations, may be both intrinsic, reflecting individual likes and dislikes, and extrinsic or socially conditioned (Crouch et al., 2004). The weight of an attributes is usually related to the relative importance that consumers confer to each attribute. This means that each opinion strictly depends on tourists' direct past experiences with other services of analogous nature. Tourists' decisions are complex and multi-faceted in which the choices for different elements are interconnected and evolve in a decision process over time (Kuang Hsu et al., 2009). In order to meet the target of tourists' expectations, hotels should provide an ample range of quality services, including reception, meals, room service, tennis courts, beach nearby location, swimming pools and gardens, among others.

But how can we define service quality? Service quality can be considered as a composite measure of various attributes. According to Dubè and Renaghan (1999) it consists not only of tangible attributes but also of intangible or subjective attributes such as safety or quietness, which are difficult to measure accurately and which are usually studied by linguistic information (Benitez et al., 2007). Lewis and Booms (1983) define service quality as a measure of how well the service matches customers' expectations. The quality perceived by consumers in a service is a function of the magnitude and direction of the gap between expected service and perceived service (Berry et al., 1990; Benitez et al., 2007). Judgments expressed by numbers are easy to interpret, but linguistic information is more difficult to measure through a mathematical function. Linguistic information characterizes subjective knowledge and is usually ignored by analysts when forming mathematical models that represent real world phenomena. However, attributes measuring service quality are characterized by uncertainty, subjectivity, imprecision and ambiguity (Benitez et al., 2007). When consumers make decisions, they usually employ this subjective knowledge and linguistic information.

Beside tourism marketing and planning, tourists are an important target audience for urban planning: in order to take into account tourists' preferences, planners must deeply study the phenomenon of tourism and attempt to understand and internalize tourists' needs and perceptions (Dickey, 2005). An accurate identification of customers' perception is the first step to maintaining the status of a city image as a popular travel destination.

3.3 Revolution in tourism: the role of Information and communication technologies

In the last decade, the diffusion of the Information and Communication Technologies (ICTs) have revolutionised the travel industry. As part of service sector, tourism has not surprisingly been associated with developments in new technologies and restored by organizational and structural innovations (Stamboulis and Skayannis, 2003). In the competitive scenario of tourism sector, any location or business aiming to do better than others, should become either a learning industry. Even more, emerging alternative tourism has to engage the element of culture, which improves in importance and has to be constantly transformed.

The e-Tourism advent reflects the digitalisation of all processes and value chains in the tourism, travel, hospitality and catering industries (Buhalis and Jun, 2003). It emerges as a term describing the entire range of applications of the ICTs on tourism and the implications for the tourism value chain (Buhalis and Deimezi, 2004). These changes are particularly evident in the way that tourism organisations communicate with their individual and institutional clients and how they manage their distribution function (Buhalis, 1998). These developments present a major opportunity for innovative tourism organisations and destinations, in order to improve their relative position in the international market (O'Connor, 1999). New sophisticated and demanding travellers require interacting with suppliers so as to satisfy their own specific needs (Buhalis, 2008). The reaction to online inquiries can thus influence customer satisfactions and booking behaviour. As a consequence, response behaviour becomes a crucial factor for the success of tourism enterprises (Pechlaner et al, 2002).

Finally, the Internet enables travellers to access to transparent and easy to compare information on destinations, holiday packages, travel, lodging and leisure services, as well as about their real time prices and availability. consumer generated content, through review portals such as TripAdvisor.com, multimedia sharing such as Panoramio.com, and blogs also create accessible content that increase the level of information available on a global basis (Buhalis and Jun 2003). These facts enhanced the role of the Internet as information source, with a secondary role as opinion source (Grabner et al., 2012). In addiction with developments in social media every piece of information, can be commented or rated in some way. Tourists could have ubiquitous access to a broad range of tourist services and also be the producers and broadcasters of information on destination-based social networks. These capabilities have disclosed innovative opportunities for tourists to become themselves users of travel social networks.

4 DEVELOPMENTS IN TOURISM SOCIAL MEDIA

In the age of Digital Information (DI), planning considerations highlight the need to use advanced tools to produce, gather and manage spatial information collected into new digital formats and available to support planning processes. Online Social Networking (SN) sites are the most popular sites on the Internet. The second generation of web-based services is characterized by having consumer-generated contents, which allow people to share information. This type of information, available on forums and reviews, is generated by users/consumers and provides relevant data for travel planning. Hence, after the early introduction of Geographic Information Systems (GIS), we are now facing a knowledge revolution in spatial planning, design and decision-making, for opportunities in knowledge building are unprecedented: not only Spatial data infrastructures (SDIs) give access to a wealth of Authoritative geographic information (A-GI), but also Volunteered GI (VGI) and Social Media related Geographic Information (SMGI) sources are growing exponentially at fast rates: integrating these sources together can substantially improve both our understanding of environmental and social ecosystems, and of people perceptions, insights, and needs. However, while A-GI entails more traditional representations and analytical models, VGI and SMGI for the impetuous modes of production feature Big Data (BD) nature.

In the light of the above premises, this section deals with the opportunities of SMGI as valuable support for analysis, design and decision-making in tourism planning practices at both local and regional level. Moreover, this section presents a brief overview of current available tourism platforms (oriented to data creation, dissemination and collection) and describes opportunities and weakness that still limit their integration into planning practices.

4.1 Social Media related Geographic Information

Social networks are online communities of people who share common interests and activities (Miguens et al, 2008). They provide a user with a collection of various interaction possibilities, ranging from a simple chat, to multiple video conferences, and from the exchange of plain email messages to the participation in blogs and discussion forums. Consumers have ubiquitous access to a broad range of information services and visit the Internet to look for information and communicate or simply spend time and shop (Buhalis 1998; Chung and Buhalis, 2008). Increasingly, it is evident that people meet online to express views, share information and often keep online blogs. The development of a shared knowledge base is the driving force of an online community. Social, economic and technological aspects are incorporated into the community (Fernback; 1999; Gleave, 2009). In addition with developments in social media every piece of information, can be commented or rated in some way. Social media employ mobile and web-based technologies to create highly interactive platforms via which individuals and communities share, co-create, discuss, and modify user-generated content (Kiezman, 2011). Social media also offer different ways for management, sharing and extraction of contents, provoking a degree of uncertainty for the knowledge processing. By contrast, with the traditional geographic information, SMGI regards users' perceptions on the Earth surface related to a specific period of time and requires advanced tools to support real-time monitoring, analysis and decision-making. SMGI platforms can be used both for leisure and for more professional purposes, ideally allowing for the integration and sharing of all the resulting information streams.

This information has been, and still is collected through effective data acquisition techniques such as global positioning systems (GPS), high-resolution remote sensing, location-aware services and surveys, and Internet-based volunteered geographic information (Guo and Mennis, 2009). In addition SMGI may be geocoded in different ways, using either the position of the author (if public), or the location of the post (i.e. recorded trough a GPS sensor of a mobile device if available), or through toponyms parsing in the text.

But the central challenge is how to manage a big amount of data and to find efficient methods to extract useful knowledge from spatial data sets of unprecedentedly large size and complexity. To address these challenges, spatial data mining and geographic knowledge discovery has emerged as an active research field, focusing on the development of theory, methodology, and practice for the extraction of useful information and knowledge from complex spatial databases (Andrienko and Andrienko, 1999;. Miller and Han, 2009; Guo and Mennis, 2009). Spatial data mining and geographic knowledge discovery is an iterative process that involves multiple steps, including data selection, cleaning, pre-processing, and transformation. These methods are exploratory in nature, more inductive than traditional statistical ones, including clustering, classification, association rule mining, information visualization, and visual analytics (Miller and Han, 2009). Their goal is to integrate and further develop methods in various fields for the analysis of large and complex spatial data.

TripAdvisor.com and Booking.com are among the most popular platforms of the latter kind. They play a significant role in the online tourism market. They can be considered as market-driven social media. While on the one hand, these platforms represent an important marketing channel through which destinations and tourism enterprises can reach and persuade potential visitors (Biassoulis, 2002), on the other hand they assist consumers in posting and sharing their travel-related comments. Travellers opinions and personal experiences based on reconstruction of their trips in turn serve as information to others.

When location also is available, all these type of information, as all information derived from forums, discussion blogs or social network, could be considered as VGI. In recent years the term VGI became popular to indicate the avalanche of information which every second is shared on the web by users acting as sensors (Goodchild, 2007). According to Sui and Goodchild (2011), more recently the convergence of GIS and social media granted by interoperability of geo-web tools is further enriching the possibility of sharing the knowledge not only about the Earth surface but also about all the biological, social and cultural phenomena there happening. In facts, as Campagna et al. argue (2013), VGI may include both geographic information collected by groups of people within crowdsourcing initiatives and geo-tagged multimedia collected for personal purposes by the Internet users and publicly shared through archives in the cloud. Social media information may be geocoded in different ways, using either the position of the author (if public), or the location of the post (i.e. recorded trough a gps sensor of a mobile device if available), or through toponyms parsing in the text. VGI has been proven useful in many application contexts such as emergency response, environmental monitoring and spatial planning (Poser and Dransch, 2010).

5 MULTIDIMENSIONAL ANALYSES OF TOURISM SOCIAL MEDIA INFORMATION

The methodological approach builds on a preliminary exploratory analysis of social networks contents of Sardinia searching for the most popular destination, the relationships between service quality and location and the spatial distribution of tourists' preferences at regional and local level. the purpose of this research is to use geographic information data, in particular both Authoritative Geographic Information (A-GI) and

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Social Media related Geographic Information (SMGI). Combined A-GI and SMGI data are used to express location, while service quality is investigated through the SMGI support.

The analysis framework is provided for two scale (regional and local levels) and two dimensions (services quality and locations) using both A-GI and SMGI.. First of all, analyses at the regional scale is implemented to describe spatial patterns of tourists' preferences and to identify locations of interest; the latter may include clusters of positive or negative preferences, or individual spots of interest. Afterwards, at the local level (i.e. within the single cluster or spot of interest) further analyses were developed aiming at understanding the possible reasons underneath the detected patterns and singularities, with the assumption that they may help in explaining success or failure factors with regards to destinations and services features. At the regional and the local levels, an investigation method is adopted, including descriptive spatial analysis and spatial statistics techniques coupled with explanatory SMGI analyses, encompassing Spatial-Temporal Textual analysis, which can be defined as the textual analysis constrained by space and time boundaries (STTx; Campagna, 2014).

Operationally, the study was carried on according to the following workflow:

(1) data collection and geocoding; data were extracted by Booking.com and TripAdvisor.com, geocoded and integrated in a geodatabase for analyses;

(2) regional preferences dynamics analysis; data were analysed for the entire region at the municipal unit of analysis with spatial analysis, spatial statistics, and STTx; in order to detect clusters and hot/cold-spots;

(3) local preferences dynamics analysis; data are integrated with authoritative information from the regional SDI and other official open data sources, in order to find explanatory hints on the tourist preferences dynamic and to get deeper insights on the relationships among these preferences, the local territorial features and the quality of the industry services in selected destinations;

(4) geographically weighted regression (GWR), to investigate how the detected patterns spatially changes within a particular place. This cartographic approach may hinder the exploration of spatial non-stationarity by inadequately illustrating the spatial distribution of the sign, magnitude, and significance of the influence of each explanatory variable on the dependent variable.

5.1 Data collection e geocoding

In the first step of the methodology, a database is created extracting data from TripAdvisor.com and Booking.com, in the period between May 2012 and May 2013. Through these applications customers can book, rank and review hotels and restaurants (or Tourism Services, TS). The focus of the portals is to filter contents based on rankings, which derived from other users' ratings. Thus, rankings are split into several categories, such as value/price, rooms, location, cleanliness and sleep quality. Available rating categories, however, are determined by the type of reviewed item. The reviews are enriched by the possibility to add multimedia elements or travel maps of previous trips or to take part in discussion forums. Thanks to the availability of the services location, they can thus be considered SMGI (Campagna, 2014).

The big issue is to manage this big amount of information. Thus, the study required the adoption of a mixed methods approach, in which quantitative information, concerns the score of tourist evaluation criteria, and qualitative information, includes customers textual descriptive review, were collected in a database for analyses. It should be noted that in TripAdvisor.com the rating scale consists of five ordinal values (or stars), ranging from 'terrible' to 'excellent'. A separate mandatory overall rating summarizes the total customer satisfaction. In Booking.com a rating scale consists of numerical integer ordinal values, ranging from 1 to 10 (i.e. the higher the better). Beside quantitative assessment, in both platforms, a text box record allows to qualitative natural language reviews. The title is a concise short text formulation of the assessment, while the comment is a long text field.

Geocoding is performed on the extracted addresses, exactly providing the place of tourism operators, in order to spatially analyse the location of the tourism business patterns in Sardinia. Point locations are found automatically for around 80% of the items and approximately 20% of the geocoding required manual editing.

As working set, a unified database of 992 records is used. The records provide TLS name, category, location, and related quantitative score, and include not only hotels, but also other types of accommodation such as resort, Bed and Breakfast or agritourism.

The analysis results revealed that the spatial distribution of the customers review on the TLS in Sardinia is divided into five main categories: agritourisms (6%), Bed and Breakfast (15.7%), hotels (42%), private accommodations (29%), residences and resorts (7.3%) of total numbers of operators). In addition three provinces have emerged as important tourist destinations in the tourists' perception: Olbia-Tempio (27,8%) Sassari (24%) and Cagliari (20,6%). Other four provinces (Nuoro 8,6%, Oristano 7,3%, Ogliastra 5%; Carbonia-Iglesias 4%) are well represented by tourism businesses; whilst the province of Medio Campidano is only represented by the 3% tourist enterprises. Finally analysis of the significance of tourist appreciation in the coast and in inner areas in Sardinia revealed that 92% of tourism reviews sample concerns TLS (917) in the coastal areas, while only less than 8% of popular tourism businesses are found inland. Nevertheless, Nuoro and Medio Campidano provinces together provide notable inland popular TLS with almost the 13% of the total number of reviewed tourism businesses. This may mean that tourists visit these areas to discover a less popular side of the island, which is characterised by its nature, cultural heritage and traditions. However, in terms of number of tourists, this kind of tourism still does not compete with massive preferences for tourism along the coastal area.

5.2 Regional preferences dynamics analysis

After the preliminary descriptive analyses of the preferences dataset, the second step of the methodology concerns the application of spatial analyses of tourist preferences, to explore spatial patterns of positive judgments at the regional level.

The application of spatial analytical techniques allows the exploration of the spatial dynamics of tourists' perception and their relationships with other territorial variables. For each TLS the database includes a score record, which is the average of six main attributes:

(1) location, which is related to the geographic position of the structure;

(2) services, referring to all transport facilities, shopping areas, bars and restaurants;

(3) price/quality ratio, referring to structure clearness, staff kindness and all type of comforts offered by the operators;

(4) staff (kindness);

(5) room cleanness (cleaning);

(6) comfort, referring to all facilities and services that hotels provide to their customers.

The attributes location and services explain the territorial features of the destination, while others express the perceived quality of the TLS supply. Thus the data model allows investigating the spatial patterns of preferences on territorial and tourism industry features at the local level across the whole region.

Figure 1 shows the distribution of the TPPI (left). The TPPI shows an overall high spatial concentration in the North-East of Sardinia. The Costa Smeralda district appears as the only area where the global tourism preferences fulfil overall tourists' expectations. Looking at individual municipalities, the analysis shows that Alghero exposes the highest TPPI rate. The other two municipalities with a high TPPI are Cagliari and Olbia.

The purpose of this map is to identify surfaces already affected by the phenomenon, but also potential development areas. It is notable that most of the municipality located into the coastal area attracted the attention of the participants, while the mostly inland area represents a cold spot. Is notable the presence of three major clusters representing the spatial distribution of the TPPI within Sardinia.

The first cluster is located into the Nurra district and includes Sassari, Stintino and Alghero municipalities. The presence of this cluster is probably due to the presence of Alghero, unique municipality which preserved Catalan tradition. The second cluster is placed in Cagliari metropolitan area. This is one of the Sardinia economy point, and due to its strategic location has become one of the most popular tourism destination.

Finally, the last cluster covers a large part of the Gallura district, which represents the ancient tourism area for the presence of the Costa Smeralda, which started to be recognised by the foreign market from the sixties thanks to Prince Aga Khan and his massive investment in this area. The Costa Smeralda has been aimed at an élite type of tourism; this should be the reason why international tourism starts to increase. Is notable the spatial continuity between the old tourism areas and the young one. In addition the map on the right shows the pattern of the negative judgments.

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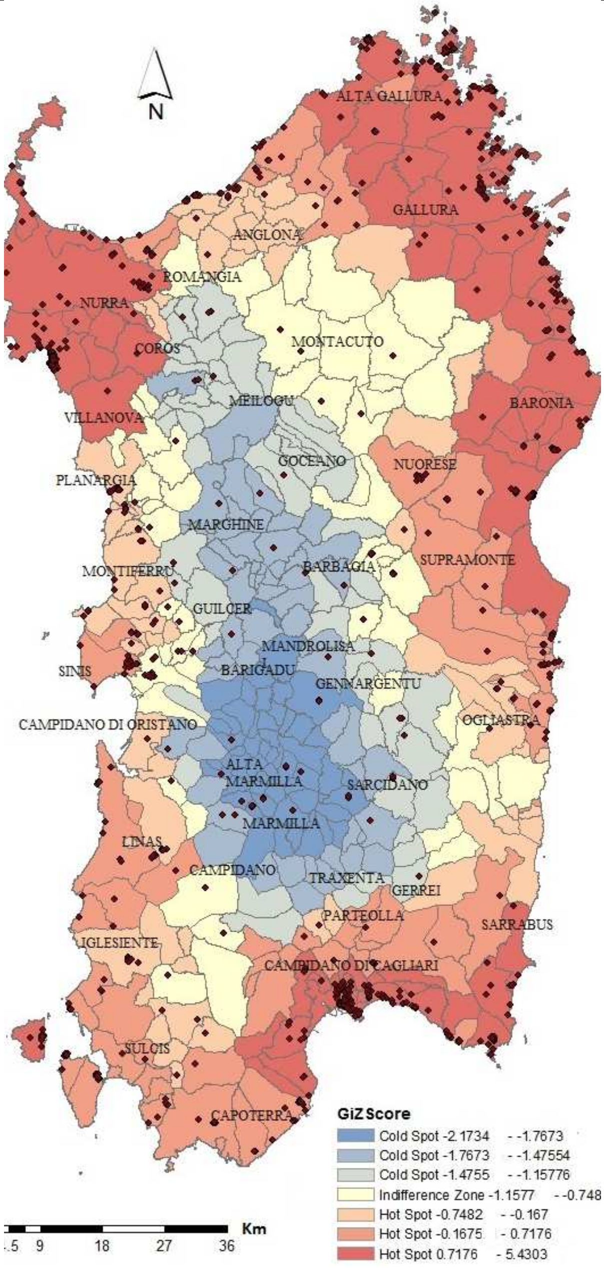


Figure 1 Cluster of positive tourist preferences (TPPI)

5.3 SMGI analytics at the local level:

After the analysis of tourism dynamics at the regional level, identifying clusters and spots of successful destinations through the preference patterns, the methodology adopted for this study has shifted to the local scale for further analyses aiming at finding explanatory answers for the phenomena under observation. The shift from the regional to the local scale is also conducted relying on spatial analysis and spatial statistics techniques on an integrated SMGI/A-GI data database. Thus, the following questions one should answer were:

(1) Why tourists' interest concentrates in this destination?

(2) What exactly in the destination does attract the tourists' attention?

(3) Why tourists chose those destinations?

The aim is twofold: on the one hand the study is performed to discover why tourists prefer some destination rather than other at the regional scale (qualitative analysis), while on the other hand to investigate quantitatively why tourists' preferences are located in these areas and what factors contribute to higher TPPI rate. As a case study for the sake of illustrating the methodology steps, the tourist destination of Cagliari have been chosen as the regional analyses demonstrated its highly successful performance. The SMGI analytics are intended to investigate the success factors within this destination in order to extract useful hints to be used for further planning in the same or other destinations.

Cagliari, the capital of Sardinia is located in the South of the region. It is nationally and internationally well connected thanks to the airport and the marina. Cagliari is the most important airport in the island in terms of traffic and size. In fact, it operates about 50% of Sardinia air traffic and can serve up to 4 million passengers per year (Benedetti et al., 2012). This destination has been recognized as one of the best-selling destination from different tourists' typologies. Thus, the following questions one should answer were Why tourists interest concentrates in Cagliari? and What exactly in the destination does attract the tourists attention? In order to answer these questions, summarising the review by neighbourhoods, the map in Figure 5 shows the spatial clusters of preferences:

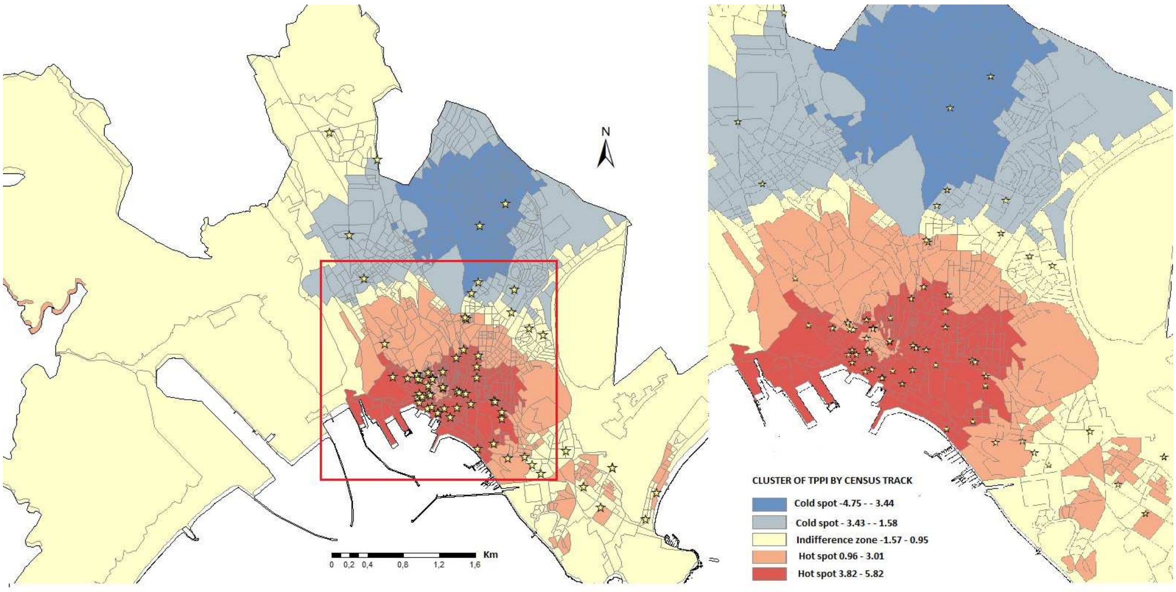


Figure 2 Significant patterns in Cagliari municipality

The location of each TLS could immediately allow detecting where the attention of the tourists who visited Cagliari has been focused on; thus, is possible to answer such question as what areas, places, or artefacts in the city attract the user attention. Spatial clusters of preferences are detected by hot-spot analysis. Firstly, a threshold distance of 1700 meters has been calculated and the spots by census track summarised: the map in Figure 2 shows the spatial distribution of TPPI: red areas, located in city centre, indicate surfaces affected by high concentration of TPPI phenomenon (hot spot), while blue areas represent locations where the phenomenon is less intense (cold spot). Not surprisingly the Cagliari city centre attracted the main attention of the tourists, while the mostly residential Pirri district represents a cold spot.

Category	WORDS [frequency]
Geographic location	location [1010]; town [476]
Services	staff [890]; restaurant [643]; room [459]; hotel [469]; pool [230]; food [180]
Accessibility	minutes [250]; habour [237]; proximity [164]; walking [146]
Natural and no natural components	city centre [426]; beach [378]; old city [132]

Table 1: Top 15 words related to Cagliari divided by category

The next step focuses on the reviews content in order to understand not only where but also what tourists think about Cagliari. Hundreds of textual reviews only located into detected spatial pattern have been investigated by STTx analysis. The possibility to analyse tourist preferences may help to investigate the move in general spatial interest pattern in order to detect possible useful hints to be used for further planning in terms of tourism development at local scale. Very interesting results have been obtained applying STTx to local subsets of data obtained by selecting high TPPI values by location. Here the tag cloud (Table 1) clearly shows the focus of the majority of the words in the posts refers to spatial or physical aspects of the city such as centre, city, location and church. The results includes keywords related both to leisure sites such as restaurants, shopping and dinner and services such as stuff and room. Additionally, outcomes indicate a high level of satisfaction with the places accessibility: words as minutes, proximity and walking could be related to the services' spatial location, natural resources or monuments. In this sense the capacity of tourists to effortlessly move from a place to another and to affect same areas of interest generate a positive tourist destination image. In addition different sectors within the local community could benefit by the presence of tourists to different degrees. Business sectors are more likely to hold favourable views of tourism because of the economic benefits that the industry is perceived to bring.

Nevertheless, local residents could have negative views, especially where their lives are affected by the noise, overcrowding and overuse of facilities. This is not the kind of information we usually find in land use planning documents, but his potential for support design and decision-making may be highly valuable.

5.4 Geographically weighten regression

Lastly, the study was also supported by the integration of SMGI with other A-GI describing topography, transport infrastructures, cultural heritage sites, and socio-economic feature. The spatial relationships and the explanatory factors behind observed spatial patterns were modeled using GWR (Fotheringham et al., 2003, p 9). The aim of the GWR is twofold: the analysis is performed to investigate quantitatively why visitors' preferences were located in Alghero rather than in other destinations, and to discover what factors contributed to the Cagliari high TPPI rate. The model is applied to a sample of 150 TLS spatially distributed over 100 of 1359 census tracts. The dependent variable is the score of the tourists' preferences (TPPI), normalized – e.g., fraction of local comments that are favorable.

For each census tract, a measure of the set of independent variables was calculated. Preliminary results and elaborations of statistical tests suggested excluding some explanatory variables from the model, because they are not statistically significant. The results of the statistical tests for measuring redundancy suggested including the following candidates variables normalised by total area of census tact:

(1) number of historical buildings;

(2) number of restaurants and facilities;

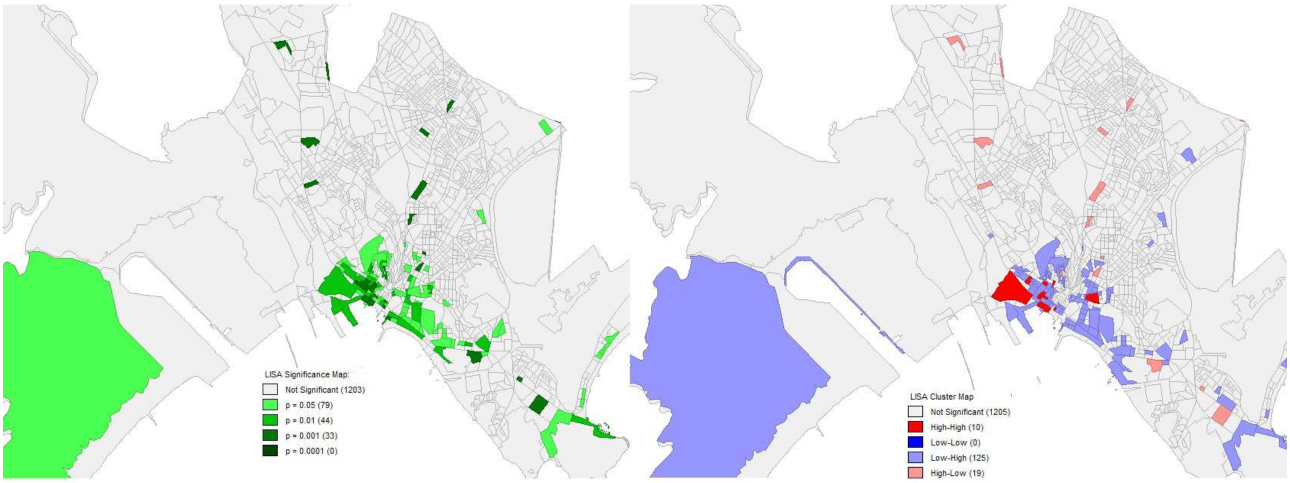
(3) hectares of natural protected areas;

(4) distance from the airport;

(5) proximity to the historical city center;

(6) distance from the most popular beach.

The assumption was that if the value of the normalised TPPI is similar to the values that it takes in the closest spatial units, the variable is characterized by spatial autocorrelation. This issue can be addressed by adding a spatially-lagged dependent variable to the set of covariates (Anselin 1988; 2003).

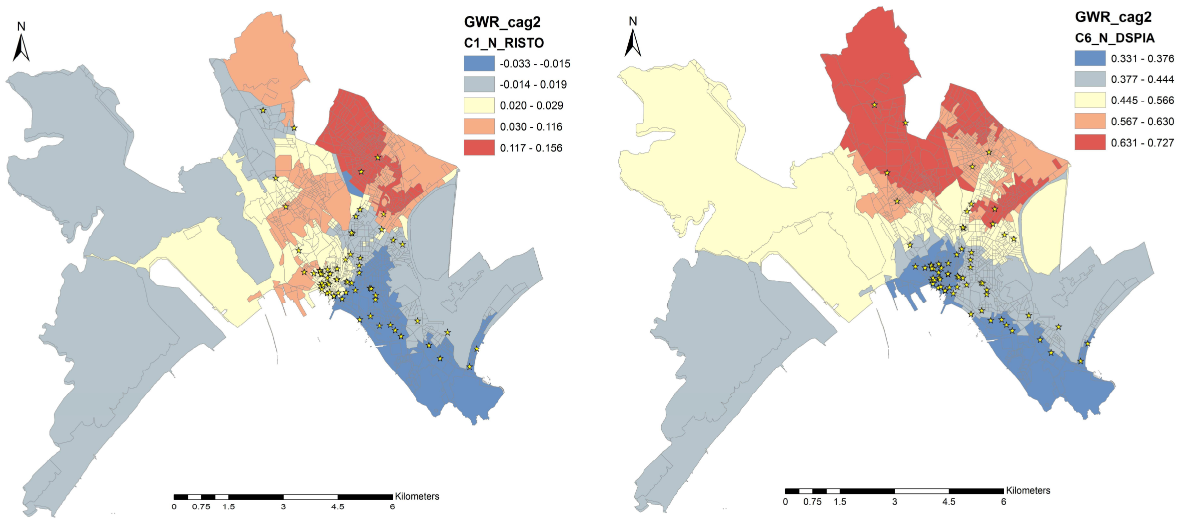


Variable	Coefficient	Std. Error	z-value	Probability
W_normalised_TPPI	0.0662904	0.0306595	2.162143	0.0306071
Constant	0.0030834	0.010238	0.301150	0.7632998
N_restaurants	-0.039035	0.0299971	-1.301316	0.1931503
Proxy_city_centre	0.4747516	0.0585060	8.114574	0.0000000
N_hist_buildings	-0.0273241	0.0313221	-0.872359	0.3830122
H_natural_areas	0.0027261	0.0096194	0.283397	0.0776872
Distance_aeroport	0.7660687	0.0339702	22.55116	0.0000000
Distance_beach	0.5470476	0.0382759	14.29221	0.0000000

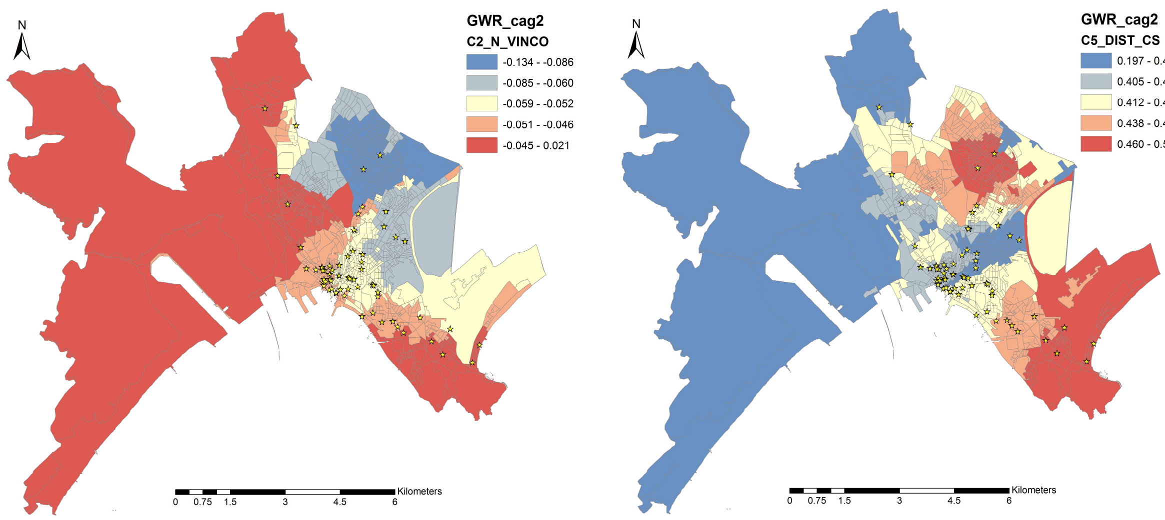
Table 2: Results of the GWR model: influence of each explanatory variable on dependent variable (tourist's preference)

The presence of spatial dependency on positive preference of census tract, which is the value of the normalised TPPI, is detected through the Moran's test. The result of the local Moran's Index is quite meaningful for the second order of queen contiguity in respect of results obtained using a 2500 meters spatial autocorrelation distance: adjusted R-squared is less than 40 percent, the coefficient of the dependent variable (p-value b) is less than 5 percent (0.000000010) and the value of Moran's Index is 0.024. The low p-value indicates that local spatial autocorrelation in dependent variable is much more than one would occur randomly. The output of a spatial lag model of autocorrelation is shown in Table 2. Thus, an analysis of spatial dependency and its significance has been developed through the LISA and results highlight homogeneous areas where spatial dependency is stronger and statistically significant. Thus, the regression with 6 indipendent variables is estimated using the tourists' preferences weight matrix

The results concerning the goodness of fit of the regression shown in Table x are significant: R-squared is very high, 0.856636, which indicates that variables in the model explain more than 85% of the variance of the positive tourists' preferences. The coefficients created to display the spatial patterns located in Cagliari show the relationship between the dependent variable and every explanatory variable (Table 2).



4.a GWR feature class output with rendered residuals of the variables number of restaurant (left) and distance from the beach (right)



4.b GWR feature class output with rendered residuals of the variables number of historical buildings (left) and proximity to the city centre (right)

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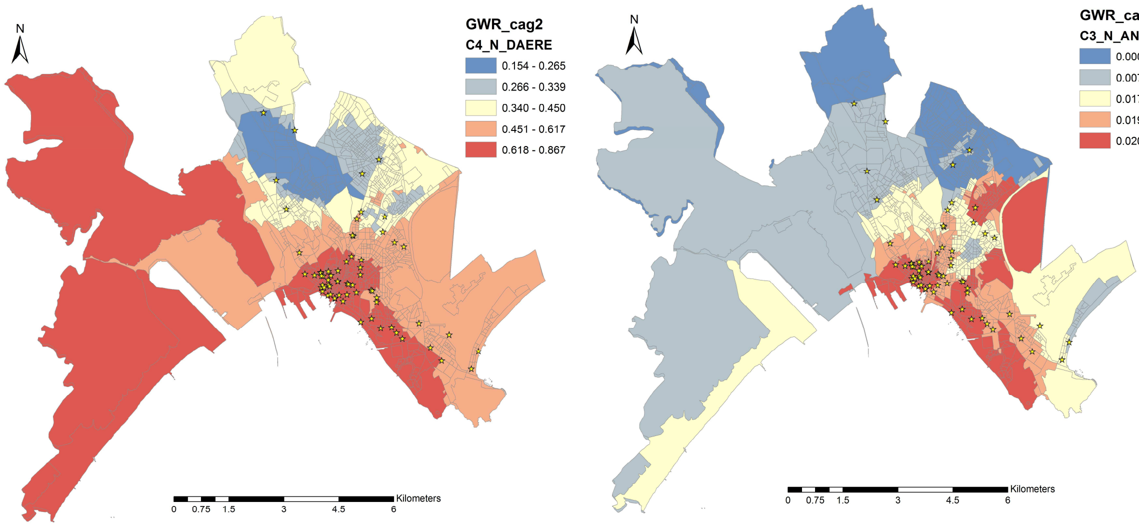

4.c GWR feature class output with rendered residuals of the variables distance to the airport (left) and hectares af natural protected areas (right)

Figure 4 GWR feature class output with rendered residuals of each variable

The outcomes of the regression model are quite significant for the description of the spatial distribution of tourists' preferences. The coefficients of the variables proximity to the city centre, distance to the airport and proximity to the beach, which are related to location, are almost always significant (p value less than 5 %) and show positive sign. The variables number of historical building and number of restaurants are not significant, for the p value is greater than 10 percent and the negative sign, while the variable hectares of natural protected areas, shows a significant coefficient (0.0027261) and a positive sign.

Overall, these findings suggest that the spatial interest of the participant is quantitatively influenced by the chosen explanatory variables. The selected variables give a more or less significant contribution to tourists' preference explanation through a coefficient. The inclusion of only intrinsic features in the function, allows saying that the values of the coefficients, related to the area, reflect positive effects of geographic position and facilities supply to the spatial patterns of tourist preferences.

6 CONCLUSION

The insights obtained through this novel and integrated approach offer interesting challenges towards the development of more specific analysis, concerning people spatial and thematic perception of places. Spatial analyses and techniques are provided to demonstrate how SMGI may be directly used and integrated with traditional authoritative spatial data layers in GIS environment.

Firstly, the results of analysis carried out by coupling SMGI and A-GI from open SDI show the potential in terms of provision of a novel kind of information which may add value to traditional planning knowledge bases so informing decision-making by community multifaceted. As a matter of facts, SMGI may disclose opportunities for further analysis scenarios in urban and regional planning, and may offer useful suggestions for sustainable development based on tourism strategies. In an integrated planning support framework, SMGI analytics might help to understand tourists' observations, preferences, interests, feelings, or needs, and possibly affect decision-making dynamics and urban and regional planning processes with customer oriented strategies. Moreover, the SMGI potentialities to generate useful knowledge for urban and regional planning, might foster citizens', or tourists in this specific case, dialogue about places and events giving the opportunity of being heard so further facilitating the integration of experiential and multifaceted information and professional knowledge. Thus, the knowledge of SMGI if competently addressed, might be used to support analysis, design and decision-making in tourism planning at differ scales, fostering public participation in processes about the current and future development of destinations.

Secondly, the study demonstrates the opportunities of SMGI as support for analysis in tourism planning. In this case both tourist preferences on destinations and tourism industry services were analysed from the spatial perspective through the review judgments collected by the social media platforms TripAdvisor and Booking.com. Results show which are the most popular destinations or areas and what tourists appreciate or disregard in Sardinia and then in Cagliari municipality. A set of spatial analysis and statistics techniques were used at different geographic scales (regional, local) to describe and visualise the spatial distribution of tourists' preferences and to detect patterns and hot-spots. The findings provide insights on the Sardinia tourism dynamics which should not be available through other data sources traditionally used in spatial or tourism planning.

Finally, considering users' preferences knowledge in supporting the tourism planning processes could represent a significant implication for future research works in the field of social sciences and tourism management. Indeed, the analysis of the Sardinian case study emphasises the importance of the stakeholders (users or tourists) within the inclusive processes. For instance, their behaviours can reinforce or discourage the existing power relations. As a result, the question concerns how tourists and the political and planning processes are linked. In other words, what the social implications of the tourists' behaviours over the planning or political processes are. In this field the thesis provides different implications for theories concerning the theme of participation and in relation to further studies in other research areas. Nevertheless, other considerations in users' perception, considering for example local communities perceptions, already demonstrate challenging and stimulating research opportunities which may eventually bring innovation to tourism planning, design and decision-making.

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On the Right Track? Evaluation as a Tool to Guide Spatial Transitions

Els Terryn, Luuk Boelens, Ann Pisman

(MSc. Els Terryn, Ghent University, Center for Mobility and Spatial Planning, Vrijdagmarkt 10/301, 9000 Gent, els.terryn@ugent.be)

(Prof. dr.ir. Luuk Boelens, Ghent University, Center for Mobility and Spatial Planning, Vrijdagmarkt 10/301, 9000 Gent, luuk.boelens@ugent.be)

(Prof. dr. ire Ann Pisman, Ghent University, Center for Mobility and Spatial Planning, Vrijdagmarkt 10/301, 9000 Gent, ann.pisman@ugent.be)

1 ABSTRACT

Spatial developments are becoming more and more non-linear, dynamic and complex with a wide range of possible actors. The awareness of uncertainty in spatial planning is growing and therefore, projects need to integrate a high level of flexibility. But at the same time, a growing demand for taking more informed and well-argued decisions is noticeable. Predictions out of the 'best estimated model' are no longer credible and no longer accepted, because they are too fragile and uncertain. How can we keep these long-lasting, multi-actor projects in permanent transition on the right track?

This article presents an evaluation methodology that goes beyond the traditional, rational evaluation attitudes with a low level of flexibility being too linear to match the current spatial developments. There is a need for more interrelated, alert and flexible means of evaluation, co-evolving with the processes and current dynamics in spatial planning. Therefore, different evaluation approaches are introduced, depending on the specific interdependencies of the object of evaluation and its context. Subsequently, the theoretical framework is translated towards a more practical level. A case study conducted in Flanders illustrates the current spatial developments and a possible evaluation approach, incorporated from the beginning of the process, to guide this kind of projects.

2 INTRODUCTION

Spatial planning is long ago described as "the best feasible mutual adaptation of space and society, such for the sake of society" (Van Veen, 1973). Therefore planners must try to understand what society wants, how it proceeds and in which way this could be embedded in space in the best reciprocal way. However neither society, nor space are fixed things. They develop, sometimes and ever more in unsuspected and even inscrutable ways, beyond the control of planners. Moreover, due to the ongoing network developments, its globalization ánd its localization by nature (Castells, 2011), there is not one society but several, which develop each in their own directions, with their own interests at different paces. Although each of these 'societies' influences each other reciprocally again, present developments become very much complex and their futures are hardly predictable anymore. There is a complex mutual dependency of actors and the capacity to achieve a consensus is increasingly being challenged by a growing and difficult to manage institutional and spatial complexity (Albrechts, 2006). Some even claim that non-linearity has become more regular than linearity; and therefore the unknown of the future is more present than the known (de Roo & Van Wezemael, 2012). This 'uncertainty in spatial planning' is described as "a perceived lack of knowledge, by an individual or group, that is relevant to the purpose or action being undertaken" (Abbott, 2005). Obvious examples of uncertainties are consequences of climate change, economic crisis, political changes, socio-cultural eruptions, warfare etc. But also less known examples occur, like the uncertainty about the predicted increase of land prices, food under or oversupply, housing market or oil prices (Rakers, van Blokland, & Topper, 2010). Although these uncertainties make spatial planning difficult, they have always been a subject (and a challenge) in spatial planning (Christensen, 1985). After all, if the gap between what is known and what needs to be known (Mack, 1971) would be reduced to zero, then there would be no need to make any major planning decisions, because the future would be clear (Abbott, 2005). Uncertainty is therefore an intrinsic part of spatial planning and a high level of flexibility is needed in spatial planning processes. The long-lasting planning trajectories need to stay flexible in order to keep up with the various spatial developments and multi-actor domain of stake- and shareholders in permanent transition.

Next to this awareness of uncertainty and the need for flexibility, planners are also experiencing a growing demand for taking transparent decisions for spatial transitions, well-argued ones, to create certainty for society (Dabinett & Richardson, 1999). These demands for a transparent ánd robust policy can be framed in a growing international call for results-based management (Van Ongevalle, Huyse, & Van Petegem, 2014).

The decisions taken by planners, should be robust across a range of futures (Walker, Rahman, & Cave, 2001). In this way, spatial planning is assumed to create greater predictability and certainty. For example, inhabitants still want to know for sure that their properties will not be flooded in the future, that they still can build on a housing plot in 15 years, … This challenge represents a need to create more robustness.

As such the current spatial planning has to deal with dual and somewhat oppositional demands. On the one hand, planners become increasingly aware of the changing contextual circumstances beyond their control, the ongoing complexity of society and the uncertainties this entails. On the other hand, however and somehow, decisions need to be taken for a long run (Hillier, 2008). One of the challenges in this context is keeping the current spatial developments (long-lasting, multi-actor projects in permanent transition) on track. Even the best model cannot predict the future behavior of spatial systems, because of the uncertainties that influence the system. So how to keep abreast of the reactions of the system on previous decisions and consequently make the system more robust? This expresses an important demand for a more integrated evaluation in spatial planning. In the remainder of this article, we will first investigate if it is possible to respond to this challenge with the existing evaluation approaches. Next, some conclusions will be drawn and be used as building blocks for an alternative approach. This approach will then be applied in a case study, followed by some suggestions for further research.

3 CURRENT APPROACH OF EVALUATION IN SPATIAL PLANNING

Planning evaluation has been an established field of research for a considerable number of years (Khakee, Hull, Miller, & Woltjer, 2008). Scriven (1991) has defined ‘evaluation’ as a scientific analysis and a process of a certain policy (or part of a policy) aimed at determining the merit, worth and value of the objects of evaluation, on the basis of certain criteria (effectiveness, efficiency, sustainability, etc.). The definition stresses the research-based link of evaluation and highlights the fact that evaluation provides a systematic and transparent assessment of an object (Pattyn, 2014). Leeuw and Furubo (2008) have added the idea that evaluation produces relevant knowledge, which helps us to make more sustainable decisions.

3.1 Regular approach of evaluation in spatial planning

In the regular, rational approach of spatial planning, practitioners attempt to manage uncertainty and eliminate or reduce ‘unruly’ conditions (Salet, Bertolini, & Giezen, 2012). They try to use more data, extended models, wider consultation or they even simply reject directions that threaten more unknowns (Abbott, 2005; Balducci, Boelens, Hillier, Nyseth, & Wilkinson, 2011). This classic approach of spatial planning matches with the regular approach of the policy cycle. In this policy cycle, evaluation is the fourth and last step of the cycle (figure 1). The cycle exists of problem definition and agenda setting in the first step (policy preparation), followed by policy formulation, policy implementation and finally policy evaluation in the last phase. At this point, evaluation mainly considers to what extent the original objectives were achieved. Moreover evaluation is used as a justification or allows, if necessary, adjusting the next policy cycle (Terryn & Boelens, 2013).

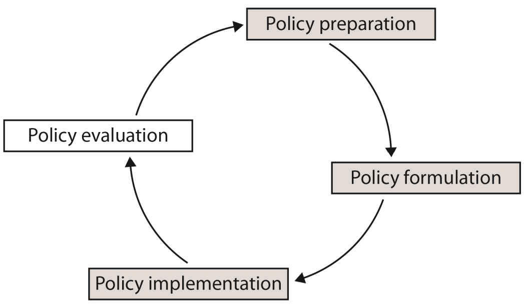

Fig.1: Regular approach of the policy cycle (based on: De Peuter et al., 2007)

This perspective on evaluation, with an important rational management focus on implementation, can also be detected in the traditional planning and evaluation literature. One of the first godfathers to write about a decision-centered view of planning was Andreas Faludi (1987). In addition and together with Ernest Alexander he elaborated this idea in a so-called ‘Policy-plan/Programme-implementation process (PPIP)’ (Alexander, 1985; Alexander & Faludi, 1989) in which they suggest a sequence of different polar evaluation questions connected to procedural planning. They characterized earlier approaches to implementation assessment as 'linear' or 'top-down', faulty assuming that policies or plans are complete at a given point in time (Alexander & Faludi, 1989). But at the same time, these authors still hold on to the traditional approach in which the delivery of the program (the implementation) became the focus of attention. Referring to Popper (1959), they argue that "evaluation is unworthy of the name unless there are criteria for the evaluator to recognize the 'good' and distinguish it from the 'bad'" (Alexander & Faludi, 1989, p. 131).

Although this evaluative approach constitutes a valuable part of the broader planning process, the alternative approach to planning evaluation of Talen (1996b, 1996a, 1997) has started as a reaction to amongst others Alexander & Faludi's view on planning and decision-making; they would make no attempt to monitor the actual implementation of plans (Talen, 1996a). If plans are formulated with the intent of being implemented, she advocates integrating an evaluative mechanism in the planning document to measure success: "Planners should invest more effort in formulating the methodology required for measuring success in the implementation of their plans" (Talen, 1996a, p. 90). In this respect she distinguishes four typologies, connected to the circular approach of planning and evaluation: (1) evaluation prior to plan implementation, (2) evaluation of the planning practice, (3) policy implementation analysis and finally (4) the evaluation of the implementation of plans. A decade later, Oliveira and Pinho (2010a) take Talen's framework as a point of departure to discuss the need to evaluate planning in a systematic way and to propose a cyclical methodology to evaluate planning and plan implementation. They presented the Plan-Process-Results (PPR) evaluation framework, which has the intention to be more comprehensive than the aforementioned ones, but it is still strongly influenced by the PPIP model.

In their turn and to systematically link plans to their outcomes, Laurian et al. (2004) suggest a conformance-based plan implementation evaluation (PIE) methodology. The methodology does not yet attempt to explain why policies are (not) implemented and is thus more a self-monitoring tool than an evaluation tool. This is the major difference with their later work in which the authors also examine performance as a conception of success in their Plan-Outcome Evaluation (POE) (Berke et al., 2006). POE was invented to provide an "innovative, robust, pragmatic and transferable evaluation approach" (Laurian et al., 2010, p. 754) to assess the effectiveness of plan policies, methods and regulations with a linear methodology in three consecutive steps to be conducted after implementation (ex post).

The danger of these approaches is an easy-going presumption of the causal connection between the policy and its outcomes. Various critiques were formulated on this subject (Sanderson, 2000; Stame, 2004; Virtanen & Uusikylä, 2004; Gerrits, 2011), which lead to more progressive approaches to conduct the evaluation in a more profound way.

3.2 Towards a more progressive approach, incorporating contextual factors

As a reaction to these evaluation approaches in more or less cyclic policy models, a slightly more progressive and integrative approach was introduced, which distinguishes the same four steps as in figure 1 but in a more integrative and relational way (figure 2) (De Peuter, De Smedt, & Bouckaert, 2007; Crabbé & Leroy, 2008).

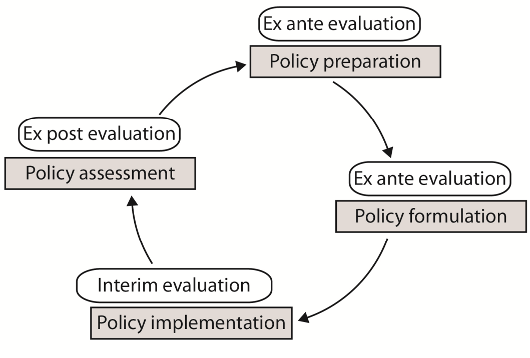

Fig. 2: Integration of evaluation in the different steps of the policy cycle (based on: De Peuter et al., 2007)

This approach integrates evaluation in each of the four phases of the cycle. For instance, during the policy preparation and policy formulation period, an ex ante evaluation can be conducted. A well-known example of this kind of evaluation in spatial planning is the environmental impact assessment, to evaluate positive or negative impacts that a proposed project may have on the environment. During the policy implementation, an interim evaluation can be executed. In comparison with the traditional management approach, the fourth phase (policy evaluation) is now named policy assessment, but it has the same content.

Although each of the previous methodologies contributed very much to the understanding of the inherent relation between planning decisions and evaluation, it proved to be difficult to take the evaluation further than the implementation assessment. As a reaction, Carmona and Sieh (2008) tried to identify a measurement framework through empirical research. They admitted that multiple measurement approaches will be required which will be different in each context, but a clear 'organizing framework' should provide a tool for learning and comparison. As a result they proposed an extra assessment to the previous frameworks: not only the planning initiative is evaluated, but also its organizational aspects. Performance should not only be measured by the planning product quality, but also by the functioning of the planning service itself (e.g. efficiency of decision-making, sensitivity to market and social contexts), and by the organization in which the planning service is inserted. As such, the evaluation should not be limited to the results of planning, but also include changes in the learning process and the organization of this process.

Based on this idea of Carmona and Sieh, Carneiro (2013) has even tried to apply this framework in a practical guidance for evaluation in marine spatial planning. He included the various models described above to develop a step-wise evaluation/learning framework. The framework consists of five steps. Like Carmona and Sieh (2008), the evaluation of the organizational performance (1) was based on the planning service quality and the organizational quality. The second step consisted of the evaluation of different criteria related to the plan-making process (e.g. participation, robustness, comprehensiveness of impact assessment methods) and the planning team (sources of funding). The next module (3) consisted of an analysis of the contents of the plan document in terms of internal coherence, relevance, conformance with the planning system and quality of communication, in reference to the POE-methodology of Laurian et al. Step 4 concerned the plan implementation, and was based on the PPR model (Oliveira & Pinho, 2010b), while the last step would be the evaluation of plan outcomes and impacts, variable from case to case. Carneiro (2013) stresses that a good evaluation has to incorporate all the evaluation steps in this order. But since marine spatial planning initiatives are very heterogeneous, a test of this evaluation framework in a real planning context has, to date, not yet been performed.

3.3 Limitations and opportunities of the existing evaluation approaches in planning

Although the more progressive policy and evaluation approach is more sophisticated than the first one, it still holds severe misfits; especially in reference to the present dynamic, complex and volatile society. In table 1 we give an overview of the main evaluation theories in the last three decades. From here major transformations in the approaches of evaluation can be detected and three in-between conclusions can be drawn from that.

Evaluation Framework	**Object of evaluation**	**Stakeholder involvement**	**Flexibility of the framework**
Policy-plan/Programme-implementation process (PPIP) Alexander & Faludi, 1989	implementation	planner	fixed framework
Alternative approach to planning evaluation Talen, 1996-1997	implementation	planner	fixed framework
Plan Implementation evaluation (PIE) Laurian et al, 2004	implementation	planner	fixed framework
Plan-outcome evaluation (POE) Laurian et al, 2010	implementation	planner and local experts	fixed framework
Plan-Process-Results (PPR) Oliveira & Pinho, 2010	implementation and process	planner and expert	a dynamic methodology, adjustable to planning context
Performance Measurement in Planning Carmona & Sieh, 2008	implementation and process	planner and stakeholders	framework with fixed and dynamic aspects
Evaluation framework for Marine Spatial Planning Carneiro, 2013	implementation and process	planner and stakeholders	fixed step-wise evaluation framework with dynamic content

Table 1: Overview of the major evaluation theories in planning in the last three decades

First, based on the object of evaluation, there is an evolution in the assessed frameworks from plan implementation to a more holistic view of evaluation in planning. A first group of authors (Alexander & Faludi, 1989; Talen, 1996b, 1996a, 1997; Laurian et al., 2004) focused on the implementation of planning, as a reaction to tried to the so-called 'New Plan Syndrome': "plans are continually redone or updated without regard to the implementation status of the originally prepared plan" (Calkins, 1979). The second group of evaluation frameworks broadened the object of evaluation to not only the implementation of the planning initiative, but also the planning process itself (Carmona & Sieh, 2008; Laurian et al., 2010; Oliveira & Pinho, 2010a, 2010b; Carneiro, 2013). Since planning processes become increasingly complex, this is an evolution that has to be taken into account. However, the evaluation and the planning processes still remain separate dimensions and none of the aforementioned scholars tries to really combine them. Mostly they are even executed by separate experts and/or entities. As such, the translation from the one to the other remains difficult and the evaluator does not always hold the thorough knowledge of the subject of evaluation or of the useful recommendations.

A second conclusion dilates upon the growing amount of actors involved in spatial projects. This trend is also noticeable in the evaluation frameworks: the more recent the frameworks, the more external stakeholders are involved in the evaluation and the execution of the evaluation. This means not that the evaluation is therefore more executed by external professionals, but that they are more and more seen as an important (f)actor in the evaluation. Even sometimes major actors are asked to define the evaluation criteria, because they are generally more aware of the critical aspects in the evaluation. This multi-actor aspect does make the evaluation itself more complex, since the group of actors in a spatial planning process evolves and their opinions and intentions are dynamic too.

The third conclusion concerns the flexibility of the framework towards its context. Most of the frameworks discussed above, apply a linear, fixed framework to evaluate, sometimes with feedback loops or a dynamic context. The evaluation moments are still put in a specific order and often executed on fixed moments. But almost no spatial developments follow this logic of linearity. "Processes run in parallel, overlap, short-cut each other or are left out"(Volkery & Ribeiro, 2009). These processes influence each other continuously and therefore also have a major impact on (the evaluation of) the whole. Each of the scholars mentioned before is increasingly aware of the contextual factors that should be able to influence the methodology, but only the last frameworks (Carmona & Sieh, 2008; Oliveira & Pinho, 2010a; Carneiro, 2013) have the intention to be more dynamic, adjustable to planning topic and context. That puts not only a continuous evaluation of all these planning parts on the agenda, but also a reciprocal interaction of all these evaluations.

4 A MATRIX OF MULTIPLE EVALUATION APPROACHES

All evaluation approaches described before result generally in holistic, generic frameworks with when not a linear, at least a circular logic, focused on several feedback-loops and assumed causal links in organization, planning-process and plan-performance. They discard the fact itself that evaluation is an inherent part of planning itself, that evaluation influences context, object and organization and therefore has to be analyzed actor-relational (Thrift, 1996; Murdoch, 2005; Boelens, 2009). Therefore here we will try to make that turn and will elaborate on how a planning evaluation would look like proceeding from a post-structural perspective.[1] One of the first ideas of such a post-structural perspective on planning evaluation is that – as mentioned before - spatial developments do not evolve linear, circular or causal. On the contrary, in our highly interdependent and volatile network society, spatial developments present themselves more and more in a non-linear, pragmatic and adaptive way (Belsey, 2002; Hillier, 2008; Teisman, van Buuren, & Gerrits, 2009; de Roo & Van Wezemael, 2012; Boelens & de Roo, 2014). The typical spatial developments display a high degree of complexity and heterogeneity, with a dynamic playing field (people involved in the situation), a dynamic topic and multiple perceptions of the situation. But in contrast, most common evaluation strategies expect a stable hypothesis to be under test (Taket & White, 1997).

The following matrix with multiple evaluation approaches takes into account the limitations and opportunities of the previous frameworks to develop several kinds of evaluation approaches in our highly fuzzy world of today. Therefore we distinguish between the object of evaluation (the problem, challenge or intention in question) and the context of evaluation (the settings, playing-field or agencies involved) in order to become more specific with regard to that ambition. The object of evaluation could be simple, regular, well known and path dependent, or highly open, new, innovative and insecure, possibly still moving in all kind of directions. At the same time the context of evaluation could be fixed, more or less static and certain, with a

[1] Further details on this post-structural perspective can be found in: Terryn E., Boelens L. & Pisman A., Beyond the divide. Evaluation in co-evolutionary spatial planning. (in review)

survey able, manageable number of actors involved, or highly dynamic and volatile, involving several, changing agents or agencies. Combining these two variables, it would need at least four kinds of evaluation approaches depending on the specific interdependencies of object and context: circular, adaptive, participatory or co-evolutionary (figure 3).

Object of evaluation	**Highly open, new, innovative**	Adaptive	Co-evolutionary
	Simple, regular, well known	Circular	Participative
		Fixed, static, certain	**Highly dynamic and volatile**
		Context of evaluation	

Fig. 3: Matrix of multiple evaluation approaches

The circular evaluation approach is situated in the bottom-left corner of the matrix. In fact it is suitable for relative simple planning questions, whereby the playing field or context is somewhat fixed with a relative robust number of stake- and shareholders, including more or less similar ambitions. The planning process seems to be manageable in a kind of linear development from intention to implementation. However, this kind of situations is increasingly less present in our network society. Therefore at the top-left corner of the matrix, we would like to introduce a so-called adaptive evaluation approach. It would be suitable for cases whereby at a given moment in time, the playing field, and (number of) agents and agencies would remain relative stable, although the object of planning could evolve highly volatile. The other way around is the bottom-right corner of the matrix. Here a participatory or collaborative approach is needed within situations when a relative fixed objective is put on the planning horizon, but within an increasingly dynamic and volatile playing field. This kind of evaluation takes the form of negotiations rather than the pursuit for an 'objective' effectivity measure.

Last but not least, we would like to introduce a co-evolutionary evaluation approach. We are convinced that such a planning and (therefore) evaluation approach is needed in cases where the object of planning, as well as the playing field of planning, has become highly open and dynamic. This is the case in situations where only highly abstract planning intentions could be formulated, which would induce various planning discourses, explorations and solutions in different and volatile settings, with a wide range of possible and altering agents and agencies (Boussauw & Boelens, 2016). In order to facilitate and partly influence that kind of resilience of undefined becoming, also a continuous evaluation of each step is needed to induce a kind of learning by doing and co-evolution towards (from the start) highly abstract ambitions of resilience and sustainability. Here the evaluation process becomes also an integrated part of the planning process itself, whereby the means, objects and focus points alter – or if possible co-evolve – with the changing objects and agencies themselves. Evaluation itself becomes a form of interactive discourse where those entirely involved can put in their values, problems and concerns (Khakee, 2003).

Generally speaking, evaluation is of course only possible when something or some progress is evaluated against common standards; otherwise we would not know which arguments are used to define specific developments evolving in the supposed 'right' or 'wrong' direction. Here we agree with Ernest Alexander and Andreas Faludi (1989). But in fact, those standards could also evolve and each of the evaluation approaches described above would induce their own standards too. Where circular evaluations would be driven by reviewing the performance of the original intentions, within the intended budget and in due time, adaptive evaluations would be more interested if the final solutions would meet the changing and possibly various interests; caring less about the original intentions, budget or time. In turn participatory evaluations would be more interested in reviewing if the volatile, dynamic and expanding playing field and interest groups would in the end be able to cooperate or collaborate to a certain end; and co-evolutionary approaches if planning itself would become more resilient, adapting itself continuously to changing situations, with ever changing agents and agencies within an ocean of all kinds of possibilities (Hillier, 2008). Evaluation itself would then become more specific, interdepending of specific objects and actor-network settings.

Since the intentions for a spatial project (the object of evaluation) and the actors involved (the context of evaluation) are very dynamic during the developments in each spatial planning project, multiple evaluation approaches are possible for each case. A very complex and dynamic spatial planning proposal –demanding a co-evolutionary evaluation approach at that moment- can for example evolve towards a really concrete project with a fixed playing-field. At that moment, the co-evolutionary approach is less suitable and can evolve towards a circular evaluation.

5 CASE STUDY: THE STATION ENVIRONMENT OF TURNHOUT

We have analyzed if and how we could apply this post-structural evaluation framework to several recent cases in Flanders. In these cases the planning process and the changes in this process have been analyzed. This is performed by desk research of the different reports and policy documents and complemented with interviews with policy makers on the different policy levels. Strategic spatial projects were selected, since these projects are complex, but representative for our current spatial context (Terryn & Pisman, 2013). The station environment in Turnhout (a city in the northeast of Belgium with a little more than 40.000 inhabitants) discussed here, is part the strategic project ‘Turnhout 2012’, of which the project coordination is funded partly by the Flemish government. This funding is provided for complex spatial projects with challenges beyond sectorial and institutional boundaries, which can be realized on the short or mid-term, forming an example of qualitative spatial planning (Vlaamse overheid, 2013). Turnhout received this funding four times (2006, 2007, 2010 and 2012). With this financial support, a team has been put together to coordinate a total of 10 project-parts, around the city of Turnhout. One of these projects was the redevelopment of the railway station and its wasted industrial environment, towards a dynamic living and working city area with economical functions. The redevelopment of this area consists of four parts (figure 4 – left): the construction of a new bicycle bridge over the canal, the development of the innovation park near the railway station, a housing area with a new park: Begijneveldekens and a new ring road: Noordboulevard. In the next paragraphs, parts of the innovation park-project and the new housing area Begijneveldekens with the ring road will be discussed in relation to the four evaluation approaches described above.

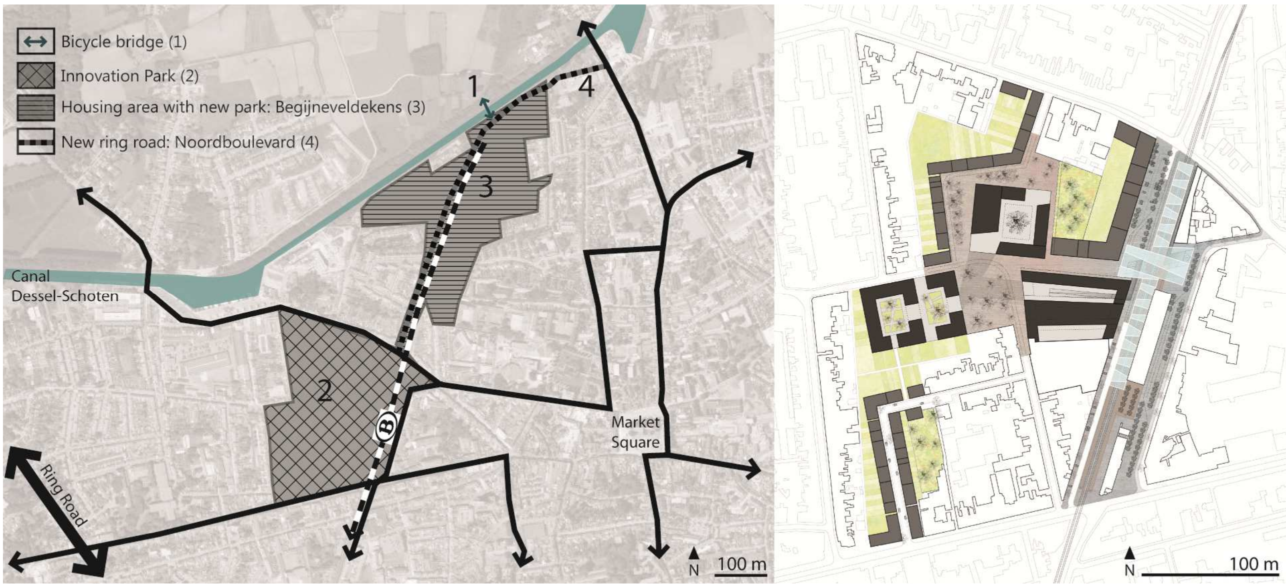

Fig. 4: Left: Projects in the station environment of Turnhout (Source: author), right: Masterplan for the Innovation Park (Source:TV B+B+B (2012))

5.1 Reconversion of the station environment

In a strategic plan for the city (2004), the main intention for this area was the reconversion of the (brownfield)sites towards ‘new economic activities for the new millennium’. What that should be exactly was very fuzzy. However, the intentions of the city government matched with the initiatives of the industrial companies to finish their activities over here. At the moment their initial economic activity stopped, one of the firms (Foresco) took the initiative for further clarification of the intentions with a first draft of possible future development by the architect’s firm M²-architecten. At that moment, Foresco planned to start the

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cooperation with a real estate developer, together with the city. This resulted in a very clear planning intention: a rather classical development of 500 housing units and office buildings in a railway area.

At this moment, a circular evaluation approach would have been the most suitable one, since the planning initiative was rather simple, well known, and the actors that would play an (important) role in the process were more or less defined. It could follow the simple classic process of ex-ante evaluation (Would the housing development, designed as such, be ready in time, and implemented within the available budget? With this kind of project, can we meet up with everyone's interest?), in-between evaluation (How is it going on, are there circumstances that would alter the original expectations, is there a need to go back to those?) and ex-post evaluation (Is the housing project realized according to initial intentions, within the intended budget and time and according to the interests of the private and the public actors?).

5.2 Innovation Park – Living and Care Lab

However, as a kind of ex-ante evaluation (although not mentioned as an evaluation), the city of Turnhout has decided at that time that a purely private initiative would not match with their idea to convert the project towards the 'new economic activities for the new millennium'. They wanted to keep a bit more control and after consulting a long list of possible partners, the city government decided in 2008 to go for 'Innovation in the social service sector' as a concept. They countersigned the 'Innovation Pact' (2009) with Thomas More Kempen (University college) and Janssen Pharmaceutics (Pharmaceutical Giant), a partnership agreement to build out the region towards a health-innovation-hub (Turnhout, Katholieke Hogeschool Kempen, & Janssen Pharmaceutica, 2009) and Idea consult (a consulting firm) made a study to refine the concept (IDEA consult, 2010). One of the intentions for example was to develop 15 of the planned houses as a part of a 'living and care lab' (LiCaLab), in which different companies could test new products in a real life situation. In 2013, a non-profit organization LiCaLab was established with the city of Turnhout, Thomas More Kempen, Cubigo (a spin-off company of Hasselt University that designed a software platform for the social service sector), Welzijnszorg Kempen (regional public welfare service) and SEL (network of social workers) as partners. Janssen Pharmaceutics retreated as a leading partner, but still has the intention to be involved as an executing partner as they still have two campuses nearby and try to focus on its embeddedness and environmental brand in the region. In the beginning of 2014, VITO (Flemish institute for technological research) was also involved in the project, to build out a transition trajectory towards a sustainable assisted-living campus. Amongst others, three workshops were organized to identify such a campus (as a care-proof environment), without being (just) a home for the elderly. At the end of 2014, the project received extra funding in a call for urban renewal projects. One of the conditions to receive this funding is the optimal quality follow up, for which B-architects is selected. To date, none of these conceptual ideas are yet translated to concrete realization.

The object of planning, as well as the playing field were and are still gaining in complexity. At the moment, both are still highly open and dynamic, without any clear point on the horizon, let alone leading actors involved. Therefore we position this project in the top-left corner of the co-evolutionary framework (figure 3); still highly fuzzy with regard to actors and intentions. Therefore we conclude that to keep this kind of projects on track and at the same time adaptable to the changing situations, a continuous evaluation is needed. In fact that kind of continuous evaluation needs to become part of the planning process itself as a learning-by-doing approach. For that reason, it is important to keep abreast with the evolution of the project, the different ways in which it is adapted and if these adaptations make the whole project more sensible and in the end more robust or resilient.

5.3 Innovation Park - Masterplan

This living and care lab is the concept for just one part of the area. The rest of the development is mainly regular housing and related functions. At the same moment the 'Innovation Pact' was subscribed (2009), the city of Turnhout worked together with the Flemish Government Architect Team to set up a call for a project definition and a vision for the masterplan. In November 2010, five candidates were selected to present their proposals and in April 2011 the joint venture Bureau B+B (urban planning and landscape architecture) and B-architects was picked out to design the masterplan (figure 4-right). In cooperation with the city, workshops with inhabitants were organized to specify the points of particular interest. The masterplan consists of 60.000m² housing, 8.000m² commercial activities, 34.000m² office space and 5.000m² public functions (TV

B+B+B, 2012). To date, this plan is translated into a building permit for one part (Niefhout), which is approved at the end of 2014. For the other parts of the masterplan, there are no concrete development proposals yet. The former industrial buildings are already demolished and there was an idea to implement temporary installations to increase the community involvement, but at this moment there is no further realization.

This phase of the project can be approached by a participative evaluation. The object of this second part of the masterplan seems to be fixed: realizing the different buildings, embedded in the urban setting as part of an overall masterplan to redevelop the area of the railway station. But the adjoining playing field or context of evaluation in this project has become fuzzy. It started with some private actors trying to develop their grounds in the area. Budgets were discussed, planning made. But as a result of the uplift of the separate projects to an integrative one it has become unclear, who will actually develop the houses and apartments. Consequently, the standards and process of evaluation should not (only) focus on the realization of the houses, clearance of the brownfield, and public space (goal attainment), but also more and more on if and how the different interests of the public and private actors could be matched and are able to evolve to a common goal on the planning horizon. Therefore, it is necessary to verify the various (whether or not explicitly declared) visions of the actors involved and induce an evaluation ex ante, in-between and ex-post if and how they could be included in the process, organization and a common discourse.

5.4 Begijneveldekens and Noordboulevard

The next case analysed is the project ‘Begijneveldekens and Noordboulevard’, which is also located in the station area of Turnhout. It concerns the realization of a housing project of 230 houses with an additional new green park (called Begijneveldekens) and a new ring road (Noordboulevard) next to it. This new ring road was planned to give access to the housing project and to form a bypass to relieve the inner-city centre from passing traffic. Due to political disagreements, the implementation of the plan for the whole area became under fierce discussion. Most of the actors did agree upon the housing project and the park, but the ring road became a moot point. Although the implementation plan was not approved formally, and although one formally stated that the implementation of the park was depending on the other parts of the plan, in the meantime the park is already in the final stage of realization.

Here we think that an adaptive evaluation strategy would be the most applicable (figure 3). Because if we would evaluate the project in a classic way, it would turn out negatively since the original intentions are not met: ring road as a conditio sine qua non for the housing project, which would also induce the implementation of the park. Nevertheless, the park is apparently already realized, without the need for a ring road and additional housing. Moreover the object of evaluation in this planning process is highly insecure, still movable in all kind of directions. Due to intense discussions between the political parties about the Noordboulevard, even a new political coalition had to be formed. To support the coalition, one party even demanded to drop the ring road out of the administrative agreement in favour of the realization of the park. Consequently, the realization of this part of the plan suddenly accelerated. The object of evaluation thus evolved from an integrated overall plan with housing, a ring road and a green zone to only the implementation of the park. The rest of the plan is still under discussion and therefore ‘highly open’. The playing field (context of evaluation) on the other hand remains relatively stable. Although there are discussions between the different actors, discourses change and stakeholders take up different roles during the process, the group of involved actors remains more or less the same. Consequently, the evaluation approach would also need to adapt itself to the changing discourses and intentions of the parties involved: would the final solutions meet the changing interests, and how could these changing objects be included in the course of evaluation itself, …next to the altered evaluation of the park itself.

6 CONCLUSION: MULTI-EVALUATION – A PLURALIST STRATEGY

In our fragmented, volatile, dynamic, and networked world, planning has become extremely complex. Heterogeneous actors and factors of importance influence each other reciprocally, making the future highly uncertain and a-linear. Past experiences are less and less any guarantee for the future. Moreover, instead of an objective or generic activity, planning is highly depending on context, while it dissipatedly influences that context too. Consequently, the act of the evaluation of planning has to adapt itself also to these changing, complex circumstances. This would not mean that we cannot say anything anymore about the evaluation act itself, or that it has become superficial. On the contrary, to our opinion it would mean that the evaluation act itself has to become more prominent and precise in what it evaluates, in which actor-relational context and therefore against which criteria, to evaluate anything sensible for future decisions.

The previous approaches towards evaluation, deducted from literature and empirical (case)research can be embedded in an academic discourse with a plea to combine different evaluation approaches (Guba & Lincoln, 1990; Sanderson, 2000; Barnes, Matka, & Sullivan, 2003; Stame, 2004; Van Der Meer & Edelenbos, 2006; Rogers, 2008; Patton, 2010; Bressers & Gerrits, 2013). This leads towards a proposition to use evaluation not only as a way to provide accountability of the current policy (a traditional performance-approach), but at the same time as a manner to start up learning processes (Stake, 1983; Guba & Lincoln, 1990; Cousins & Earl, 1992; Abma, 1996; Patton, 1996; Teisman & van der Meer, 2002). This can be linked with the dual vision for evaluation in a spatial context of Teisman and van der Meer (2002): a rational-analytical and a social-constructivist approach. In the rational-analytical approach, the assessment of the executed policy is the central point and the degree to which the executed policy leads towards the predefined objectives. The social-constructivist approach conceives the policy process as a dynamic one, in which the interaction of the actors is one of the main points. The focus is not on making an inventory of successes and failures, but on the achievement of improvement for the project (Edelenbos & van Buuren, 2005).

In our opinion, this dual vision for evaluation is needed as a reaction to the dual and somewhat oppositional demands for flexibility versus the need to create certainty for society and integrate more robustness in spatial planning. The first, rational-analytical approach can be reached by the traditional evaluation approaches described earlier. The social-constructivist evaluation method can consist of the matrix of different evaluation approaches, suggested in this article (figure 3). We have developed a post-structural diagram of object versus context of evaluation in order to distinguish at least four distinctive settings for planning, evaluation and their respective criteria. Moreover and at the same time, each of these settings induces a specific amalgamation of planning and evaluation: circular, adaptive, collaborative and co-evolutionary.

If evaluation should be regarded in this multi-planar, bilateral way, it would also provoke two distinct positions and roles for the spatial planer, public servants and/or politicians. The first is an elusive, detached external one, more formally standoffish and neutral from the subject of evaluation. This position stresses a supervisional role, orchestrating constitutional ordering, institutional legitimacy and the maintenance of the general credibility of the course taken. But while society itself has taken a fragmentary, complex, a-linear and highly unpredictable course, this position would be a humble one, in the background, only referring to basic, general items, facilitating and where possible escorting developments within the mutually agreed frameworks; just until these are challenged too.

The second position however is an inclusive, very much involved one; in which the planning action itself is part of the progress and tries to intermediate between the various evolving actors, factors and changing circumstances at hand. This kind of adaptive planning can only be effective informally, in specific cases and ambitions, whereby monitoring and evaluation procedures are incorporated at the beginning of the process and not simply added post hoc after implementation. In these positions - and instead of the usual principle of accountability and legitimacy -evaluation should be considered a learning principle, to fulfill a more active role than in the current planning approaches. That kind of learning-by-doing or learning-by-planning principle (Abbott, 2005), can then be described as a continuous evaluation, supporting the adjusting and re-adjusting to new planning circumstances. In these positions, evaluation becomes more than a feedback loop (Lee & Shabecoff, 1993; Walker et al., 2001), but a continuous adaptive learning tool and planning and evaluation become increasingly interdependent.

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Online Territorial Consultation Tool

Anneloes van Noordt, Sophie De Mulder

(MSc Anneloes van Noordt, Spatial Development Department Flanders, Koning Albert II-laan 19, 1210 Brussel, Anneloes.vannoordt@rwo.vlaanderen.be)
(MSc Sophie De Mulder, Spatial Development Department Flanders, Koning Albert II-laan 19, 1210 Brussel, Sophie.demulder@rwo.vlaanderen.be)

1 ABSTRACT

Spatial planning plays an important role in shaping places and cities in which people live and work. As planning affects the lives of people, it is obvious that people should be involved in the planning process. Based on a complex planning process in the Northern Fringe of Brussels, this paper discusses firstly the data exchange on projects between two Belgian regions: the Project Monitor. Within this initiative a visual overview is given on all the running projects in this cross-border area.

Secondly, it discusses the use and the results of an online public consultation tool. This online territorial consultation tool has been developed in order to let inhabitants and users of the Northern Fringe of Brussels express their opinion on the area. The goal of this initiative is to gather local (territorial) knowledge and to involve and get people enthusiastic about the TOP project. An online consultation has been started where people can indicate on a map which areas within the Northern Fringe of Brussels they like, and which ones they think need a little work. This paper will discuss the results of the online consultation which has been open from the 6th of November 2014 until the 15th of January 2015.

Finally, it investigates how an interactive tool can enhance the collaboration between stakeholders.

2 INTRODUCTION

Brussels is the most metropolitan city in Belgium and its influence spreads out in both the Brussels Capital Region as well as in the Flemish region.[1] Issues for this metropolitan area are, among others, future demographic growth, resource efficiency, lack of resilient green infrastructures, congestion and enhancement of the economic development. Cooperation with different partners and stakeholders from different sectors, policy levels and across the regional borders of this area is key to tackling these challenges. Being one of the most dynamic spaces in the metropolitan area, the northern fringe of Brussels was identified as a crucial area and will also serve as a testcase for territorial principles that should be included within the spatial policy plan of the region of Flanders.

2.1 Territorial Development Programme

The Spatial Development Department Flanders has started a Territorial Development Program (TOP Northern Fringe) together with the BrusselsCapital Region, the Public Waste Agency of Flanders (OVAM) and the province of Vlaams Brabant focusing on this northern border of Brussels. TOP Northern Fringe is a collaborative approach to planning, with participation as core principle. It aims at a shared vision for the territory between stakeholders and at a shared plan of actions and projects for the territory for the short term and the long term. Stakeholders are co-producers of the TOP Northern Fringe programme, each organisation whether it is pulic, private or an individual person that has „something to gain or to lose“ is considered a stakeholder. In order to achieve this co-creation four workshops with a broad set of stakeholders have been organised.

The Nortnern Fringe is composed of (parts of) de municipalities of Brussels, Evere, Grimbergen, Machelen, Schaarbeek, Vilvoorde and Zaventem.

[1] Through constitutional reforms in the 1980’s, Belgium became a federal state consisting of three Regions (Flemish, Walloon and the Brussels-Capital Region, referring to the name of the territory they represent) and three Communities (Flemish, French and German speaking community, based on the language). Each Region and Community has certain competences. Spatial Planning is a competence for the Regions. “When the borders between the Regions were drawn, most of the urban area of Brussels was incorporated into the Brussels-Capital Region, surrounded by the region of Flanders, but not all. Its Northern Fringe, including Brussels National Airport, “spills over” into Flanders. Both parts of the Northern Fringe have seen diverging spatial policies since the 1980’s” (Vandaele, 2014).

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2.2 Outline of the paper

The first part of this paper will focus on planning, participation and crowdsourcing. It shows how participation can be utilised within a spatial planning process in order to enhance the proposed actions and create a broad support for the interventions. A further zoom will be done on the tool of crowdsourcing within a participative approach and the advantages it can have.

The second part will explain the concept of the Project Monitor: an initiative between the Brussels and the Flemish region to keep each other up to date about the different starting and running projects in the area of the Northern Fringe.

The third part will discuss the online public consultation tool. This tool uses crowdsourcing to acquire local knowledge about the Northern Fringe. It will discuss the setting up and the results of the consultation .

In the conclusion we will summarise the advantages and disadvantages of crowdsourcing and make a critical reflection on both the project monitor and the online public participation tool. Possible further developments for the future will be suggested.

3 PLANNING, PARTICIPATION AND CROWDSOURCING

The discipline of spatial planning plays a role in shaping the cities in which we live. But planning should obviously not only be focused on the built environment, as cities are complex systems in "which only some aspects express themselves in terms of physical buildings or locational arrangements" (Reeves, 2005: 51). As people live in the cities that planners modify or design, it is only natural that involvement of those people is required in the planning process. Moreover, the people who live in the city or the users of the city have a valuable specific knowledge of the place. This idea of public participation and involvement is not new. Arnstein identified in 1969 several degrees of citizen participation by introducing a "ladder" of citizen participation. This ladder shows that there can be more or less participation (Taylor, 1998: 89).

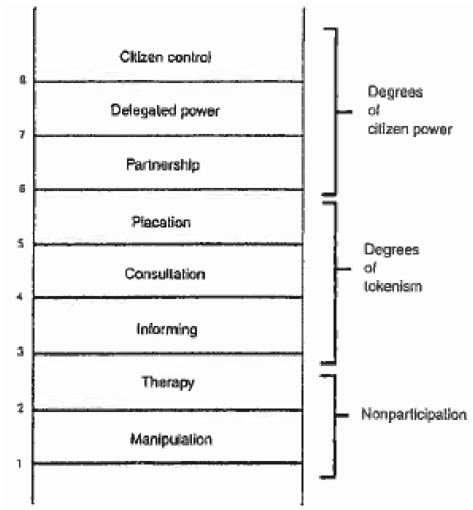

Fig. 1: Participation Ladder, according to Arnstein (1969) (Taylor, 1998: 89)

There are several approaches to planning such as economic, physical, public administration, etc..., but one approach has participation as a core principle and that is the collaborative planning approach (Reeves, 2005: 39 and 131). A collaborative planning approach aims at a relation of partnership with stakeholders from different fields. Collaborative planning "recognizes the need to make use of expertise from both professionals and communities of interest in order to identify key planning problems and appropriate solutions which are owned by everyone" (Reeves, 2005: 59).

An interesting web based phenomenon in the context of knowledge acquisition from the crowd and reliance on the problem solving abilities of the crowd is "crowdsourcing". There are several definitions for the word "crowdsourcing". Howe defines crowdsourcing as the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined network in the form of an open call (Howe, 2006). Zhao and Zhu recognize that crowdsourcing can facilitate the connectivity and collaboration of people, organizations, and societies: crowdsourcing is based on the concept that virtually everyone has a potential to plug valuable information and it seeks to mobilize competence and expertise (Zhao, Zhu, 2012).

Estellès-Arolas and González-Ladrón-de-Guevara analyzed several existing definitions and propose an exhaustive and consistent definition: “Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage that what the user has brought to the venture, whose form will depend on the type of activity undertaken” (Estellès-Arolas, González-Ladrón-de-Guevara, 2012). In short, the process of crowdsourcing is as follows: “the online release of the problem, the generation of alternative solutions by the crowd (participants), the evaluation of the proposed solutions, the selection of the best provided solution and the exploitation of the selected solution by the company or institution that initially posted the problem online” (Papadopoulou, Giaoutzi, 2014: 112). In the context of spatial planning, crowdsourcing introduces e-participation in the planning process and a great number of applications have been designed to serve different planning purposes (Papadopoulou, Giaoutzi, 2014: 115). For example, the impact of environmental characteristics on people’s affective responses can be studied by gathering affective responses (Klettner, Huang, et al., 2013) or psychological maps of inhabitants can be drawn and analysed (Quercia, Pesce, et al., 2013). In some cases the main purpose of the web application is the involvement of stakeholders and the concern is then to reach a consensus among stakeholders, by discussing, sharing content and knowledge and using maps. If the focus of the participation process is mainly on the communal use of maps and sharing knowledge through maps a special form of participation is used: it is called PGIS, or Participatory GIS. PGIS is a form of participatory spatial planning which makes use of maps and other geo-information output, especially using GIS (McCall & Dunn, 2012:82) In other cases, citizens may participate even during the design stage of a platform through which a web community can be created (Papadopoulou, Giaoutzi, 2014: 115). In short, for crowdsourcing in a planning context it is important to stress the important “role of maps as a means of communication amongst users and planners” (Papadopoulou, Giaoutzi, 2014: 116).

The project TOP Northern Fringe, that initiated the Project Monitor and the online territorial consultation tool, explores the possibilities of a collaborative planning approach. The TOP Northern Fringe project knows several degrees of participation, but it aims at a partnership with stakeholders. In the planning process, several design workshops are organized to bring the stakeholders from different fields (administration, private sector, owners, and organizations) together in order to elaborate a common vision and plan of actions for the territory. Interactive tools, such as the Project Monitor and the online territorial consultation tool are examples of crowdsourcing. The first objective of the Project Monitor is the exchange of information between stakeholders; the second is to find synergies between the projects. The online territorial consultation tool aims at collecting knowledge from the crowd. Ideas for further development are still being discussed and will be elaborated in the final part of this paper.

4 PROJECT MONITOR

4.1 Exchange of information between partners

A first step towards collaboration between stakeholders is no doubt the exchange of up to date information. Therefore, one of the actions within the TOP Northern Fringe project was to start a Project Monitor. The Northern Fringe is a complex and dynamic area where a huge amount of projects is ongoing or starting up with a multitude of involved actors. All these different projects have their own, sometimes contradictory, goals and their own, sometimes overlapping, territories. In order to streamline these projects and find possible synergies a cross-regional Project Monitor has been started. In this Monitor information on ongoing projects can be found. The major advantage of the Project Monitor is that it works on the basis of a map, so all the different projects can spatially be determined, while specific attributes on the projects can be associated. The final goal is to get a spatial overview of all the ongoing projects and the potential impact they have on each other. The necessary data is collected and distributed by both the Flemish region and the Brussels Capital Region for its respective territory.

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4.2 Making sense of a complex situation

While the total area of the Northern Fringe is not that large, a bewildering amount of, often overlapping, projects is taking place. In some cases, a masterplan comprehends several interrelated projects. In other cases, for one particular spot several projects can be identified, but they are developed independently. To add to the complexity of the Northern Fringe, many sites are obsolete and vacant –this is due to the industrial history of the area. In order to prepare these vacant and obsolete sites for redevelopment a brownfield agreement is established between the Flemish Government and the private sector. That is why the Project Monitor is not only a list of projects that are taking place in the area, but an interactive territorial tool in which the geographic component is crucial. In order to be able to make sense of all the different projects a good overview on a map is important. Moreover, the background information of all these different projects is made available by simply clicking on a location. A pop-up will then appear showing all the relevant data and providing a link, if available, to the website of that project. In the case of a complex group of projects overlapping each other in one place, like described above, a series of pop-ups will appear each describing one of the several projects taking place in that area. In order to be able to do this the initial descriptive project fiches have been transferred to a geodatabase.

The possibilities as described above are already available with standard GIS systems. But because not everyone has the knowhow or ability to work with GIS software a website is under development to provide a simple map component showing all the different ongoing projects. This will make sure that every stakeholder involved in the TOP Northern Fringe project will be able to get an overview of all the projects, but more importantly, the stakeholders will see for their own project whether or not there are overlapping or neighbouring projects that might give cause for synergies.

5 ONLINE PUBLIC CONSULTATION TOOL

There are several goals of the online public consultation tool. First of all, we want to gather the local territorial knowledge of the users (with ‘users’ we mean people who are born there, who grew up there, who live there, who work there or who go to school there) of this area. Secondly, we want to involve the local users and give them the opportunity to participate in the TOP Northern Fringe project. Finally, the consultation tool will be (literally) used to put the Northern Fringe of Brussels on the map and to start creating an identity for this area and a sense of ownership for the people who live there.

It is important to note here that the results of the online public consultation tool did not have the aim of being a representative overview of the opinion of all the people who use the Northern Fringe of Brussels. Most community initiatives have a very small and limited involvement that tends to be biased against poor people, members of ethnic minorities, women, old and young people and others facing particular discrimination (Croft and Beresford, 1992). Although through the communication campaign efforts were made to reach as many people as possible, participating in such an online consultation requires a certain amount of material facilities as wel as competences that no doubt exclude a certain part of the population. People need a computer and internet access, should be able to work with them and be able to locate specific sites on a map.

5.1 Preparation

The main question within the consultation was to indicate on a map a place that is liked by the respondent or a place that could be improved. Besides this main question several background questions were asked in order to categorise the respondents, like age and connection to the area. This questionnaire was deliberately as short as possible in order to engage as many people as possible without scaring them away with a too elaborate questionnaire. A communication campaign was started once the consultation tool was online. The direct stakeholders in the TOP project were asked through mail to campaign for the consultation tool, a news item was send to all the main newspapers in Belgium and to the regional news in the area and a Facebook campaign was also started specifically focussing on people who live or work in the Northern Fringe.

5.2 Consultation and geo-information

According to McCall & Dunn (2012), the online territorial consultation tool as used within the territorial development programme of the Northern Fringe belongs in the exploration phase of a spatial planning and management proces. In this exploration phase, spatial problems and conflicts are recorded, described and measured. The spatial bounderies and time bounds of these problems and conflicts are recorded by defining locations, but also by recording the spatial ranges of actors. Working with web-based GIS like google earth but also like the online territorial consultation tool facilitates the potential to interact effectively and cheaply with vast numbers of users (McCall & Dunn, 2012).

If we look more in detail to the different types of participation on the participation ladder (Arnstein, 1969, McCall, 2003) we can see that the online consultation tool can be situated between "information sharing" in which a two-way communication between insiders and outsiders is established and "consultation" in which locals can refine or prioritise external ideas. This last step on the ladder works with mapping local needs and priorities.

5.3 Results

A total of 2.500 website views resulted in 322 added places. A number of these places were however double posted (a result of the fact that posts were checked to refuse insulting posts) resulting in a total of 279 posts which will be analysed in the following section.

There is an almost equal division between places which are posted that are liked (139) and places that need improvement (140). Figure 2 gives an overview of the added places that were liked and the places that needed improvement.

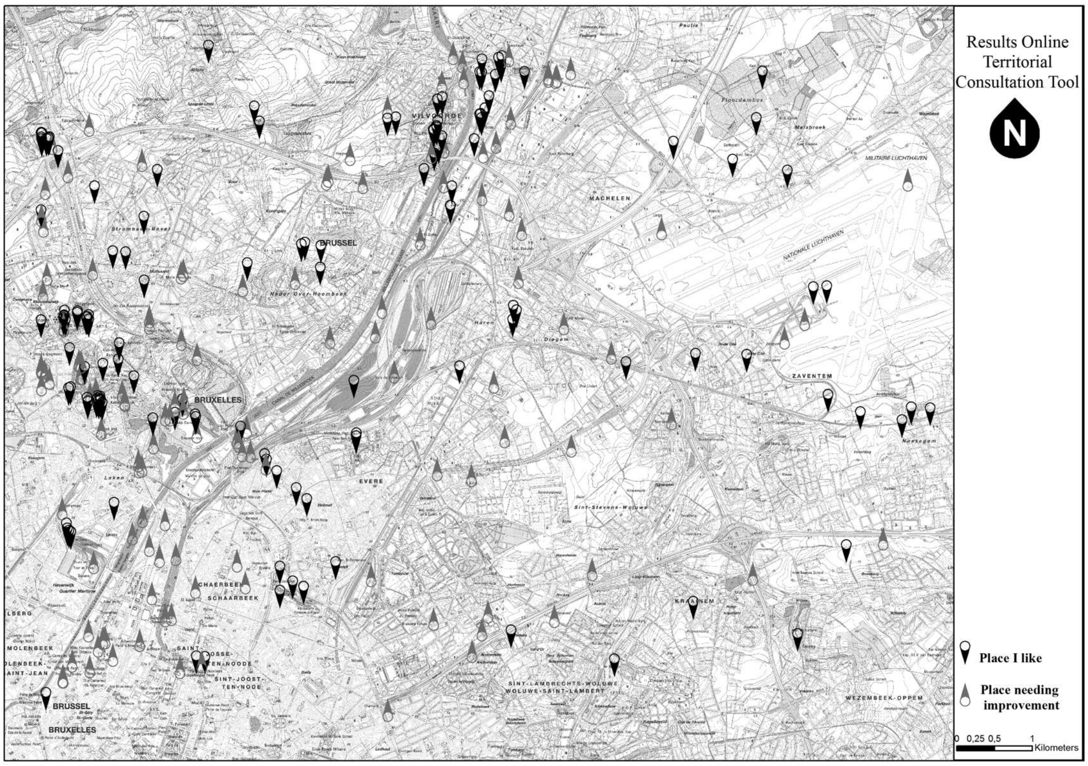

Fig. 2: Overview results online territorial consultation tool

5.3.1 Themes

In order to analyse the responses, a number of distinct themes was made on the basis of the responses. A total of 15 themes were determinded in which the theme "Green Space" was mentioned the most (84 times). The subsequent places were taken by "Mobility – Car" (32), "Mobility – Bike" (23) and "Safety" (23). In figure 3 an overview can be seen of the different themes, how often they were mentioned and whether it was a place that was liked or if it was a place that needed improvement. A clear distinction can be made between those themes that are associated by the participants with liked places and those themes that are accociated with places that coud be improved. For the themes "Architecture", "Green Space", "Personal", "Recreation" and "Services" mostly liked places were indicated. For the themes "Noise", "Redevelopment", "Spatial Design", "Airquality", "Mobility – Car", "Mobility – Bike", "Mobility – Public", "Neatness" and "Safety" mainly places that could be improved were indicated. For the theme "Economic development" the distribution was equal.

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5.3.2 Characteristics of the respondents

Regarding the question of age 265 out of the 279 respondents have answered. The classes 0-10 and 80+ did not have any respondents, the class of 30-40 was the biggest (110), followed by 40-50 (61) and 20-30 (52). If a division is made based on age of the type of places added, the 20-30 year olds are more positive and have added more places which are liked, while the 40-50 year olds added more places that could be improved. Within the category of 30-40 year old an equal number of places have been added.

All of the age categories added the most places in the category "Green space". The 20-30 year old place the theme "Recreation" on second place, while the themes "Spatial Design", "Mobility – Car" and "Personal" are third. Both the 30-40, the 40-50 and 60-70 year old place the theme of "Mobility – Car" second. For the 60-70 year old the theme "Spatial Design" is also on second place. The third places are "Safety" for 30-40, "Redevelopment" and "Mobility – Bike" for 40-50, "Personal" for 50-60 and "Mobility – Bike" and "Mobility – Public" for 60-70 year old age category.

The division of language used is very unequal. The biggest part of the respondents used the Dutch language (237), while only 39 respondants answered in French. Only 3 respondents used the English language to complete the questionnaire. As stated above this result jeopordises the respresentativeness of the questionnaire. A possible reason for this disparity is the fact that the communication campaign was more intense in the Flemish region as opposed to the Brussels region.

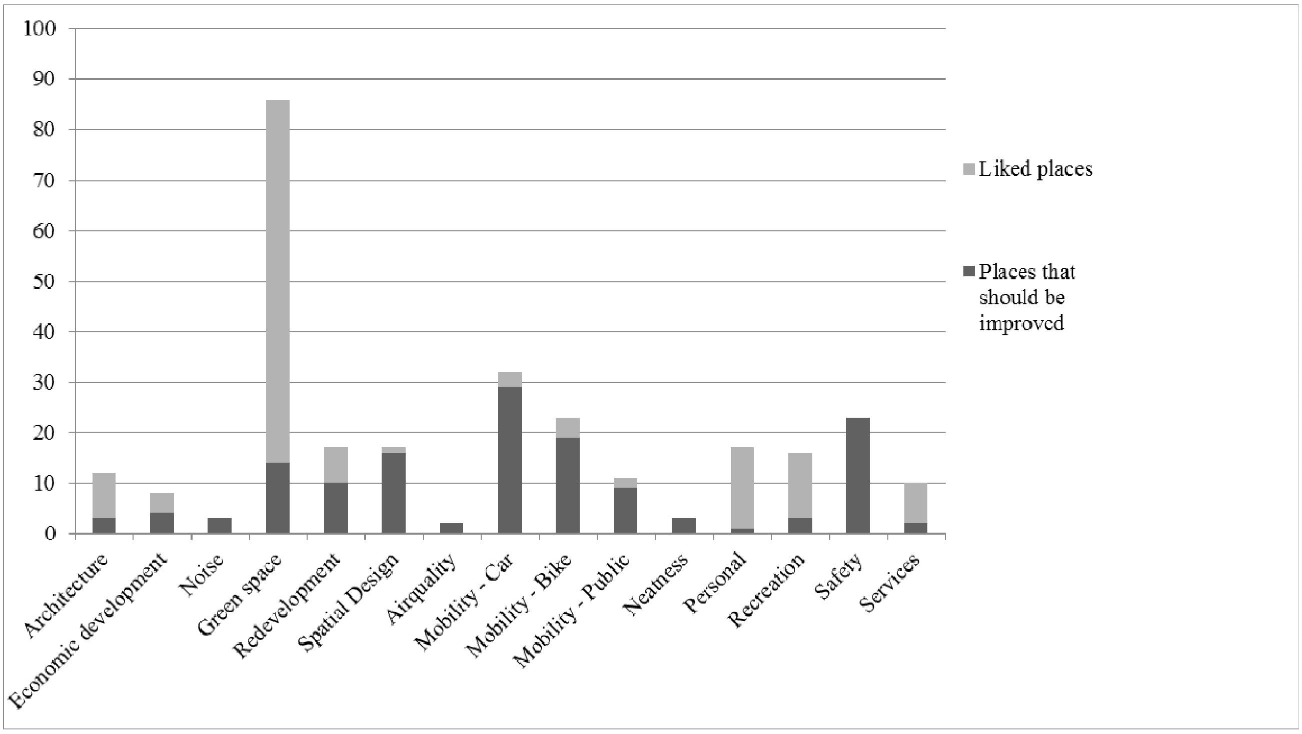

Fig. 3: Overview of places that are liked and places that need improvement by theme

5.3.3 Connection to the area

The respondents could indicate what their connection with the area was, multiple answers were possible. 145 people indicated they lived in the area, 63 people worked there, 47 grew up there, 18 were born there and 10 went to school there. 60 people did not fill in this question. It is interesting to see if the type of connection with the area influences the type of response. People who were born there and/or grew up there are more positive about the area and added more places they liked. People who work or go to school in the Northern Fringe added more places that should be improved.

If an analysis is made between the connection to the area and the theme of place that is liked or that should be improved, all of the different connection groups added the most places within the theme "Green space" except the group that went to school in the area they had "Safety" on the first place. The people that were born there had "Personal" second and "Recreation" third. For the people who grew up there this is respectively "Personal" and "Mobility – Bike". People who go to school there have "Mobility – Bike" second and "Architecture" third. The people who work there find "Mobility – Car" and "Security" second and third most important. The people who live there put "Security" second and "Mobility – Car" third. The people that did not indicate their connection with the area placed "Mobility- Bike" second and "Mobility – Car" and "Redevelopment" third.

One third of the respondants is living in the Nortern Fringe, the others are mainly originating from the municipalities directly surrounding the Nortern Fringe.

5.4 Spatial Statistical Analysis

Based on the spatial spread of the places added within the online territorial consultation tool a spatial analysis can be done. Visually it can already be stated that more places are added in the North-western part of the area against the South-eastern part.

To test this visual observation a density cluster analysis has been conducted using the ArcGIS "Hotspot analysis" function. This function will produce ‘hotspots’ (areas with relatively more places added) and ‘cold spots’ (areas with relatively few places added). The resulting map confirms the visual observation by indicating a zone is the Western part of the research area and a zone in the Northern part as "hotspot" while marking the eastern part as "cold spot".

When a more in depth analyses is made by separating the liked places from the places which need improvement the image shifts slightly. In figure 4 it can be clearly seen that the "hotspot" in the North, located above the municipality of Vilvoorde remains. Places which are added in this area mention the green space of "Domein Drie Fonteinen" and the industrial architecture south of the Ring. The redevelopment of the area between the Canal and the Zenne is also appreciated. The hotspot in the West is caused by the great number of places added to praise the green nature of the "Beverbos", the different parks around the Atomium like "Ossegempark", "Park van Laken" and "Bloemist van Stuyvenberg" as well as the Atomium and the site of Expo ’50. Areas that obviously lack favourite spots are the military airport, the area around Brucargo and Machelen, the area around the crossing of the highway E40 and the ring road around Brussels and the NATO site together with the area around the cemeteries of Brussels and Evere. This last lack of added favourite places could also be explained by the underrepresentation of participants of the Brussels communities.

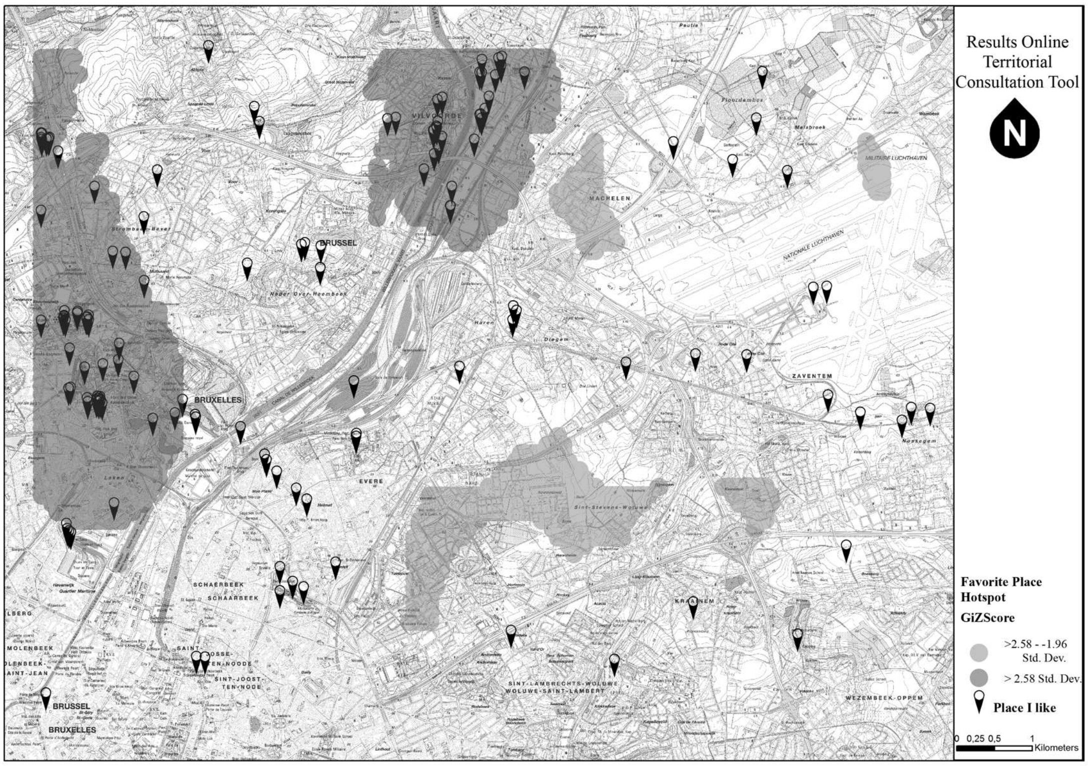

Figure 4: Hotspot analysis for the liked places

These results tell us not only something about the places that people like, it shows us as well which places are generally known by the participants and which places attract little or no attention. Indeed, it is possible to assume that spots on the map with no icons, are not very significant to the participants –or at least they feel

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neutral about it. It seems striking that in the North East of the map, there are no icons, whereas there is some green space in that area ("Woluweveld"). This is striking because green space generally received a lot of positive responses.

If the focus is shifted towards the places that need improvement, again a cluster in the North can be distinguished which focuses on the area of the municipality of Vilvoorde around the Canal. Remarks concentrate on the bad state of footpaths and bicycle lanes, the dangerous traffic situation for cyclist, lack of parking space, the amount of cut through traffic, the bad shape of the railway station of Vilvoorde and the lack of facilities in the quarter of Kassei. In the West the cluster stretches from the centre of Brussels, over the Canal and Tour & Taxi untill the Heizel. Participants added places that need improvement about the lack of green space, noise of the airplanes, lack of development or unwanted development like the new football stadium or the shopping centres, lack of public transport, the need to make the royal park a public park and too much and dangerous traffic. See figure 5 for an overview.

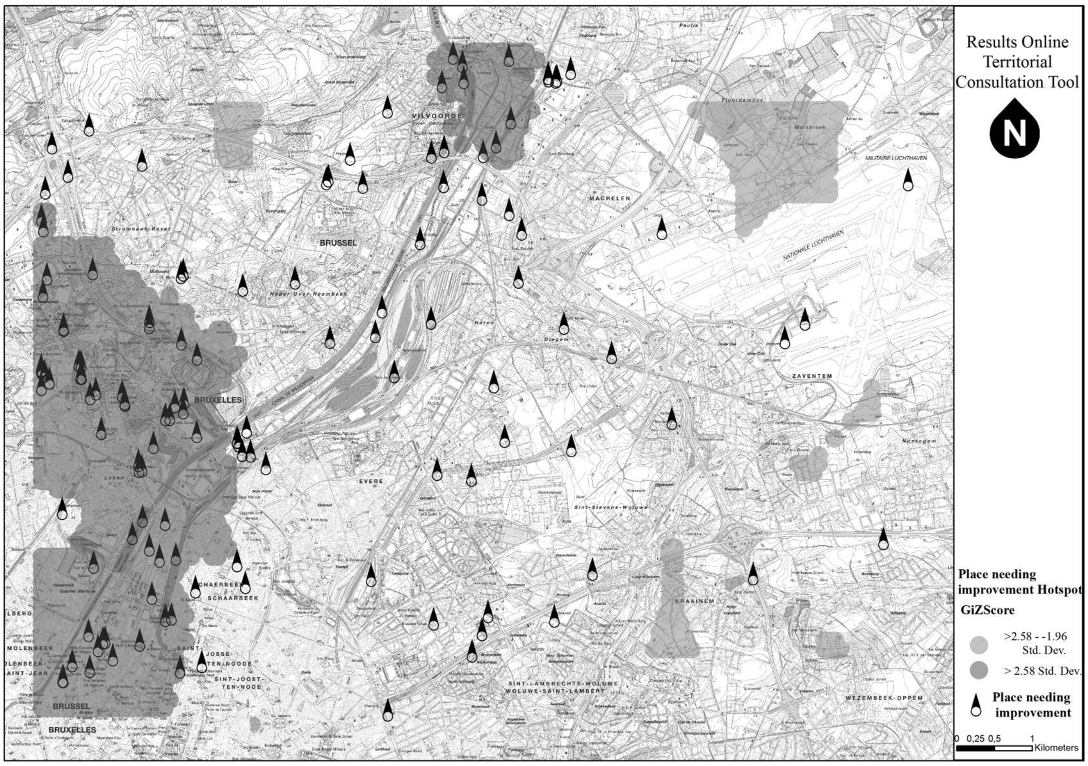

Figure 5: Hotspot analysis for the places that should be improved

The hotspot analysis clearly shows in which areas the most places were indicated, both places that were liked and places that need improvement. We can assume that the respondents are less acquainted with the areas that turned up as Coldspot. Like mentioned above, this could be a result of the communication campaign not reaching the inhabitants of the areas now indicated as Coldspots.

6 CONCLUSION AND DISCUSSION

The TOP Northern Fringe project centers around participation, both with selected stakeholders, but also, as explained in this paper, with users and inhabitants of the project area. The arguments for community participation in urban regeneration centre around the principle that local residents do know best what their needs are (Reeves, 2005:134).

The two tools described above, the Project Monitor and the online consultation tool, are used in the project of TOP Nortern Fringe as participation tools. Both tools have potential for further development. In case of the Project Monitor, this further development is already under way. In case of the online teritiorial consultation tool, the first step will be to undertake action with the results of the consultation. In this part, a critical note will be made on both tools about the advantages and disadvantages of using these types of tools for participation. We will also outline some potential further development of both tools.

Regarding the Project Monitor, the first critical remark that can be made is that this type of monitor is only usable when it is constantly kept up to date. This implies a commitment and a clear agreement between partners. In this case, the Project Monitor is a joint project between two different regions, each responsible for their own territories. Although the TOP Northern Fringe project is a joint effort with several stakeholders, the administration leading the process is the Spatial Development Department of Flanders. Therefore, it is not unthinkable that the Spatial Development Department of Flanders will put more energy into keeping the Project Monitor up to date than other stakeholders.

As stated above, steps are undertaken to put the Project Monitor online. An even further step would be to allow stakeholders to add their own project into the Project Monitor by indicating on the online map the site where their project is starting or taking place and by filling out a form with information. Like the online territorial consultation tool, the Project Monitor would in this way make use of crowdsourcing in order to add information on the Project Monitor. Working in this fashion, however, implicates that a bigger communication campaign would be necessary in order to reach all the potential contributors.

If we look at the online public consultation tool, the fact must be stressed that this is the first time that the Spatial Development Department tries to engage the public with a map as a means of communication . The whole online territorial consultation tool was therefore seen as an experiment to discover whether or not this type of participation process could work. Like in most countries or regions, there is in Flanders no legal obligation, no mechanism, no framework and no resources for considering community ideas and initiatives (Reeves, 2005:135). The initiative of the online territorial consultation tool was therefore the first step to experiment with participation in general and with crowdsourcing in particular. The outcomes, however minor, have raised the enthusiasm within the Department to continue with this project. In a nearby future, the results of the participation will be published on the website. On the long term, we want to develop the website as a platform for further discussion, sharing and mapping that can be used by the crowd. This consultation tool has the potential to grow towards a more active tool that allows further participation.

The biggest drawback of the consultation tool, as it was used, is the lack of respondents and the uneven distribution of respondents. Due to the limited communication campaign and the bigger focus of this campaign on the Flemish side of the project area, only a small number of people actually consulted the website and, even fewer, posted ideas. This resulted in a biased participation. Moreover, the part of the population that is not able to work with online material or is not familiar with maps, is excluded from participation The lack of added places in the Region of Brussels, revealed by the hotspot analysis, can partly be explained by the equal lack of Brussels participants. A further explanation could be that the participants originating form the northern and western part of the project area are not familiar with the eastern part of the area. An interesting question is then why they are less familiar. Is it because the connection between these two parts is not good? Are people not interested in neighbourhoods outside their own? Does the neigbourhood around the NATO have a bad reputation causing less people visiting it? Or did the campaign not reach the users of this area, because they use other information channels? These questions could be answered with more in depth qualitative research.

According to Papadopoulou and Giaoutzi, this paper is the third step in the proces of crowdsourcing: evaluation of the proposed solutions. Next steps will be to generate a long list of potential projects based on the input of the consultation. This long list should then be judged by the direct stakeholders of the TOP Northern Fringe project and after defining a shortlist, projects should be selected which would actually be developed. This would be an answer to the places added in the tool that need improvement. This is then step four: “the selection of the best provided solution and the exploitation of the selected solution by the company or institution that initially posted the problem online” (Papadopoulou, Giaoutzi, 2014: 112). Therefore, the challenge for the projectl eaders will be to show how the public’s comments are taken on board and to help sustain longer term public involvement.

To conclude, we can ask ourselves if TOP Northern Fringe is an example of collaborative planning. To some extend, it is: stakeholders have been involved as partners. The planning process includes several design workshops with stakeholders, recognizing the need to make use of their expertise and problem solving abilities. Regarding the users and the inhabitants of the area, there has been participation, thanks to the online consultation tool. The suggestions made by the participants will be put into actions. However, this participation was limited and cannot be called representative. By further developing the website, by making

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the Project Monitor public, we hope to enhance the participation of the users and inhabitants of the area, bringing the TOP Northern Fringe a step further towards collaborative planning.

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🏆 *reviewed paper*

Place-Branding and the Public Realm: a Typological Study of Public Spaces at Yas Island, Abu Dhabi

Anamika Mishra, Ahmad Okeil

(Instructor, M.Arch in Urban Design, Anamika Mishra, Department of Architecture and Design, College of Engineering, Abu Dhabi University, Abu Dhabi, UAE. Anamika.mishra@adu.ac.)
(Professor, Dr.Ing in Architecture, Ahmad Okeil, Department of Architecture and Design, College of Engineering, Abu Dhabi University, Abu Dhabi, UAE. A_okeil@yahoo.com)

1 ABSTRACT

As cities worldwide compete to attract human resources and investment, Place Branding has emerged as a key urban development strategy. With the growing importance of tourism as a basis for building and diversifying the economy, Place Branding has played an instrumental role in marking a place as a destination. Creating and promoting the quality of place, lifestyle and availability of opportunities are regarded as critical measures when publicising the competitive advantage of a place.

This research examines the nature of the public realm which is shaped primarily by Place Branding forces in the context of the Yas Island development in Abu Dhabi. The Yas Island, which gained international attention as the venue for the Formula One races in 2009 is also home to several notable attractions such as the Yas Waterworld, Yas Ferrari World and Yas Mall with still others in the pipeline.

The research attempts to identify emerging public space typologies in branded environments such as that of Yas Island. A mixed-method qualitative approach is used to understand the context of the study area, followed by detailed analysis of smaller units of study. A framework for typological analysis of public spaces is proposed in order to discuss both the place characteristics and the network characteristics. In the final section, the paper discusses the need for greater awareness of emerging typologies and reports on findings which highlight areas for improvements in typological characteristics.

2 MAKING PLACES THROUGH PLACE-BRANDING

2.1 Place-Branding – City positioning and image creation

With the intensification of competition between cities in a post-globalized world, place-branding and place-marketing are regarded as critical strategies in publicising a city's competitive advantage (Eleishe, A. 2005). Correspondingly, there has been extensive interest in academic research spanning various disciplines. Several terms such as urban-marketing, city-marketing, city-branding, place-branding and place-marketing have been discussed. Van den Berg et al (1990) describe urban marketing as the set of activities intended to optimize the supply of urban functions to the demand from inhabitants, tourists, companies and other stakeholders. Ashworth and Voogd (1990) describe the city-marketing process in terms of consumers, markets and producers and further classify marketing measures as promotional, spatial-functional and organizational. With the growing importance of tourism as a basis for building and diversifying the economy, place-branding has garnered greater interest as a strategic instrument in marking a place as a destination. Literature on destination branding refers to developing and managing tourism destinations as brands to support tourism growth (eg. Morgan et al, 2002).

Kavaratzis (2004) distinguishes city-branding from marketing and describes it as a focus on the communicative aspect of all marketing measures which attempts to create associations with the city. Landscape strategies and infrastructure projects are categorized as primary communicative elements of urban branding (Kavaratzis and Ashworth, 2008). Several authors have discussed the role of architecture and urban design in the creation of an image which is fundamental to branding of places by creating a strong association with a brand. Koetler et al (1993) discuss 4 strategies for place improvement that are the foundations for building a competitive advantage – Design (Place as character); Infrastructure (Place as fixed event); Basic Services (Place as Service provider) and Attractions (Place as entertainment and recreation). In contexts where there is a huge premium on an architecture which conveys the desired image, Sherman (2011) states that 'urbansim has at one level become a form of entertainment'and further suggests that the role of an architect-planner is 'not unlike that of a Disney imagineer' when creating and marketing forms to 'engage the politics of identity'.

Another section in literature studies the nature and effect of place-branding on the physical and social characteristics of places (Evans, 2003). Griffiths (1998) highlights the similarity and uniformity in marketing goals in cities all over the world and the resulting monotonous environments.

Cities around the Arabian Gulf make for interesting cases due to their concentrated efforts to expand their economic base thus making place-branding a focus area for current research. Helmy (2008) presents key literature in developments in the Arab Gulf city, a comparitive case study analysis of urban branding in select cities and recommendations for designing the city image in Gulf cities. She discusses the strategy for branding social life through staging of events and festivals which are organized to carry a particular message and engage with the relevant audience. The evolution of Abu Dhabi and the role of branding in particular has also been the subject of examination by Hashim (2012). Ponzini (2011) provides an in-depth analysis of Sadiyat Island and discusses the role of large-scale development and star–architecture as a part of place-branding. Lefebvre and Roult (2011), while conducting a historical analysis of the F1 circuit expansion phases, recognize the new interest in 'dominant-emerging'cities like Abu Dhabi which are on a 'visibility quest'.

2.2 Place-Branding and the Contemporary Public Realm

Castello (2010) reflects on the complementary nature between place-making and place-marketing with place-marketing having become a modern instrument and constant complement to the process of creating new urban places. These development trends are creating new public space typologies such as event plazas, strongly themed spaces, ceremonial routes etc. which are in turn influencing the public realm. The emerging public realm may be characterized by strong physical expressions of the brand through architectural iconography, creation of places dedicated to consumption of products and services, wide swings in temporal use of spaces and singularity or reduced diversity in activities and users.

A review of literature on emerging public realm in branded environments needs also to be discussed in a wider context of critiques on the contemporary public space. Carmona (2010) comprehensively summarises these diverse critiques and highlights the role of the management aspect of these spaces in categorising the critiques. While acknowledging the heavy criticism on privatisation and commercialisation of public spaces, he also discusses counter-critiques to this view, which can help expand the academic perspective from which public space is discussed.

While traditionally, streets, squares and gardens have been considered as examples of public space, several critics have observed that these typologies do not fully address contemporary realities of social life. Cooper (1989) remarks that new times appropriate new places and new modes of spending time in them and stresses the importance of the emergence of these new shared places to encourage their potential contribution to public life. Gehl and Gemzoe (1989, 2001) discuss the changing nature of public spaces and cite malls, arcades, atria, festival markets, underground cities and skywalk systems as contemporary counterparts of traditional public space. Hajer and Reindorp (2001) comment that the quality of a place and its potential role as part of a public realm are not determined by aspects such as privatisation and commercialisation. Worpole and Knox (2007) argue that if a broader notion of public space is accepted, then opportunities for association and exchange are observed to have increased and arenas for such exchange maybe in the form of schoolgates, malls, cafes, car boot sales etc. By supporting a wider definition of public space, these critiques allow greater sensitivity to the emerging public realm, allowing means of building on their inherent potential.

While there exists extensive literature on place-branding in diverse fields of marketing, urban policy, urban management and architecture, urban studies which examine the nature of public realm created through such stategies and consequent emergence of new public space typologies remains a fairly unexplored area.

This research examines the nature of contemporary public space created through the overt influence of place-branding with a particular focus on identifying emerging typologies as well as existing public space typologies which are undergoing change in the highly marketed context. It is felt that the research findings will help evaluate opportunities for successful public realm design through place-branding.

3 RESEARCH METHODOLOGY AND SITE OF STUDY

3.1 Research Methodology

Most discussions of public realms are centred around two aspects – that of public space, referring to the physicality of the space itself and public life, referring to the social interaction supported by the place. Since the central focus of the research is the typological analysis of public spaces in the context of place-branding, there has been an attempt to understand the physical implications of branding strategies. While another study in the social use of public spaces is simultaneously underway, this aspect has been excluded from this paper.

The research methodology comprises 2 levels, aiming to first understand the context as a whole together with the various layers that make up the built environment and then conducting a more detailed analysis of each unit of study. A mixed-method qualitative approach consisting of site analysis, direct observation accompanied by record of field notes and photography was adopted to guide and structure the research. Based on intitial walk-throughs and drive-bys as well as using satellite imagery, the overall urban structure of the study area, as well as its relation to the larger city context were presented.

The classification of public spaces uses simple, easy to perceive physical attributes – forecourts, internal connectors, water edges etc. 5 public spaces were selected for typological analysis and selection was based on their representative value and existing and potetntial significance in contributing to the public realm. A framework for typological analysis of the public spaces was created to analyse the physical characteristics of the place and how it related to the greater public realm. This was done under 2 heads respectively – Place characteristics (Space configuration, Program and Design of public space) and Network characteristics (Edge conditions, Access and Relation to larger network of public spaces). In the final section of the paper, conclusions from the typological analysis have been reported along with recommendations to optimize their potential.

3.2 Area of Study

Like other cities in the Middle East, Abu Dhabi has been working towards establishing and securing a post-oil economy. Recent years have witnessed the emergence of a unique city image, strongly themed around concepts of culture, leisure and sustainability. Place Branding has been a pivotal strategy in this endeavour and is exemplified through projects such as the Cultural District at Sadiyat and the Leisure and Entertainment District at Yas.

The selected area of study is the southern zone of the Yas island, a 2,500 ha development project which was initiated in 2006, by Abu Dhabi based Aldar properties with the aim of creating the region's prime leisure and entertainment destination. The project proposals have since been sufficiently developed to support physical evidence which can be recorded and discussed using visual research methods.

The island is located at a distance of about 15km from the international airport and is connected to the city through the major transportation arterials – E10 (Al Raha Beach Highway) and E11(Sheikh Zayed Road which connect Abu Dhabi to Dubai and E12 (Sheikh Khalifa bin Zayed Highway) which connects the island to the city via Sadiyat island (Fig 1). The E12 creates a strong edge within the island bisecting it into 2 zones. A park known as the gateway park, extending below the E12, attempts to create a partial seam along with minor roads facilitating access between the 2 zones (Fig 2).

As illustrated in Fig. 1 and 2, the island enjoys good global connectivity. However, connections with the city itself and surrounding areas are limited. Further, the exclusivity in the island location, makes it essential to rely on vehicular access.

The 3 major anchor attractions at Yas – the Yas Mall, the Ferrari World theme park and the Formula One motor sport track are all strung along a road, known as the Leisure Drive. The development is further supported by marinas (one existing and one proposed), a beach, golf course, equestrian sport track, high end hotels and a water theme park called Yas Waterworld.

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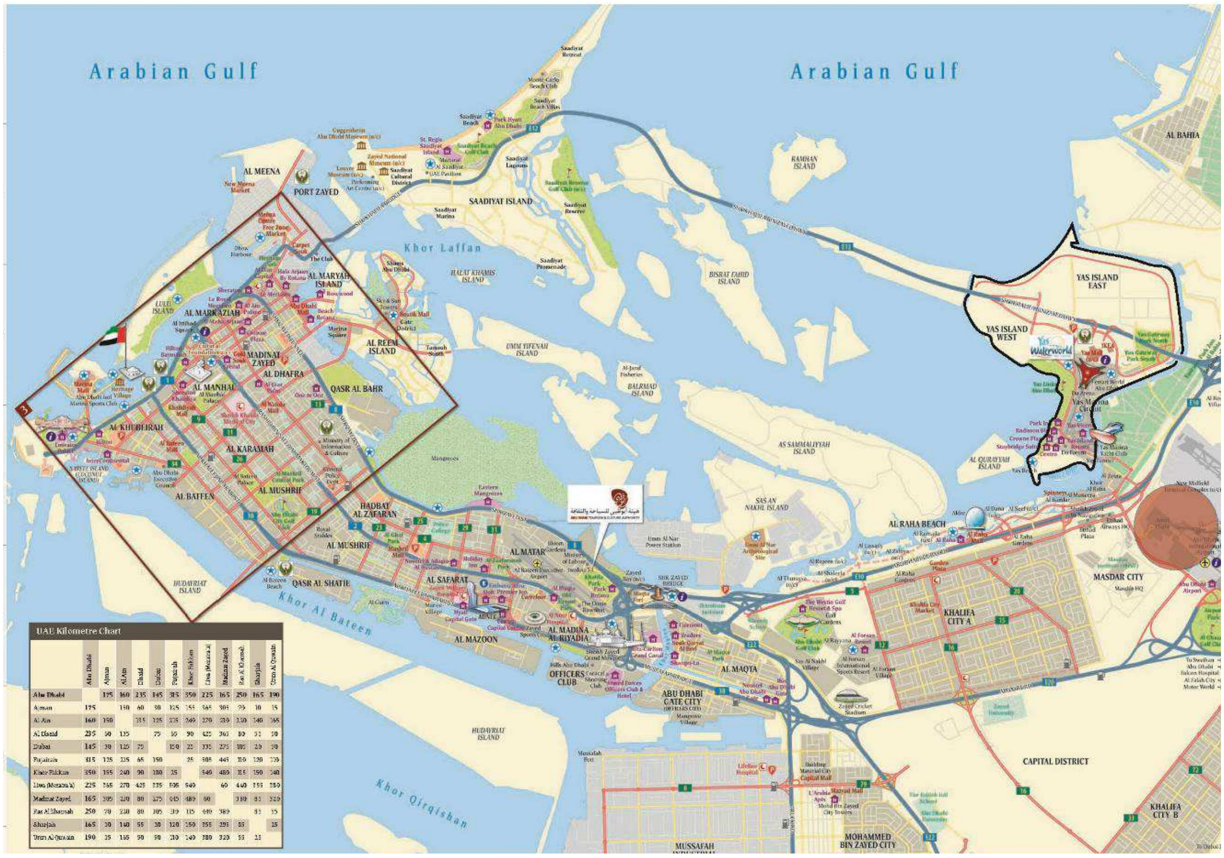

Fig. 1: Yas island (highlighted with dark boundaries): Linkages and Connectivity. Source: Abu Dhabi Tourism and Culture Authority

The island first shot to international attention in January 2006 at the Formula one Grand Prix festiveal wherein it was announced that Abu Dhabi had won the rights to host the Grand Prix races from 2009 – 2016, thus establishing itself as an important landmark with reference ot the much-loved sport. The opening Grand Prix event was considered an important trigger to launch and brand the Yas development and event-staging continues to be used as a branding strategy. This is supported by the provision of several event venues and associated characteristics.

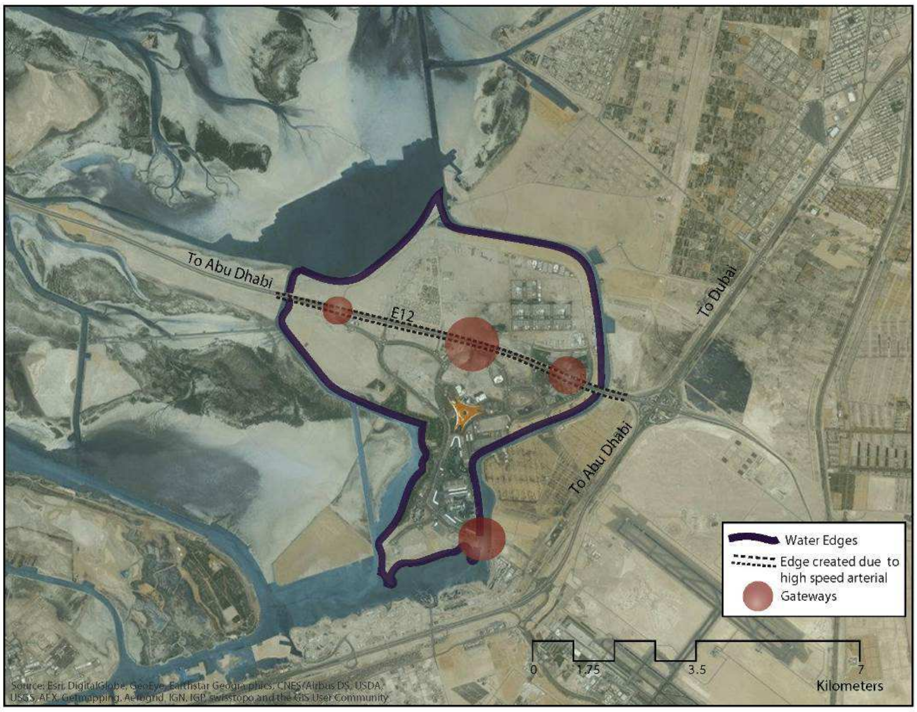

Fig. 2: Entrances and Edge Conditions

The strong association of the F1 races has helped theme the development and the architectural iconography as seen in Ferrari World and the Yas Viceroy hotel. Landscaping and urban design detailing evident in street furniture etc. are of a high quality and are also a part of the branding process (Fig. 3). However, the temporal nature of events implies that the activity patterns show wide fluctuations and in non-event times, several of the places seem desolate. The large setbacks between the attractions and the street also result in poor image structure along the streets.

Fig. 3: Yas Island –Branding through street furniture, landscaping and architectural iconography.

3.3 Units of Study

Units of study for detailed analysis were identified after a general review of existing public spaces. The Leisure Drive, the primary circulation corridor, though essentially intended for the vehicle, has been provided with generous pedestrian areas on either side and is also used as a cermonial route for occasions. Leisure spaces along the waterfront include the Yas Marina and the beach. However, the beach lacks free access and has therefore not been considered as a unit of study. Many of the attractions and tourist destinations have a public component such as an entrance lobby or forecourt which often sees a lot of public activity. Similarly entrance areas of event venues may also be considered as another public space type, witnessing concentrated periods of very high activity.

The Gateway Park is an example of the more traditional public space typology. However it has not been considered as a site of study since much of the adjoining development on the northern side is yet to be completed and is expected to have a strong influence on the use of the park. Yas Mall and adjoining spaces are also excluded since the mall had not opened when the research was being conducted.

The units of study (Fig. 4) were identified based on their representative value, ease of access for research and appropriateness of size and scale. Only spaces which had free, non-ticketed entry were considered. Another criteria was also the requirement that adjoining areas which could influence the use of these places, were sufficiently developed.

3.3.1 Yas Marina (P1)

Essentially a marina for yachts overlooking the race circuit, the Yas Marina has a promenade, seveal restaurants and a recently opened children’s play area. The interactive water fountain is a highlight of the place and temporary markets and other events are often held here.

3.3.2 Ferrari World Entrance (P2)

Entrance, vehicular drop-off and waiting area for Ferrari World, a Ferrari-themed amusement park which opened in 2010. With 86,000 sq.m. enclosed area, the Ferrari World structure claims to be the largest indoor amusement park and its popularity as a tourist destination ensures that there is heavy footfall in the selected public space.

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3.3.3 Entrance Hall to Ferrari World and Yas Marina (P3)

The pneumatic roof covered structure encloses an indoor public space which functions as an entrance lobby for Ferrari World and also provides direct connectivity between Yas Mall and Ferrari World.

3.3.4 Du arena entrance (P4)

The plaza and entrance area is associated with the du Arena, an outdoor enterntainment venue which regularly hosts high-profile musical concerts. The space witnesses wide ranges in temporal activity with the presence of large crowds on event days.

3.3.5 Leisure Drive (P5)

Though the Leisure Drive is itself intended for vehicular circulation, it is flanked by wide strips of pedestrian areas with great attention paid to landscaping, street furniture and detailing. One such stretch adjoining the du Arena entrance has been considered for the study, in order to investigate the changing role of the linear public space.

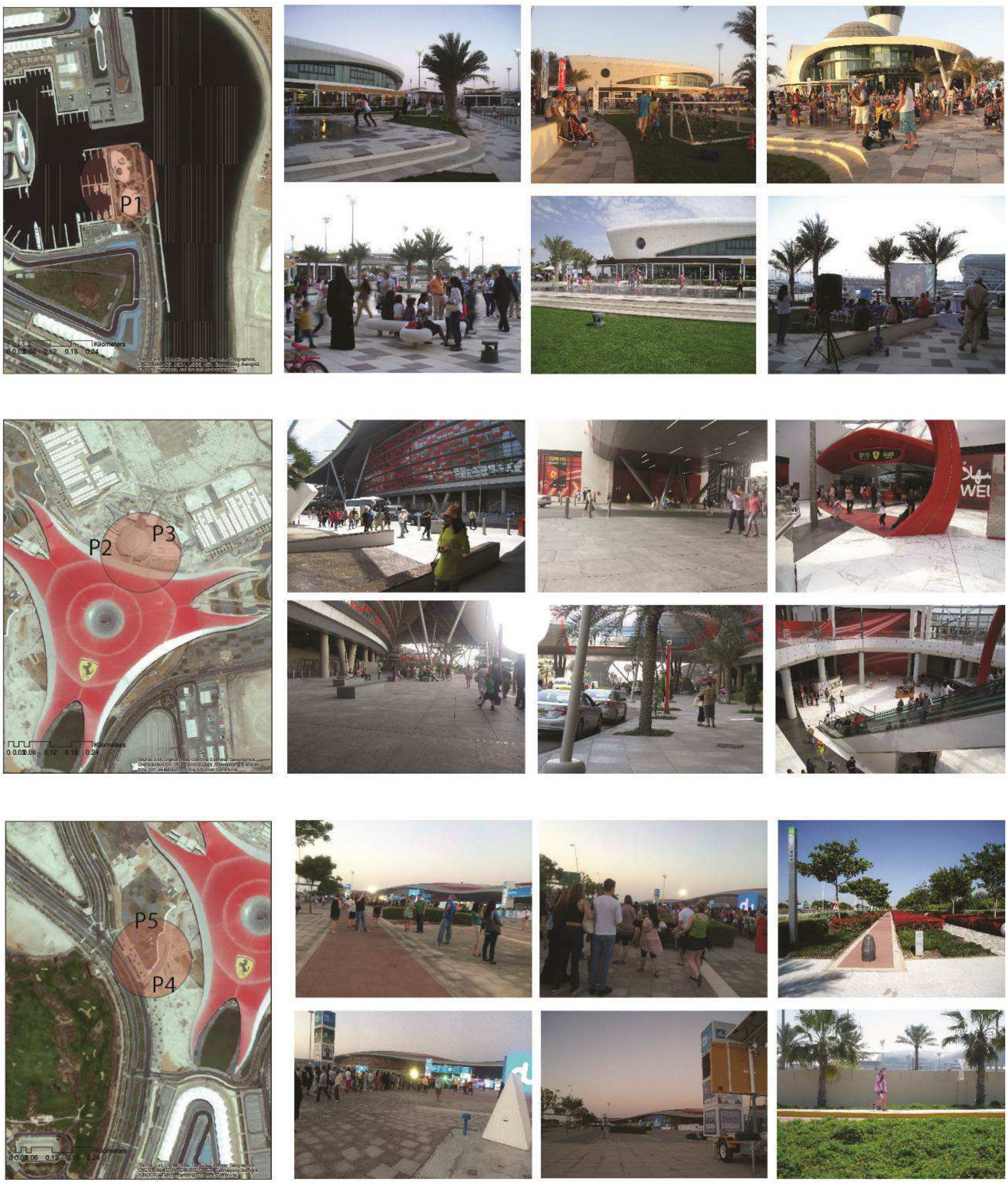

Fig. 4: Selected units of study – Yas Marina (P1), Ferrari World Entrance (P2), Internal Hall connecting Yas Mall and Ferrari World (P3), Du Arena entrance (P4), Leisure Drive (P5).

3.4 Typological Analysis of selected Public Places

A framework for typological analysis of the public spaces (Table 1) was created to analyse the physical characteristics of the places, how it related to the greater public realm and could foster public life. This was done under 2 heads respectively – Place characteristics (Space configuration, Program, Design of public space) and Network characteristics (Edge Conditions, Access, Connection / relation to larger network of public spaces).

Yas Marina (P1)	Place Characteristics	Space Configuration	Program	Design of Public Space
		Promenade and small-scaled plazas and open spaces.	Landscaping with play areas for children. Events such as weekly market fairs, themed evenings and outdoor film screenings are frequently organized.	High quality landscaping with the interactive water fountain serving as a very popular feature. Promenade widths are fairly restricted and visitor amenities like toilets etc. are insufficient.
	Network Characteristics	Edge conditions	Access	Relation to larger public space network
		Active and permeable edge with restaurants. Edges of spaces blend with ground floor uses of buildings. All restaurants have outdoor seating areas and some have walls with very large windows, which are kept open in cooler weather.	Accessed through private vehicles and tourist buses only. Vehicular access is off a fairly large distance from the main circulation.	Limited access by public transport results in this being a stand-alone place. A security checkpoint (though it does not stop vehicles) may create ambiguity regarding the public status of the space.

Ferrari World Entrance (P2)	Place Characteristics	Space Configuration	Program	Design of Public Space
		Shaded open space and pedestrian areas between the Ferrari world and the entrance hall create a sense of enclosure.	No formal program. Essentially a drop-off and waiting area for a destination. Also a common meeting place between groups of people who are visiting the attractions.	Space configuration between buildings allows it to be shaded at most times. Paving of areas allows pedestrian priority. Sufficient seating is provided.
	Network Characteristics	Edge conditions	Access	Relation to larger public space network
		Edged by Entrance Hall and Ferrari World parking. Limited interaction with ground floor uses, particularly since the ground floor of the Ferrari World only has parking and the building front is not active.	By personal vehicles and public transport. A bus stop for the Yas shuttle is also located within the space. Location at a considerable distance from the main island circulation is a deterrent to pedestrian access.	Important nodal location due to adjacency with Yas Mall and Ferrari World.

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Internal Hall connecting Yas Mall and Ferrari World (P3)	Place Characteristics	Space Configuration	Program	Design of Public Space
		Enclosed public space over 2 floors having a circular plan with access to Yas Mall and Ferrari World being diametrically opposite to each other. Translucent roof ensures the area is flooded with natural light.	Visitor amenities, souvenir shops, small food outlets, ticketing area to Ferrari attractions.	Focus on facilitating circulation between entrance level and upper floor from which both the Yas Mall and Ferrari World are accessed. Food court type seating is available on the ground floor. Greater focus appears to be laid on external architecture of space.
	Network Characteristics	Edge conditions	Access	Relation to larger public space network
		Internal public space – hence defined through external shell of building	Located at vehicular drop-off for Ferrari World. Bus stop for island shuttle is located across the road. Location at a considerable distance from the main island circulation is a deterrent to pedestrian access.	Serves as an internal pedestrian connection between 2 major activity nodes – the Yas Mall and Ferrari world allowing visitors to continue from one attraction to the other.

Du Arena entrance (P4)	Place Characteristics	Space Configuration	Program	Design of Public Space
		Crescent-shaped, entrance forecourt to major event venue.	Used as Queuing area for ticketing. Heavy presence of media, event organizers and security during event times. Event-related promotional activities are sometimes planned here. Very limited activity is observed on non-event days.	Mainly paved area with pockets of green. Seating provided is very inadequate and unimaginative. Temporary installations and signage, themed as per the event are sometimes set up.
	Network Characteristics	Edge conditions	Access	Relation to larger public space network
		Edged by Leisure Drive on one side and the du arena (major events venue) property line on the other.	Accessed by vehicle from Leisure Drive and by public transport – bus stops. Tourists living in the hotels choose to sometimes walk to the location.	Limited connectivity with larger public realm probably since users of this space have a very narrow interest in the event.

Leisure Drive – Stretch adjoining du Arena (P5)	Place Characteristics	Space Configuration	Program	Design of Public Space
		Major circulation route - a 6-lane road with extensive pedestrian strips, cycling tracks and landscaped plantation along its length.	Predominantly a circulation route for the vehicle. Serves as a ceremonial route in select events. Also used by cycling / jogging enthusiasts. Limited pedestrian traffic except in case of events.	High quality landscape design – sidewalks, street furniture, plantation, signage and lighting have been provided.
	Network Characteristics	Edge conditions	Access	Relation to larger public space network
		Absence of continuous and active street wall. Buildings have very large setbacks from property lines and therefore do not create a built edge.	Good connectivity at a global scale. However, edge conditions of island limit the access from surrounding communities.	Limited integration and transitioning with public components of developments, which adjoin the Leisure Drive.

Table 1: Framework for typological analysis of selected public spaces

4 DISCUSSION AND ANALYSIS

This study discusses the physical manifestations of place-branding which is essentially a non-physical phenomenon, by analysing resultant public space typologies and examining their characteristics.

A common pattern which emerged, when analysing the various units of study was that place characteristics appear to have been given far more attention in comparison to network characteristics with most spaces having poorly defined edges and little or no connectivity with the larger public realm. This may also be interpreted as an indicator of the overall need for better definition of the larger public space network itself. The deficiency in network characteristics also brings to light somewhat conflicting goals between place-branding, where exclusiveness helps create a clear brand image, and public realm creation, which generally aims to be inclusive. While location and edges of the Yas Island may help create an exclusive brand image, controlled access and easier place-management, they do not facilitate its integration with the greater urban fabric of the city.

As previously mentioned, edge conditions in most areas were a feature that needed improvement since the buildings are separated from the public space with no intemediate transition spaces. A notable exception was the Yas Marina where the restaurant buildings with their porous edges and transition areas in the form of outdoor seating helped create an active edge along all building fronts, even though a continuous enclosure was absent for the precinct.

The Ferrari World drop-off area and the internal hall connecting it to Yas Mall present an interesting case in emerging public space typologies. The drop-off area is directly plugged onto a circulation route with favourable public transport access and aims to connect with the adjoining activity node of the tourist circuit, the Yas Mall through an internal hall. These are favourable features which can respond positively towards greater vibrancy in the public realm. There is also an attempt to design the drop-off area for public use by allowing pedestrian priority in crossings, provision of seating, lighting effects and water features. While the entrance hall may easily be dismissed as a mall extension, it too offers an alternative by serving as a connector typology and may be found to be an appropriate response, suiting both the context of place-branding as well as the climate, which often calls for enclosed or covered public places. This may be appreciated further when compared with other destination entrance forecourts such as the Yas Waterworld (not in study) which does not address issues of public transport access and allocates very limited area in front of the ticketing check. Hence appropriate treatment and expansion of this public-private interface can be a strategic measure in activating a greater public response.

On the other hand, the du Arena forecourt enjoys direct access off the Leisure Drive, but does not adequately consider public space design, leaving the space as a large neutral space used only for queuing for events and for streamlining large crowds. While it may be argued whether such spaces for occasional queuing can rightly be considered a public space, however, they remain arenas where exchange and interaction takes place and measures to enhance their place characteristics and improve their adaptability could help such spaces become more meaningful components of the public realm.

Despite the high quality detailing, the landscaped sections along the Leisure Drive are vastly underutilized. This illustrates the problem presented by event-centred developments, which are common in branded contexts, wherein sizing and treatment needs to tackle both peak as well as non-event use.

In addition to the greater importance assigned to place characteristics, it was found that special emphasis was given to programming of spaces, primarily through events in order to encourage their use. This may be seen as a possible counter measure to overcome the deficient network characteristics of the public spaces. Announcements for various events of varying scales are made with regularity and in turn create a public realm which shows high temporal variations in activity.

5 CONCLUSION

As explained in the section on research methodology, this paper focusses on the physical public space and excludes the other facet of the public realm, namely its social use. Another research is simultaneously underway which studies the use of these spaces and collects feedback from users. It is expected that findings from that study will provide further insights into the contemporary public realm created in the context of place-branding. It must also be mentioned that public realms require sufficient time to grow and evolve.

Hence, follow-up studies which track developments in public transport and growth of adjoining areas would also yield interesting results regarding the changes in the public realm.

The findings from this research help highlight potential areas where improvements in typological characteristics could contribute towards a more vibrant and sustainable public realm, while leveraging on the place-branding efforts. As an example, public components of individual project programs could be identified and articulated so as to create a cohesive and integrated public space network. Increased awareness among architecture and urban design professionals regarding the potential of new public space typologies, such as entrance forecourts to tourist attractions and event venues, would result in greater sensitivity and potentially a positive contribution.

The heavy reliance on program, as opposed to public space typology implies that there is a constant demand on management and programming of public spaces, for the space to be adequately used. The development of emerging public space typologies can help offset this demand by offering a useful tool which helps institute the public realm as an integral layer of the urban infrastructure.

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Plan and Design Together – Just a Vision?

Sigrid Hehl-Lange, Eckart Lange, Gulsah Bilge

(Dr. sc. techn. Sigrid Hehl-Lange, The University of Sheffield, s.hehl-lange@sheffield.ac.uk)
(Prof. Dr. Eckart Lange, The University of Sheffield, e.lange@sheffield.ac.uk)
(MLA Gulsah Bilge, The University of Sheffield, g.bilge@sheffield.ac.uk)

1 INTRODUCTION

Landscape visualization is a representation of the real world that can be displayed as 3D simulations with various levels of realism (Schroth, 2010). Landscape visualization may demonstrate past, present conditions or future scenarios (Lewis et al., 2005). Therefore, it can be said that landscape visualization gives a chance to display scenes that are non-existent (e.g. current state visualization of altered land use, possible future design scenarios). It can be represented as static, animated or interactive scenes (Sheppard and Salter, 2004) and immersive or outside of the context (Danahy, 2001; Bishop and Lange, 2005).

Human perception towards to 3D visualizations has been studied in recent years by comparing visualization and its effectiveness (Campbell and Salter, 2004; Lange, 1994; Zube et al. 1987). According to comparisons made between visualizations and realism, computer generated environments still need to be developed in order to demonstrate the high degree of realism (Bishop and Rohrmann, 2003). There have been studies investigating various degrees of realism depicted in images, especially in regard to vegetation and moving objects within the virtual environment. However, further study is required for future projects to improve the degrees of realism, raise awareness and stimulate public participation.

In the field of landscape architecture, virtual reality and internet-based landscape visualization technologies (Lange, 2001) and public participation during the decision- making and design process (Saleh and Nassar, 2011) gained rising recognition over the last decade. Development in 3D landscape visualization, now, allows using mobile devices as a valuable tool in landscape design, planning and management (Lange, 2011). There is a possibility that mobile devices can be the standard method for planning and design processes (Lange, 2011).

This paper focuses on the use of interactive 3D visualisation of an urban park to enhance public participation during the planning and decision-making process using mobile devices. The work presented in this paper is part of the EU Project Value+ a collaborative INTERREG IVB project. Unique to the kind of project, the research is linked to a real world investment site. Edward Street Park in the city centre of Sheffield is one of the investment sites in the INTERREG project.

2 CASE STUDY SITE

Edward Street Park is located in the St. Vincent Quarter. Historically St. Vincent Quarter was a typical quarter in Sheffield for the traditional metal and cutlery industry with densely built up terraced housing (Stenton 2010). The area became the home of Irish emigrants. After post-war municipal ‘slum’ clearances a basketball court had been constructed at the open space of Edward Street. This open space served the entire residential area but was poorly designed and maintained (Sheffield City Council 2004). The quarter was a derelict and underused site with a deprived neighbourhood, which has suffered deep-rooted problems with vandalism, drug abuse, and prostitution. The area is now home to a population with various ethnic backgrounds. New accommodation for students (Castle, Huntsman House and Brearley House) and for young professionals (Impact and Atlantic1) representing high-middle income groups is provided (see Fig. 1). This is next to low-income social family housing in the Edward Street Flats. Edward Street Flats built 1939 - 1943 by Architect Davies are the largest tenement block of its time in the city of Sheffield. Edward Street Flats were built as social housing in the shape of an oval building block with arched entranceways to the large inner green space courtyard., built in 1939 - 1943. The new designed Edward Street Park is intended to serve as a multi-functional inner-city urban park near the University of Sheffield campus.

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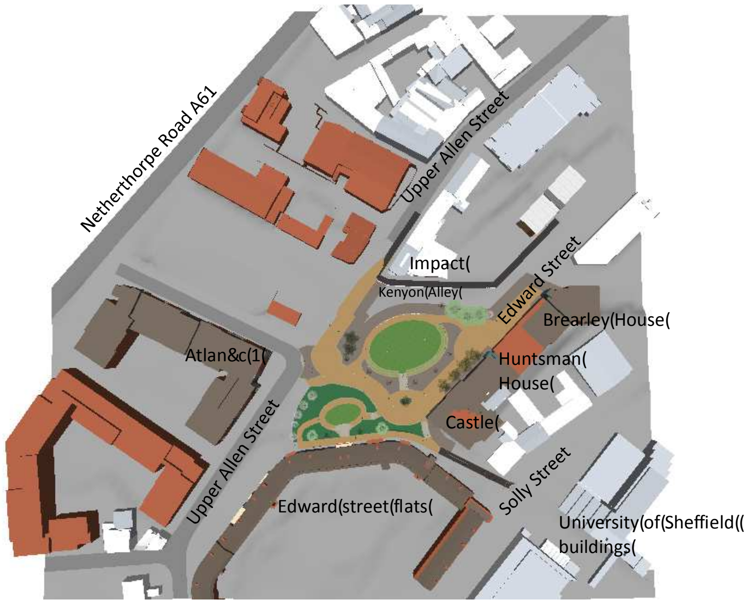

Fig. 1: Location of Edward Street Park

The aim for the new design of Edward Street Park is to engage the various stakeholders using inclusive design tools and techniques, including interactive 3D visualisation techniques to enable them to be involved in the collaborative planning process and partcipative decision making.

3 VISUALISATION OF THE PROJECT

The 3D modelling software SketchUp was chosen to be used in Value+ project due its availability for everybody with its free to downloadable version Trimble SketchUp, formerly Google SketchUp and due its relative ease to learn and use. Another reason to chose SketchUp was, that vegetation in general, in particular perennials for the flower beds, was seen to be important within the visualisations for Edward Street Park. SketchUp provides the possibility to access a great variety of free plant models in Google warehouse.

As SketchUp is not ideal for navigation and in terms of speed, in addition a real-time visualisation solution for interactive landscape visualisations was required. Therefore the software Walkabout3d from Deliverance Software with its excellent SketchUp compatibility was chosen. Walkabout3d allows easy, real-time navigation of the 3D model environments and can be used for walk-throughs and bird's eye views. Sketch-up data can be directly imported to the Viewer. The Walkabout3D Viewer is a free-to-download software.

On-site, mobile device visualizations (e.g. iPads) are used to explore the views of stakeholders including hard-to-reach groups, students and professionals (Bilge et al. 2014) and to involve the stakeholders in the decision-making and in the participatory planning process. To collect people's design ideas, ZoomNotes - a mobile note-taking application for iPad developed by Deliverance - was used. People were asked to sketch their ideas on 3D models displayed on a mobile device (Bilge at al. 2015).

4 SURVEY

In the Value+ project in Sheffield the views of stakeholders including hard-to-reach groups, students and professionals are sought regarding the usability of mobile device technology and regarding the park design. The opening event of Edward Street Park in September 2013 was a unique opportunity to inform the residents of this neighbourhood and other stakeholders about the recent developments of the park including the 3D visualisation work by the Value+ project. Immersive visualizations have been used in the past to communicate design interventions interactively to the stakeholders (e.g. Hehl-Lange et al. 2012). It is not yet clear how mobile devices can be employed to engage with stakeholders. Participants, with different cultural backgrounds and different income level were asked to give feedback regarding the current situation of the new urban park development. During the day a survey was conducted using a pre-recorded animation presented on an iPad in combination with a questionnaire. At the time of the open day the 3D model was not yet finished.

The respondents of the survey suggest that there is strong potential for 3D mobile device visualisation to contribute to the enhancement of public participation and understanding of design scenarios of residents, including socially vulnerable groups, students and businesses. The respondents rated the level of realism of the 3D model as ‘good’ (mean 4.25 on a 5-point Likert scale), (see table 1 and Fig. 1). They point out that the 3D model enhances the understanding of the space and proposed plan (mean 4.12 on a 5-point Likert scale).

	Valid n (from 81)	Mean	Standard Deviation
Level of realism of the 3D model	79	4.25	0.646
Enhancement of understanding	78	4.12	0.524
Usefulness of the 3D model on mobile device for the decision-making	79	4.32	0.631

Table 1: Respondents feedback on the use of the 3D model

Considering that this survey is based on the draft model, these scores could perhaps be higher if the latest version of the Edward Street Park model with textured building facades (Fig. 2), which gives the model a greater sense of place, would be used.


Fig. 2: SketchUp model for the survey. Fig. 3: Final SketchUp model with textures

5 THE CHARRETTE

A charrette is a meeting activity that allows people to share their ideas about designs and planning. During the charrette, relevant people (stakeholders, citizens/local people, representatives) meet professionals (planners, architects, landscape architects) and experts (government agencies, developers) (Lennertz et al, 2006) to share ideas about the project that they will start or have started designing (Gordon et al, 2011). A charrette usually allows lay people to draw their ideas on paper after the information session regarding the context (Gordon et al, 2011). The most important advantages of a charrette are being most reliable involvement process, as it prevents work duplication or rework, encouraging in-person dialogue by bringing together lay people, experts and professionals together to develop their community via collaborative planning and producing a high quality plan at the end (Lennertz, 2003).

In addition to the survey a design charrette for Edward Street Park took place in October 2013 with students from three participating universities of the UK and the Netherlands. The organisers tried to widen the list of participants to engage local residents (including students, migrants, young people and new residents), small and medium enterprises and NGO’s (e.g. ZEST), but due to a weak response the charrette was run as a cooperation between the academic departments of the three participating universities of the UK and the

Fig. 4-6: Charrette: After a site visit students using visual representations to convey their design ideas

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Netherlands assisted by South Yorkshire Forest Partnership, the lead partner of the Value+ project, and Sheffield City Council. The students developed and designed further ideas for Edward Street Park based on responses from the survey. The design charrette provided an ideal opportunity to make use of the 3D model and visualisation as a tool in the bottom-up participatory design to support decision-making.

6 ZOOMNOTES

By using the Edward Street VALUE+ Project as a case study, public use and preferences were identified. After the design charrette, the site was visited to assemble feedback from local community by showing a pre-recorded walk-through video of the site. They were asked to specify the problems and problematic areas around the park and where they would be willing to make changes. After having mentioned the part they were suggesting the change, a screenshot image was provided to them to make sketches on them. They had a chance to experience using digital tools to sketch their suggestions on the images they had chosen. ZoomNotes, a mobile note-taking application for iPad developed by Deliverance software, was presented to people with the digital screenshot according to their choices. ZoomNotes is an application that people can use for note taking, annotating, planning or sketching. It provides variety of pens, fonts and colours. It allows easy drawing and writing, and helps users to create editable sketches by converting the rough drawings into the precise geometric shapes.

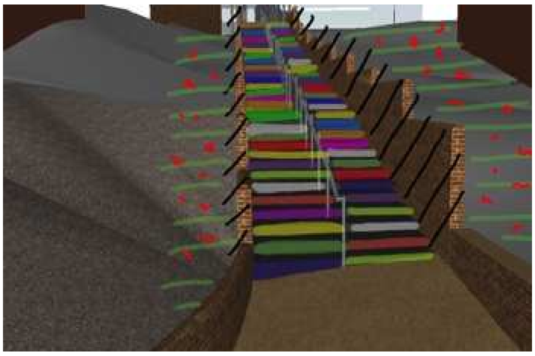


Fig. 7: Sketches made by public via ZoomNotes. Fig. 8: Suggested features in the upper garden

The participants used ZoomNotes with an iPad and made sketches with a stylus pen. In this way, participants were able to make meaningful interaction by drawing their ideas on the 3D model images they wanted to have changes (Fig. 6 and Fig. 7). These helped the participants to understand the project environment better and create ideas in a reasonable way. ZoomNotes allowed people to draw what they want, what they want to see in the neighborhood rather than using verbal descriptions. This approach aimed to enhance the understanding of the space. After the survey and the design charrette, new design scenarios were prepared for future scenarios. For the visualization process of future scenarios Trimble SketchUp were employed. The reasons why SketchUp is chosen for 3D representation are easy of use, availability of the software without any cost.

7 LIMITATIONS

Initial results suggest that the use of 3D mobile device visualization has a strong potential to contribute to the enhancement of public participation and understanding of design scenarios of residents.

Ideally, the charrette would have benefitted from further input and engagement with stakeholders and local residents to develop and discuss design ideas for the park in a collaborative setting and visualise the outcomes as future scenarios. One of the reasons for the lack of interest in participation of stakeholders and residents could be, that the park is not anymore in an early stage of a design proposal. Most of the park was already built, at the time of the charrette.

Some limitations require mention. Since there are 26 different languages spoken in the community, communication sometimes was an issue during the surveys. As English is not the first language of some participants, some tended to avoid communication and those who were willing to participate did not feel comfortable during the survey. Another issue was that people who were not familiar with digital devices. Some residents abstain from using technological devices due to the thought of inadequacy. As students tend to stay short term around the area, most of them were not aware of the change and did not have opinions about the project.

8 ACKNOWLEDGEMENT

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reviewed paper

Possibilities and Opportunities of Mobile Devices to Measure the Physical (In)Activity of Young Citizens – First Results of a Case Study in Vienna

Florian Reinwald, Thomas Schauppenlehner, Franz Mairinger, Irene Bittner, Anna Höglhammer, Rosa Diketmüller, Doris Damyanovic

(DI Florian Reinwald, University of Natural Resources and Life Sciences, Vienna, Department of Landscape, Spatial and Infrastructure Sciences, Institute of Landscape Planning, Peter-Jordan-Straße 65, 1180 Vienna, Austria, florian.reinwald@boku.ac.at)
(DI Dr. Thomas Schauppenlehner, University of Natural Resources and Life Sciences, Vienna, Department of Landscape, Spatial and Infrastructure Sciences, Institute of Landscape Development, Recreation and Conservation Planning, Peter-Jordan-Straße 65, 1180 Vienna, thomas.schauppenlehner@boku.ac.at)
(Mag. Franz Mairinger, University of Vienna, Centre for Sport Science and University Sports, Institute of Sport Science, Auf der Schmelz 6a, 1150 Vienna, Austria, franz.mairinger@univie.ac.at)
(DI Irene Bittner, University of Natural Resources and Life Sciences, Vienna, Department of Landscape, Spatial and Infrastructure Sciences, Institute of Landscape Planning, Peter-Jordan-Straße 65, 1180 Vienna, irene.bittner@boku.ac.at)
(DI Anna Höglhammer, University of Natural Resources and Life Sciences, Vienna, Department of Landscape, Spatial and Infrastructure Sciences, Institute of Landscape Development, Recreation and Conservation Planning, Peter-Jordan-Straße 65, 1180 Vienna, anna.hoeglhammer@boku.ac.at)
(Ass.Prof. Mag. Dr. Rosa Diketmüller, University of Vienna, Centre for Sport Science and University Sports, Institute of Sport Science, Auf der Schmelz 6a, 1150 Vienna, Austria, rosa.diketmueller@univie.ac.at)
(Ass.Prof. DI Dr. Doris Damyanovic, University of Natural Resources and Life Sciences, Vienna, Department of Landscape, Spatial and Infrastructure Sciences, Institute of Landscape Planning, Peter-Jordan-Straße 65, 1180 Vienna, doris.damyanovic@boku.ac.at)

1 ABSTRACT

"New Media" starting with the introduction of television followed by Video to DVDs and computer games are often made responsible for the lack of movement and outdoor exercises of young people. With the spread of mobile devices such as smartphones and tablet computers, digital tools became spatially independent which offers new options and possibilities especially among young people (Direito et al. 2014). Instead of blaming new media as a reason that the young people increasingly stay at home and neglecting physical activities, the possibilities and opportunities of particularly mobile devices are to be examined in the project "ActivE Youth". The project aims to determine how mobile devices can contribute for collecting data regarding the mobility behavior of the youth and how mobile devices can be used to reduce the lack of physical activity of young people.

2 MEASURING PHYSICAL ACTIVITIES AND MOBILITY BEHAVIOUR OF YOUNG PEOPLE - THEORETICAL AND METHODICAL BACKGROUND

Due to the heterogeneous composition of the group of adolescents and the rapid changes of youth trends there is little knowledge in Austria about young peoples' physical activity and mobility behaviors in public spaces (BMFLUW 2009). Furthermore, the contribution of these different activities to their health has not been researched sufficiently.

Studies such as those of the research network "Health Behavior in School-aged Children" (Schnohr et al. 2013) show that only one out of five adolescents achieves the recommended minimum of 60 minutes of moderate exercise activity per day (Edwards & Tsouros 2008; Titze et al. 2010). Additionally the physical activity of 15-24 year olds is decreasing with increasing age and the gender gap (men are more engaged in physical activity and sports than women) within this age group is specifically high (European Commission 2014). Different factors are responsible for this situation (Sallis et al. 2000; Smith & Biddle 2008): In addition to a variety of internal and behavioral factors, environmental factors play an important role in motivating and enabling movement activities for young people (Owen et al. 2004; Salmon et al., 2008; Fein et al. 2004).

2.1 The project "ActivE Youth"

One approach of the research project "ActivE Youth" aims to analyze which active mobility forms are chosen by young people depending on the spatial setting. Active mobility within the project is primary defined as walking or cycling and also includes mobility forms which need more advanced physical abilities and practice (e.g. skateboards, rollerblades, micro-scooters).

To answer the complex and multifaceted research questions an interdisciplinary and transdisciplinary approach is chosen. Traffic and landscape planning, social science, technical and sports-science skills and methods are combined for the analysis and the development of measures. The key approaches and methods

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that guide the processing of the research questions are (1) a socio-spatial access (2) a triangulation of theories, methods and results for detecting the different dimensions of the mobility and movement behavior of young people, and (3) the approach of "living labs" that allows early involvement of future users in the development of innovative instruments and tools.

A socio-spatial access means that the social and spatial structures and physical parameters but also qualitative and "soft" factors are included in the analysis by employing and combining subject-specific, qualitative and quantitative methods (Riege & Schubert 2005; Urban & Weiser 2006; Kessl & Reutlinger 2010). The socio-spatial analysis combines physical and social aspects as well as their functional linkages with the space in relation to each other (Damyanovic et al. 2012).

Together with school students aged 15 to 16 years from two different secondary schools (one school located in the inner City of Vienna the other one in the urban fringe) we investigate their daily mobility behaviors with the aim to identify strolling areas and physical activity patterns. This requires a link between spatial information and activity measurements.

2.2 Accelerometer to gather physical activity data

For measuring human activity, a circumspect approach is necessary to ensure that the measurement instrument does not influence the activity of the test-person. Accelerometers are used in many sports- or health-science areas for measuring the intensity of physical activities. Accelerometers were for example used to analyse the effects of reconstructions of school grounds and parks (Colabianchi et al. 2009) or for gait analyses of convalescent patients.

In the research project “ActivE Youth” the ActiGraph GT3X+ (an international standard) is used to measure physical activity. In addition to the acceleration data this accelerometer provides data on the number of steps and body positions. The measured acceleration data can be classified in levels of intensity (e.g. light, moderate or intense) (Sasaki et al. 2011). So it can be estimate whether the person is rather sitting or inactive, mild, moderate or of high intensity physical active.

Accelerometers record the movement activities and intensities of the test person, but have the disadvantage that no spatial data are collected. Thus no correlation between the activities and the spaces used can be analyzed. For the purposes of the research project, it is therefore necessary to additionally record spatial data.

2.3 GPS and Apps for gathering quantitative spatial data

The rapid development of mobile and positioning technologies like GPS or WI-FI positioning has influenced mobility behaviors but also the possibilities for planners to collect spatially explicit data. As mobile devices are usually also equipped with accelerometer and gyro sensors they are often used as fitness tools to measure, share, compare or analyze different types of activities (running, cycling…). Combined with additional hardware (fitness tracker) this type of applications are widespread and extensively used. So far, research focusing on both accelerometer data and positioning devices to measure physical activity patterns in a spatial context, rarely use mobile devices or apps to collect spatial data (Demant et al. 2015; Hurvitz et al. 2014; O’Connor et al. 2013; Oreskovic et al. 2012).

Conventional GPS devices can generally be used for collecting spatial data, though study participants have to carry an additional device with them, and they need to carry them in a specific way, as GPS receivers need a visual connection to the open sky to ensure a correct data logging with a high accuracy and without missing data.

In contrast, mobile devices like smartphones offer greater possibilities for collecting spatial data. On one hand, especially within the group of adolescents smartphones are widespread and there are hardly any situations, where they do not carry them with them. Additionally to GPS as positioning technology, also WIFI positioning or cell phone tower triangulation can be applied. Therefore a reasonable positioning accuracy is possible especially within urban environments without specific carrying rules. Additionally, smartphones allow to combine position tracking with incentive measurements as for example Location Based Games, mobile Apps, Data sharing, GPS drawing,… (see also Chapter 4).

2.4 Spatial analysis and travel diaries to gather qualitative data

By combining activity data with geo data new opportunities for analyzing activity behaviors of young people in their home or school environment, as well as streets and open spaces they choose as additional activity areas are arising (Maddison et al. 2010; Cooper et al. 2010). The characteristics of the places visited by adolescents e.g. their design, form or usage as well as behavioral aspects e.g. the motivation and meaning of physical activity at certain places are central aspects which also influence the physical activities of young people. The combination of quantitative and qualitative methods allows to examine socio-spatial characteristics and the influences of built environment on the everyday physical activity of adolescents.

Studies so far mostly used basic theoretical classifications that combine indoor and outdoor spaces found in the movement patterns. For example Oreskovic et al. (2012) classified the visited spaces of young people according to findings of Papas et al. (2007) in either

- „home“ that also included private open space such as gardens or backyards,
- “school” that included school indoor and outdoor spaces,
- “car” that included public transport or even active mobility such as cycling (!) because of its velocity higher than 5 km/h,
- “indoor/other” used in the meaning of non-home and non-school spaces,
- “park/playground” that included all outdoor recreational spaces, or
- “street/walking” that meant all linear physical activity slower than 5 km/h and did not differentiate the spatial characteristics of streets e.g. if it is a small quiet street or a highway.

Van Loon and Frank (2011) stated that quantitative methods are able to assess frequency, duration and intensity of physical activities at classified locations whereas qualitative descriptors are needed to distinguish between different types or modes of physical activity. At the moment, independent vs. supervised activities of children and youth and active transportation are the main research fields of qualitative studies within the sport scientific and public health community (van Loon and Frank 2011).

From a landscape an open space planning perspective the quantitative classification of locations are insufficient. Therefore also a qualitative analysis of visited places is needed and goes beyond these basic classifications of visited spaces in order to gain more specific information regarding active everyday mobility in differentiated and unique urban open spaces. Schubert (2000) and Herlyn et al. (2003) identified six types of urban open spaces that the young use and perceive as positive spaces:

- open space of the neighborhood,
- green open spaces,
- youth related infrastructures (e.g. football yards, youth centres),
- (pedestrian) streets,
- central city squares and
- vacant plots and forgotten spaces.

The findings of the GPS and activity levels measurements will show the daily frequented areas for further qualitative investigations. This is important, because predefinition of youth neighborhoods (e.g. census defined areas or other administrative areas) seems to be inadequate due to the fact, that adolescent (same as adults) use multiple ‘neighborhood areas’ and are physically active in various contexts not in a single area nor in a single context as many study designs are based upon (Robinson & Oreskovic 2013).

The aim is to develop a typological comparison of identified open spaces important for adolescents’ daily active mobility. Therefore we combine the findings from the geospatial data with in-situ survey of places used by adolescents. Discussions with adolescents about the suitability of the existing open spaces will be included in the research process. This will generate a more precise and differentiated view regarding open spaces characteristics.

Travel diaries will be used to complement and validate the measurement methods. The state of discussion tends to be inspired by the KONTIV Design – a well-established method to conduct travel diaries (Socialdata

2009; Axhausen 1995) combined with physical activity entries. Additionally feedback workshops after the primarily quantitative survey weeks (accelerometer, moves-app, mobility diaries) will be used to discuss the accessibility, the design, the furnishings and equipment of the specific streets and open spaces from the adolescent's point of view. The workshops should also clear the motivation why they are active or inactive in certain open spaces.

3 FIRST RESULTS FROM A PRE-TEST TO DEVELOP THE SETTING FOR TEST CASES

For the development of the test cases with the schools a pre-test was conducted to analyze different apps and their possibilities to gather spatial data and to link them with the accelerometer data. Concerning applicability several aspects have to be considered. Especially impacts on battery life are often reported, as particularly pure GPS-based apps are very energy consuming. Furthermore some applications decelerate the system software and can cause abnormal system end, especially on outdated systems and also privacy aspects needs to be considered as many apps use personal data for marketing or profiling purposes.

During the pre-test different application were tested on different mobile devices (hardware and software). Several applications were tested over a week. A precondition was the availability of the apps for Android and IOS platforms as these operating systems are with about 90% penetration rate are dominant in Europe (Kantar Worldpanel 2015).

3.1 Selection of appropriate apps to gather spatial data and movement patterns

To identify potential apps for the research purpose, we performed a combined web and app store (iTunes store, Google Playstore) research, using initial keywords and continuing using the snowball method. Additionally, we applied a literature research to identify apps that were developed and/or used within comparable research projects. The main evaluation criteria for the tested apps are battery life impacts, data accuracy and export options, app usability and stability as well as privacy issues (see Chapter 3.2).

The market of location-based tracking app is huge, but only a few fits the main specific project demands mainly regarding data resolution and export formats for data integration as well as battery life impacts. The first aspect is important to link activity data from the accelerometer with spatial information from the smartphone. The battery life impacts are crucial, as there should be no significant impact on the normal smartphone usage of the participants. It is necessary to record full day patterns (24h) which means, that the phone battery needs to last for one day minimum (with loading cycles during the night).

Impacts on battery life vary highly depending on the recording methods and specific algorithms to identify movements and steadiness of the user. Apps, that only uses the GPS module to record data, have the highest impact on battery life accompanied often with significant heat generation. For example, the app SmartMo consumes about 15% of battery capacity each hour and is therefore only useful for short recording periods. Alternative positioning methods such as Wi-Fi based positioning or cell phone tower triangulation can help to reduce impacts on battery life significantly – especially in urban environments with a high density of Wi-Fi router and cell phone base stations.

Regarding data accuracy and export options we identified some apps that are lacking export options – especially fitness apps often allows data analysis only within the own environment. When a data export is possible, supported formats are usually text-based data structures such as GPX, KML or CSV which it is easy to integrate into existing data structures and GIS applications. Data accuracy depends on different factors and is therefore hardly to compare. One fact that influences position accuracy significantly is not the app itself, but the storage location of the smartphone. Most time of the day, users are carrying their phones in trouser pockets or bags. With means, that GPS as the most accurate positioning method is not working properly. This technology needs a visual conjunction to at least four GPS satellites. This can produce errors up to a few kilometers especially outside the urban environment. Within urban fabrics, additional methods such as Wi-Fi positioning and mobile phone tracking works highly accurate (up to a few meters) and can therefore compensate missing GPS signals.

Usability is central when it comes to practical application and a bad user experience is often a reason to refuse an app. Especially among adolescents, the user interface, simple usability, self-explaining procedures and a nice design is very important. Regarding usability, the app Moves comes with a very clear and stylish interface which is very easy to use. Other apps need some settings to be done (e.g. activity selection etc.) or needs an active recording start (e.g. SmartMo, Garmin Forerunner, Mobile Motion Advisor…). The latter apps requires and active involvement of the users to start and stop recording or to enter additional categories etc. which means that recording gaps can be expected. Apps like Moves or OpenPaths can run fully in the background without any necessary manual tasks. A few apps were excluded from the test due obvious high battery usage or difficult applicability. Two apps were identified as generally suitable for data gathering – Moves and OpenPaths.

Moves is available for iOS and Android and has a very clear and easy to use interface. Main goal of the app is to record daily routes and auto-recognize the form of mobility (especially waking, cycling and running). The data can be stored on a server that requires a registration with an email and password (no other personal data is required). For positioning, Moves uses A-GPS and WIFI and has algorithms to deactivate positioning when stationary which means, that the app has very little impact on the battery life.

OpenPaths serves also the two dominating mobile operating systems and is also very easy to operate. Compared to Moves, the Graphical User interface is not that fancy, but straight forward. OpenPaths recognizes position changes and saves a point when being stationary, which means, that the spatial resolution is much lower compared to Moves. The points can be joined when being processed in GIS but there are limited opportunities to indicate detailed paths and activity types. Regarding the battery life, OpenPaths performs very well, which means, that there is no significant impact on battery life when running the app in the background. Data is also stored on a server and requires a simple registration. Additionally, personal data can be automatically shared with projects, so every user can participate in research or citizen science projects.

Privacy issues are an important topic when gathering personal data with third party apps on smartphones. The companies behind the apps often give the apps away free of charge, but for the price of personal data for consumer analysis, location- based marketing, etc. Moves as well as OpenPaths store the user data in an encrypted format, nevertheless it is not impossible to hack and access these data by third parties. The major problem in this context is the use of weak passwords. This risk can therefore be actively reduced by choosing strong password and avoid multi-use of passwords.

Moves is part of the facebook group and in their privacy policy they remark, that data can be shared for analysis and service improvement. It is possible to register with an anonymous account, but as other things like phone identifier number are also submitted, it seems to be possible to link the data to existing social media accounts or other cloud services. OpenPaths has a more closed data policy. Data will be only provided to research projects when a user actively grants rights to a specific project.

Smartphone App	Usa-bility	Use of resour-ce	Platform Indepen-dency	Pri-vacy	Costs	Suitability for reseach purpose	Notes
Moves	++	++	++	-	++	++	Detailed recordings of point locations and routes possible
OpenPaths	+	++	++	++	++	+	Only point recordings of locations
Ohmage	?	?	++	++	0	-	High Administration effort (Server infrastructure)
Mobile Motion Advisor	?	--	--	?	?	--	Not on the market yet
SmartMo	--	--	++	++	++	--	High energy consumption; instable (crashes reported), manual adjustment of form of mobility
Runtastic (Orbit)	++	++	++	-	-	-	No geo data recording
iHealth	0	++	++	-	-	-	No geo data recording
Garmin Forerunner 210	++	-	k.A.	+	--	--	high energy consumption, high GPS accuracy
PROVAMO – App	?	?	++	? (+)	?	?	This App is a still a prototype and is not published for end users yet.

Table 1: Comparison of different available apps regarding their suitability for the research purpose

In combination with accelerometer data, the apps Moves and OpenPaths prove to be the best applications. Moves also provides the incentive to look at a ranking over the last few days and generates daily reports on the performance on the previous day, which can be a motivating factor for the school-children. OpenPaths provides better data protection policy as Moves, but records only places and no paths and thus has a much lower temporal resolution than Moves. Thus Moves was chosen for the pre-test.

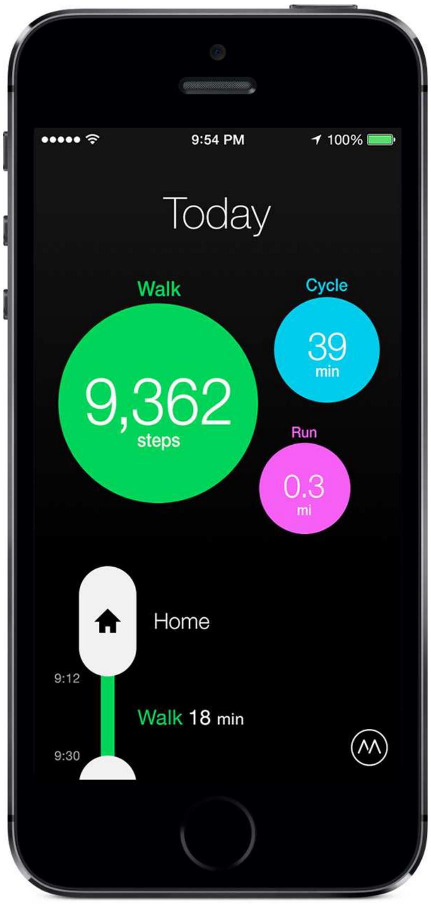

Fig. 1: MovesApp (Source: https://www.moves-app.com/assets/moves-on-iphone5s.jpg)

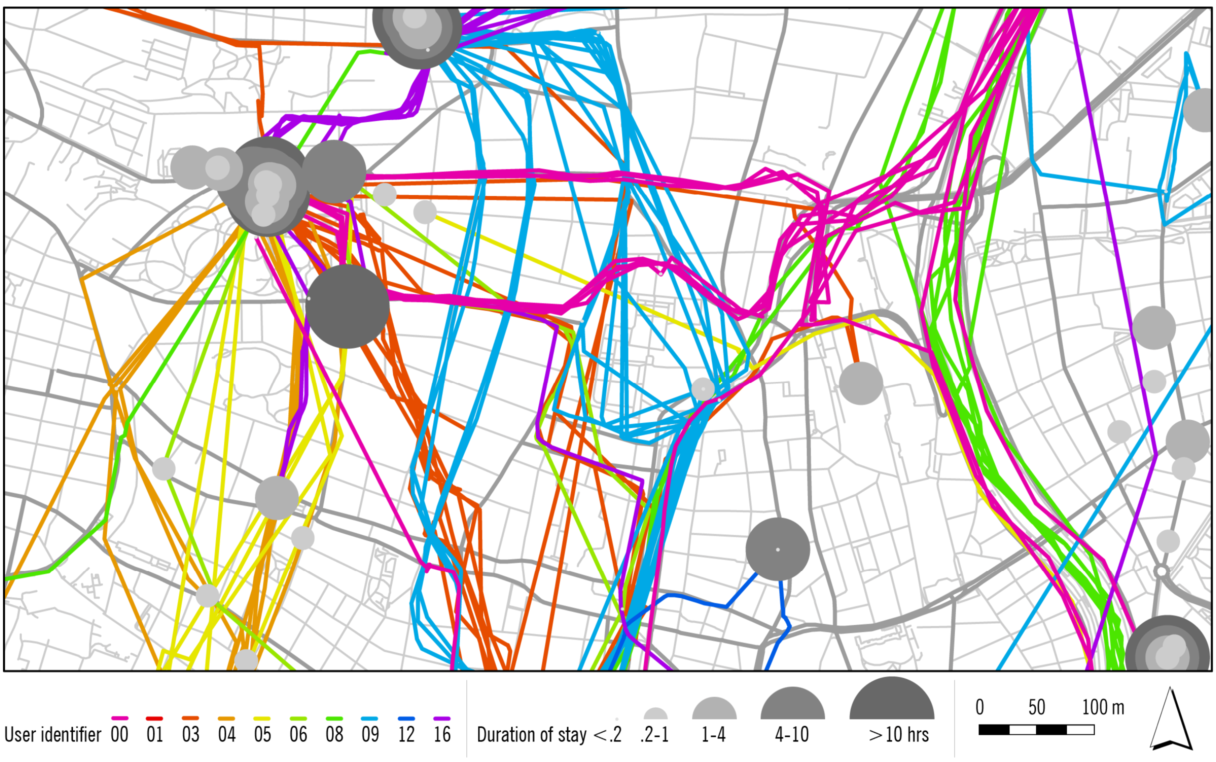

Fig. 2: Different user tracks from the pre-test week and visualization of the duration of stays

3.2 Results of the pre-test – combining and mapping the data of the app and accelerometer

The pre-test was performed by members of research team. The aim was to gather practical information on the usability of different applications on different smartphones and operating systems. Also the analysis of opportunities to combine and map the gained data was an aim of the pre-test. Therefore 10 persons tested the smartphone app Moves together with accelerometer for 7 days and reported issues on usability, stability and battery life. Analysis of the recorded data provides information on data quality. Additionally, the app OpenPaths runs on two devices to compare data quality.

The test pointed out, that Moves is generally suitable to record spatial data at a high resolution for a longer time period. To guarantee a suitable data accuracy, a few aspects need to be considered. Firstly, when carrying the phone in a bag, it is crucial that WIFI is permanent active; otherwise a lot of data gaps and inaccurate data are being recorded. Secondly, when leaving urban areas with a high density of WIFI routers and cell phone towers, it is highly recommended to place the phone as often as possible with a direct connection to the open sky, as in this context, GPS positioning is important for data accuracy. Thirdly, Moves comes with a special energy saving function that ensures, that the battery impact is significantly reduced. This option needs to be activated once, as it is inactive by default. The auto recognizing process works well but produces some mistakes in urban environments with a lot of stop-and-go movements. This causes that e.g. car rides in the city are sometimes identified as bicycle rides. Wrong allocations can be changed easily within the application, but can also be corrected semi-automatically later in professional GIS environments. Moves also counts steps with a build-in pedometer for walking activities, but compared to the accelerometer, this data seems very inaccurate. The reason for that is, not the accelerometer of the smartphone itself but the different carrying positions (e.g. carrying in bag, holding in the hand while walking, putting the phone away at home or other private environments). The accelerometer is fixed around the waist and can therefore produce data at much more constant conditions.

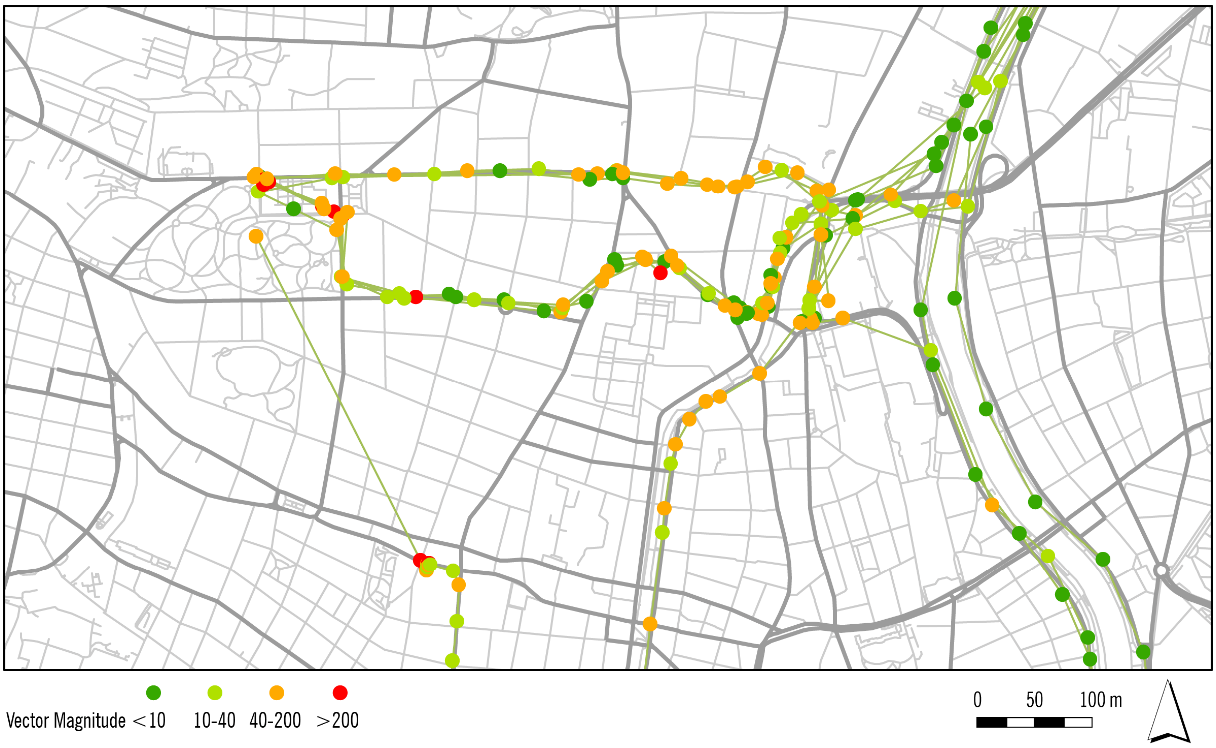

Fig. 3: Vector Magniture values from the accelerometer combined with the spatial explicit data from Moves for a single user

The data collected by the ActiGraph GT3X accelerometer were exported for 10 sec intervals (resolution up to one second possible) and on the basis of Sasaki et al. (2011) assigned to the intensity categories of activity: light-moderate-vigorous-very vigorous. Due to the time stamp the accelerometer data can be linked to the data of the Moves app.

Moves data as well as accelerometer data can be exported to simple table-based text files (coma-separated-values). Both tables contain timestamps for each event and can therefore be linked using database operations. Additionally, we developed a database script for automatic correction of mobility types based on speed

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statistics (mean, maximum and minimum statistics) and analysed the stays regarding length and daytime to identify potential public places for further analysis. The test persons are identified using a unique key that cannot be linked to the real person behind the tracking pattern. The combined data-table is transferred to the GIS environment using recorded position data in decimal degrees (WGS84).

4 OUTLOOK – TEST CASE WITH SCHOOLS AND INTERVENTION

The pre-test is the basis for a test case with classes from two secondary schools in Vienna. The school-children are aged 15-16 years when starting the project. In the first year the activity patterns of all participating school children are recorded for one week (Monday to Monday). The identified areas, streets and open space are analyzed using field mapping, workshops and interviews. In the second project year it is planned to develop together with the school-children interventions to change their mobility behaviors and physical activity.

Playful and communicative instruments on mobile devices, which are used by young people every day, can create incentives and motivation for choosing active forms of mobility. But there is little knowledge about the effects of these tools (Bort-Roig et al. 2014; Middelweerd et al. 2014). Therefore location-based-games such as alternate-reality-games (like Ingress or PacManhatten) geosocial games (multiplayer games), treasure-hunts (geo-cache, multi-caches) or GPS drawing (GPS art, figure running) and their possible effects and influence on the physical activities are going to be tested together with the school-children. To measure the impact a second measurement will take place a year after the first round.

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Promoting Public Participation in Post-Disaster Construction through Wechat Platform

Gong Zhang, Qilin Wu,Xiaojin Qi, Xiaowei Huo

(Gong Zhang,Beijing Tsinghua Urban Design and Planning Institute, Beijing, zhanggong@thupdi.com)
(Qilin Wu, Beijing Tsinghua Urban Design and Planning Institute, Beijing, wuqilin@thupdi.com)
(Xiaojin Qi, Beijing Tsinghua Urban Design and Planning Institute, Beijing, qixiaojin@thupdi.com)
(Dr. Xiaowei Huo, Beijing Tsinghua Urban Design and Planning Institute, Beijing, huoxiaowei@thupdi.com)

1 ABSTRACT

Purpose - How could memory, heritage and post-disaster construction integrated in practice? The purpose of this paper is to introduce our approach in public participation of reconstruction plan, after a raging fire destroyed part of the historic town of Shangri-la, China.

Approach – We develop two kind of crowd sourcing platform to collect and also present memory of the vanishing streets which were distroyed completely by fire. One is on Wechat platform. Through secondary development on Wechat Platform, we built a public service account that allowed users to upload photos, hand-painted pictures, and text, all of the files can be saved automaticly in our database. The other platform in on web. The website is designed for users to upload photos based on location where they were taken. All the images collected from the two platforms can be open accessed viewed with location information, which had been sort out by volunteers.

The wechat platform is also used to communicate and provide education and information of the historic town to promote awareness of the heritage value. Users can send text to the public account, without privacy risk.

Findings – Spreading with help from a local non-government organization, the invations of the wechat public service account received amazing amount of attention, which, according to automatic web statistics, reached up to 40,000. About 150 people followed the Wechat public account. At last we received nearly 1000 photos and hand-painted pictures. About half of our users are from Shangrila local community, Their uploaded files including historical photos of the community, providing us local perspective with long period of concern. The other half users come from travlers from all over the world, mostly from China but also european people. Their photos and paintings also contribute to the memory construction.

Implications –The widespread use of smart mobile devices can make individuals more active as participants of public fairs, with the premise of carefully designed infrastructure. In this way, new technologies may contribute to a people centred principle in our conservation and design process.

Value – Our approach is so-called Volunteered Geographic Information(VGI)(Goodchild,2007) in collecting memory fragments for post-disaster construction. By convenience of uploading photos and texts from mobile devices, we successfully involved local people and travlers'participation. The case might bring insight into the field of public participation practice.

2 INTRODUCTION

The paper drawing from the post-disaster construction plan and community engagement we conducted in the ancinet town of Shangri-la. The ancient town, named Dukezong, is listed as one of the historic town in Yunnan Province, China, well known for its well-preserved Tibetan dwellings. About 17.8% of the core protected area was totally damaged, including commercial streets and the center square of the town.

As a preceding part of post-disaster construction plan, we launched an online programme to collect images and texts which represent the memory of the old town, espetially the damaged part. The data collected would not only make a memorial for local community, but also serves as important reference for reconstruction plan. As the aim of post-disaster construction plan is to respect the authenticity local tibentan style and former landscape of the old town, we need mass storage of documentations of the old town, which was scarce at the time we began.

This paper will explain our approach of crowdsourcing in collecting data and also the strategy of post-disaster construction plan. With the help of widespread use of smartphones among local tibetan people, our approach successfully involved local tibentan communities and also former travelers from all over the world to engage.

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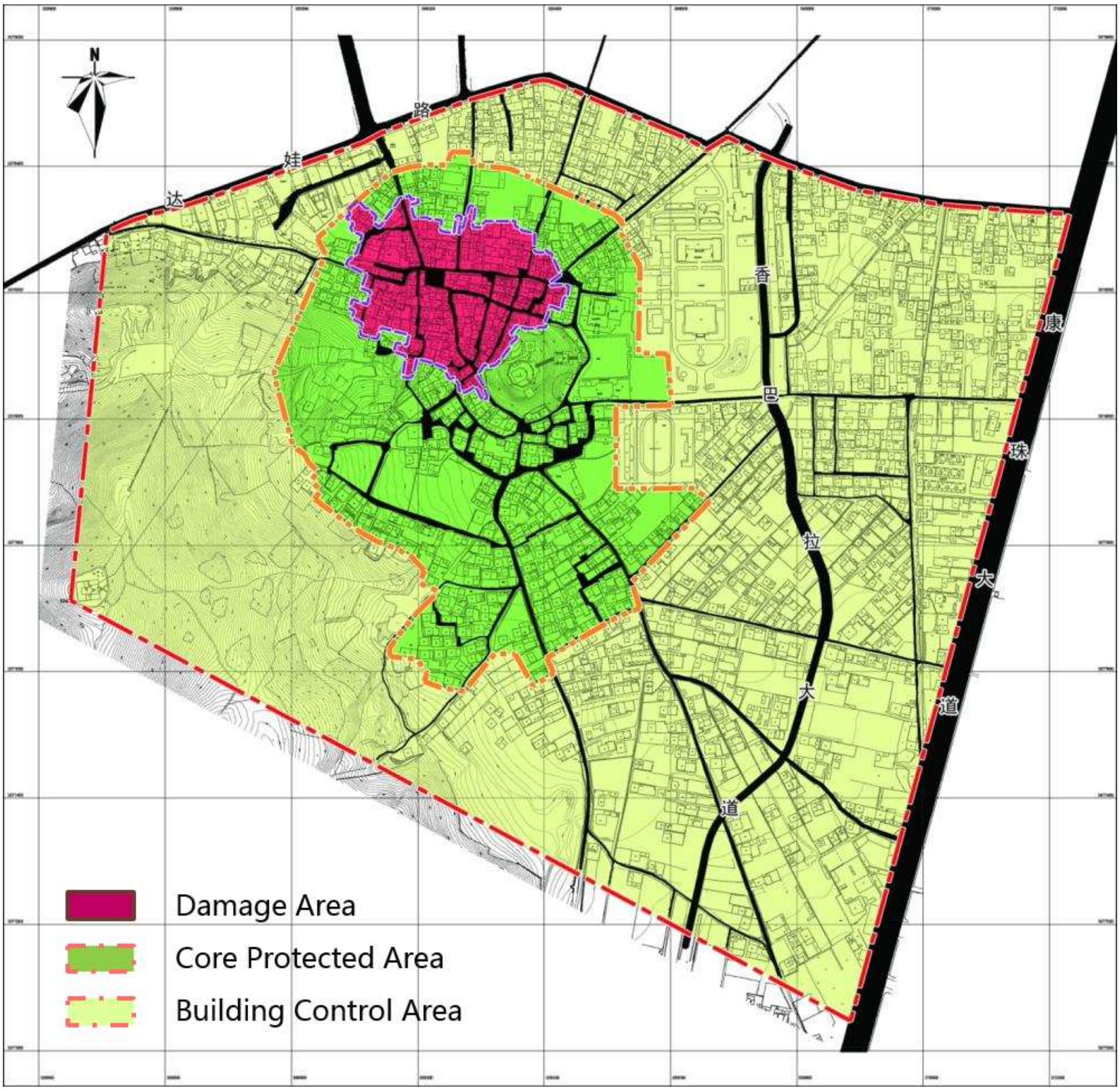

Figure 1 The Damage Area of Dukezong

3 THE CONTEXT OF PUBLIC PARTICIPATION IN SHANGRILA

3.1 Public Participation Overview

The term "public participation" is quite new in the Chinese language, which was first used by the Chinese leadership in October 2003. For more than a decade, China has been exploring and beginning to institutionalize mechanisms to permit the general public to have greater input into urban plan and other government decisions that affect their daily lives. However, in daily practice of public participation in urban planning, experts and genral public can only give their opinions within 30 days after the draft is published for comments. To promote better community engagement, we need a new understanding of the role of the public. The public are not only interested parties, but also the provider of knowledge. This means that community engagement should include the process of informing, mobilising and enhancing deliberation to seek common ground of decision making.

The past decades is also the period that information communication technologies played an important role in daily lives. Naturally the web become an main interface for information about and the promotion of planning in progress.

3.2 Features of the Shangrila Case

Shangri-la, famous for the earthly paradise legend, is located at the south-east edged of Tibetan Plateau. The ancient town of Dukezong is the central tibetan town of Shangri-la.As a key stop on the Ancient Tea-horse Road and a focal point for Han-Tibetan exchanges, the town has a history of 1300 years. As Shangri-la located in Yunnan Province and its traffic advantage, the region is an open center place for mainly Tibentans but alsoother minority groups in the southwest of China. Situated at an altitude of 3,200m above sea level, Dukezong town was known for its well-preserved Tibetan dwellings and the old Tibetan way of life, which attract many tourists every year.

The raging fire broke out in Dukezong in January 2014 lasted for 10 hours. The blaze broke out in an Inn after its owner forgot to turn off the heater. The fire burned over 59,980 square meters, damaging more than 240 houses, with another 43 properties having to be dismantled to isolate the fire. Most of damaged house were in commecial use, including several listed historic venacular buildings.

North to the ancient town is the modern part of Shangri-la city, and most local people dwell in the south and east part of the old town, leaving the left part where the fire damaged mainly constitutes of handicraft shops, café, restaunts and hotels. As a central market and famous tourist destination, to maintain more space for commecial use, many houses on these streets experienced a expansion or rebuiding in the last ten years. All of them maintained a tibetan style, but some features are no longer local but of lasa style.

As model of ancient tibentan town and tourist destination, local government and community expressed their concern in respecting tibentan culturen and maintaining the local style in post-disaster construction plan. To achieve this goal, we need to identify the authentity of local style and features, and tracking the transition of buildings, streets in last 20 years.

3.3 The Challenges

The first challenge is that we need to cross the borders to inform tibetan communities the principle of the plan, and that we need their help. The mobilisation for data collection led by local government tend out to be of little effect, which means that we need a more effective approach to raise awareness of the local community to become involved. The second challenge is that also Dukezong has been a popular destination in the last ten years, it’s hard to find any integrated documentation or a completed record of houses of the old town. There should be mass photographs taken by tourists and local people, the problem is, where to find them and how to get their involvement?

4 THE TECHNOLOGY OF WECHAT PLATFORM AND OUR APPROACH

One of the main problems we have to face and solve is how to get the public to actively participate in a short time. Smart phones and micro-channel depth popularity in China offers the possibility for this work.

4.1 The Widespread Use of Smartphones and Wechat App

According to theInternational Telecommunications Union 2011 statistics the twothirds (2/3) of the global population does not have access to theInternet. In contrary, while 87% has a mobile phone. The situation in Shangri-la is not an exception. In underdeveloped areas, more people through mobile phones instead of computers to access the Internet.

Wechat is a popular instant messaging tool that can be used on apple, android, windows phone, Blackberry and nearly all smartphone platform in China. Since its first release in 2011, it has experienced a rapid growth in the Chinese language users, and quicklybecame the most popular mobile applications in China.According to the research firm Penguin Thinktank’s report in 2014, the current global active users of wechat has reached 468 million, including at least 50 million users outside China. According to a sample survey of all Chinese provinces covered by this report, as the APP maintains a high degree of user stickiness. More than 60% of respondents launchit every day and use the wechat more than 10 times, even more than the use of short messages. 62.7% of the wechat usershave over 50 contacts in their wechat addressbook, more than 40% users have more than 100 contacts.

4.2 The Functional features of Wechat

Wechat’s services integrate communication and information with entertainment, personal media and e-commerce, include Moments, which is similar to Instagram; Hold To Talk voice chat, Groups, and Public Accounts.

Wechat design a series of programs to promote contact between people through the establishment of wechat. Firstly, WeChat is an outward looking service that can be registered through a QQ number, Weibo account, phone number or Facebook account. Secondly, in face to face ocassions, you can add friends to wechat contacts by the built-in two-dimensional code scanning tools.Thirdly, the design of the wechat group function, allows every member to add new member to the group. According to the theory of Six Degrees of Separation, it brings a brand new way to gather people freely and quickly under a common interest.In a word, the design and widespread of wechat brings an important opportunity for people to build new social ties under common topic or interest.

Public Accounts is a light app based on wechat platform, which provides a secondary development of the port, so that in addition to the one-way dissemination of information in the public platform, a number of interactive features can be realized through mobile wechat end. The report above shows that eighty percent of the users has subscribed to at least one Public Account. Every one with an ID card can register up to 5 Public Accounts on the paltform.

The design of Wechat Public Account made information that integrated with graphs and texts quite easy to push to the subscriber, and also easy to share through repost on the Moments. The dissemination mechanism made it possible for an article to spread through the help of Public Accounts, Moments and Groups. On Feb. 28th, a new video concerned China's haze by Tencent quickly reached the click number of 29, 530, 000 within 24 hours, thanks to the amazing spread efficience of Wechat Platform.

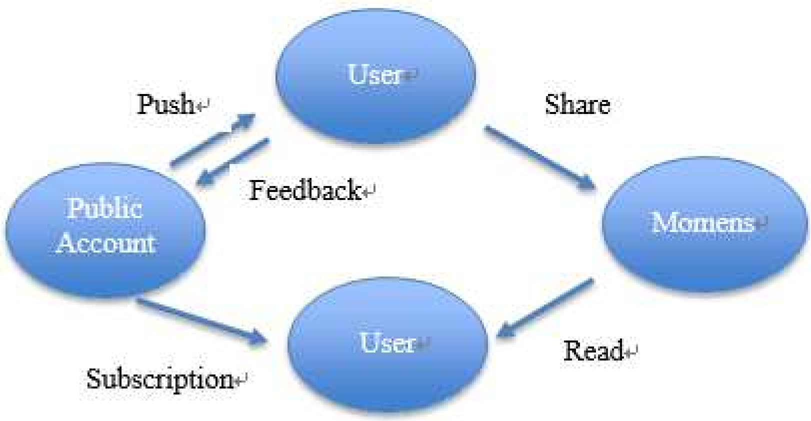

Figure 2 The Dissemination Mechanism of Public Accounts

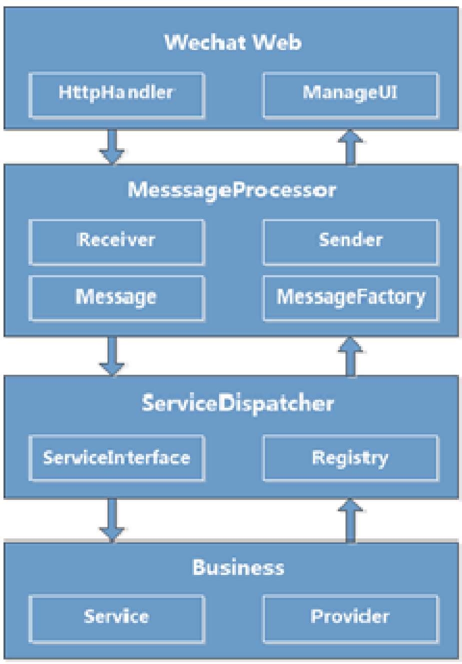

Figure 3 (left) Structure of The Public Account Service. Figure 4 (right) Interface of Wechat for participants to upload photos

Our Approach of Using Public Accounts for public participation

Through secondary development on Wechat Platform, we built a public service account that allowed users to upload photos, hand-painted pictures, and text, all of the files can be saved automaticly in our database. The back-stage website is also open for users to upload photos based on location where they were taken. All the images collected from the two platforms can be open accessed viewed with location information, which had been sort out by volunteers.

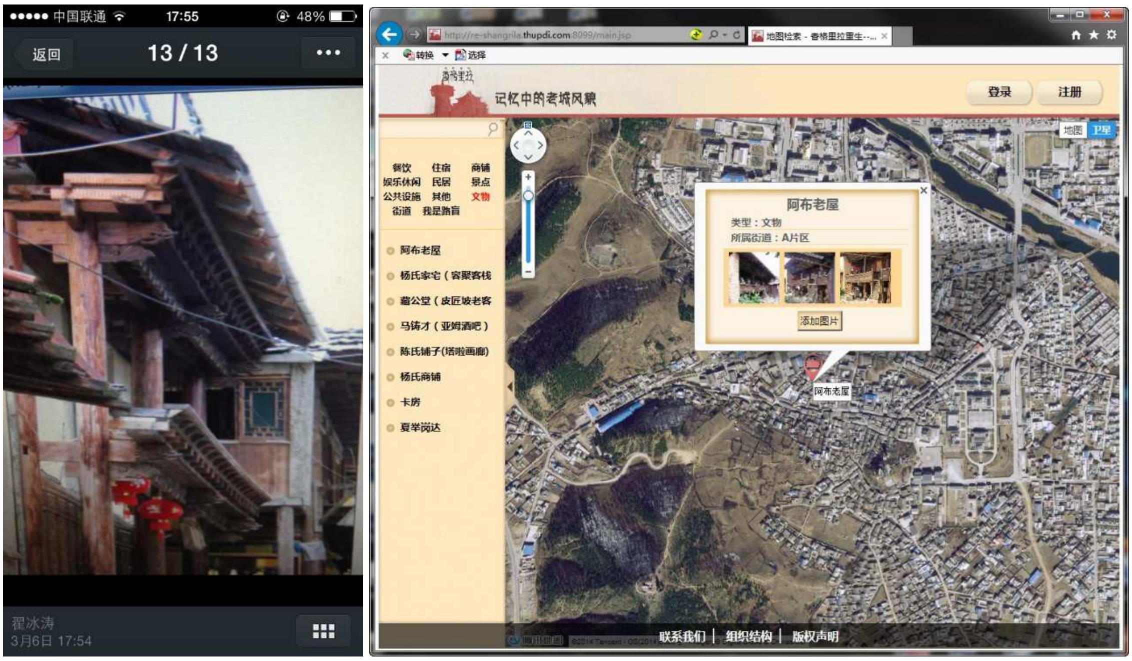

Figure 5 Interface on Mobile Device and PC

Besides data collecting, the wechat platform is also used to inform our principle of the plan to the public, to communicate and provide education and information of the historic town to promote awareness of the heritage value. Users can send text to the public account and get feedback right from operator of the Account.

4.3 The Strategy on Getting Local Community Engagement

Based on the fact that smartphone and Wechat App were widely used in Shangli-ra region, we searched web and quickly find a Shangri-la local Public Account named Rila Linka, whose topic is to promote the spread of Tibentan Culitre, which has many local subscribers in Shangri-la. With help from Rila Linka, the invations of the wechat public service account received amazing amount of attention. About 170 people followed the Wechat public account, half of them are supposed to be from local community. At last we received nearly 1000 photos and hand-painted pictures, all of which came from Wechat platform, none from website. The uploaded files includes historical photos of the community, provided us a local perspective with long period of concern. The other half users come from travlers from all over the world, mostly from China but also european people. Their photos and paintings also contribute to the memory construction. What’s more, finally we were able to track the transition of buildings, streets in last 20 years.

5 CONCLUSION

The widespread use of smart mobile devices can make individuals more active as participants of public fairs, with the premise of carefully designed infrastructure. In this way, new technologies may contribute to a people centred principle in our conservation and design process.

The so-called volunteered geographic information played a great role in collecting memory fragments for post-disaster construction. By convenience of uploading photos and texts from mobile devices, we successfully involved local people and travlers‘participation. The case might bring insight into the field of public participation practice.

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Reformating the Agglomeration's Edge: Elements of Urban Design in Dagu Revitalization

Yifan Wang, Teng Xing

(PhD candidate Yifan Wang, Tsinghua University, School of Architecture, Beijing 100084, China, evan7128@gmail.com)
(MUP Teng Xing, Harvard University, Graduate School of Design, Cambridge, MA 02138, USA, linda_slxt@sina.com)

1 ABSTRACT

This paper discusses an urban design case in which the elements of urban fabric and their relationship are repaired in order for regeneration of brown field in Dagu, Tianjin, China. It starts with the typological study on the elements including ecological system, architectural context and existing neighbourhoods, which often are merely the discard of rapid urban renewal. In order to preserve the existing communities and reuse the brown field, the design work is to provide: 1) healthy relationship between original and new communities; 2) good public space; 3)vibrant urban life in existing places; 4) connection with Old Town and CBD; 5) environment free from chemical pollution. The idea is to reformat the old and new agglomeration's edge based on a circular public space which is organized by the existing elements. The design strategy follows the issues on ecology, community and factory. Firstly, industrial reservoirs and canals are preserved to provide open space in the neighbourhoods. The reservoirs are made use of to develop lakeside public space and the canals as ecological corridors define several clusters. Secondly, to ensure the continuity of the memory of the locals, the original communities and villages are encouraged to grow spontaneously, but not sprawling. This falls into two strategies, with green belts define the limit for the village development, and new communities merged with the old ones to help compensate for public facilities and open spaces. Thirdly, industrial heritage is preserved as a park for later development. It creates pedestrian links between the city and nature and helps cleaning the polluted land as well, bringing citizens and tourists together while keeping resilience for future commercial renovation. Green and public space acts as a buffer zone between different urban fabrics so that all the identical agglomerations can be merged and can share a structural view corridor. Also, various types of the interaction between people and the nature around the green belt are comparatively studied and applied to detailed design, including waterfront cultural center, riverside parks, and the public spaces around the northern living communities.

2 INTRODUCTION

2.1 Dagu: An Isolated Island

Tianjin, a mega-city with 15 million people, has China's most ambitious CBD Yujiapu under construction near its port Tanggu, which is 3km away from the Tanggu Old Town. Looking at the ravishing urban planning model for the next booming center of China, one does not notice an inarticulate site between Tanggu Old Town and Yujiapu CBD. Here at the site, Dagu, one sees a dilapidated village with 3000 villagers who ferry daily to Tanggu Old Town, a river which isolates Dagu with developing areas, quite a few chemical factories which are to be relocated. While distance from the village Daliangzi to the old town is no more than 1km, this village is still falling into decay. Based on the Spatial Structure of Tianjin, Dagu serves as a cluster of service function near several important clusters and it is on the main axis of Tanggu's central area, connecting Tanggu's past and future. However, Dagu has been designated to no clear position despite its important location.

2.2 Dagu in the Metamorphosis of Tanggu

It took almost a century before the historic agglomeration of Dagu, which once was the core of Tanggu with its polar industry and shipping lane, became an isolated place. After a 100-year development, Daliangzi Growth Agglomeration, one of the cores of historic Tanggu back in 1930s, becomes the edge of the urban agglomerations because its being separated by the Haihe River and limited by the chemical factories (Fig. 1). Because of the chemical factories, the site has monolithic industry and industrial pollution, with poor connection to the city in regard to the transportation. From the two sections of Tanggu, one can tell that the Haihe river and chemical factories separate the site from outside, giving it a sudden variation from neighboring spaces (Fig. 2). The connection between the site and its surroundings is so loose that sharp contradiction can be perceived. While the chemical industries influence the site so profoundly, there are only three connections between our site and the surroundings.

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Analysis on Tanggu’s economy shows that Dagu lacks reasonable industrial layout. Yujiapu CBD will have 28% land use percentage for office and much of the residential function is undertook by its neighbouring Xiangluowan Business District, whose percentage of land use for residence is 41%. However, the functional layout of Dagu has not been related to these neighbouring districts.

Daliangzi village and its surrounding brownfield is now ignored by the city’s general plan. At the same time, people are wondering what can be done after the relocation of chemical factories on the site and what will the new CBD bring to Dagu.

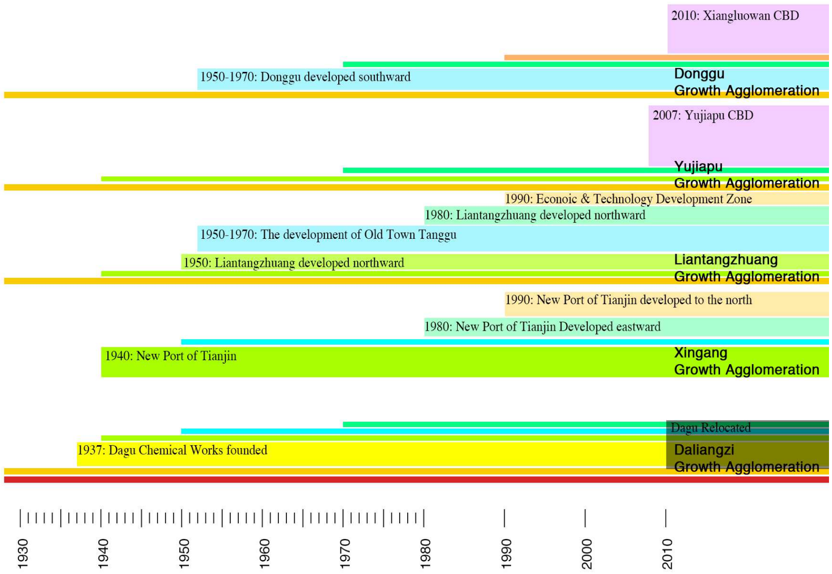

Fig. 1: The Metamorphosisi of Tanggu: Growth Process of Five Agglomerations.

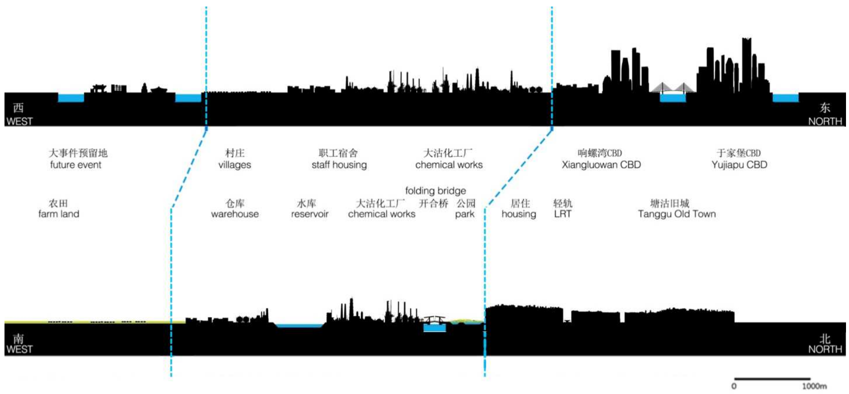

Fig. 2: Sections of Tanggu.

3 LITERATURE REVIEW AND CASE STUDY

In his article A City Is Not A Tree, C. Alexander (1965) proposed a way of thinking from hierarchy of the city, in which the elements of a city can be organized into tree structure or semi-lattice structure. According to G. Hack (2009), the elements that give structure to the urban area differ depending upon scale. Some urban design cases give a clue of how various elements can be organized into structures in different scales. For regional structure, D. Burnham’s Plan for Chicago exemplifies how the region is envisioned with the arterial system including major transit lines, regional infrastructure and protected lands, which remain almost unchanged after 100 years. In the cases of Ontario Greenbelt of Toronto, Regional Plan of Vancouver and Regional Plan Hanoi, we can see how ecological and river corridors shape the urban form. For sector scale, green spaces act as buffer zones between communities so that a network connects distributed different function. Such structure can be found in Milton Keynes and Modi'in New Town in Israel, which creates corridors for community life with existing geomorphology and water bodies. For architectural scale, elements such as existing infrastructure and buildings can create three-dimensional structure, as in the cases of Sejong City PAT and Makuhari Messe. By applying design strategy with utopian paradigm, new towns such as Shanghai Anting New Town and Qingdao Sino - German Ecopark achieve picturesque background. However, it is paradoxical that they lack good space for individual perception. The agglomerations in these new towns are alienated from their existing contexts and differentiated with long distance between each other.

4 DISSECTING THE URBAN DESIGN ELEMENTS OF DAGU

4.1 Ecological Elements

Ecological system is one of the most important elements to control the morphology of a city, as the urban agglomerations are mostly defined by ecological elements such as river, farmland and woods. Ecological elements are literally important for Tanggu, not only because the agglomerations of this city are separated by several ecological elements, but also because the metamorphosis of different parts is well recorded by the soft boundary which controls the shaping process. Ecological system also plays an important role in Tanggu, especially the water system including natural water system, reservoir and canals. It is testimony to both the geography of the port region and the interactions between nature and industry. So it is the concept of urban design in the site Dagu to respect the ecological background of Tanggu.

Plenty water elements can be found in Dagu site. Although most of the water system is made for industrial purpose rather than typical aesthetic value, some of the waterfront spaces have a very good view. In the process of planning for Dagu, the ecological system can still be used as a guide in separating the whole site into smaller, controllable parts, and offering flexible boundary for different agglomerations. At the same time, instead of copying the form of ecological system of Tanggu, the edge is reformatted when multiple function is added to the green belt, which makes it a loop garden providing leisure spaces for the residents.

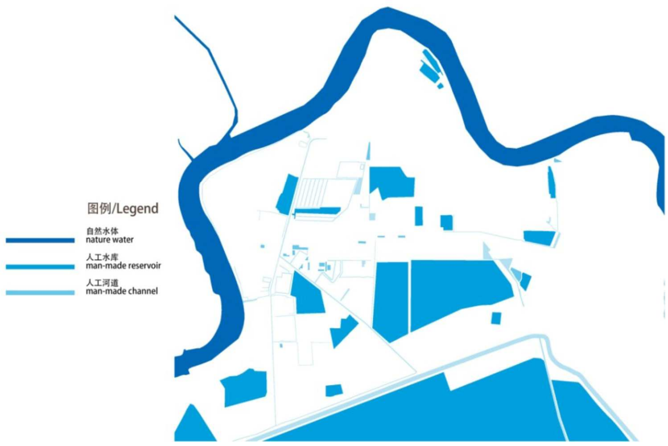

Fig. 3: The Urban Design Elements of Dagu: Water Elements in Dagu site.

4.2 Architectural Context

The urban fabric of the site is marked with informal and autonomous characteristics of factories and communities. Clusters of Dagu Chemical Works with many industrial buildings accommodate diversity of architectural typology for potential renovation. Original pattern of factories and communities is formed as a result of the interaction between hydrogeological transition and industrial layout, which authentically reflects the logic of the growth process of the site. The pattern is typical for an old port city like Tanggu, yet more and more historic agglomerations are replacing their characteristic urban fabric with a single and unified pattern nowadays. Here at the site of Dagu, by understanding the urban morphology, the place identity and collective memory of the locals are respected. Unlike Yujiapu CBD on the east or Tanggu Old Town on the north, the buildings are not following an urban planning paradigm. Instead, it clearly records the development sequence of the industrial constructions and has its own inherited order and archetype. The unique pattern also leaves much open space, providing more resilience for the development of this mega-region.

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Various industrial elements are potential for future reuse because these huge constructions have the capacities to accommodate greater densities with experimental typologies that reshape conventions of urban life, and also provide possibilities for industrial heritage conservation to memorize Tanggu's history and development of the past century.

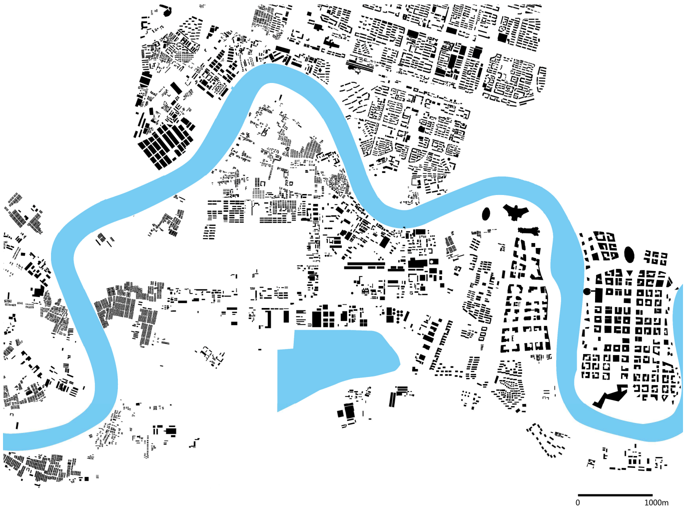

Fig. 4: The Urban Design Elements of Dagu: Architectural Context of Dagu.

4.3 Existing Neighbourhoods

After the relocation of the Chemical Works, most people working at Dagu will leave and only the existing communities and villages would be the source of public social interactions. The vibrancy of the neighborhoods is continuously expressed in a network of public places such as farm market, ferry and parks in the neighborhoods. The existing agglomerations are not following any general plan, resulting in the distribution of sporadic domestic spaces.

Preserving these existing communities and villages is extremely vital to retain place sense and attachment for a site of vast regeneration and replacement. Dagu needs image and identity that respects its history and defines its place in the region. These preserved communities and villages are fitted into a flexible clustered network. The flexible structure makes it possible to accommodate the original villages and communities without destroying their irregular boundaries, creating a vibrant diverse community network that includes existing and developing urban form. The structure also allows future growth in high density clusters of development centered on future transit oriented hubs.

The structure relies on the ecological system of Dagu. By making use of the ecological elements and providing features and amenities of leisure, the spaces between the clusters also to attract students, staff, and residents from across Dagu and its adjacent CBD.

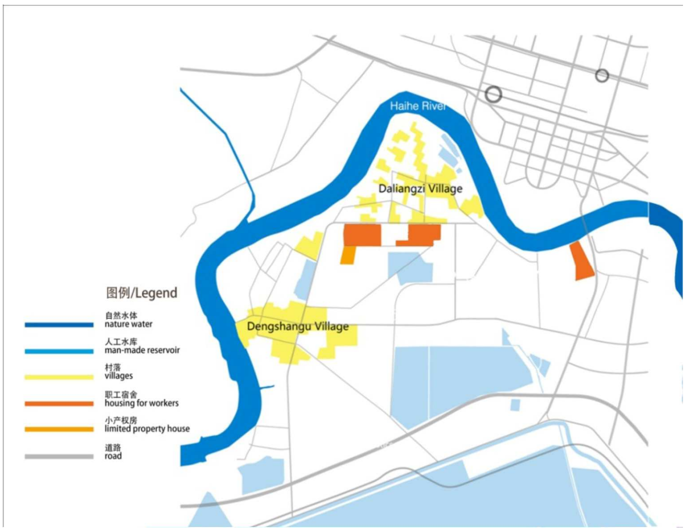

Fig. 5: The Urban Design Elements of Dagu: Location of Original Communities.

5 EDGE OR CENTER? ENVISIONING A VIBRANT DAGU

Unbalanced development between center and the edge has led Dagu to an awkward position and an unpredictable future. It is a great challenge to have so many fragmented urban edge areas to be regenerated at the scale of the mega-region. In between several rapidly developing areas, Dagu is also in the threat of losing its own cohesion and becoming the offcut of Tanggu's development, as is shown in the general plan of Tanggu and Tianjin.

This paper makes no claim to revise the general plan. It does, however, attempt to achieve a vibrant urban environment by repairing the elements of urban fabric and their relationship. The approach starts with the typological study on the elements of urban design including ecological system, architectural context and existing neighborhoods, which often are merely the discard of rapid urban renewal. These elements are potential to express vibrancy in the regeneration process of mega-region in regards with health, safety, pride, dependence, engagement and diversity. These aspects of vibrancy explain why people seem to form a sense of cultural identity and attachment to the features of certain urban spaces when they have easy access to natural, cultural and public spaces.

In order to preserve the existing communities and reuse the brownfield near Yujiapu CBD, the ecological system should be well preserved and made use of. The three elements are influenced by each other and engender new tasks for design work to provide:

(1) healthy relationship between original and new communities;

(2) good public space;

(3)vibrant urban life in existing places;

(4) connection with Old Town and CBD;

(5) environment free from chemical pollution.

As the three elements are in correlation with each other in the plan of Dagu. They should be considered as an intertwined whole. The idea is to loop the old and new elements based on a circular public space which is organized by the existing water system. Dagu will not be simply a suburb or a sleeping town. It will reformat the agglomeration's edge and be a center that is a destination place of its own image. People can wander in this rounded public space while engaging in the activities of communication between different groups.

6 URBAN DESIGN STRATEGY

According to the above analysis, the industrial buildings, the vibrancy of old communities and the river system are three main features of Dagu site, which provide the source of our design. As an approach to revitalization, organizing the design task with these elements of urban design can help analyzing and shaping complex metropolitan systems. The strategy of Dagu Revitalization will focus on how an expanded notion of elements specifically vital to the site can serve as the backbone of a much more integral urban project.

The first step of reformatting the edge is to connect the site with Tanggu city in important nodes of the public loop, especially to Tanggu Old Town, Yujiapu CBD and Nanyao Pennisula reserved for future big event. The following strategy is to strengthen the ecological structure which can separate different clusters. The ecological system plays a role as a public garden for people to relax. At the same time, different clusters play a role in enriching the garden's types, providing a colorful life for the people. These clusters include the existing community, industrial heritage, lakeside cultural center and central cluster, forming a loop garden as the conceptual structural urban design (Fig. 6). The design strategy follows the issues on ecological structure, the vitality of neighbourhoods and conservation of factory buildings, of which the first one is the most fundamental element connecting all of the existing water and building the basic structure of the site. The road system, the public traffic system, land use and the form of urban spaces are fitted in it, which helps improve human scale pedestrian movement with a rich network of integrated public places to encourage social interaction. As a method to combine the original communities and other parts of Dagu, public facilities and open space are shared at the edge of each cluster, thus developing a network of linkages to connect the new development and its public amenities to adjacent neighbouring communities. It encourages compact development to connect people and places on domestic spaces and beyond.

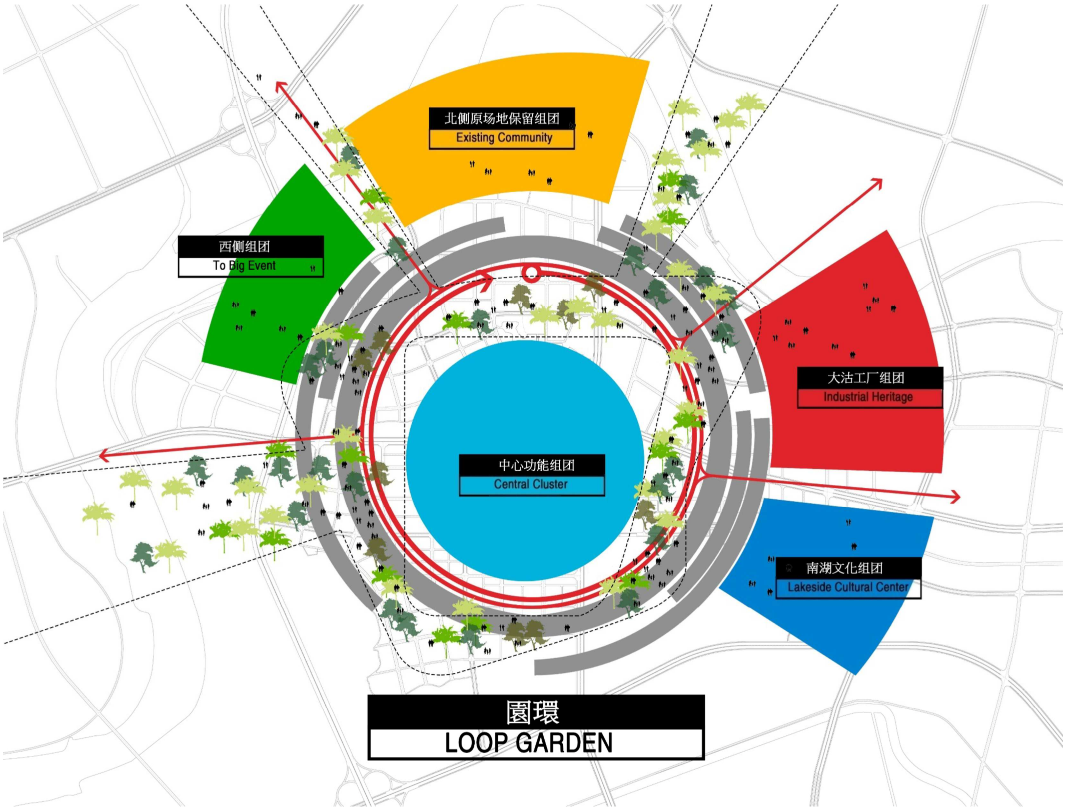

Fig. 6: The Conceptual Structural Urban Design.

6.1 Form a Green Loop

Industrial reservoirs and canals are preserved to provide open space in the neighbourhoods. The reservoirs are made use of to develop lakeside public space, forming the central districts of the city. The ecological corridors are extended on the basis of existing canals in order that the green space can define different clusters. The preserved rivers and canals are interwoven into the fabric of the neighborhoods to provide open space for residents. Various types of access to nature are achieved by combining Different kinds of water and green land, which either serves as an edge or view corridor of the clusters, or as channel flowing through the communities.

6.2 Preserve Vitality of Neighbourhoods

In this flexible structure, each cluster can be identical, which makes it possible to accommodate the existing villages and communities. To ensure the continuity of the memory of the locals, the old communities and villages are encouraged to grow spontaneously, but not sprawling. The green belts — ecological corridor as natural barrier will define the limit for the village development. New community merges with the old one when public activities take place in the green loop between them. The Merging edge helps compensate public facilities and open spaces for the old neighbourhoods.

6.3 Regenerate Industrial Heritage

Industrial heritage and open space in brownfield is preserved as a park for later development. It creates pedestrian links between the city and nature and helps cleaning the polluted land as well, bringing citizens and tourists together while keeping resilience for future commercial renovation. For example, gas pipelines can be reconstructed as a pedestrian trail. By expanding the park's landscape, cultural and creative industry is attracted. It activates the heritage park with cultural and recreational life.

Fig. 7: Urban Design Strategies: Form a Green Loop, Preserve Vitality of Neighbourhoods, and Regenerate Industrial Heritage.

7 STRUCTURAL PLAN

With the ecological system of a fundamental structure on the site, a structural plan is developed. For land use in Dagu, the major public space is on the east, which can serve the Yujiapu and Xiangluowan CBD, and the commercial axis extends westwards to the residential clusters, to make a balance between residential and public functions.

Each cluster has its own center, which is related to the lake or reservoir, so the ecological space can be shared. In each cluster, memorials, heritage, and other physical vestiges of the city's history are embedded in the urban fabric rather than exiled to a certain spot. Subway system provides support for the cluster spatial structure. Underground lines will link the centers. Expressways go between the cluster in order that arterial roads link to Old Town and CBD. Dagu can be pedestrian friendly in the approach of adopting a multi-level walking system. For underground level, there will be some commercial space near subway stations. For upper level, the gas pipes in the factory will be reconstructed as a pedestrian bridge. In between them is the ground pedestrian system and ferry route on water (Fig. 8).

Ecological green space separates clusters, and lakeside area becomes center of urban public activities, with more accessible green space in the communities. The ecological system also contributes to development intensity control. From east to west on the site, the Building height and intensity of development go down, make a transition between the CBD and the Nanyao Pennisula reserved for future big event.

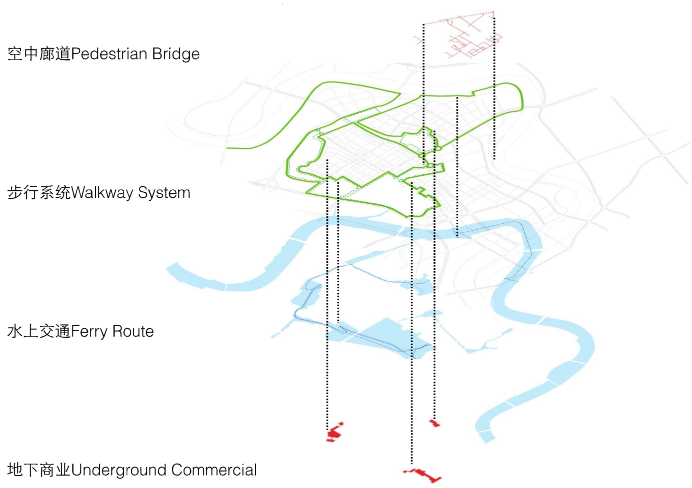

Fig. 8: Traffic Structure: Multi-level Pedestrian Space.

8 DESIGN REFINEMENT

8.1 Zoning

Good urban fabric plays an important role in improving physical environmental qualities and human behaviors. The texture of the city is derived from typological analysis on the existing buildings. The analysis illustrates that each cluster has its own identity. This conclusion becomes the foundation for urban fabric

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repair work, so that the various types of urban space can create various urban life scenario. For the heritage park cluster, resilient urban landscape is overlapped on the industrial buildings. The South Reservoir cluster acts as the core of urban public space, with its waterfront pedestrian friendly so that people can get easy access to nature. The North Reservoir cluster provides public service to 3 communities around it, which is a leisure space for citizens. The West Reservoir follows the regional view corridor, with the water flowing through the communities to form a green space for people's daily life. Meanwhile, green and public space acts as a buffer zone between different urban fabrics so that all the identical clusters can be merged and share a structural view corridor. Also, various types of the interaction between people and the nature around the green belt are compared and applied to detailed design, including waterfront cultural center, riverside parks, and the public space around the northern communities.

Based on the typological studies of urban design elements, some images of phenomena are intersected. This study approach is applied to the site as a criterion for zoning before detailed design, and it draws some vivid perspectives to guide further design. Through this process, 6 different types of relationship between people and the nature around the ecological corridor are concluded, and become the core areas of the site for detailed design (Fig. 9). For Each of them, arrangement of public facilities such as parks, concerts and museums is uniquely studied to make full use of its background conditions, and to create new typologies combined with the re-organization of the center and edge.

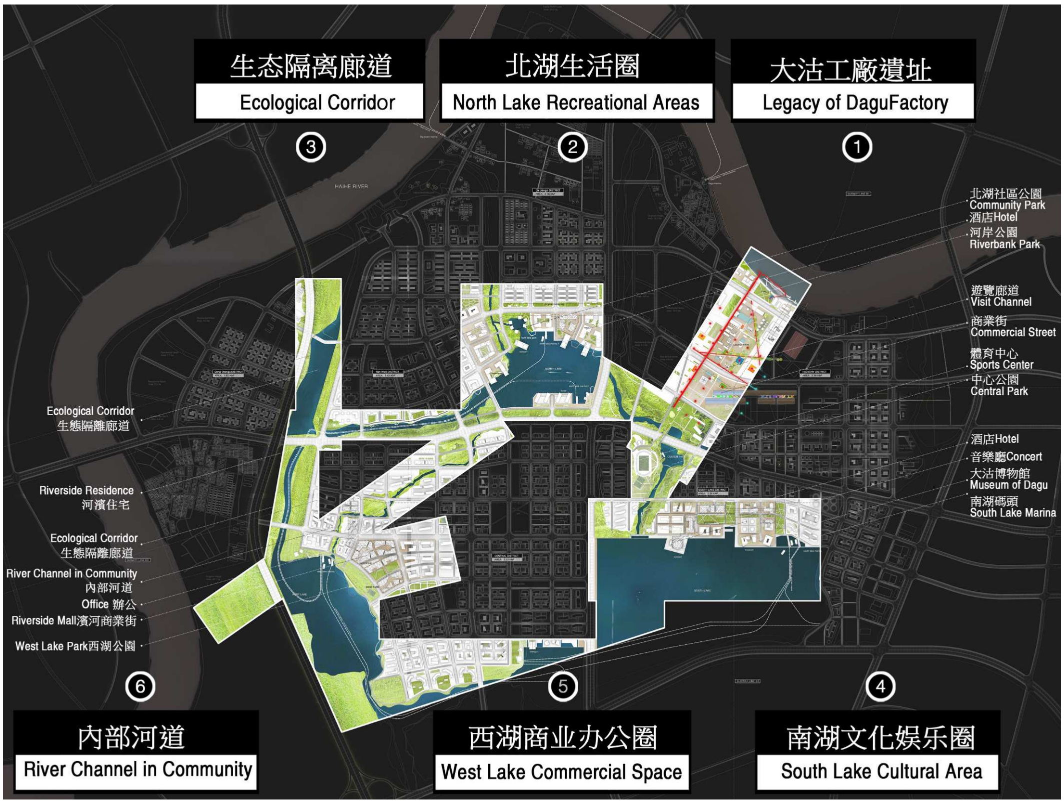

Fig. 9: Structure of Dagu Revitalization Urban Design and Detailed Design for Core Areas.

8.2 Typologies and Principles for Design

8.2.1 Waterfront Cultural Center

The South Lake Cultural Center is influenced by Yujiapu CBD in the east, community development in Central District in the west and the Dagu factory in the north. At the same time, it is the biggest ecological element in the loop green belt, which can provide a comprehensive interaction between nature and human. Thus, people working in Yujiapu, residents from Central District may meet here and bring vitality to it. The design should catch every chance to build a healthy relationship between human activities and nature.

- Provide commercial, leisure, cultural spaces and sports facilities around the lake.
- The buildings should be mix use to bring vibrancy day and night.
- Arrange the public buildings near the water.

- Add open spaces for people to meet each other or have a rest along the waterfront.
- Create nice environment and convenient facilities for people to enjoy the nature.
- Make use of subway lines to bring more new vitality into the area.
- Use the underground space for public activities.
- Reuse the industrial pipeline for the upper level pedestrian trail and gardens for staffs.
- Introduce light, green space and other natural elements into public space, commercial and office in section.
- Balance the relationship between large buildings and view corridor.

8.2.2 Industrial Park

The industrial park is the most important historic place and the core of the site for decades. Dagu Chemical factory has influenced almost every community on the site, and its moving out has become one of the most significant motives for the design. Based on its effect, the design should find out the method to reuse this area by introducing cultural creative industry, technology industry and industrial park. Industrial park plays an important role among the three and serves the staffs and residents as a part of the ecological system. The axis of the park is from the Haihe River bank to the parks on the site. The park extends as this linear shape connects with nodes on the site, establishing the pedestrian space of river bank and emphasize landscape connectivity between Old Town and the site.

- Emphasize link with Tanggu old town by connecting the riverside park and ferry.
- Implant new functions to factory buildings of high quality and create exciting space of their own characteristics.
- Reuse pipelines in the factory as a pedestrian bridge to connect the bank of Haihe river and parks on the site.
- Expeiment with modes of pedestrian space along the riverside.
- Use elevation difference to maintain the independence of the area along the riverside.
- Use the upper floor system to connect the bank with the city.
- Add facilities for recalling people’s memory of the factory.

8.2.3 Public Space for Communities

The North Lake Area is respondent to the concept of preserving existing communities in the site. There are several communities located beside the lake, so it becomes the public center of the whole area. Hotel, commercial space and city park are located beside the lake, which provide public space for residents around the North Lake. As all of the public space is connected by the loop, it is possible for residents of all communities to use the Central Park and Sports Center.

- Increase low-story houses as well as paths where people can interact with water easily.
- Build public buildings between the lake and the existing community, which is in the north of the lake.
- Keep the texture and function of existing communities to maintain their vitality.
- Add schools, hospital and other public facilities to improve the quality of life in old communities, and decrease excessive frequent travel to Tanggu Old Town.
- Preserve Daliangzi Village and its resilience for future development.
- Control architectural height and outline to keep the river bank open and accessible.
- Reduce interference between private and public.
- Public buildings should be located close to the water but not block the access of waterfront area.

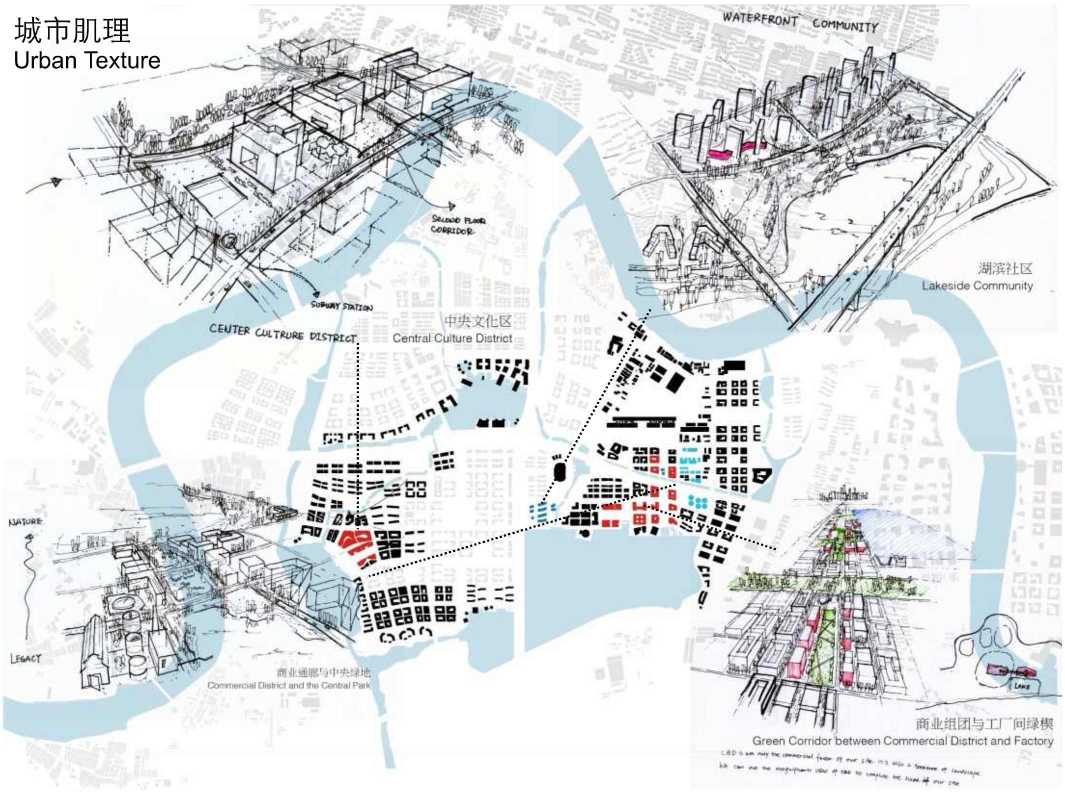

Fig. 10: Texture Study of Dagu Revitalization Urban Design.

9 CONCLUSION

The outside vision of site does not merely mean the structure of planning or the bird view, it should convey the designer's perspective of the question of what is the city, which is the core idea of a design. Meanwhile, the outside vision of a site should be corresponded with the inside vision of a design.

Revitalization of Dagu is a case to exemplify how urban design rather than a general plan can deal with urban structure by starting with marginal elements people intuitively feel as vibrant. Inspired by the proposal of Christopher Alexander, this study aims to implement the exercise operating on the living urban fabric instead of simplified structure that we were educated and supplied with.

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reviewed paper

Revisiting Production and Ecosystem Services on the Farm Scale for Evaluating Land Use Alternatives

Frederik Lerouge, Kurt Sannen, Hubert Gulinck, Liesbet Vranken

(ir. Frederik Lerouge, KU Leuven, Department of Earth and Environmental Sciences, Division Bio-Economics, Celestijnenlaan 200E, 3001 Heverlee, Belgium, frederik.lerouge@ees.kuleuven.be)
(ir. Kurt Sannen, 'Het Bolhuis', Asdonkstraat 49, 3294 Molenstede-Diest, Belgium, info@bolhuis.be)
(Prof. Hubert Gulinck, KU Leuven, Department of Earth and Environmental Sciences, Division Forest, Nature and Landscape, Celestijnenlaan 200E, 3001 Heverlee, Belgium, hubert.gulinck@ees.kuleuven.be)
(Prof. Liesbet Vranken, KU Leuven, Department of Earth and Environmental Sciences, Division Bio-Economics, Celestijnenlaan 200E, 3001 Heverlee, Belgium, Liesbet.vranken@ees.kuleuven.be)

1 ABSTRACT

Land is a scarce resource and should be used in such a way that the increasing global demand for food and feed can be fulfilled, while ensuring sufficient levels of ecosystem services. While the demand on open space to deliver a multitude of services is increasing, drivers like global change and urbanization are undermining these services. Decision makers, from individual farmers to spatial planners, are in need of appropriate diagnostic tools to estimate trade-offs and synergies associated with land allocation and land use intensity decisions. This often implies trade-offs between food and biomass production and other non-provisioning ecosystem services. This paper presents an assessment on the farm scale using an integrated approach that combines spatial and economic analyses. It relies on the ecosystem services concept to evaluate land use alternatives. The analysis highlights current challenges to reach a societal optimal land allocation.

2 INTRODUCTION

Population pressure results in an increasing demand for food and bio-energy products and hence also in an increasing demand for agricultural land (Meyfroidt et al., 2013; Tscharntke et al., 2012). This demand is in competition with the additional demand for land for residential, conservation, forestry, recreational, and other purposes (Zasada, 2011). With land as an increasingly scarce resource, spatial planners seek to balance land use allocation among competing stakeholders. This has led to a polarization in land use policies between demands for expanding urbanized fabric and the remaining open space used for agriculture, whilst natural areas are largely pushed back to relatively small and fragmented relics. Spatial planning has mainly focused on allocation of land to space demanding sectors and minimizing spatial conflicts. This approach falls short in considering present-day demands for multifunctionality, sustainability, ecosystem services, resilience and adaptive governance. While an integrative and spatially explicit approach to land allocation is highly needed, it is largely missing (Bomans et al., 2010b; Termorshuizen and Opdam, 2009). Particularly in strongly urbanized regions, the relation between the availability and use of space, and the potential services this space is able to provide to society, needs to be explored further. Increasing service delivery per unit of space can allow a decreasing spatial requirement for delivering this service, and hence, freeing space for other services. Fragmented peri-urban landscapes in particular, where interfaces between different forms of land use and associated actors are plenty, are in need of innovative concepts for land use allocation. Meanwhile, concepts of multifunctionality and ecosystem services already bridge the distinction between classical sectors like agriculture, nature and forestry. In the light of food and biomass production, the principal challenge is to simultaneously assess and maximize production as well as the other ES provided by bioproductive land (Balmford et al., 2012) which inevitably implies trade-offs. A conceptual framework as proposed by (Foley et al., 2005) argues how agro-ecological cropland management might support a larger portfolio of ES. Moving away from a predominantly 'production-oriented' view on the landscape will aid policy makers and other stakeholders to recognize opportunities and innovations within and across landscapes.

In order to gain a better understanding of how this relates to adaptive farm development, we looked into the management rationale for a case farm in the region of Flanders, Belgium. Flanders is a largely peri-urban region with high population pressure. Some challenges and lock-ins for spatial planning can be identified when developing integrative approaches to land allocation in this region. First, the use of space in Flanders is intrinsically multifunctional, while spatial planning policies are largely monotypic in nature (Kerselaers et al., 2013), with for agriculture, a clear focus on productive functions (Leinfelder, 2007). Current spatial planning frameworks have difficulties facilitating multifunctional land use strategies. Second, a high spatial fragmentation leads to scale dissociations of spaces from policy, as the role and potential of many small fragments are systematically underrated. Also, there is little knowledge about the privatization (e.g. use of agricultural land in residential gardens) and domestication (e.g. use of agricultural land for hobby activities) of land use types (Dewaelheyns et al., 2014; Gulinck et al., 2013). This results in an additional dissociation of spaces from policy. A fourth dissociation stems from the discrepancy between a relatively static policy framework and a dynamic reality shaped by climate change, biodiversity loss, species' adaptation, market change, change of norms and preferences, a.o. As such the case of Flanders is representative for many other peri-urban regions that experience high urbanization pressures and face similar dissociations of spaces from policy.

The concept of ecosystem services (ES), which was popularized by the Millennium Ecosystem Assessment in the early 2000s (Millennium Ecosystem Assessment, 2005), has proven to be useful in supporting resource management decisions (Wainger et al., 2010). ES are defined as the benefits of ecosystems to human beings and are categorized in provisioning services such as food, biomass and water production, regulatory services such as carbon sequestration and air and water purification, and cultural services such as recreational and aesthetic experiences (Haines-Young and Potschin, 2010). Meanwhile, the EU called its member states to assess and map the state of ES within their territory in the framework of the Biodiversity Strategy 2020. This development will provide opportunities to incorporate ES into decision making. Nonetheless, application of the ES concept to real-life land management decisions is a major challenge (Crossman et al., 2013) and there is a continuing need to evaluate the available tools against existing cases (Dale and Polasky, 2007). This is despite the growing awareness that agricultural systems also provide other services besides food and biomass production, for example cultural services such as recreation and landscape amenity, as well as regulating services such as flow regulation and pest control (Haines-Young and Potschin, 2010; Zasada, 2011), which need to be recognized (Daniel, 2008; Swinton et al., 2007). Many of the services delivered by agricultural systems are non-marketable, so the market economy fails to provide sufficient incentives for delivering these services. A dominant production logic may push provisioning agricultural systems towards a state that is sub-optimal from a societal point of view because several non-provisioning services are not rewarded in the market. On the other hand, semi-natural lands are also able to contribute to the food and biomass supply, while they simultaneously maintain the capacity to deliver a wider array of essential non-provisioning services (Foley et al., 2005). Hence, there is a need to evaluate land use scenarios with respect to the provisioning services, as well as the non-provisioning services that they deliver (Bernués et al., 2011; Swinton et al., 2007).

We use an integrative and transdisciplinary approach to evaluate potential land use alternatives. We used a thorough indicator-based approach, applied to a case farm. For this case farm, representing a limited stock of land, we benchmark land use alternatives by comparing the services they would deliver. This sets the foundation for a policy supporting approach to evaluate spatial productivity under various land use and land management rationales.

3 APPROACH OF THE STUDY

To develop an integrative regional approach to evaluate land use strategies for open spaces, the concept of bioproductive land is introduced. 'Bioproductive land' is defined as the area providing services through primary production processes. It includes semi-natural as well as agricultural ecosystems. This bioproductive land is key in delivering ES in a landscape. By incorporating also non-provisioning ES, we acknowledge both the importance of production, while other essential sustainability concepts are not neglected. Hence, we emphasize that 'bioproductive land' encompasses more than the notion of 'bioproductive capacity' in ecological footprint calculations. While both terms relate to primary production, the latter term refers to the fraction specifically required for human consumption in the material sense and waste product absorption. In contrast, bioproductive land provides a multitude of provisioning, cultural, regulating and maintenance services. As such we are able to consider different sectors and land-use categories, which in turn allows us to take into account 'hidden' land uses. A first form of 'hidden' land use would be due to underrated transformations, i.e. land use changes that are not or insufficiently picked up by monitoring and feedback systems (Bomans et al., 2010b, 2009; Verhoeve et al., 2015). Our case is an example of farm diversification and recreational use of semi-natural land, which can be seen as underrated transformations. The selected case farm is also 'hidden' in the sense that much of the area used for production is not situated within the statutory demarcated agricultural space. A second form of 'hidden' land use is the amount and use of tare land, i.e. those parts of the agricultural landscape not directly supporting crops (Bomans et al., 2010a). We also take tare land into account since they provide ES. We use an indicator based assessment to take ES into account. This allows for identifying differences in societal benefits between land use alternatives. These benefits can either be marketable or, alternatively, be regarded as externalities. Adaptive management of bioproductive land aims amongst other at internalizing positive externalities. Adaptive governance can both aim to facilitate internalizing such externalities, as well as compensating for those externalities that are difficult to internalize, e.g. through subsidies, payments for ES (PES), tax reductions, or other means.

To assess land use alternatives we assess the output of several ES per unit of bioproductive land. This corresponds to agricultural land productivity measures but we take into account the value of non-provisioning ES instead of considering only agricultural output, and we look at all bioproductive land instead of only considering the agricultural land. By assessing agricultural output, which is traded on the market, as well as other valuable services for the society but which are mostly not traded on the market, we are assessing the optimality of land use scenarios from a societal point of view rather than from a private or farmer's point of view. Depending on the availability of data and aggregation techniques, this allows to take potential externalities into account in evaluating land use alternatives.

4 CASE FARM DESCRIPTION

The case farm is an organic farm that was established in 2001 on the land of a former conventional dairy farm. It covers about 112 hectares in 2013. Most of this area is located within nature reserves called 'Dassenaarde-Groot Asdonk' and 'Webbekoms broek'. The farm is located at 51°00'47"N; 5°02'41"E, in two subcatchments of the Demer river. The catchments suffer from relatively poor water quality, mainly due to a contamination with a.o. heavy metals and chlorides (VMM, 2014). Aquatic vegetation is largely absent in the main tributaries. Hence, flooding events pose a contamination risk, which needs to be taken into account when evaluating possible land use alternatives for some parcels.

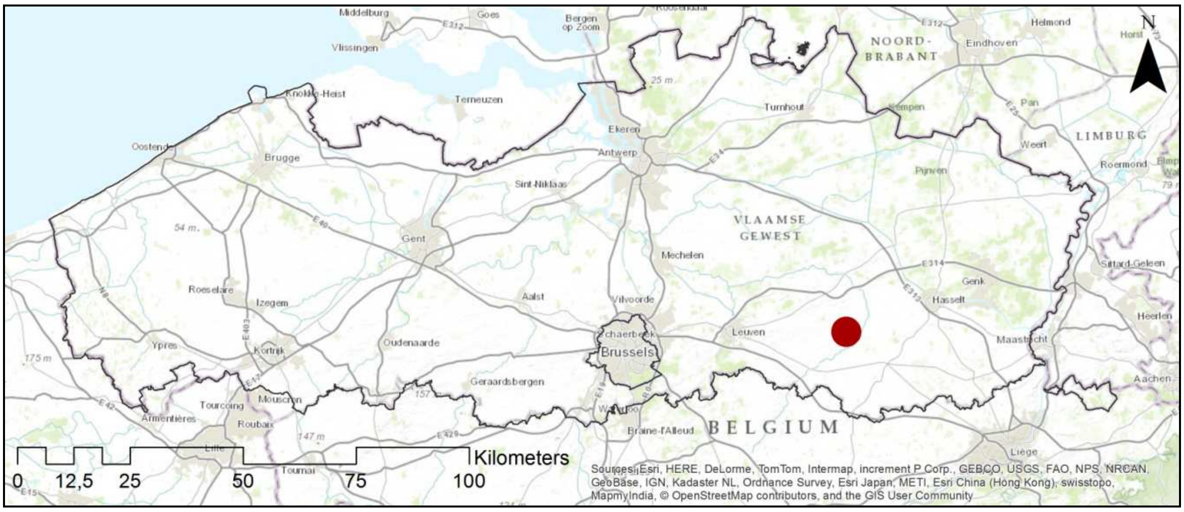

Fig. 1: Location of the case farm in Flanders.

In an ongoing effort to counteract atmospheric nitrogen deposition (Stevens et al., 2011), semi-natural grassland management in Flanders has to deplete nutrient stocks (Oelmann et al., 2009). Consequently, semi-natural grassland management typically produces biomass waste streams from mowing and haymaking. In general, grass from semi-natural grasslands is less suited for conventional livestock breeds, both in terms of digestion and nutritional intake. Therefore, ecological farms typically resort to more sturdy and self-reliant livestock breeds (Bedoin and Kristensen, 2013). The case farm uses the rustic cattle breed 'Kempisch Roodbont' and the rustic sheep breed 'Ardense Voskop'. Both are able to digest low-quality feeds and convert it to high-quality animal protein (i.e. dairy products and meat). Both breeds are threatened by extinction so that preserving their genetic resources can be considered as an additional provisioning service delivered by the farm system, internalized by means of live sales.

5 METHODOLOGY

5.1 Data compilation and general analysis

The case farm parcels were mapped in ArcGIS 10.1. Land use was based on the farms register, the Biological Valuation Map (AGIV, 2010), and verified using aerial imagery (Aerodata International Surveys, 2007) combined with verification in the terrain (early 2013). The following data were added to this spatially explicit database: production data (grazing and cutting) from the farm register, soil texture and moisture data (AGIV, 2006), the Habitat map v5.2 expliciting the occurrence of habitats falling under the EU Habitat Directive (INBO, 2010), flood risk zones (VMM, 2006), and presence of woody vegetation such as hedgerows, isolated trees and orchards based on a map of green components in the landscape, i.e. the 'Groenkaart' (ANB, 2013, 2010). Livestock and feed production figures were attributed to the respective parcels by a parcel-by-parcel breakdown of the livestock movement and mowing registers. Statistical analysis was done using R 3.1.

5.2 Aggregation of ES delivered by bioproductive land

In order to evaluate the relative performance of land use scenarios in providing ES, a selection of ES is aggregated. For this study, we used monetary valuation as an aggregation tool. Differences in provision of ES among different land use alternatives were estimated using the "Ecosystem Service Valuation Tool" developed by VITO (Broekx et al., 2013; Liekens et al., 2013). The land use alternatives include a reference scenario based on the actual land use, and some more conventional land use scenarios. They are described in detail in Section 4.3. Some corrections in the calculations were applied based on additional data, e.g. for the added value of crop and livestock under the Reference scenario (see further). In order to take local variations into account, the farm was divided in five spatially distinct clusters, and each of these clusters was evaluated separately. The evaluation of cultural services was done for the case farm as a whole. The valuation tool provides a lower and upper estimate for the value of the considered ES, and the comparison is based on the minimal estimates to avoid potential overestimation of the positive externalities.

The crops and livestock values as well as wood production value under the Reference scenario were quantitatively estimated based on accountancy data of the farm case and interviews with the case farm manager. For the other land use scenarios, these estimations are based on average Flemish farm income registrations over various sectors, combined with crop registration and soil suitability data.

Calculation of feed production values cannot be done based on market prices since most feed is cultivated and used on the farm itself. Instead, gross livestock revenues are distributed over the area used for feed production (Liekens et al., 2013). Quantitative assessment and valuation of wood production is done by multiplying the area under forest cover with matched productivity figures (Jansen et al., 1996), related to the type of forest and the typology of the physical system. The results are multiplied with a harvest factor (%), the percentage wood actually harvested in relation to the maximal potential harvest, to estimate the effective wood production. Valuation is done by multiplying this estimate by the market price for standing timber.

For the regulating services, fine particle filtration ('air quality'), carbon sequestration in soil and biomass, and N and P sequestration in soil were evaluated. Subsidies are not taken into account in the aggregation. The air quality estimations in kg/year are based on figures by Oosterbaan et al. 2006. Valuation is done by multiplying these estimates by a generic avoided medical cost of 54 €/kg PM10, derived from De Nocker et al. 2010. For soil carbon storage the regression model by Meersmans et al. 2008 is applied, estimating maximal potential carbon stocks taking soil texture class, water tables and land use into account. Valuation is again based on De Nocker et al. 2010.

The valuation function used to calculate cultural services was obtained using a stated preference method (willingness to pay, WTP) (Hoyos, 2010). This value function combines the values for recreation, amenity and education, and takes the number of households and the distance to the case site into account. The methodology calculates the number of households within a 50km. This is the radius for which the value function is larger than zero. This number is multiplied with a mean WTP based on the type of ecosystem, species richness, accessibility, surrounding land use, size and distance to the household (Broekx et al., 2013). A similar approach was used by Costanza et al. (1997) to estimate the value of world ES.

5.3 Land use alternatives for crop and livestock production

To evaluate land use configurations and practices, we considered different scenarios to determine the output of selected ES for the case study area. The existing extensive farm model is used as the baseline scenario, referred to as the *Reference* scenario in the remainder of the paper. On the same land, we assume three additional normative land use scenarios, which we call *IntensiveMIN*, *IntensiveMAX* and *IntensiveSRC*.

The Reference scenario describes the case study area as it is currently cultivated by a farm that combines ecological meat production and livestock breeding with nature management and ecotourism. Cultivated grasslands are combined with semi-natural grasslands, but the share of semi-natural grasslands is relatively high and the livestock production is very extensive. This results in a high nature conservation potential. The other side of the coin is a penalty in terms of animal growth and carcass quality (Bedoin and Kristensen, 2013; Fraser et al., 2009). In addition, the spatial footprint of livestock rearing is relatively high.

The *IntensiveMIN* scenario is designed as a realistic intensive livestock production using the same land as the case farm. It assumes conventional livestock production, and local biophysical constraints are taken into account. Using a spatial overlay with the flood risk zone dataset in a GIS environment, frequently inundated parcels and zones showing inundation risks were excluded for intensive livestock production. A similar approach was used to identify and exclude parcels with species communities subject to the EU Habitat Directive. For reasons of comparison and in order to minimize dependency on off-farm land, we assumed a largely autonomous production, i.e. the *IntensiveMIN* farm meets its own feed requirements from own production within the analyzed area. The required ratio of land for grazing to land for feed production could be derived from figures from the agriculture monitoring network of the Flemish Department of Agriculture and Fisheries (Gavilan et al., 2012; Raes et al., 2011). In 2010, an average specialized livestock farm had 81.51 livestock units (LSU) on 30.47 hectares of grassland and an additional 35.48 hectares of feed production. Therefore, the *IntensiveMIN* alternative assume a spatial ratio between grassland and feed production of 0.86.

Within the case area several parcels are unsuited for intensive grazing. The ‘Bekkevoortse beemden’ (BVB) mainly consist of wet, semi-natural grasslands and reedbeds. Frequent inundations make most of the parcels unsuited for intensive grazing or feed production. The cluster ‘Bolhuis’ (BH) comprises the farm building, stables and associated infrastructure, as well as all surrounding parcels, mainly semi-natural grasslands with high levels of biodiversity. All grasslands that are not frequently flooded can potentially be used for intensive livestock rearing, either as grazing lands or for feed production. The cluster ‘Catselt’ (CT) consists mainly of biologically very valuable land dune ecosystems dominated by very nutrient-poor grass- and heathlands, which are grazed by sheep in the Reference scenario. Based on the previously stated criteria, less than half of this cluster would be converted to intensive grazing lands. The cluster ‘Webbekoms Broek’ (WB) is a protected natural area, mainly wet grasslands and wetlands under extensive grazing. Intensive grazing would be the principal intensive land cover for this cluster. The cluster ‘Zwarte beek’ (ZB) is located upstream in the Winterbeek-Ossebeek subcatchment and consists of species rich grazing lands. Intensive grasslands and feed production are realistic land use alternatives.

In the *IntensiveMAX* scenario, we formulate a corner solution where all land of the case study area is taken into intensive production, irrespective of biophysical constraints that would make some lands unsuitable for intensive livestock production. As such this scenario would be difficult to establish within the spatial footprint of our case farm, but it provides an estimate of the differential output of ES of an unrestrained intensive livestock enterprise within the same catchments. The scenario assumes the removal of all small landscape elements such as hedgerows and isolated trees. Also, and in line with the *IntensiveMIN* scenario, maximal autonomy and a grassland over feed production spatial ratio of 0.86 is maintained.

Finally, the *IntensiveSRC* scenario explores the application of short rotation coppice (SRC) (willow and poplar) for biomass production in the most humid parcels. The cultivation of SRC can be seen as a relevant alternative strategy to increase the provisioning services delivered by the most humid parcels in this farming system. To select parcels for SRC production, a spatial overlay with the flooding risk zones was used and a total of 12.7 ha was selected. Willow (Salix spp.) was assumed for the parcels that effectively inundate, otherwise, poplar (Populus spp.) was assumed. All small landscape elements (single trees, hedgerows) and forest cover on land dunes remain in place. On the other parcels, livestock production remains as in the *Reference* scenario.

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The land use distribution for each of these scenarios is provided in Table 1.

	Land Clusters					
	BH	CT	BVB	ZB	WB	**Total**
Reference						
Urban land	0.5	0.1	0.0	0.0	0.0	**0.6**
Agriculture and pastures	9.2	0.1	0.0	0.2	0.4	**9.9**
Rivers and ponds	0.1	<0.1	<0.1	0.0	<0.1	**0.1**
Wetlands	<0.1	0.0	0.9	0.0	1.3	**2.2**
Heath and land dunes	1.4	6.0	0.0	0.0	0.0	**7.4**
Forests and shrubs	3.0	6.1	0.0	<0.1	6.7	**15.8**
Semi-natural grasslands	35.6	9.3	4.9	4.5	22.0	**76.3**
IntensiveMIN						
Urban land	0.5	0.1	0.0	0.0	0.0	**0.6**
Agriculture and pastures	21.4	5.4	0.0	4.7	0.4	**31.9**
Rivers and ponds	0.0	0.0	<0.1	0.0	<0.1	**<0.1**
Wetlands	0.0	0.0	0.9	0.0	1.3	**2.2**
Heath and land dunes	1.4	6.0	0.0	0.0	0.0	**7.4**
Forests and shrubs	2.8	6.1	0.0	0.0	6.7	**15.6**
Semi-natural grasslands	23.7	4.0	4.9	0.0	22.0	**54.6**
IntensiveMAX						
Urban land	0.5	0.1	0.0	0.0	0.0	**0.6**
Agriculture and pastures	44.0	9.4	5.8	4.7	9.6	**73.5**
Rivers and ponds	0.0	0.0	0.0	0.0	0.0	**0.0**
Wetlands	0.0	0.0	0.0	0.0	1.3	**1.3**
Heath and land dunes	1.4	6.0	0.0	0.0	0.0	**7.4**
Forests and shrubs	2.8	6.1	0.0	0.0	6.7	**15.6**
Semi-natural grasslands	1.1	0.0	0.0	0.0	12.8	**13.9**
IntensiveSRC						
Urban land	0.5	0.1	0.0	0.0	0.0	**0.6**
Agriculture and pastures	9.2	0.1	0.0	0.2	0.4	**9.9**
Rivers and ponds	0.1	0.0	0.0	0.0	0.0	**0.1**
Wetlands	0.0	0.0	0.9	0.0	1.3	**2.2**
Heath and land dunes	1.4	6.0	0.0	0.0	0.0	**7.4**
Forests and shrubs	13.3	6.1	2.4	0.0	6.7	**28.5**
Semi-natural grasslands	25.3	9.3	2.5	4.5	22.0	**63.6**

Table 1: Land use (in ha) for each cluster under different scenarios (see text for acronyms).

6 RESULTS

For livestock production, the valuation tool estimates a mean yearly added value of € 6 971 (min: € 5 480, max: € 8 460) under the reference scenario. However, semi-natural grasslands are considered unsuitable for livestock production in the valuation tool's methodology. As such, this tool only takes into account parcels with intensive grasslands. Since sturdy and self-reliant livestock breeds enables the case farm to use most semi-natural grasslands for production, we derived the estimates for the *Reference* scenario from accountancy data. As such, a value for livestock production of 27 000 euro is used for the *Reference* scenario. About 55% or 15 000 euro of this output stems from meat production, while the remaining 45% or 12 000 euro results from rustic breed sales. Concerning livestock productivity on semi-natural grasslands, research by Pelve et al. (2012) indicates that live weight gain of about 400 to 500 g/day is feasible using adapted breeds. While weight gain figures reported in literature surpass 1 000 g/day for meat production breeds like Limousin, they only range between 260 g/day and 650 g/day for Galloway (Bedoin and Kristensen, 2013; Fraser et al., 2013), a breed typically used in nature management practices in Flanders. With an estimated live weight gain of about 800 g/day, the Kempisch Roodbont perform relatively well. Kempisch Roodbont has the added advantage of being suited for both milk and meat production, contrary to Limousin.

In terms of crop and livestock output, the *IntensiveMIN* and *IntensiveMAX* scenarios perform better than the *Reference* scenario, while the added production value of the *IntensiveSRC* scenario is lower. The differences are much less obvious for the value of wood production, for which *IntensiveSRC* performs slightly better.

For most regulating services taken into account, the *Reference* scenario is preferred over *IntensiveMIN* and *IntensiveMAX*, and is on par with *IntensiveSRC*. The exception here is the service air quality, for which *IntensiveSRC* is the best performer. Differences are negligible for carbon storage services in biomass. The differences in terms of fine particle filtration (air quality) can be attributed to the presence of small landscape elements in the *Reference* scenario, and of coppice in the *IntensiveSRC* scenario.

The value of the cultural services is highly dependent on the aesthetic value of the local landscape and is much higher under the *Reference* scenario than under the *IntensiveMIN* and *IntensiveMAX* scenarios. The WTP for cultural services is depending amongst others on the number of households living within a certain radius and on the site area. Although relative WTP/ha is higher for smaller sites, the WTP per ha quickly decreases when households are living farther away from the site. This is in particular the case for smaller parcels that are remotely located so that the WTP drops to zero very fast. As such, for remote sites the site area has a strong positive impact on the valuation of the cultural benefits in the methodology used.

Table 2 and Figure 2 compare the relative monetary value of ES delivered under the *Reference* scenario with these delivered by the other scenarios. The vertical line in the graph marks the *Reference* land use. Positive values in this table are situated to the right of this line and indicate that the alternative land use performs better that the *Reference* land use for that particular ES. The largest differences between the land use alternatives are in crop & livestock production, air quality, and cultural services. Table 2 and Figure 2 illustrate that the potential societal benefits (in terms of selected ES) provided by bioproductive land of the case study is considerably higher in the *Reference* scenario than in the *IntensiveMIN*, but the difference between both is less obvious for the *IntensiveMAX* scenario. Of course one should take into consideration that *IntensiveMAX* is a corner solution that neglects biophysical constraints.

Ecosystem service	IntensiveMIN - Reference	IntensiveMAX - Reference	IntensiveSRC - Reference
Crop & livestock	20 200	65 900	-8 900
Wood	300	500	3 300
Air quality	-7 300	-17 450	17 800
C storage in soil	-100	-5 300	500
C storage in biomass	-200	-850	0
N storage in soil	-4 000	-8 850	0
P storage in soil	-4 250	-9 450	0
Cultural services	-9 250	-23 750	2 600
Total (€)	**-4 600**	**750**	**15 300**

Table 2: Aggregated differences in ES delivery between the Reference and respective intensive scenarios, based on conservative estimates. A negative value indicates the respective land use alternative performs worse than the Reference scenario, a positive value indicates it performs better.

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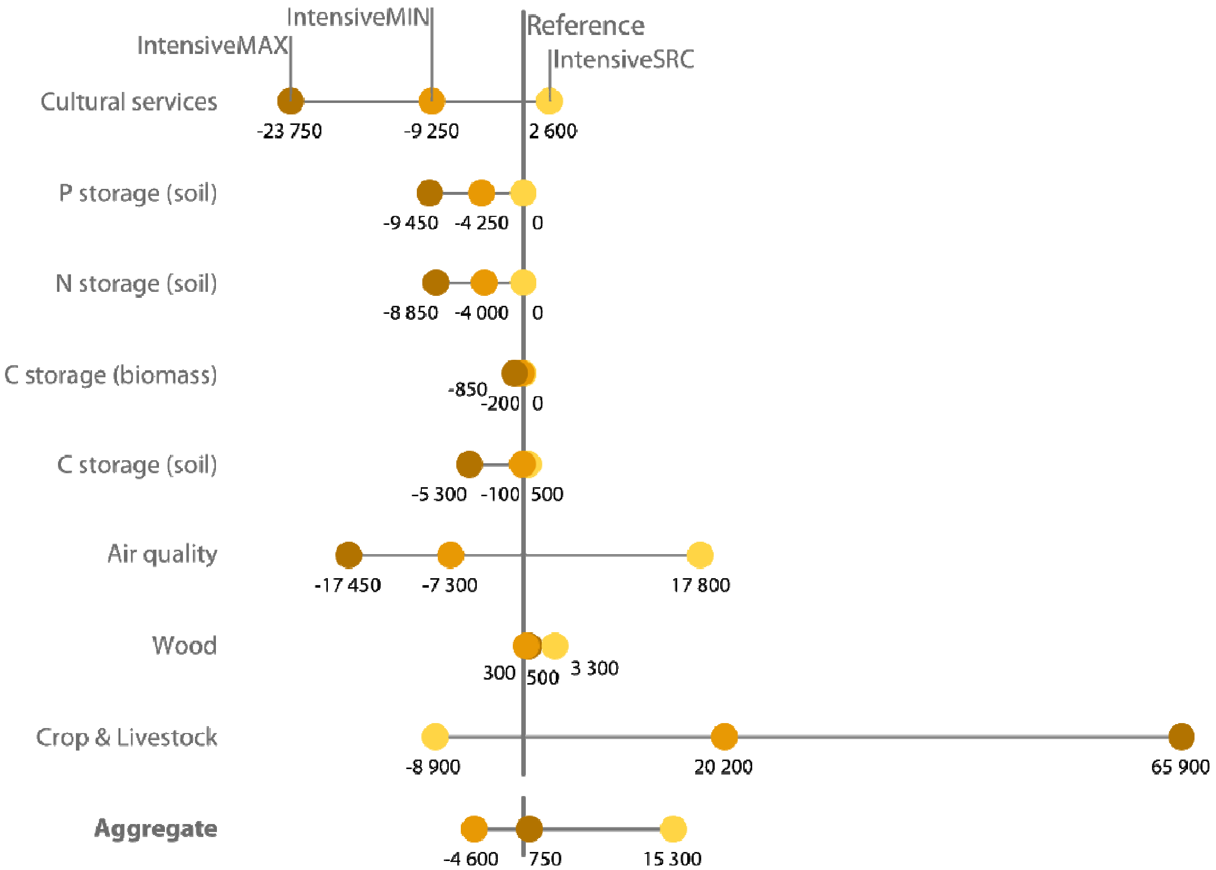

Fig. 2: Relative differences in valued ecosystem service provision between the Reference scenario and the intensive scenarios. The central axis represents the Reference scenario. Alternatives performing better for a given ecosystem service are positioned to the right of this line, and alternatives performing worse are positioned to the left.

We compare land use scenarios by aggregating ES at 3 levels (Figure 3): (1) aggregation of only provisioning services; (2) aggregation of provisioning and regulating services, and (3) aggregation of all selected ecosystem services.

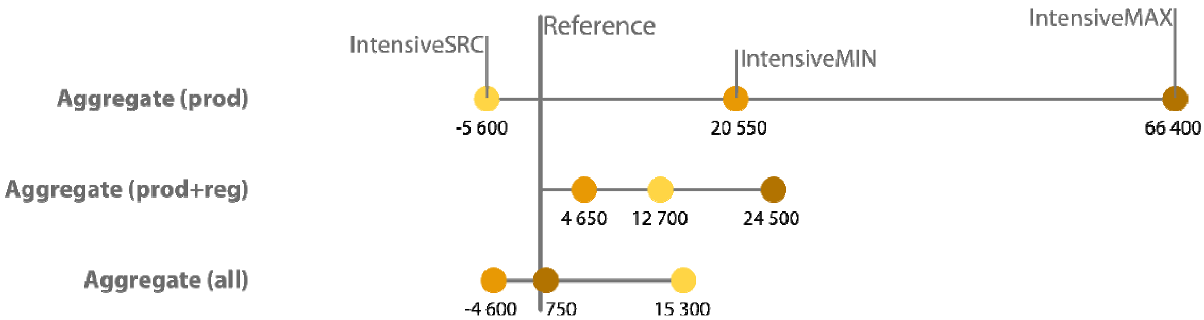

Fig. 3: Comparison of aggregation based on (1) only provisioning services, (2) provisioning and regulating services, and (3) all selected ecosystem services.

The success of the *Reference* scenario relies in the successful adaptation of the farm to biophysical constraints, while the natural environment also benefits from the chosen strategy. The ecological farm adapts to its environmental constraints by using specific livestock breeds. While traditional cattle grazing preferably takes place on grasslands that are less subjected to inundation, the rustic cattle breed does allow for limited grazing management on parcels that are effectively sensitive to flooding. However, parcels with tree cover and small landscape elements are less suited for cattle breeding. This is not the case for the sheep breeds used (Figure 4). Sheep provide grazing management on those parcels that inundate significantly less frequent (Wilcoxon $W=130$, $p<0.05$), but contain significantly more trees (Wilcoxon $W=43$, $p<0.05$).

As such, the farm also acts as a buffer zone for water retention and reduces flooding risks in the downstream city of Diest. In addition, using rustic breeds on semi-natural grasslands and heathlands reduces the biomass waste streams from these natural grasslands.

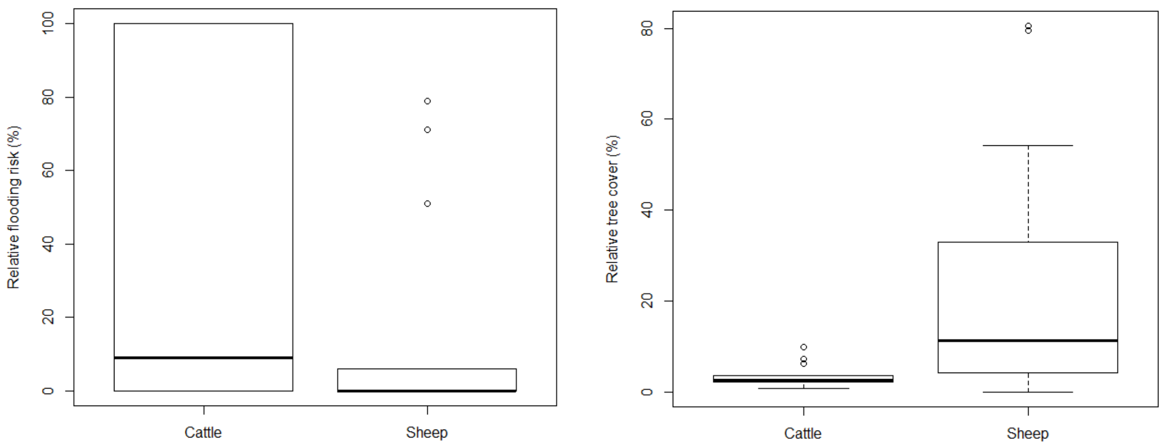

Fig. 3: The use of cattle and sheep in an adaptive farming strategy: in relation to the flooding risk (left), and in relation to tree cover (right).

7 DISCUSSION

In this study we assess a farming model that combines livestock production and nature management on relatively marginal lands and compare it with more production-oriented land use alternatives. We compare the monetary value of ES under different land use scenarios to benchmark the land use alternatives. The results illustrate how the optimal land use from a societal perspective depends on biophysical constraints, and points out the importance of internalizing positive externalities. It provides insights in the rationale of on-farm diversification. In the case study area, organic livestock production is able to provide comparable societal benefits compared to more conventional approaches, while serving the local biodiversity targets. However, if biophysical constraints are less restricting, a situation corresponding to the *IntensiveMAX* scenario, the differences in delivering non-provisioning societal benefits decrease and more intensive approaches might outperform extensive approaches.

According to the valuation method used, the value of cultural services depends on both local population densities and area. Small sites are only valued by those living close by, while the cultural benefits of large and well connected sites are also valued by people living further away. As such, in a different spatial and socio-economic context (e.g. smaller sites that are not connected or lower population densities), the outcome of the evaluation of optimal land use strategies could be very different.

Aggregating only provisioning services would result in a distinct choice for *IntensiveMAX* and *IntensiveMIN* over the *Reference*, which in turn would be preferred over *IntensiveSRC*. This corresponds to an exclusively production-oriented rationale. Taking regulating and cultural services into account shifts the preference towards more unconventional land use alternatives. Taking all selected ES into account, the aggregated differences between the *Reference* and the *IntensiveMIN* land use become very small, highlighting the potential of the *Reference* land use in delivering a broad range of societal benefits. The *IntensiveSRC* scenario performs relatively well, also in comparison with the *Reference* land use. Possible limiting factors for this development path can be economical, logistic, cultural, or related to legislation, e.g. conflicts with nature development targets. Future research is needed to reveal which, if any, factors are the most limiting.

Furthermore, the results should be interpreted with care because a comparison is made between real-life and hypothetical scenarios. Obviously, some assumptions needed to be made in drafting the intensive scenarios. We stress that the objective of the research is not to provide an absolute valuation of the ES delivered, but rather a relative positioning of the alternative farming models that might emerge in the considered subcatchments. The extensive farming model co-evolves in response to very common nature management strategies in developed regions such as Flanders, where ecosystems are dealing with excess nutrient loads. Through combined grazing and cutting management, nutrients are removed from the system and floristic diversity is able to increase. This should at minimum compensate for the nutrient influx through dry and wet deposition, but from a floristic diversity perspective, it is desirable for the system to progressively become more nutrient poor.

On-farm diversification is aiming to validate this biodiversity, e.g. by engaging in ecotourism, but also subsidies and payments for ES partially enable to internalize positive externalities. While the *Reference* scenario is able to outperform the *IntensiveMIN* farming strategy, and is almost on par with the *IntensiveMAX* corner solution when taking a wider range of ES into account, the increasingly limited income for farmers remains a cause of concern. The case farm is partially dependent on additional government subsidies and this adds to its vulnerability.

Some functions and services provided under the *Reference* scenario are underestimated. First, the case farm manages to valorize the biodiversity in its surrounding through ecotourism. Revenues from ecotourism are not included in the valuation of the land use scenarios. Second, as agricultural research faces a lock-in that favors innovations in the field of genetic engineering and risks locking out agro-ecological innovations (Vanloqueren and Baret, 2009, 2008), this case illustrates the potential of using selected rare breeds and generates positive externalities through the conservation of genetic resources. Third, several parcels managed by the case farm inundate regularly, contributing to the flooding risk reduction for a nearby provincial town. This flood protection service delivered by the case farm is also not yet taken into account.

For the calculation of the ecosystem services, the study applies the “Ecosystem Service Valuation Tool” developed by VITO. This tool applies benefit transfer functions to estimate the value of the ES delivered by the considered bioproductive land. Benefit functions are based on several other studies and easy to use. As such, benefit transfer has some advantages and is widely used (Costanza et al., 1997). However, it typically fails to consider the specific characteristics of study area of interest. This became clear when we calculated the value of crop and livestock production under the Reference scenario with the valuation tool and compared that estimate with the on-site production data. The value calculated by the tool was considerably lower than the actual production value because high-diversity semi-natural grasslands are not properly considered as sites suitable for livestock production. However, the case farm does manage to use these grasslands and to sell its meat to local customers by organizing periodical sales in collaboration with other producers of regional products . As such, decision making based on such tool can be biased towards conventional land use systems. This stresses the need to highlight the potential of agro-ecological innovations and take them into account in spatial planning processes. One of the key innovations in our case is the use of adapted rustic breeds. Further, the added value of agro-ecological innovations that rely on land use complementarities, such as buffer strips or agroforestry, are not yet included in the methodology, while it is an important lever for spatial planning to work with.

8 CONCLUSION

Like many urbanized regions, Flanders is characterized by a high degree of polarization between expanding urbanized tissue and the remaining open space used for agriculture, with natural areas largely pushed back to relatively small and fragmented relics. As pressure on remaining open spaces increases, more actors adopt a conservational attitude of safeguarding a spatial niche from claims of other sectors. However, there is growing awareness that one spatial niche can provide services that are beneficial to several sectors. Not surprisingly, efforts to reconcile food production with ecosystem rehabilitation in Flanders have therefore mainly been focusing on land sharing strategies. While nature organizations are increasingly willing to cooperate with livestock farmers, many farmers show little interest in managing nutrient-poor or wet grasslands. In addition, land sharing strategies, in particular agri-environmental schemes, are not achieving the expected results (Balmford et al., 2012; Kleijn et al., 2011, 2001; Pe’er et al., 2014). This makes it difficult for land planners to assess whether a land sharing or sparing policy is preferable. An assessment and valuation of all ES provided by bioproductive land can be used as a framework to assess land use strategies. ES can help to make the services provided by different land uses more easy to understand and more comprehensive. Our study applies an integrative and transdisciplinary approach to evaluate land use of a case farm.

The results demonstrate how the agro-ecological land use strategy of this farm may or may not be preferred over more conventional land use strategies, depending on which services are taken into account. The results demonstrate the potential of the agro-ecological land use to provide higher levels of societal benefits (i.e. output of ES) in regions with both ‘inferior’ and high quality land and with high population densities. However, if there are no biophysical constraints, if the potential area for extensive land management is small and/or not connected, or if the population density is low, the intensive land use strategies might outperform agro-ecological land use strategies. A local demand for ES can thus be addressed by a multitude of different farming models (Firbank et al., 2012). The analysis illustrates that the optimal land use strategy is likely to be context and scale-dependent and that the concept of ES can be very useful in designing optimal land policies.

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Sicherung der Daseinsvorsorge in ländlichen Regionen in Europa – internationale Begegnungen zum Informations- und Erfahrungsaustausch

Julia Anslinger, Swantje Grotheer, Kirsten Mangels

(Dipl.-Ing. Julia Anslinger, University of Kaiserslautern, Department of Regional Development and Spatial Planning, Pfaffenbergstraße 95, 67663 Kaiserslautern, julia.anslinger@ru.uni-kl.de)
(Dr.-Ing. Swantje Grotheer, University of Kaiserslautern, Department of Regional Development and Spatial Planning, Pfaffenbergstraße 95, 67663 Kaiserslautern, swantje.grotheer@ru.uni-kl.de)
(Dr.-Ing. Kirsten Mangels, University of Kaiserslautern, Department of Regional Development and Spatial Planning, Pfaffenbergstraße 95, 67663 Kaiserslautern, kirsten.mangels@ru.uni-kl.de)

1 ABSTRACT

Viele Kommunen und Regionen, vor allem in ländlichen Räumen, sehen sich vor dem Hintergrund des demografischen Wandels mit zunehmenden Herausforderungen bei der Sicherung ihrer Daseinsvorsorge konfrontiert. Benötigt werden neue Vorgehensweisen und Lösungsansätze, um Infrastrukturen und Dienstleistungen der Daseinsvorsorge erhalten und schaffen zu können. Ein Austausch über Erfahrungen, Vorgehensweisen und Good-Practice-Beispielen kann dabei helfen, Projekte zur Sicherung der Daseinsvorsorge zu initiieren und zu realisieren. Ein internationaler Austausch erlaubt zudem neue Perspektiven über Rahmenbedingungen und Werte und bietet die Chance eine internationale Zusammenarbeit und verschiedene Projektkooperationen anzuregen. Im Rahmen der Begleitforschung Internationale Erfahrungen des Aktionsprogrammes regionale Daseinsvorsorge (als Modellvorhaben der Raumordnung (MORO) des Bundesministeriums für Verkehr und digitale Infrastruktur (BMVI) und betreut durch das Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (BBR)) wurde ein Partnerschaftsprogramm entwickelt, um einen internationalen Austausch zu ermöglichen. Die durchgeführten internationalen Informations- und Erfahrungsaustausche (als Fachexkursionen) gaben den Akteuren zur Sicherung der Daseinsvorsorge Anregungen für Projekte und Projektideen, boten die Chance zum persönlichen Erfahrungsaustausch und zu Diskussionen, lieferten Hinweise zu Lösungsansätzen und regten zum Überdenken von Rahmenbedingungen an. Über die Intiierung von persönlichen Kontakten, informellen Netzwerken und formellen Projektkooperationen (wie z.B. eine Zusammenarbeit in gemeinsamen INTERREG-Projekten) kann der internationale Austausch verstetigt werden. Somit kann die Durchführung von internationalen Austauschen einen Beitrag leisten, erfolgreiche Projekte zur Sicherung der Daseinsvorsorge zu initiieren und umzusetzen, internationale Kontakte und Kooperationen aufzubauen sowie langfristig eine zukunftsfähige Entwicklung von Gemeinden und Regionen zu ermöglichen.

Aufbauend auf den während der Fachexkursionen behandelten europäischen Strategie- und Projektbeispielen konnten verschiedene Erfolgsfaktoren für Strategien und Projekte zur Sicherung der Daseinsvorsorge festgestellt werden. Diese wurden in fünf Erfolgsfaktoren zusammengefasst:

- Zusammenarbeit und Kooperation,
- Bürgerbeteiligung, Bürgerengagement und Persönlichkeiten,
- Innen-und Außenkommunikation, Öffentlichkeitsarbeit und Marketing,
- Unkonventionelle Projekte, flexible Standards, integrierte Strategieentwicklung, Fürsorge auch für Kleingruppen,
- Nutzung und Bereitstellung digitaler Infrastruktur (Breitbandversorgung).

2 SICHERUNG DER DASEINSVORSORGE FÜR EINE ZUKUNFTSFÄHIGE ENTWICKLUNG VON KOMMUNEN UND REGIONEN IN EUROPA

2.1 Problemstellung: Bevölkerungsverluste, und -altersstrukturelle Verschiebungen, Tragfähigkeitsprobleme, Attraktivitätsverluste und Imageprobleme - europaweit

Die Sicherung der Daseinsvorsorge wird vor dem Hintergrund des demografischen Wandels, insbesondere in ländlichen Räumen, zunehmend vor große Herausforderungen gestellt. Bevölkerungsverluste erhöhen die Infrastrukturkosten pro Kopf und führen zu Tragfähigkeitsproblemen in verschiedenen Bereichen der Daseinsvorsorge. Auch Attraktivitätsverluste und Imageprobleme können mit Bevölkerungsabnahmen

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einhergehen. Die altersstrukturelle Verschiebung der Bevölkerung, insbesondere die Zunahme älterer Bevölkerungsgruppen führt zu einer veränderten Nachfrage an Infrastrukturen und Dienstleistungen der Daseinsvorsorge, bspw. im Gesundheits- und Pflegebereich. Hinzu kommen geringe finanzielle Spielräume der Kommunen, weshalb Leistungen oftmals nicht wie bisher aufrecht erhalten bzw. zur Verfügung gestellt werden können.

Infrastrukturleistungen und Dienstleistungen der Daseinsvorsorge erfüllen jedoch einen wichtigen Beitrag zur zukunftsfähigen Entwicklung von Städten und Regionen. Somit ist ihr Erhalt und Aufbau von großer Bedeutung für eine attraktive kommunale und regionale Entwicklung. Neue Konzepte und Strategien zur Sicherung der Daseinsvorsorge werden deshalb dringend benötigt.

Europaweit beschäftigen sich vom demografischen Wandel betroffene Kommunen und Regionen mit der Entwicklung von Strategien und Konzepten zur Sicherung der Daseinsvorsorge. Ihr Erfolg hängt von verschiedenen Faktoren ab und oft sehen sich die Akteure ähnlichen Problemstellungen gegenüber. Die Arbeit vor Ort kann daher durch Austausch von Wissen und Erfahrungen, der Präsentation innovativer Ansätze und Projekte sowie durch Vernetzung, Beteiligung und Strategieentwicklung erleichtert werden. Deshalb gilt es nun, diese neuen Konzepte zu erkunden, Erfahrungen auszutauschen und als Best-practices weiter zu verbreiten.

2.2 Zielsetzung: Internationaler fachlicher Austausch, Verstetigung des internationalen Austausches und Erfolgsfaktoren der Projekte zur Sicherung der Daseinsvorsorge

Um den fachlichen internationalen Austausch zu fördern, innovative Konzepte aufzubereiten und internationale Netzwerke und Projektkooperationen zum Thema Sicherung der Daseinsvorsorge zu initiieren wurde im Rahmen der Begleitforschung Internationale Erfahrungen des Aktionsprogramms regionale Daseinsvorsorge ein Partnerschaftsprogramm entwickelt. Das Aktionsprogramm ist ein Modellvorhaben der Raumordnung (MORO). Mit diesen Modellvorhaben „unterstützt das Bundesministerium für Verkehr und digitale Infrastruktur (BMVI) die praktische Erprobung und Umsetzung innovativer, raumordnerischer Handlungsansätze und Instrumente in Zusammenarbeit zwischen Wissenschaft und Praxis, d.h. mit Akteuren vor Ort, in den Regionen.“[1] Die Betreuung übernimmt das Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (BBR).[2]

Das Aktionsprogramm unterstützt 21 Modellregionen „sich innovativ den infrastrukturellen Herausforderungen des demografischen Wandels zu stellen und mit einer Regionalstrategie Daseinsvorsorge erforderliche Infrastrukturanpassungen vorausschauend und kooperativ zu gestalten.“[3]

Ziel des Beitrages „Sicherung der Daseinsvorsorge in ländlichen Regionen in Europa - Internationale Begegnungen zum Informations- und Erfahrungsaustausch“ ist zum einen auf die Bedeutung eines fachlichen Austausches in Form von Fachexkursionen für (regionale) Akteure, auch im internationalen Umfeld, hinzuweisen sowie zum anderen Erfolgsfaktoren für Projekte zur Sicherung der Daseinsvorsorge zu generieren und Beispiele erfolgreicher Projekte zu geben.

2.3 Vorgehensweise und Methodik: Internationaler Informations- und Erfahrungsaustausch mit guten Beispielen zur Sicherung der Daseinsvorsorge

Im Rahmen des Aktionsprogrammes fanden drei internationale Informations- und Erfahrungsaustausche (als Fachexkursionen) in europäische Regionen mit ähnlichen Problemlagen und innovativen Ansätze zur Sicherung der Daseinsvorsorge statt. Das Format der Fachexkursionen wurde aus unterschiedlichen Gründen für den internationalen fachlichen Austausch gewählt:

- Exkursionen ermöglichen eine Auseinandersetzung mit den Herausforderungen und Lösungsansätzen in den jeweiligen räumlichen Kontexten,

[1] Internetauftritt Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) im Bundesamt für Bauwesen und Raumordnung (BBR), aufgerufen unter: http://www.bbsr.bund.de/BBSR/DE/FP/MORO/moro_node.html, Zugriff 24.02.2015.

[2] vgl. ebenda

[3] Internetauftritt Aktionsprogramm regionale Daseinsvorsorge, aufgerufen unter: http://www.regionale-daseinsvorsorge.de/22/, Zugriff 24.02.2015.

- im Rahmen einer Exkursion können durch Fachvorträge, Diskussionsrunden aber auch dem Besuch konkreter Umsetzungsprojekte verschiedene Formen des Fach- und Erfahrungsaustausches realisiert werden.
- Die mehrtägigen Fachexkursionen führten nach
- Niederösterreich (Österreich),
- Graubünden (Schweiz) und Südtirol (Italien) sowie
- Västernorrland (Schweden).

Diese Zielregionen der Fachexkursionen zeichnen sich dadurch aus, dass sie in peripheren ländlichen Räumen liegen, geringe Bevölkerungsdichten und einen Trend zur Überalterung der Bevölkerung aufweisen. Gleichzeitig sind diese Regionen von sehr unterschiedlichen siedlungsstrukturellen Besonderheiten (z.B. alpine Dörfer und Höfe in Tallagen, weit auseinanderliegende Siedlungen in flacher Küstenlandschaft) sowie teilweise gegenläufigen Entwicklungen gekennzeichnet, z.B. starke Zentren mit noch steigenden Bevölkerungszahlen neben sehr ländlichen Gebieten mit sinkenden Bevölkerungszahlen.

Für die Auswahl der Zielregionen der Fachexkursionen waren neben den bereits dargestellten strukturellen Merkmalen auch das Vorhandensein von innovativen Strategien und Projekten zur Sicherung der Daseinsvorsorge ausschlaggebend.

Für die Auswahl der europäischen Strategien und Projekte und waren folgende Kriterien wichtig: Innovative, möglichst integrierte (d.h. verschiedene Bereiche der Daseinsvorsorge umfassende) Ansätze zur Sicherung der Daseinsvorsorge auf regionaler und kommunaler Ebene sowie die Organisations- bzw. Governancestrukturen der jeweiligen Ansätze. Auch die Bearbeitung von Schwerpunktthemen (medizinische Versorgung/Gesundheitsversorgung, Bildung und Weiterbildung, Mobilität und Erreichbarkeit) in den einzelnen Fachexkursionen und nicht zuletzt eine Einschätzung zur Übertragbarkeit der Ansätze auf deutsche Regionen waren wichtig.

Die Initiatoren und Träger der innovativen Strategien und Projekte zur Sicherung der Daseinsvorsorge in den Zielregionen setzen sich aus unterschiedlichen Verwaltungsebenen und Institutionen zusammen. Somit waren während der Exkursionen Referentinnen und Referenten bzw. Ansprechpartner unterschiedlicher Akteursgruppen (politische Verantwortungsträger, Verwaltungsvertreter unterschiedlicher Ebenen, Vertreter von Forschungs- und Beratungsinstitutionen, Unternehmensvertreter) vertreten, die Lösungsansätze, Vorgehensweisen und Projekte vorstellten. Zudem sahen die Exkursionsprogramme Diskussionsrunden und Zeit zum persönlichen Fach- und Erfahrungsaustausch vor. Vorgestellt und diskutiert wurden Ansätze und Projekte u.a. in folgenden Bereichen

- Bildung,
- Mobilität,
- Gesundheit, Pflege,
- Digitale Infrastruktur sowie
- Querschnittsstrategien.

Aufbauend auf den Erkenntnissen, Erfahrungen und Diskussionen der - während den internationalen Informations- und Erfahrungsaustauschen behandelten - europäischen Strategien und Projekte, wurden Erfolgsfaktoren für Strategien und Projekte zur Sicherung der Daseinsvorsorge zusammengefasst. Diese stellen keinen Anspruch auf Vollständigkeit und Repräsentativität dar.

3 POSITIVER BEITRAG EINES INTERNATIONALEN INFORMATIONS- UND ERFAHRUNGSAUSTAUSCHES ZUR SICHERUNG DER DASEINSVORSORGE

Ein internationaler Austausch kann zur Sicherung der Daseinsvorsorge und somit zur zukunftsfähigen Entwicklung von Kommunen und Regionen aufgrund folgender Faktoren beitragen:

Durch das Kennenlernen von innovativen Ansätzen, Strategien und Projekten zur Sicherung der Daseinsvorsorge in anderen europäischen Ländern, können deutsche Akteure Anregungen für die eigene Arbeit bekommen. Im Sinne von Best-Practice-Beispielen können erfolgreiche und innovative Projekte Anregungen zu geeigneten Vorgehensweisen und Lösungsansätzen liefern, zur Reflektion übertragbarer

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Elemente animieren und dazu ermutigen, Projekte vor Ort zu initiieren und umzusetzen. Durch das Erleben des Raumes vor Ort und die Vorstellung der Projekte durch beteiligte Akteure entsteht ein Raumgefühl und die Ansätze können besser nachempfunden sowie ein direktes Nachfragen und Diskutieren ermöglicht werden.

Das Kennenlernen unterschiedlicher Rahmenbedingungen, die Teilnahme an fachliche Diskussionen und der persönlicher Austausch unterstützen den Prozess, bestehende Regelungen und Standards zu überdenken und darüber hinauszudenken. In den Diskussionen kann ein Blick von außen oft helfen, Schwierigkeiten in den eigenen Projekten zu erkennen.

Durch die aufgebauten Kontakte während der Fachexkursionen kann auch eine Verstetigung des internationalen Austausches in Form von informellen Kontakten und Netzwerken erfolgen.

Ein weiterer Faktor, der über die in den Exkursionen aufgebauten informelle Netzwerke und persönlichen Kontakte hinausgeht sind formelle Kooperationen. Die während der Exkursionen hergestellten Erstkontakte können für eine weitere Zusammenarbeit genutzt werden. Eine solche Zusammenarbeit kann im Rahmen von öffentlichen Förderprogrammen geschehen, wie bspw. im internationalen Kontext durch Förderprogramme der Europäischen Union (INTERREG A, B oder Europe). Die Nutzung solcher Förderprogramme unterstützt den Wissens- und Erfahrungsaustausch und kann wichtige Impulse für Projektfinanzierungen im Rahmen von Modell- oder Pilot- Lösungen geben. Zudem tragen geförderte Projekte der Europäischen Union zu einer positiven Eigen- und Außenwahrnehmung bei.

Eine Befragung der Teilnehmerinnen und Teilnehmer der internationalen Informations- und Erfahrungsaustausche im Anschluss an die jeweiligen Fachexkursionen ergab, dass 84% der Aussage zustimmen, dass der internationale Informations- und Erfahrungsaustausch für die Erarbeitung von Strategien zur Sicherung der Daseinsvorsorge interessante Anregungen für die Arbeit vor Ort brachte (davon stimmten 37% voll zu und 47% eher zu, bei n=38). 16% sind noch unentschieden. Hinsichtlich der Konzeption, Organisation und Umsetzung von Pilot- und Modellprojekten zur Sicherung der Daseinsvorsorge stimmten 81 % zu, dass der internationale Informations- und Erfahrungsaustausch interessante Anregungen für die Arbeit vor Ort brachte (davon stimmten 34% voll zu und 47% eher zu, bei n=38), während 13% unentschieden waren und 6% eher nicht zustimmten.

Über die Hälfte der Teilnehmerinnen und Teilnehmer empfahl ihren Regionen, weitergehende Kooperationen bzw. einen weiter gehenden Austausch anzustreben, während 16% noch unentschlossen waren.

4 FÜNF WESENTLICHE ERFOLGSFAKTOREN FÜR ERFOLGREICHE KONZEPTE UND PROJEKTE ZUR SICHERUNG DER DASEINSVORSORGE

Die hier zusammengefassten Erfolgsfaktoren leiten sich aus den Erkenntnissen und Erfahrungen, die während der Fachexkursionen gesammelt werden konnten, d.h. aus verschiedenen Strategien und Projekten sowie den Diskussionen über Vorgehensweisen, Rahmenbedingungen und Ergebnisse, ab. Sie stellen somit keinen Anspruch auf Vollständigkeit und Repräsentativität dar.

4.1 Zusammenarbeit und Kooperation

Zusammenarbeit und Kooperationen können sowohl in

- räumlicher,
- thematischer und
- organisatorischer Hinsicht

zu erfolgreichen Projekten zur Sicherung der Daseinsvorsorge beitragen. Synergieeffekte können genutzt und Win-Win-Situationen geschaffen werden.

Interkommunale bzw. regionale Kooperationen haben sich in mehrfacher Hinsicht als hilfreich herauskristallisiert. Zum einen ermöglicht ein erweiterter räumlicher Blickwinkel für Strategien zur künftigen Sicherung der Daseinsvorsorge neue Lösungsmöglichkeiten und –alternativen, die sich bei rein kommunaler Betrachtung nicht erschließen. Zum anderen können finanzielle oder personelle Ressourcen gebündelt werden, um gemeinsam Projekte zur Sicherung der Daseinsvorsorge zu stemmen, die die Finanz- oder Verwaltungskapazität einzelner Kommunen übersteigen würden.

Das Beispiel des Kommunförbundet Västernorrland in Schweden hat dabei gezeigt, dass interkommunale Kooperationen neben „klassischen Aufgabenfeldern“ auch darüber hinausgehende Impulse für die Regionalentwicklung setzen können: Der Kommunförbundet, der sich aus Beiträgen der Mitgliedskommunen finanziert, hat eine eigene Forschungs- und Entwicklungseinheit eingerichtet (FoU Västernorrland (Forsknings- och utvecklingsenhet)[4]), die beispielsweise innovative Projekte in der Pflegeversorgung aber auch der Zusammenarbeit von Schulen in der Region wissenschaftlich begleitet und für solche Projekte auch Drittmittel einwirbt.

Die thematische Zusammenarbeit scheint ein großes Potenzial zur Sicherung der Daseinsvorsorge zu bergen. Integrierte und interdisziplinäre Strategien und Projekte zur Sicherung der Daseinsvorsorge bedürfen einer Zusammenarbeit verschiedener Fachdisziplinen. Durch diese Zusammenarbeit können Synergieeffekte entstehen und innovative Projekte zur Sicherung der Daseinsvorsorge konzipiert werden. Multifunktionale Projekte entstehen durch den fachlichen Austausch und bieten zusätzliche Perspektiven zu sektoralen Lösungen. In den europäischen Regionen wurden Beispiele multifunktionaler Projekte etwa aus den Themenfeldern Tourismus und Gesundheitsversorgung (Nationalparkregion – Gesundheitsregion, Graubünden[5]) aber auch Mobilität und Tourismus (Bus alpin, Graubünden[6]) vorgestellt.

Die organisatorische Zusammenarbeit betrifft die Zusammenarbeit der Verwaltungsebenen und -ressorts sowie weiterer Institutionen und Einrichtungen. Integrierte Strategien sowie interdisziplinäre Projekte und Maßnahmen zur Sicherung der Daseinsvorsorge bedürfen der Abstimmung und Zusammenarbeit verschiedener Experten, Verwaltungsebenen und Zuständigkeitsbereichen. Somit können Kräfte gebündelt sowie Doppelstrukturen und -aufgaben vermieden werden. Die möglichst frühe Einbindung und das Informieren von verschiedenen (betroffenen) Akteuren erhöht zudem die Akzeptanz der einzelnen Projekte. Auch für fachbezogene Strategien und Projekte, die eine integrierte Betrachtungsweise beinhalten, ist eine organisatorische Zusammenarbeit verschiedener Ebenen und Ressorts notwendig. Transparenz und Offenheit sind dafür notwendige Voraussetzungen. Zusammenarbeit sollte stärker belohnt und somit attraktiver werden. In diesem Bereich sind die deutschen Regionen mit dem MORO-Ansatz durchaus Vorbilder für die europäischen Regionen.

Aus den europäischen Regionen ist hier als Beispiel die Digitale Agenda von Västernorrland zu nennen. Für eine Strategie zum Ausbau der Breitbandversorgung arbeitet die Provinizialregierung (Länsstyrelsen Västernorrland) mit verschiedenen Akteuren zusammen. Dazu gehören verschiedene Verwaltungsebenen, Fachressorts (z.B. Straßenbauabteilung zur zeit- und kostensparenden Verlegung von Leitungen), Unternehmen (Anbieter und Entwickler) sowie private Akteure.[7]

4.2 Bürgerbeteiligung, Bürgerengagement und Persönlichkeiten

Ehrenamtliches Engagement von Bürgerinnen und Bürgern unterstützt Lösungsansätze und Projekte zur Sicherung der Daseinsvorsorge. Die Beteiligung der Bürgerschaft und (Schlüssel-)Akteure sensibilisiert für die Thematik und erhöht die Akzeptanz. Engagierte Persönlichkeiten treiben Projekte voran und setzen sich für deren Umsetzung ein.

Das frühzeitige und umfassende Informieren und Einbinden der (interessierten) Bürgerschaft und wichtiger Akteure trägt maßgeblich zur Schärfung und Sensibilisierung des Problembewusstseins bei und erhöht vor allem auch die Akzeptanz von Lösungsansätzen und Projekten zur Sicherung der Daseinsvorsorge sowie die Bereitschaft zur Beteiligung und Mitarbeit. Durch eine breit angelegte und frühzeitige Bürgerbeteiligung und Beteiligung lokaler Akteure können vielfältige Projektideen generiert werden. Gerade wichtige Schlüsselakteure sollen von Beginn an über den Prozess informiert und daran beteiligt werden. Dies wirkt sich positiv auf den weiteren Verlauf und vor allem die Realisierung aus.

[4] Vgl. Internetauftritt Kommunförbundet Västernorrland, aufgerufen unter: http://kfvn.se/in_english_1859.html, http://www.fouvasternorrland.se/, Zugriff 26.02.2015.

[5] Vgl. Tagungsband „Zukunftsorientierte Lösungsansätze zur Sicherung der Grundversorgung“ der Schweizer Arbeitsgemeinschaft für Berggebiete (SAB), aufgerufen unter: http://www.sab.ch/uploads/media/ST226_GrundversorgungFT_09.2014.pdf, Zugriff 26.02.2015.

[6] Vgl. Internetauftritt Bus alpin, aufgerufen unter: http://www.busalpin.ch/de/kurzvorstellung.html, Zugriff 26.02.2015.

[7] Vgl. Internetauftritt Länsstyrelsen Västernorrland, aufgerufen unter: http://www.lansstyrelsen.se/vasternorrland/Sv/om-lansstyrelsen/eu-och-internationellt/vara-projekt/Pages/nya-digitala-perspektiv.aspx, Zugriff 26.02.2015.

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Aufgrund der vielfältigen Herausforderungen bei der Sicherung der Daseinsvorsorge wird die Unterstützung vieler Akteure benötigt. Gerade das ehrenamtliche Engagement kann in vielen Kommunen und Regionen, die unter Schrumpfungsbedingungen auch mit knappen Kassen zu kämpfen haben, einen erheblichen Beitrag leisten. Durch die Zusammenarbeit mit Vereinen können bereits engagierte Persönlichkeiten gewonnen werden. Auch die Ansprache verschiedener Altersgruppen zur Mitarbeit ist erfolgsversprechend und erhöht die Verbundenheit mit dem Ort und das Problembewusstsein. Gerade Menschen zu Beginn ihrer Rentenzeit sind oft bereit sich zu engagieren und bringen gleichzeitig viel Erfahrung mit. Dabei sollte der zeitliche Aufwand für das ehrenamtliche Engagement für jeden Einzelnen überschaubar sein und das Ehrenamt entsprechend gewürdigt werden.

Ehrenamtliches Engagement ist in Niederösterreich im verschiedenen Projekten zur Stärkung von Angeboten der Daseinsvorsorge, beispielsweise zur Verbesserung kleinräumiger öffentlicher Mobilitätsangebote in Form von Gemeindebussen[8], besonders ausgeprägt und wird zumeist in Vereinsarbeit realisiert.

Engagierte Persönlichkeiten benötigen immer auch einen Ermöglichungsspielraum, ohne ausgebremst zu werden. Solche Gestaltungs- und Unterstützungsstrukturen erhöhen die (nachhaltige) Motivation und Mitwirkung von engagierten Persönlichkeiten in Projekten zur Sicherung der Daseinsvorsorge. Solche „Projekt-Treiber“ setzen sich für die Bearbeitung, Weiterentwicklung und Realisierung von Projekten ein. Sie können darüber hinaus die Fähigkeit besitzen, weitere Akteure zu motivieren und zur Mitarbeit zu aktivieren. Sie zeigen sich für das Projekt bzw. den Prozess bis zur Realisierung verantwortlich und ermöglichen die erfolgreiche Verstetigung.

4.3 Innen- und Außenkommunikation, Öffentlichkeitsarbeit und Marketing

Für ein erfolgreiches Projekt ist eine gute Kommunikation notwendig. Dabei spielt sowohl die Kommunikation innerhalb des Projektes zwischen den Projektpartnern und Akteuren eine wichtige Rolle als auch die Kommunikation nach außen. Die Öffentlichkeitsarbeit kann über aktuelle Projektstände und erzielte Projekterfolge berichten. Ein professionelles Marketing spielt für die Außenkommunikation eine zentrale Rolle.

Erzielte Erfolge sollten sowohl innerhalb als auch außerhalb des Prozesses bzw. Projektes kommuniziert werden. Dabei ist es wichtig erste, wenn auch kleine, Erfolge schnell zu erzielen. Diese motivieren die beteiligten Akteure zur weiteren Mitarbeit und dienen auch dazu die (interessierte) Öffentlichkeit stetig zu informieren und eine Akzeptanz für die Maßnahmen zu erzeugen. Eine positive Wahrnehmung in der Bürgerschaft kann somit erreicht werden, wodurch wiederum weitere Unterstützung für den Prozess bzw. das Projekt generiert werden kann. Für die Öffentlichkeitsarbeit stehen verschiedene Kanäle zur Verfügung. Dies kann über Veröffentlichungen in Zeitungen, Newslettern, Flyern, Homepages usw. geschehen. Auch die Bewusstseinsbildung und Themensensibilisierung werden dadurch unterstützt.

Ein professionelles Marketing unterstützt den Erfolg für Strategien und Projekte zur Sicherung der Daseinsvorsorge. Der Projekterfolg allein reicht nicht aus, er muss auch „verkauft“ werden und sichtbar sein. Dies geschieht bspw. durch Internetauftritte und einem einheitlichen Erscheinungsbild weiterer Materialien.

In Västernorrland wurden beispielsweise so genannte „Service Points“ eingerichtet, die in einem Geschäft oder einer Tankstelle sein können, um die Versorgung der Bevölkerung mit Lebensmitteln und weiteren Dienstleistungen zu verbessern. Zum Angebot gehört ein Lieferservice für Lebensmittel, ein kleines Café, ein Computer mit Internet- und WiFi-Verbindung sowie Informationen über die jeweilige Gemeinde. Ein einheitliches Logo, das jeder Service-Point benutzt und von außen gut sichtbar an dem Gebäude angebracht wird, erhöht den Wiedererkennungseffekt. Service Points erhalten von der Provinzialregierung Västernorrland (Länsstyrelsen Västernorrland) eine Anschubfinanzierung.[9]

[8] Vgl. Internetauftritt Gemeinde Ernstbrunn, aufgerufen unter: http://www.ernstbrunn.gv.at/system/web/sonderseite.aspx?menuonr=222529618&detailonr=222529618, Zugriff 26.02.2015.

[9] Vgl. Vortrag und Präsentationsfolien Ann Holst: „Örnsköldsvik. A simple choice“, am 25.06.2014 in Söråker, im Rahmen des internationalen Informations- und Erfahrungsaustausches Västernorrland.

4.4 Unkonventionelle Projekte, flexible Standards, integrierte Strategieentwicklung, Fürsorge auch für Kleingruppen

Unkonventionelle Ideen und Projekte können einen Beitrag zur Sicherung verschiedener Daseinsvorsorgebereiche leisten. Sie können beispielsweise durch die Verknüpfung verschiedener Themenfelder entstehen (multifunktionale Projekte) sowie durch die Erforschung und Entwicklung neuer Themenfelder (wie z.B. digitale Daseinsvorsorge) oder durch neue Kooperationen verschiedener lokaler und regionaler Akteure. Auch die Flexibilierung von Standards ermöglicht neue Vorgehensweisen und innovative Projekte. Aufbauend auf lokalen Gegebenheiten kann es sinnvoll sein, quantitative und qualitative Kriterien und Rahmenbedingungen der Daseinsvorsorge zu flexibilisieren und somit den Gestaltungsspielraum zu erhöhen. Zunächst sind dafür kreative und offene Herangehensweisen notwendig.

Chancen der Flexibilisierung von Standards bestehen beispielsweise in den Bereichen der Schulentwicklung (Zwerg- und Kleinschulen mit hoher Bildungsqualität in Graubünden).[10]

Der internationale Austausch hat gezeigt, dass integrierte Strategien, d.h. langfristige und themenübergreifende Strategien, am Beginn des Diskussions- und Anpassungsprozesses stehen können. Solche Strategien können aber auch aus zunächst fach- und themenspezifischen Überlegungen heraus entwickelt werden und sich weiter ausweiten.

Die Sichtweise auf die Herausforderung „Sicherung der Daseinsvorsorge" zeigte im europäischen Vergleich teilweise andere Denkweisen als diese in der deutschen Diskussion üblich sind. Es zeigte sich, insbesondere in Schweden, ein ausgeprägtes Fürsorge-Denken als Ausgangspunkt strategischer Überlegungen. Konkret ist darunter eine positive Sichtweise zu verstehen (kein negatives bedauern sich verändernder Strukturen), die immer von den Fragen ausgeht: Was brauchen die Menschen vor Ort und wie kann dies geleistet werden? Ein Denken unter dieser Prämisse erlaubt zunächst einmal unabhängig von gesetzlichen Vorgaben oder bewährten Standards zu überlegen wie welche Bedürfnisse der Daseinsvorsorge befriedigt werden können. Hier kann der internationale Austausch zu einer kritischen Reflexion eigener Denk- und damit verbundener Handlungsmuster beitragen.

4.5 Nutzung und Bereitstellung digitaler Infrastruktur (Breitbandversorgung)

Der Ausbau der Breitbandversorgung wird zunehmend zu einem wichtigen Entwicklungs- und Standortfaktor für ländliche Räume. Die Entwicklung und Anwendung digitaler Dienstleistungen kann für die Daseinsvorsorge, gerade im ländlichen Raum, einen erheblichen Beitrag leisten. Angebote werden nicht mehr lokal vorgehalten, sondern digital erbracht. Der hohe finanzielle Aufwand der digitalen Erschließung im ländlichen Raum kann somit amortisiert werden. Dieses enorme Potenzial gilt es zukünftig zu nutzen, zu erforschen und weiterzuentwickeln. Digitale Dienstleistungen können insbesondere im Gesundheits- bzw. Pflegebereich als ergänzende Unterstützungsmaßnahmen eingesetzt werden und damit eine Qualitätsverbesserung erreichen.[11]

5 FAZIT

Das Projekt zeigt, dass bei gemeinsamen Problemen und Herausforderungen, teilweise gerade durch unterschiedliche nationale Rahmenbedingungen, interessante Projekte zur Sicherung der Daseinsvorsorge sowohl in einzelnen Daseinsvorsorgebereichen als auch im Sinne von querschnittsorientierten Strategien entstehen. Eine Übertragbarkeit kann in vielen Fällen möglich und sinnvoll sein. Standards und rechtliche Rahmenbedingungen der Zielregionen können auch dazu anregen, Regelungen und Verantwortlichkeiten in Deutschland zu überdenken und gegebenenfalls zu verändern, um Handlungsspielräume zu erhöhen. Das Erleben der Regionen vor Ort war ein Mehrwert für Teilnehmerinnen und Teilnehmer. Die Fachexkursionen trugen zu einem intensiven Austausch und zu anregenden Diskussionen der Modellregionen untereinander sowie mit den europäischen Zielregionen bei. Gleichzeitig konnten auch die Zielregionen vom Austausch mit den Modellregionen und dem MORO Ansatz profitieren. Es wurde deutlich, dass die Entwicklung von Konzepten und Strategien zur Sicherung der Daseinsvorsorge wichtig sind, um langfristig lebenswerte und

[10] Vgl. Internetauftritt Schule alpin Gesamtprojekt 1 und 2, aufgerufen unter: http://www.schulealpin.org/einstiegsseite.html; http://www.schulealpin.org/, Zugriff 26.02.2015.

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zukunftsfähige Regionen auch in 2025 und 2050 zu ermöglichen. Der internationale Austausch leistet einen aktiven Beitrag, neue Konzepte zu erkunden und innovative Anregungen zu erhalten.

Die wesentlichen Erkenntnisse der Begleitforschung „Internationale Erfahrungen“ des Aktionsprogrammes regionale Daseinsvorsorge werden in einem Abschlussbericht als Online-Publikation des BMVI sowie in einem Magazin veröffentlicht werden.

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reviewed paper

Smart Meters for Accounting Smart Solid Waste Mangement for Smart Cities in India

Sanhita Bandyopadhyay

(Sanhita Bandyopadhyay, Environmental Planner, Ph.D Scholar, D-79, South City II, Gurgaon, bsanhita2@yahoo.co.in)

1 ABSTRACT

Rapid urbanization along with increases in population has led to the deterioration of physical environment in India. Effective Solid Waste Management is one of the major challenges faced by the local authorities. High volumes of waste generation, inefficient collection and transportation system and limited disposal options are continuously impacting the health, environment and quality of life in the area. A number of technologies are being proposed for management and disposal of garbage in general for different city or towns but so far no technology has been shortlisted as the one which would be viable not only from the environment angle but also in terms of the cost involved for unanimously in urban local body in India.

During the last century urban population of India increased ten folds from 27 million to 270 million. India produces 48.0 MT of MSW annually at present. Central Pollution Control Board, India (2009) said that by the year 2021, the urban population is expected to represent 41% of the overall population and subsequently MSW is expected to increase to 300 MT per year, by the year 2047 (490 g to 945 g per capita). Due to an increase in population and subsequently increase in waste generation, landfills could become a major source of atmospheric pollution.

Cities which are not clean do not exhibit a smart character. Cities which are clean are perceived to be smart, providing a healthier environment and a better quality of life. Therefore, they attract people – both people who want to live and work in the city and those who want to invest in the city.

It is in this context that the Government has decided on developing 100 “Smart Cities” in the country. It includes one satellite city of each of the cities with a population of 4 million people or more comprises of 9 cities, most of the cities in the population range of 1 – 4 million people about 35 out of 44 cities, all State/UT Capitals, even if they have a population of less than one million including17 cities, Cities of tourist, religious and economic importance not included 10 cities and Cities in the 0.2 to 1.0 million population ranging 25 cities.

Smart city meters segregation of recyclable and non-recyclable waste as well as wet and dry waste at the source so that there can be 100 percent recycling of solid waste. Appropriate technology should be adopted for treatment of waste at decentralized locations, put in place an effective collection and disposal system, encourage use of products based on recycling of solid waste especially – power, compost, building material (based on cycling of debris & construction materials).

Now the question is how to make it smart mechanism. What are the parameters to account the smartness of solid waste mnagement process including smart storage, smart collection mechanism, smart transportation, smart process and smart disposal. This paper has attempted to frame out web based automatic database mechanism to account the the process metering of solid waste mangement for 100 smart cities in India.

2 INTRODUCTION

Research on smart cities has been coinaged to Indian vision by Govt and many applications have been framed. Typical example includes smart transport to find the best route taking into account the current traffic conditions in mega polis and metro polis. All these applications are a step towards the realisation of a complete smart city. Another field of interest that should be made smart concerns the waste management. All cities, regardless their size, their geographical location or their economic level, spend huge amount of money every year for waste collection rather than its mangement. The number of bins located in the streets and the number of vehicles used to empty them are generally estimated based on the number of citizens, but the resulting estimation is sometimes either too high or too low or not accounted the feasibility of waste collection, further transportation, processing and disposal. The natural consequence is the provision of poor service or to incur in high costs (e.g. the cost of fuel for too many trucks for ultimate disosal). Furthermore, the collection of waste, regardless the type of material (recycling or unsorted), is typically fixed without taking into account the actual state of the level of fullness for each bin. The result is the collection of semi-empty bins or the trash accumulation degrading conditions of hygiene of the city (C. Vincenezo & V. Daniela, 2014, FRUCT Conference Proceedings). Their paper has framed the architecture for smart

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collection of waste, monitoring the fullness of bins through the use of various types of sensors, was assumed to help to achieve a more efficient system and defined “smart waste system management”. But the question how much Indian citizen is pro to react with this smart system. Moreover, in a smart city context, it is also important to allow users to interact with ubiquitous information produced by the city, anytime and from any device. This paper is stating the framework to propose a solution for smart metering for Smart visionary cities of India.

3 IDENTIFIED SMART CITIES IN INDIA

There are various agencies have defined the term ‘SMART City’.

The UK Department of Business, Innovation and Skills considers smart cities a process rather than as a static outcome, in which increased citizen engagement, hard infrastructure, social capital and digital technologies make cities more liveable, resilient and better able to respond to challenges.

The British Standards Institute defines it as “the effective integration of physical, digital and human systems in the built environment to deliver sustainable, prosperous and inclusive future of its citizens”.

IBM defines a smart city as “one that makes optimal use of all the interconnected information available today to better understand and control its operations and optimize the use of limited resources”.

CISCO defines smart cities as those” who adopt scalable solutions that take advantage of information and communications technology (ICT) it increase efficiencies, reduce costs and enhance the quality of life”.

Institutional Infrastructure (including Governance), Physical Infrastructure, Social Infrastructure and Economic Infrastructure constitute the four pillars on which a city rests as Smart City. The centre of attention for each of these pillars is the citizen. In other words a Smart City works towards ensuring the best for its entire people, regardless of social status, age, income levels, gender, etc.

The rapid urbanization of indian cities has resulted in unplanned development and urban sprawl. Most of the cities in our country are marred by congested CBDs and deteriorating city core.It is in this context that the Government of India has decided on developing 100 “Smart Cities” in the country. It includes

(1) One satellite city of each of the cities with a population of 4 million people or more (9 cities)

(2) Most of the cities in the population range of 1 – 4 million people(about 35 out of 44 cities)

(3) All State/UT Capitals, even if they have a population of less than one million (17 cities)

(4) Cities of tourist, religious and economic importance not included in above (10 cities)

(5) Cities in the 0.2 to 1.0 million population range (25 cities)

Out of four pillar Physical Infrastructure Pillar of smart city refers to its stock of cost-efficient and intelligent physical infrastructure such as the urban mobility system, the housing stock, the energy system, the water supply system, sewerage system, sanitation facilities, solid waste management system, drainage system, etc. which are all integrated through the use of technology.

Cities which are not clean do not exhibit a smart character. Cities which are clean are perceived to be smart, providing a healthier environment and a better quality of life. Therefore, they attract people – both people who want to live and work in the city and those who want to invest in the city.

4 SOLID WASTE MANAGEMENT SCENARIO OF INDIAN CITIES

Indian cities are facing many issues with regard to waste management practices, which include:

- Absence of segregation of waste at source.
- Lack of technical expertise and appropriate institutional arrangement.
- Lack of proper collection, segregation, transportation, treatment and disposal system.

It is estimated that solid waste generation in small, medium and large cities and towns is about 0.1 kg, 0.3 – 0.4 kg and 0.5 kg per capita per day respectively (CPHEEO Manual). CPCB in assistance with NEERI has survey records of waste generation and characteristics for 59 cities (35 Metro Cities and 25 State Capitals: 2004-05) of the country and the characterization of waste which can be used for composting or for incineration practice. MSW characteristics indicate the effect of urbanization and development in India. In urban areas, the major fraction of MSW is compostable materials (40–60%) and inert (30–50%) as referred in following table. Per capita generation rate is high in some states (Gujrat, Delhi and Tamil Nadu) and cities (Madras, Kanpur, Lucknow and Ahmedabad). This may be due to the high living standards, the rapid economic growth and the high level of urbanization in the states and cities. However, the per capita generation rate is observed to below in other states (Meghalaya, Assam, Manipur and Tripura) and cities (Nagpur, Pune and Indore).

Population range (in million)	No. of cities surveyed	paper	Rubber, leather and synthetics	Glass	Metal	Compostable matter	Inert material
0.1-0.5	12	2.91	0.78	0.56	0.33	44.57	43.59
0.5-1.0	15	2.95	0.73	0.56	0.32	40.04	48.38
1.0-2.0	9	4.71	0.71	0.46	0.49	38.95	44.73
2.0-5.0	3	3.18	0.48	0.48	0.59	56.57	49.07
5.0 and above	4	6.43	0.28	0.94	0.8	30.84	53.9

Table 1.1: Physical characteristics of MSW in Indian cities population wise (weight basis %). Source: NEERI report strategy paper on SWM in India, August 1995.

In urban areas, the major fraction of MSW is compostable materials (40–60%) and inerts (30–50%). The relative percentage of organic waste in MSW is generally increasing with the decreasing socio-economic status; so rural households generate more organic waste than urban households. It has been noticed that the physical and chemical characteristics of MSW change with population density. With the increasing of population size calorific value is less in waste material where as C/N ratio is almost same in all types of cities in India as stated following table.

Population range (in millions)	Nitrogen as total Nitrogen	Phosphorus as P_2O_5	Potassium as K_2O	C/N Ratio	Calorific value kcal/kg
0.1-0.5	0.71	0.63	0.83	30.94	1009.89
0.5-1.0	0.66	0.56	0.69	21.13	900.61
1.0-2.0	0.64	0.82	0.72	23.64	980.05
2.0-5.0	0.56	0.69	0.78	22.45	907.18
5.0 and above	0.56	0.52	0.52	30.11	800.70

Table 1. 2: Chemical characteristics of MSW in Indian cities population wise in percentage (on weight basis). Source: NEERI report strategy paper on SWM in India, August 1995.

Storage of MSW at the source is substantially lacking in most of the urban areas. The bins are common for both decomposable and non-decomposable waste (no segregation of waste is performed), and the waste is disposed at a communal disposal center. Storage bins can be classified as movable bins and fixed bins. The movable bins are flexible in transportation but lacking in durability, while the fixed bins are more durable but their positions cannot be changed once they have been constructed (Nema, 2004). The collection efficiency ranges between 70 to 90% in major cities whereas in several smaller cities the collection efficiency is below 60% (ref in table 1.3). Street sweeping is another type of collection method for the collection of street litter; many cities spend 30-50 % of their solid waste budgets on street cleansing (the Expert Committee, 2000). Most of the cities are unable to provide waste collection services to all parts of the city. Generally, overcrowded low-income settlements do not have MSW collection and disposal services. The reason is that these settlements are often illegal and the inhabitants are unwilling or unable to pay for the services. They throw away the waste near or around their houses at different times, which make the collection and transportation of waste very difficult in these areas.

The recycling sector in India has been in operation since the 1960's and while only a fraction of the total plastic waste is being recycled in most western countries (APME, 1995), around 75% of the plastic wastes are recycled in India (Haque, 1998). Rag pickers mainly carry out the recycling process in India and they play a vital role in the economy of solid waste recycling process (Aggarwal, et al 2005).

However, the rag pickers do not have sufficient protection and are exposed to waste and sometimes even the hazardous waste present in MSW. A study carried out in 2003 has shown that 75 percent rag pickers have upper and lower respiratory symptoms (Bhattacharya, 2005). Even the quality of the successively recycled products in the informal sector in terms of their physical appearance, polymeric properties, health hazards (for the recyclers and users of such products involved) are in serious question (Haque, 2000).

Another aspect to be noted is that plastic carry bags do not figure in the list of priorities for rag pickers, because collecting them is not profitable. This is primarily because the rewards do not match the efforts

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required for collection, and this leads to plastic bags continuing to pose a major threat to the environment (Narayan, 2001).

State	Per capita generation (g/cap/day	Per capita disposal (g/cap/day)	Collection efficiency (%)
India (sample average)	377	273	72
Andhra Pradesh	346	247	74
Bihar	411	242	59
Gujarat	297	182	61
Haryana	326	268	82
Karnataka	292	234	80
Kerala	246	201	82
Madhya Pradesh	229	167	73
Maharashtra	450	322	72
Orissa	301	184	61
Punjab	502	354	71
Rajasthan	516	322	62
Tamil Nadu	294	216	73
Uttar Pradesh	439	341	78
West Bengal	158	117	74

Table 1.3: Per capita generation, disposal and collection efficiency of MSW for Indian state. Source: Nema, 2004

In the process of rapid urbanization solid waste management from a low priority, localized issue to a pervasive social and environmental problem with risks to public health and environment. MSW management is constrained by institutional weakness; lack of proper funding, lack of proper management and operational systems, public apathy, lack of municipal will become financially self-sufficient through municipal taxation, etc. Disposal is the only favorable method to urban local body without any further action. Day by day increasing trend practice of dump to dump yard won't sustain the function. So there is a requirement of taking integrated policy and technology to manage waste more scientific method and metering system to account.

5 SMART METERING TECHNIQUE

Indian solid waste scenario are highly heterogeneous class produced by public or private (household waste), institutional waste and commercial waste. This category covers both the unsorted and the recyclable. The differentiates these two types of collection is just the process of garbage disposal. So, the design of a smart waste metering system that deals with both types of waste is equal until to the transfer of waste either to recycle plant for processing or biodegradable for manuring . The end priduct from the processing should go for landfill. The smart metering technique includes from begining of the waste mangement process ro end product of the cycle as under:

(1) Waste Generation

(2) Waste Collection

(3) Waste Transportation

(4) Waste Processing/Disposal

As per visionary note of Smart City smart Solid Waste Mangemnt is:

- 100% households are covered by daily door-step collection system.
- 100% collection of municipal solid waste
- 100% segregation of waste at source, i.e. bio-degradable and non-degradable waste
- 100% recycling of solid waste

Waste Generation: Price sensitive Indian market is unwilling to pay the cost of `smart` benefit. It is assuming that 100 smart cities citizen will be smart enough to pay their waste mangement process as thay will pay their utility bills. Now the question is how to meter their waste. The whole city will be censores prone or accounting their utility by individual household metering system. Need to monitoring the system is to address, account and follow. Per capita waste generation need to address first. Each household is generating waste. But no one wants to NIMBY (Not in My Back Yard). So induvidual househld should have three bucket system:

- Biodegradable : Green

- Non Bi-Degradable/Recycled : Yellow
- Hazardous : Red

Waste Collection: waste collection system has been framed in metering system with sorting of waste. Green accounting waste needs to be addressed everyday . Indian high moisture content waste would be more good manure within 12 hours system. This system will be monitored by local residential welfare. Composting plant should be mandatory to each sector. Each household will deposit or dump their waste by waste metering system. This waste will be measured by weighing machine of each floor/house and through smart card it will open the box and each individual will dump the waste. Through machinery collecting system it will be transported from individual house/ multi storyed building through convere belt and store at intermediate haul statiion and there after to compsoting plant. This waste network should be built like water pipeline/sewer line/gas line system. Each individual household should have one smart card to open the shaft and pour the bucket. Number of scratches the card will acount the value as well as measuring unit will be added with that number. Now the question is how to account the heterogenous waste and how to track only green waste. This shaft system will first scan the bucket if any hetrogenous material would find it won't open shaft. This system will be easy access to individual safe and metered for accounting each waste in terms of weight and types and cost will be levied basis of total waste. But shaft system for waste always make odour. So this system is required control engineering system like sewer. Conveor belt will be battery operated and connected with haul station. Each haul station should be mechanised to clean the belt after dispose off the waste. This mechanism can be motorised by solar system and heat generated by waste. This system will be dynamic system for accouting each waste and need to vigilance by local welfare system for awareness and maintain, repairing etc.

Yellow accounting metering system shaft will be placed beside the green shaft of residential square and can access at each floor. But the recyclable waste should be free from organic waste and hazardous`waste including battery, lead, e-waste etc. Same system shall be followed by individual and total waste would be counted by weighing system. The smart card can access to open the shaft and placed the bucket first to scan and then dump it into shaft. This shaft will be stored at underground storage system and from there trucks/ dumper can take away to destination processing plant of city.

Red waste accounting system should have access of individual/houseld by smart card and shall follow the same format once in a week to store the waste in particular underground storage system. Hazardous waste is need to take care and regular storage in residential or institutional area would be disasterous. One in a week to access for transportation system will help to monitor the waste types, quntum and management practices.

Waste Transportation:

Indian Transportation of waste is carried out by the municipalities employing vehicles like open trucks, tractor-trailers, tipper trucks and dumper placers. Transfer stations (except in a few cases as in Madras, Mumbai, Delhi, Ahmedabad and Calcutta) are not used, and the same vehicle, which collects refuse from individual dustbins, takes it to the processing or disposal site (Colon and Fawcett, 2006; Khan, 1994). The municipal solid waste (MSW) collected from the dustbins and collection points is transported to the processing or disposal sites using a variety of vehicles. In smaller (rural) towns, bullock carts, tractor-trailers, tricycles etc., are mainly used for the transportation of MSW. Light motor vehicles and lorries are generally used in big towns or cities for transport of MSW. The trucks used for transportation of MSW are generally of an open body type and are usually kept uncovered; thus during transportation, the waste tends to spill on to the road resulting in unhygienic conditions. In some cities, modern hydraulic vehicles are gradually being introduced. Collection and transportation activities constitute approximately 80–95% of the total budget of MSWM; hence, it forms a key component in determining the economics of the entire MSWM system. Municipal agencies use their own vehicles for MSW transportation though in some cities they are hired from private contractors (Ghose et al., 2006; Siddiqui et al., 2006; Nema, 2004; Bhide and Shekdar,1998).

Smart Metering system for Smart city has envisaged secure transport system from individual hoesehold to destination point. Mid term haul and spillage of waste is very common in Indian waste transportation system. Unhygenic transportation system has engulf the workers for directly hazardous waste. This smart metering system will help to eradicate the unhygenic access of waste to individual.

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Green waste wil be transported through conveor belt to direct composting plant. Only mechnical way will be applicable to access the waste. Machines sytem will endores the safe mangement for smart city fot smart transport. Yellow waste would be access to transport system by transport agency. Night time acess for collecting the waste from residential and instiutional city hubs. And will be transported to processing plant. Red waste will be transported through mechnised lifting system from once in week in different part of city's redential, commercial and institutional area at night time and directly will be stored at processing plant. Agency should have log metering system for collecting waste and weighing system at processing plant. This metering system not only make sure the safe transportation but also ensuring the clean, hygenic and cost effective sytem. No of trips won't account the system, total waste quntum will be measured for accounting metering log book for tranporter.

Processing or Disposal:

The three R's are commonly used terms in waste management; they stand for "reduce, reuse, and recycle". As waste generation rates have risen, processing costs increased, and available landfill space decreased, the three R`s have become a central tenet in sustainable waste management efforts (El-Haggar, 2007; Seadon, 2006; Suttibak & Nitivattananon, 2008; Tudor et al., 2011). (Gary Davidson, 2011 et). The recycling sector in India has been in operation since the 1960's and while only a fraction of the total plastic waste is being recycled in most western countries (APME, 1995), around 75% of the plastic wastes are recycled in India (Haque, 1998). Rag pickers mainly carry out the recycling process in India and they play a vital role in the economy of solid waste recycling process (Aggarwal, et al 2005). They feed the need of the intermediary buyers, who, in turn, meet the demand of factories using recyclable solid waste as raw materials. However, the rag pickers do not have sufficient protection and are exposed to waste and sometimes even the hazardous waste present in MSW. A study carried out in 2003 has shown that 75 percent rag pickers have upper and lower respiratory symptoms (Bhattacharya, 2005). Another aspect to be noted is that plastic carry bags do not figure in the list of priorities for rag pickers, because collecting them is not profitable. This is primarily because the rewards do not match the efforts required for collection, and this leads to plastic bags continuing to pose a major threat to the environment (Narayan, 2001).

The concept of waste reduction, or waste minimization, involves redesigning products or changing societal patterns of consumption, use, and waste generation to prevent the creation of waste and minimize the toxicity of waste that is produced (USEPA, 1995). Common examples of waste reduction include using a reusable coffee mug instead of a disposable one, reducing product packaging, and buying durable products which can be repaired rather than replaced. Reduction can also be achieved in many cases through reducing consumption of products, goods, and services. The most effective way to reduce waste is by not creating it in the first place, and so reduction is placed at the top of waste hierarchies (USEPA, 2010). In many instances, reduction can be achieved through the reuse of products.

Waste management systems must remain flexible in light of changing economic, environmental and social conditions (McDougall et al., 2001; Scharfe, 2010). In most cases, waste management is carried out by a number of processes, many of which are closely interrelated; therefore it is logical to design holistic waste management systems, rather than alternative and competing options. Integrated waste management (IWM) has emerged as a holistic approach to managing waste by combining and applying a range of suitable techniques, technologies and management programs to achieve specific objectives and goals (McDougall et al., 2001).

Here Waste metering technique is such technique to approach the selection method for waste into:

Re-use

Reduce

Recycle

Reuse product can be sorted through mechanised system in processing plant ant would make again the same product and can sale the open market. This total input waste will become raw material of product. The debris of waste will be disposed off to sanitary landfill system of city. This transportation cost will be managed by processing plant itself.

Reduce: The mechanised method of reductin of size and shape of waste will make different product and metering system of transporter will get payment by the processing plant not by city municipality. City municipality will pay the operation and maintenance cost to transport agency to follow th smart metering technique.

Recycle method is complete processing unit where hardous and recylable waste have been transported and mechanically sorted and product will generate or incinerated. The cost of this processing unit will be subsidised by municipality and individual owner in 70:30 percentage ratio.

Disposal

Uncontrolled landfilling has been mainly adopted for ultimate disposal of municipal solid waste in India; thereby causing numerous health, environmental and aesthetic hazards (Ambulkar, 2004). However, now landfilling is the most preferred method of disposal of solid wastes as it is an effective and low cost method of disposal (Ramachandran, et al). Onionskin method of lying i.e., alternate building rubbish of thickness 30 cm and municipal waste with thickness of 1 to 3 m is adopted in few cities like Delhi, Chennai and Hyderabad (CPCB, 1998). However, the numbers of sanitary landfills are extremely low compared to the dumpsites, where uncontrolled dumping is observed, leveling and provision of earth cover is rarely provided. The rag pickers are further observed to be active at disposal site. Methane gas that is emitted at the landfills is not collected, hence adding to the GHG emissions (Kumar, S., et al 2004). Despite the best efforts to reduce, reuse and recycle, there will always be residual waste requiring disposal. For that methane capturing and waste to energy plant is mandatory for smart city. Smart metering system will also accounting the heating potentiality for energy sale for waste amangement to municipality. Eah municipality will be liable to purchase energy to ensure the market of waste to energy plant establishment on cities as well as it will help to transmit energy for composting plant and individual sector energy flow for moving the bio degradable waste transporting system conveor belt.

6 CONCLUSION

The Solid Waste Manual published in 2000 by the Ministry of Urban Development (MUD) (CPHEEO, 2000) states that, “In India, the system of primary collection of waste is practically non existent thus streets are generally treated as receptacles of waste. Most cities lack primary collection systems: MSW is often left on streets or in community bins that are overflowing. House-to-house collection of MSW is carried out in only some locations in large cities in India. A large portion of the waste is collected by street sweeping, which is not done on a daily basis in some areas. The collection efficiency in India ranges from 50-90%. A survey of Indian cities in 1989 showed that the average collection efficiency was 72.5%. However, given the results of the survey, described below, the national average must have been considerably lower than 72.5%. (Gupta, Mohan, Prasad, Kansal. 1998). A study conducted by the National Institute of Urban Affairs of India in 1989 found that collection efficiencies in Indian cities were low due to two main factors: availability of labor and transportation facilities. (Gupta & Kansal,1998). Using a benchmark of 2,800 workers/million population for an optimum manpower requirement, the survey found that less than 10% of the cities surveyed met this requirement, and that over 77% of the cities had a shortfall of at least 46%. With regard to transportation, another survey used a benchmark of 320 m3/million population for transport volume. This survey concluded that 95% of the cities had a shortfall ranging from roughly 22-53%, and that 5% of the cities had a shortfall of over 68%. A more recent study in 2006 found that 70% of urban areas in India lack proper transportation facilities to transfer MSW to disposal sites.

The rapid and unplanned urbanization process lead too many problems in which solid waste is one of the aspects which are changing the nature. In the process of rapid urbanization solid waste management from a low priority, localized issue to a pervasive social and environmental problem with risks to public health and environment. MSW management is constrained by institutional weakness; lack of proper funding, lack of proper management and operational systems, public apathy, lack of municipal will become financially self-sufficient through municipal taxation, etc. Disposal is the only favorable method to urban local body without any further action. Day by day increasing trend practice of dump to dump yard won’t sustain the function. So there is a requirement of taking integrated policy and technology to use less land. Land is precious. Footstep to sustainable development it is an imperative requirement to understand the basic concepts concerned to the solid waste management practice and bare minimum requirement of land at each level. Smart metering system is web based technology for accounting waste in each step and addres to sort, process and waste won’t become waste for city but a resource of flow dynamic.

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Smart Mobility: Opportunity or Threat to Innovate Places and Cities?

Enrica Papa, Dirk Lauwers

(Ph.D. Enrica Papa, Department of Civil EngineeringCenter for Mobility and Spatial PlanningGhent University, Vrijdagmarkt 10/301 B-9000 Gent, Belgium, enrica.papa@ugent.be)

(Prof. Dirk Lauwers, Department of Civil Engineering Center for Mobility and Spatial Planning Ghent University, Vrijdagmarkt 10/301 B-9000 Gent, Belgium, dirk.lauwers@ugent.be)

1 INTRODUCTION

The concept of the "smart mobility" has become something of a buzz phrase in the planning and transport fields in the last decade. After a fervent first phase in which information technology and digital data were considered the answer for making mobility more efficient, more attractive and for increasing the quality of travel, some disappointing has grown around this concept: the distance between the visionarypotentialthatsmartness is providingis too far from the reality of urban mobility in cities. We argue in particular that two main aspects of smart mobility should be eluded: the first refers to the merely application to technology on mobility system, what we called the techo-centric aspect; the second feature is the consumer-centric aspect of smart mobility, that consider transport users only as potential consumers of a service.

Starting from this, the study critics the smart mobility approach and applications and argues on a"smarter mobility" approach, in which technologies are only oneaspects of a more complex system. With a view on the urgency of looking beyond technology and beyond consumer-oriented solutions, the study arguments the need for a cross-disciplinary and a more collaborative approach that could supports transition towards a"smarter mobility" for enhancing the quality of life and the development ofvibrant cities. The article does not intend to produce a radical critique of the smart mobility concept,denying a priori its utility. Our perspectiveisthat the smart mobility is sometimes used as an evocativeslogan lacking some fundamental connection with other central aspect of mobility planning and governance.

Main research questions are: what is missing in the technology-oriented or in the consumers-oriented smart mobility approach? What are the main risks behind these approaches? To answer this questions the paper provides in Section 2 the rationale behind the paper;Section 3 provides a literature review that explores the evolution on smart mobility paradigm in the last decades analysing in details the "techno-centric"and the "consumer-centric" aspects. Section 4proposes an integrated innovative approach for smart mobility, providing examples and some innovative best practices in Belgium. Some conclusions are finally drawnin Section 5, based on the role of smart mobility to create not only virtual platforms but high quality urban places.

2 BEYOND THE SMART MOBILITY PARADIGM

Different approaches to mobility systems and mobility planning have been developed and described within the transport and land use literature. The first one is defined "conventional mobility" planning and it focuses on the physical dimensions and on traffic (and in particular on the car) rather than on people: it is large in scale, rather than local, it is forecasting traffic and it is based on economic evaluation. In synthesis, the conventional approach "is based on the premise that travel is a cost, and that travel times should be as short as possible" (Banister, 2008). In other words, traditional transport planning aims at improving mobility, especially for vehicles, and may fail to adequately consider wider impacts.

In opposition to this, the sustainable mobility paradigm arose (Banister, 2008) which strengthens the links between land use and transport. The sustainable mobility refers to the broad subject of transport that is sustainable in the senses of social, environmental and climate impacts and the ability to, in the global scope, supply the source energy indefinitely. It is aimed at the ultimate goal of mobility, which is accessibility (Litman, 1998). In this sense it aims at improving access while simultaneously at reducing environmental and social impacts, and at managing traffic congestion, to reduce the need to travel (less trips), to encourage modal shift, to reduce trip lengths and to encourage greater efficiency in the transport system. The shift from conventional mobility to sustainable mobility involves moving from an idea of transport system performance, primarily evaluated based on speed, convenience, and affordability of motor vehicle travel (thus favouring automobile-oriented improvements) to a more comprehensive, multimodal system of evaluation that considers a range of modes, objectives, impacts and improvement options (Litman, 2013).

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Another approach to overcome the conventional mobility planning has been proposed and applied. It can be defined as the "city as a place" paradigm, and has been proposed within the urban design literature and practice. According to it, the city and the transport system have to be embedded first at the small scale, looking at the quality of the urban places in small contexts. The attention here has been directed to the people and the places of the city (Gehl, 2013). The paradigm that follows the principle of New Urbanism is a set of development practices to create more attractive, efficient, and liveable communities. Accordingly, the community has to have a marked activity centre. Special attention is paid then to protecting the public realm and creating quality public spaces, including sidewalks and paths, parks, streetscapes and public buildings. This helps create more community identity and cohesion, leading to stronger and healthier communities. In synthesis, emphasis is on the creation of quality of life and urban sense of spatial definition.

Finally,a third approach has been proposed as an opposition the "conventional" mobility planning: the smart mobility approach. With this term, academic research and industrial applications refer to the potential of optimizing existing city infrastructure, services,and urban behaviour through the deployment and utilization of digital networks. The smart mobility approach, and its evolution, as described in the following section, is in fact mostly based on the application of new information technology for the innovation of transportation systems and it has been quite fashionable in urban and transport planning domains and in the policy arena in the last decade. According to some studies, the smart city and the consequent smart mobility concepts are no just limited to the diffusion of ICT, but it looks at people and community needs (Batty et al., 2012). Nevertheless, as explained in the following paragraphs, some important links with other aspects of mobility planning are still missing.

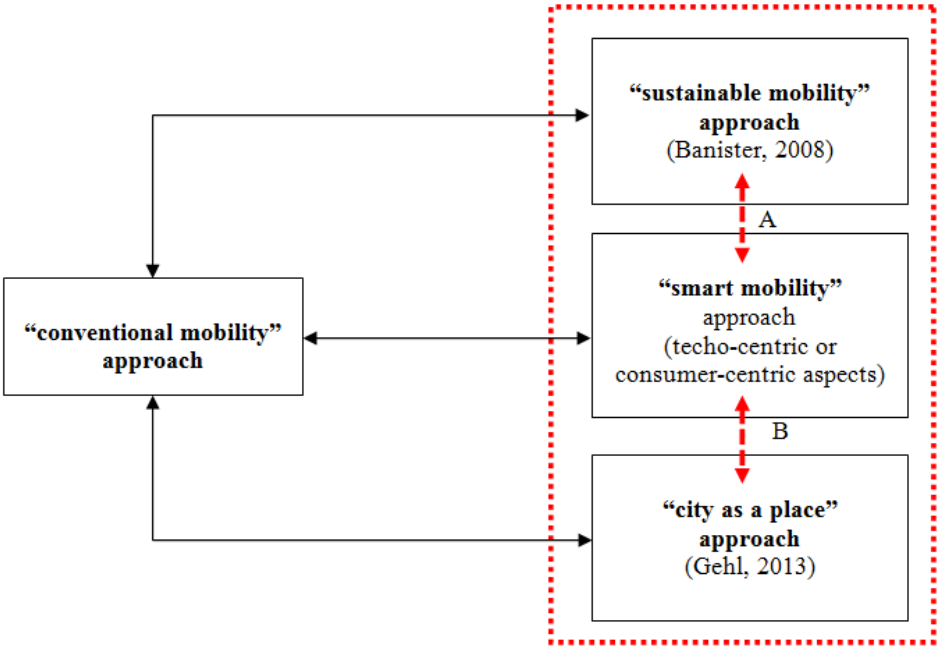

Fig. 1: The approaches on mobility planning and their missing links

Starting from the definitions of the different approacheswe want to provide insights on the weak or missing interrelations within them (Figure 1) and to analyse potential area of cross borders. Our main argument is that arrows A and B in Figure 1 that describe respectively the interrelations between smartness, sustainability and quality of places should be strengthen both in theory and in practice. In fact as stated by Lefevre, executive director of the New Cities Foundation, the smart city (and in particular the smart mobility) seems to have lost its contact with humans: "if you type smart city on your image search engine, the first human being appears on the page number eight. The first hundred or so images are sci-fi renditions of cities that will probably never exist". The same happens by searching "smart mobility" or "smart transport". In literature and in practice there is a gap between the smart approach, sustainability and quality of lifer approaches, and we argue that in most case the paradigm shift is occurring directly from the "conventional mobility" approach, towards the smart mobility one, by apply new technology to infrastructure of by spreading real time information a transport system that instead would need better other solutions. In other words, the concept of smart transport as synonymous with innovative technological or consumer-centric solutions should goes beyond this. Technology and infrastructure are central, but they only go so far without coordinated planning and vision. Truly smart urban mobility systems leverage technology to improve quality of life and inform decision-making. Above all, these systems are socially, environmentally, and financially sustainable.Furthermore,smart strategies are not related in many cases to a more comprehensive goal of sustainability and quality of life in cities. In other terms, innovation in mobility has to include sustainability and quality of life planning goal in its applications ain practice.

In this general framework, in the following paragraphs we examine the links between the smart mobility concepts and the other described: the “conventional approach”, the “sustainable mobility” approach, and the “city as a place” approach, stressing the missing crossovers in theory and practice of the three concepts. We will argue this issue with the help of practical applications of smart mobility into practice, with a specific selection of examples from the Flanders region in Belgium.

3 THE EVOLUTION OF THE SMART MOBILITY CONCEPT

The term smart or intelligent mobility appeared at the beginning of the Nineties in order to point out at a city with a mobility system more and more dependent on technology and on innovation. Within the “smart city”, studies have defined it in many different ways (for a complete and updated list see Albino et al., 2015).

Despite the difficulty to account for the multiple meanings attributed to the concept and the many different approaches in current urban planning literature, we focus on two main aspects, described in the following paragraphs. The first is a “techno-centric”approach based on the application of information technology to transport infrastructure, and the second one is a “consumer-centric” approach, based on the idea of providing new mobility products for transport users, considered as consumers.

3.1 The techno-centric smart mobility

The techno-centricaspect of smart mobility is characterized by a strong emphasis on the “hardware” and, namely, on the idea that ICT infrastructure represents the keystone for building up the Smart Mobility. According to this approach, ICTs represents the keystone for building up the Smart Mobility, relate the infrastructure of smart cities to their operational functioning and planning through management, control and optimisation (domain of both large and small ICT companies).

The techno-centric approach, largely widespread in the early 2000s and mainly focused on the technological aspects, provides a vision of smartmobility as capable of maximizing its efficiency thanks to a large and widespread use of ICT. Such a vision, which has been largely sustained by multinational companies, leaders in the sector of ICT manufacturing, focuses on infrastructural innovation. The techno-centric approach is still largely widespread, but even the vice-president of CISCO has recently pointed out that something should be changed. He stated indeed: “we are crossing the threshold to put internet-based tools to work in cities (….) technological devices are merely tools that can make our life better only if they are put in the hands of users who understand and can make the most of them” (Elfrink, 2012).

We will use some examples from the Flanders context to better describe thisaspect and the applied strategies.

3.1.1 <u>“Techno-centric smart mobility” practices in Belgium</u>

The first example consists in the ITC traffic controller of Antwerp. The project consists in the replacement of the current systems that for 35 years have been co-ordinating the signalling and automatic braking of Antwerp’s pre-metro network. The new installations will organize the flow of trams more quickly and precisely, while increasing safety by constantly checking the speed of trams and braking automatically if necessary. The main difference from the actual system is that the future technology will be able to modify traffic lights times, and thus the roads capacity in real time and will have the ability to adjust its decision-making in the case of unexpected situations. The intelligent traffic lights will also be able to inform users of the traffic that is queuing at each junction in real time.Based on optimization principle and real time information, this intelligent technology, applied in the mobility field, could be able to reduce the time wasted in traffic jams at junctions by 64%, with a consequent reduction of economic losses, emission of greenhouse gases and traffic aggression. Another aspect will be the increasing safety for cyclist and pedestrian.

Another example of the “techno-centric smart mobility” is the “smart road” and the “road network sensing”, which already have some pilot applications in Flanders. The“smart road” consists in incorporating technologies into roads for the generation of solar energy, for improving the operation of autonomous cars, for lighting, and for monitoring the condition of the road.An application in Flanders of this strategy is the project “Vebimove”. The project started with the creation of a traffic sign database created in 2008 on the initiative of the Government of Flanders. The project usesa database to set up sustainable route navigation and mobility optimisations for Flanders. For this use the data are converted into an ITS compatible form.The aim of this route navigation is to encourage sustainable driving behaviour (safe, low consumption, etc.) and combines various ITS applications, for example astandard route navigation or a Smart Speed Control, which consists into a smart in-vehicle system, which ensures that more road users respect speed limits. Another application is dynamic route information, thanks to which the driver is advised about the optional speed or route depending on the situation along his route (e.g. when approaching a queue the system advises the driver to reduce his speed). Other examples are traffic viability criteria, which provide additional information so that the surrounding area experiences as little ‘nuisance’ as possible (e.g. advise the driver to avoid areas around schools at certain times of the day)The dynamic combination of traffic sign information with structural information can contribute to optimising traffic flow. User cases can be introduced in several industries, which may benefit the efficiency of cargo flows, distribution channels, service organisations, insurance companies, etc. (http://www.vim.be/projects).

The last example of the “techno-centric smart mobility” is the driverless car. Following the leader Netherlands industry in this sector, some first pilot example of self-driving cars are also running in Flanders. An autonomous car, also known as a driverless car, self-driving car and robotic car, is an automated or autonomous vehicle capable of fulfilling the main transportation capabilities of a traditional car.Some experiment going on in Belgium regards only some aspects of a complete driverless car, as for instance the Fully Assisted Parking Aid system led by the automotive industry who is working on a fully automated parking and charging system for electric cars. The future development of these technology applied at the individual vehicles, are based on sharing information obtained from other vehicles in the vicinity, especially information relating to traffic congestion and safety hazards. Vehicular communication systems use vehicles and roadside units as the communicating nodes in a peer-to-peer network, providing each other with information.

Some risks are referred to this aspect. By increasing the quality of driving, or the efficiency of the road systems, the car demand and use will increase as well. In other term a new possible car euphoria could spread in cities. Some disadvantage consists in the risk that they will increase car ownership and car use because it will become easier to use them and they will ultimately be more useful. This may in turn encourage urban sprawl and ultimately total private vehicle use. Others argue that it will be easier to share cars and that this will thus discourage outright ownership and decrease total usage, and make cars more efficient forms of transportation in relation to the present situation.Another issue regards the implication on sustainability and quality of places in cities. Do optimization techniques and technologies has a direct impacts on these issues? Cities that employ optimization techniques have reported improvements in energy efficiency, water use, public safety, road congestion. However, optimization has its limits. For instance, the improvement of traffic flow in most cities can approach 10% based on current Smart Cities approaches such as sensing the road network, predicting the demand, and controlling traffic signalling.

3.2 The consumer-centricsmart mobility

The consumer-centered aspectof smart mobility is characterized by a strong emphasis on the human side and it has been largely widespread in the second half of the 2000s; according to such an approach, the human component represents the crucial element for building up a smart mobility system: technologies, more and more widely available, are intended as “enabling tools”, but insufficient to make “smart” an urban context, only by themselves.In practice, this idea has been applied, by considering innovations (infrastructures, vehicle and services) at looking at people, seen as end-consumers of a service, reflecting their individual needs. Applications furthermore are aimed at again optimizing consumer’s mobility behaviour through the ITCs (behavioural aspects), but without considering other more comprehensive central goals.

In other terms, while the techno centric approach is mainly focusing on the supply side, the consumer centricfocuses on the demand side of transport system, but with the limit of looking at transport users more at consumers of a service, than as citizens.

3.2.1 “Consumer-centric smart mobility” practices in Belgium

Within this category, we can count the numerous mobility applications developed for users information, which are spreading for the data and information sharing within the mobility system users.In Flanders are in fact numerous the different software that many public or private stakeholders are designing and that are targeting to mobility.One example is the CONNECT app that offers detailed insights on multimodal mobility and travel purpose. The behavior of participants is monitored through the CONNECT smartphone app, which samples location, transport mode and purpose with control of the participant. The CONNECT web-based survey, used to broaden the reach or to approach participants which are more difficult to follow for long periods (e.g. tourism), has a user-friendly interface to quickly gain insight on people's behavior and polls not only for survey questions, but reads in actual multimodal trajectories of people in a weekly agenda (Gautama et al. 2014).Another example is the APP YOUR RATE application, that allowscollecting valuable users’ assessments about home to work routes, which will be turned into maps allowing bikers to select the best route to work. This application is related to the “Bike to work”, an initiative of the Fietsersbond and Cracq to support employers who wish to give their employees incentives to cycle to work, whether or not in combination with public transport or a car (http://move2.ugent.be/index.php/en/)

Another example on consumer-centric smart mobility are software could be used to increase mobility sharing, is the Velo bike sharing system in the city of Antwerp, which count more than 2000 registered users; make an extensive use of new information system. In detail, the Velo website is used to manage the registration. Further a wap cell phone application is being used for ordering day and week tickets. A digital map on the Velo website shows where operational, empty or full stations are. If a user arrives at a full station, he or she can scan their card to see where the nearest station with empty spots is located. (www.velo-antwerpen.be).

Finally, another case of consumer-centric smart mobility is the driving behaviour campaign run within the project Belgian ISA-trial (Vlassenroot et al. 2007). To analyse the impact of an eco-driving course on fuel consumption and driving behaviour a data-logging device has been developed to monitor people’s driving behaviour.

Passenger cars were equipped with an on-board logging device that logged the position and speed of the vehicle by means of a GPS tracking system as well as real time electronic engine data extracted from the Controller Area Network (CAN). The CAN data included information on mileage, number of revolutions per minute, position of the accelerator pedal and instantaneous fuel consumption. Data gathered over a period of 8 to 10 months for 10 different drivers during real-life conditions enabled an individual drive style analysis.

This aspect has a stong “human” component than the previous one, as it is directly designed for the people, who are recognize to have a key role in the “functioning” of the smart city system. The problem with this aspect is the risk of a higher separation from the physical planning. Furthermore, with all this flows of information, will people be able effectly to change the quality of their travel and in general of their daily life? Will this strategies have an impacts of the transition towards a sustainable living enviroment if those are still not coordinated with urban planning and design measures?

4 TOWARDS A SMARTER MOBILITY

4.1 A smarter integrated approach for mobility

In the debate on smart cities and in detail on smart mobility, next to the attempts of definition and declination of the concept of smartness, a series of studies to formulate new approaches and methods have been conducted.

In the previous paragraphs two different aspect of the smart mobility approach have been described and what emerge in both cases is the gap between the“smartness” and sustainability and quality of life aspects. Starting from this,we here want to stress the need of a new integrated approach, characterized by an emphasis both on the quality of life that a Smart Mobility have to ensure through the integration between technological and social innovation and on the capacity of cities “to create the conditions of a continuous process of learning and innovation” (Campbell, 2012).

We refer in particolar on the definition of smart city proposed by the British Standars Institution (PAS, 2014) whichmention “an effective integration of physical, digital and human systems in the built environment to

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deliver a sustainable, prosperous and inclusive future for its citizens". In this definition three aspect are crucial:

(1) the integration between physical and digital;

(2) the focus on the local context: the smart city is not described as a "perfect" end-state for cities, taking into account the importance of the specific local context: "all cities are different: the historical, cultural, political, economic, social and demographic context for each city is different; as is the legacy of business processes and technology implementation from which it starts".

(3) the centrality of "citizen" (including residents, businesses, visitors and commuters to the city) which are not just users of services, but have a specific and active role in the transtion.

This approach combines the previous visions, looking at smart mobility as a system capable uf using ICT in an extensive and intelligent way, in order to improve the overall urban performances and, above all, the quality of life of citizens.

Among the main elements that characterize the integrated approach to the Smart Mobility, it is the awareness that enhancing through ICT the performance of individual sectors (from transport to energy, from constructions to urban safety, etc.) does not necessarily result in the building up of a smart mobilty: "a smart mobility should be viewed", indeed, "as an organic whole – as a network, as a linked system. In a smarter mobility system, attention is paid to the connections and not just to the parts" (Kanter and Litow, 2009). Furthermore, the idea that a smart mobility represents the final goal of a virtuous path – along which investments are addressed to achieve a sustainable growth, in economic and environmental terms – aimed at improving the quality of life of citizens and based on the involvement of settled communities – is currently more and more widespread.

The smart city framework (SCF) (PAS, 2014) also refers to these concepts and distils current good practices into a set of consistent and repeatable patterns that city leaders can use to help them develop and deliver their own smart city strategies. The SCF infact dedicate a specific focus on:

- make current and future citizen needs the driving force behind all city spaces and systems;
- integrate physical and digital planning;
- identify, anticipate and respond to emerging challenges in a systematic, agile and sustainable way;
- create a step-change in the capacity for joined-up delivery and innovation across organizational boundaries within the city.

As in the previous paragraphs, we decribe this integrated approach with the help of two best practices in which it is stronger the interrelation between the techology, the human, the sustainable and the quality of life aspects selecting some examples from the Belgium context.

4.1.1 "Smarter integrated mobility" practices in Belgium

A first example of a smarter and integrated approach for mobility planning is the Brussel Mobili2014 initiative. To get people dreaming about tomorrow's mobility, Brussels Mobility launched an exploratory initiative with Mobil2040, a forward-looking and multidisciplinary study undertaken by the consultancy offices Technum (Tractebel Engineering) and Espaces-Mobilités. Mobil2040 delivers a very 'refreshing' vision of mobility, with a people-first approach.The Mobil2040 vision is described through different themes. "Spaces and Places" is looking at spatial development, sharing of public space, a 'local city', car-free areas, new places for working and communicating: these are just a few of the avenues explored by Mobil2040 in terms of spaces and places.Another theme is instead focusing at "data and Information", explaining the powerful potential of data for supporting urban policies and offering users multimodal and multifunctional information.The main strength is that all the themes are strictly interrelated and the different component of smartness are connected one to the other (http://www.mobil2040.irisnet.be/en/7-themes-to-consider-the-mobility-of-the-future.html).

Lab of Troy is another example of smarter and integrated approach for mobility planning in which technology has no role, but still innovation is central in the governance process.Lab of Troy was born in Ghent and it is an independent network of collaborating citizens, businesses, governments and organizations. Lab of Troy gains practical experience and show that structural changes are possible.The Living Street is an experiment developed by Lab of Troy in which residents take their road construction and conversion into their dream street. Together by temporary (part of) to the street was made temporally car-free and the place dedicated before to parked cars has been used as space for greenery, meeting and living together. Along with volunteers from the Lab Trojan network, inhabitants provided street furnishings, coupled with less car use, in order make life in the city more comfortable and durable. Furthermore, during the test period, to be less dependent on the car inhabitants tried alternative modes of transport, for example electric bicycle for commuting displacement, cargo bike, home delivery or shared cars. The initiative and the practical organization of the temporary living street lies primarily with enthusiastic street residents and volunteers from the Lab of Troy. They were supported by different companies and organizations that participate to the goals of the experiment. The city council and the various city services are a key partner to realize the project, and to lead in the right direction.The purpose of this experiment is to demonstrate and experience that a different approach to the street and public space is possible. An interagency working group ensures that the necessary lessons can be drawn from this experiment. Experiences that can help players regime like the city in the development of their policy frameworks around. The design of streets and parking area contribute to the transition to a climate-neutral city.The first edition of the pilot project ran from 1 June to 30 June 2013. The second edition took place in May, June, September and October 2014 (http://www.leefstraat.be).

5 FINAL THOUGHTS

The study give some insigths on the debate on the smart mobility. It provides through a set of selected applications in Belgium the evolution of the concept of smart mobility through a more techno-center towards a consumer centered one. Solutions to the mobility problem are seen in technological fixes and high tech solutions, such as alternative fuels, intelligent transport systems, integration of information and communication technologies and means of transportation etc. In the face of the outlined challenges of current mobility regimes, mobility scholars tend to see potential solutions in new technologies and their combination, e.g. smart mobilities systems.

This study argues that these solutions are not complete and that smart mobility is beyond technology or consumers. Our final thoughts are then stressing that a new concept of smart mobility is necessary that would address the positive, integrated, and sustainable future, as the one described in Figure 2(British Standard Institution, 2014).

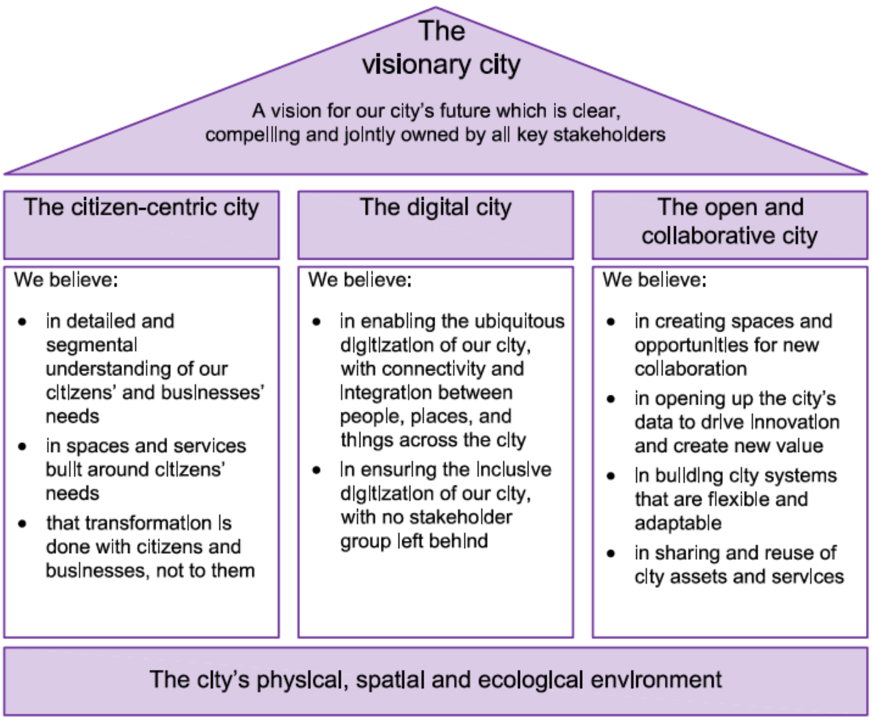

Fig. 2: The visionary city and the integration between the citizen-centric, the digital city, and the collaborative city (source: British Standard Institution, 2014)

With regards to the goals, the new smarter approach should aim at quality of life that a Smart Mobility has to ensure through the integration between technological and social innovation (Moss Kanter and Litow, 2009) and sustainability (Banister, 2008). The new approach should develop a holistic and system-level perspective on smart sustainable cities that follow an integrative approach towards complex problems leveraging Big Data analytics and strategies related to planning, zoning, and public policy. For urban mobility are then necessary more integrated approaches that would make the best use of technology. Urban transportation requires more than technology ans a new cross-disciplinary and collaborative approach is necessary in order to support planning, transition and implementation of a ‘smart mobility’ for quality of life and sustainable urban mobility. The solution should extend beyond technology, but we should still value the indispensable role of it. Smart mobility should integrates technologies, systems, infrastructures, and capabilities, where this innovation is a means, not an ends. The emphasis on human infrastructure highlights social learning and education. Towards more progressive smart cities, mobility system should start with people from the human capital side. A smart mobility solution is not just about using less energy or making use of ITC, it is about being able to function as an integral part of a larger system that also regards participation, urban and space quality, human capital, education and learning in urban environments (Siegele, 2012).

With regards to the governance aspects, one key element is the interactive and participatory process to commit “citizen” and not just “users” to a “smarter” mobility paradigm. The open and active involvement of people and stakeholders would be far more effective. Thus, broad coalitions should be formed to include specialists, researchers, academics, practitioners, policy makers and activists in the related areas of technology, transport, land use, urban affairs, environment, public health, ecology, engineering, green modes and public transport. It is only when such coalitions form that a real debate, smarter mobility can take place. There must be a willingness to change and an acceptance of collective responsibility. It is crucial to create conditions for a continuous process of learning and innovation.

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Smart Urbanization – Key to Sustainable Cities

Neha Bansal, Vineet Shrivastava, Jagdish Singh

(Research Scholar Neha Bansal, Indian Institute of Technology, Department of Architecture and Planning,Roorkee, India, nehabansal02@gmail.com)
(Research Scholar Vineet Shrivastava, Maulana Azad National Institute of Technology, Department of Architecture & Planning, Bhopal, India, vviinneeeett@gmail.com)
(Associate Professor Dr. Jagdish Singh, Maulana Azad National Institute of Technology, Department of Architecture & Planning, Bhopal, India, jagdishsinghj@gmail.com)

1 ABSTRACT

Urbanisation is a major change taking place globally. It is estimated that 500 million people will be urbanised by 2030 which is around 60% of the world's population will be living in cities. Cities fuel economic development through mobilizing capital, work force, knowledge/information and technology and offer better chances of wealth generation, better health facilities, education and a good quality of life with better services and facilities. This has led to the increase in "megacities" (urban areas with a population of 10 million or more) and primate cities (leading cities in the region disproportionately larger than others in the urban hierarchy) across the globe. Urbanization propelled by economic reforms are putting cities under perpetual pressure of population concentration and energy intensive growth model. The cities are often confronted with a multitude of key problems like high urban densities, traffic congestion, energy inadequacy, unplanned development and lack of basic services. Due to high land values, migrants often have no choice but to settle in shantytowns and slums, where they lack access to decent housing and sanitation, health care and education thus adding to urban poverty. Urbanisation is also contributing significantly to climate change as 20 largest cities consume 80% of the world's energy and urban areas generate 80% of greenhouse gas emissions worldwide. The challenges of rapid urbanisation are to deal with the social, economic and environment development through more effective and comprehensive land administration functions, supported by efficient per capita infrastructure supply , resolving issues such as climate change, disaster management, insecurity, energy scarcity, environmental pollution, and extreme poverty. Urbanization must be able to support urban planning to achieve sustainable development in order to meet the growing energy and housing demands, reliable public transportation systems and be able to meet essential urban services without putting pressure on resources. Therefore it needs to support innovative urban planning policies and strategies beyond traditional urban planning paradigms. Urbanisation on the positive side provides an unparalleled urban planning opportunity to pre-address social and environmental problems, including reduction of greenhouse gas emissions combined with the retrofitting and upgrading of facilities and networks in existing urban centres, as well as smart urban planning of cities can provide better education, healthcare and high-quality energy services more efficiently and with less emissions because of their advantages of scale, proximity and lower geographic footprints. Thus "Smart Urbanisation" is the key to safer cities of tomorrow. Building cities sustainably using smart growth principles, compact development planning form, using eco-city concepts, concept of low carbon electricity ecosystem etc, provides an opportunity to avoid future sources of greenhouse emissions, while developing more liveable and efficient urban centres. It could also alleviate population pressure on natural habitats and biodiversity thus reducing the risks to natural disasters. High-level integration of existing technologies to deliver a smart energy network, enhanced electricity transmission, energy efficient transportation, and low carbon building footprints, will make it easier to manage the unfolding urbanisation, and could have much positive impact on energy use and consumption. Policy interventions and government investments are important determining tools to its success. This paper attempts to discuss the principles of "smart urbanisation" in light of sustainable cities of tomorrow.

2 INTRODUCTION

Urbanisation is a global phenomenon occurring all around the world (Doytsher et al. 2010). Around 70% population is expected to be living in urban areas by 2030. It is advantageous to be urbanised as it brings prosperity and increases economic development. But the pace of urbanization is far more than the local and civic authorities can cope and there is a lack in demand and supply of basic urban services (Kingsley 1955; Doytsher et al. 2010). As a result there are greater negative impacts in the form of insufficient urban infrastructure, uncontrolled population concentration, haphazard planning of urban centres, which in turn is

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energy exhaustive and creates a greater pollution. The problems are innumerable and un-accountable. But we need a solution. The solution to be able to cope up with the pace of urbanization, sustainable use of resources, sustainable urban development coupled with smart technology and energy efficient urban systems. Thus we need to adopt smart urbanisation. Smart urbanization strategies shall look into smart growth, using the power of urbanized areas to increase GDP rather than getting affected by them (Dobbs et al. 2012). There are many ways of achieving smart urbanisation. Intelligent cities, adaptive and eco-sensitive development, and to begin with change in the system by green retrofit of existing infrastructure are some steps towards it. Cities need to adopt green growth to improve the day-to-day lives of residents. “Smart cities” can reconcile growth and sustainability (Hoornweg & Freire 2013). It can be tool in dealing with global issues like poverty reduction, climate change, and disaster management. But at the same time, the impact and sustainability of smart technology is a major question. Thus there is a need of holistic and integrated approach (Hall 2002). We explore these in the subsequent sections. To start with it is necessary to know what urbanization trends speak.

3 URBANISATION TRENDS

Urbanization refers to a process in which an increasing proportion of an entire population lives in cities and the suburbs of cities. It is estimated that 500 million people will be urbanised by 2030 which is around 60% of the world’s population will be living in cities (Unfpa.org; UN 2014) Economic drivers make cities the ideal places to work and live (Bouton et al. 2013). Modern urbanized life has produced a new environment, creating new prob¬lems of adaptation in comparison to rural areas where community development is in relation to their immediate environment. With the present pace of urbanization 1.5 million more square kilometres of land will be urbanised by 2030, an area comparable to that of France, Germany and Spain combined. That indicates that average 1 million more city dwellers every week for the next 38 years, with the world’s total urban population forecast to increase from present 3.5 billion to 6.3 billion by 2050, (according to Planet Under Pressure 2012 conference organizers.) (Burger 2012). These trends are impossible to stop, and not desirable also as everyone wants a modernized civic life; which means that the question is how best to urbanize, states Dr. Michael Fragkias of Arizona State University, in “Planet Under Pressure 2012” conference held at London in March 2012. It is clear that the path to sustainable development is has to be smart and adaptable to future demands of energy supply. Cities play a vital role in the process.

4 CITIES

Accounting for approximately 70% of global GDP, cities drive the world's economy and are vibrant engines of opportunity, commerce, culture, and an improved quality of life (Sensiable.mit.edu, 2014).Cities has better economies and thus offer increased job opportunities, improved health and education facilities, a good quality of life with better services and facilities etc. these are major pull factors inviting more and more people in urban areas or cities. The increasing urbanisation has led to the increase in “megacities” (urban areas with a population of 10 million or more) and primate cities, many a times these cities are held responsible for regional economic imbalance due heavy concentration of investment, job opportunity, higher level of goods and services. Though megacities are economic hubs, and have modern technologies, high standard of living with greater comfortable life, but the economic disparity is wider between rich and poor in these areas. They have some mega issues like poverty, poor health, social issues and environmental degradation. Thus the negative impact of urbanization is seen greater. The cities are often confronted with a multitude of key problems like high urban densities, traffic congestion, energy inadequacy, unplanned development, lack of basic services, illegal construction, creation of slums, poor natural hazards management, crime and public safety issues, water, soil and air pollution leading to environmental degradation, aging infrastructure and environmental impact (Little 2012; Homeland Security 2010) on climate change coupled with poor urban governance. These can be seen as:

4.1 Increase in poverty and deterioration of quality of life and health

Cities generaaly lack access to decent housing and sanitation, health care and education thus adding to urban poverty (Grayson et al., 1994). Intensive urban growth can lead to greater poverty. Large volumes of uncollected waste due to concentrated populations and lack of basic services create multiple health hazards and deteriorate quality of life. As per a study, The Regional lifestyles 1992 report it has been found people don’t prefer cities, for example, the two-thirds of its 1,000 sample would prefer to live in the country rather than the city because of its open space, cleanliness, quietness and lack of stress. This has been anticipated to urban problems rather than any other issue. Another study in the early 1960s by the geographer Peter Hall showed that the "desired future place" of residence of 59% of people lay in the countryside. Nearly 30% favoured the suburbs, and only 8% the town egestas.

4.2 Increase in climate change and disasters- a global concern:

Urbanisation is also contributing significantly to climate change as 20 largest cities consume 80% of the world's energy and urban areas generate 80% of greenhouse gas emissions worldwide(Chauhan 2008). Urban development can magnify the risk of environmental hazards such as flash flooding.

4.3 Environmental pollution and Degradation of eco system:

Concentrated energy use leads to greater air pollution with significant impact on human health. Automobile exhaust produces elevated lead levels in urban air. Pollution promotes loss of urban tree cover. Animal populations are inhibited by toxic substances, vehicles, and the loss of habitat and food sources. According to the World Health Organization's air quality standards, the concentration of suspended particulates (made up of airborne smoke, soot, dust, and liquid droplets from fuel combustion) should be less than 90 micrograms per cubic meter. Indian megacities like Mumbai (240), Calcutta (375) and Delhi (415) cubic metres of suspended particulates, are some of one the highly polluted cities (World Bank 1995).

4.4 Increase in Housing crisis:

The authorities are often fail to meet the housing demands. The shortage of houses leads to overcrowding; insanitary conditions and it result in slums (Dalal et al. 2013). In Indian context There is shortage of 18.78 million houses in urban areas most of which is from economically weaker section (EWS) and lower income group (LIG) section of the society (HPEC & MoUD 2011) . The concentrated population of cities also leads to many transport problems like traffic jams, accidents, etc. The inhabitants of the cities also become unsocial. They lack social feeling and sympathy.

4.5 Cities fail to meet the infrastructure and urban services:

Over population in cities always create problems for the Municipal authorities such as water shortage, electricity breakdowns etc. In certain cities water is available for few hours only (Economist 2015). Sometimes the water gets contaminated. It is also a problem to keep the streets, roads, etc properly cleaned. As per the studies, 2.5 billion have unreliable or no access to electricity and 2.8 billion lives in areas of high water stress, by 2035 energy consumption will increase by 35% which will increase water consumption by 85% (World Energy Council 2010).

4.6 Problem of counter urbanization:

in developed countries, more and more people are choosing to live on the edge of urban areas. They try to escape these problems by moving away from the city - a process called counter-urbanisation (Islam 2009). Long term, solution must be to make cities more sustainable.

4.7 Problems of urbanization is concentrated in city cores or CBDs (Central Business Districts)

The CBD of a city is economic hub, where business, commercial and economic activities are predominant. This invites more movement of people and vehicles as many people work here. Thus there is severe problem of traffic congestion. Since there are limited residential areas around this people come from far and this increases the trip to work, increasing more motor vehicles, which means more CO2 emissions (Olayiwola et al. 2014).CBDs are linked up with smaller, older, narrower roads. This further causes bottleneck and congestion. These areas are also having poor and older construction resulting in sudden accidents at times.

4.8 Social problems and Problems of inequality:

Inequality means extreme differences between poverty and wealth. Other social problems may include crime, safety and security of women and children (Stephens 1996). Cities have higher crimes rates. Thus uncontrolled urbanization creates many social and criminal problems in cities. Unemployment and incidents of long-term illness are seen on rise.

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4.9 Urbanisation is eating up Brownfield and Greenfield sites:

The housing demand and supply shortage forces people legally or illegally to settle for Brownfield and Greenfield sites around habitations. Brownfield sites are often disused or derelict land; they are valuable as existing site has already been developed. Greenfield sites Are sites which have not previously been built on. This includes the greenbelt land around cities. These are cheaper to build on but are not favoured by environmentalists, as it encourages urban sprawl.

4.10 High infrastructure demand:

Global urbanization is creating demand for an estimated $40 trillion in infrastructure over the next two decades, and a broad range of stakeholders - the IT industry, real estate developers, citizens and civic leaders – are looking for new opportunities to address the urban problems using "intelligent" systems (Wagner.nyu.edu, 2014).

Some cities have tried to manage these problems by introducing many strategies that include traffic management schemes. These schemes may include: park and ride schemes, cycle lanes, congestion charging schemes, such as those in Durham and London, car-pooling, as used in the USA, to encourage people to share cars, Low Emission Zones, as in London, Local councils have also tried to make the roads in urban areas safer by introducing traffic calming, pedestrian zones, vehicle-exclusion zones and permit-only parking schemes (European Commission 2004)(Heydecker 2009). But the solutions to these problems need to be planned even before they occur, right at the inception stage. We need to learn lessons and strategize the solutions to it.

5 CHALLENGES OF URBANIZATION

The challenges of rapid urbanisation are to deal with the social, economic and environment development through more effective and comprehensive land administration functions, supported by effective Infrastructures, resolving issues such as climate change, disaster management, insecurity, energy scarcity, environmental pollution, and extreme poverty(Doytsher et al. 2010). Yet present cities have complicated these challenges. In the Global South and East, the scale and pace of urbanization is straining physical infrastructure, fiscal capacity, and natural resources in many places. It is challenging institutional and political structures that often lack the capacity and flexibility to respond to fast-paced growth. Meanwhile, cities in the Global North and West are also facing challenges, including finding efficient ways of retrofitting and upgrading outdated infrastructure. Regardless of the region, the main issues of cities are climate change; achieving economic stability, social and environmental sustainability; and building a better quality of life (Senseable.mit.edu,2012). These factors form the framework, in which everything else is embedded and must operate. Economic growth needs to emphasize creativity and innovation and to strengthen the environmental, social and cultural amenities of the city. Community-oriented sustainable urban design principles are needed to be adopted in urban development (Kenworthy 2006). Strong city planning will be essential in managing the problems of urbanization and coping with its pace of development. There is thus a need for sustainable development with smart, policies adaptive to the future needs and energy efficient.

6 CONCEPT OF SUSTAINABLE DEVELOPMENT

There have been many concepts of sustainable development but most accepted definition of sustainable development is the one given by Brundtland[1] report, which says sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs. It aims at assuring the on-going productivity of exploitable natural resources and conserving all species of fauna and flora",(World Commission on Environment and Development 1987). There is a need to understand the deeper meaning of it. And to bring this definition into practice, it is important to understand the sustenance of people and resources in the present context, and trends of their future needs and requirements. The sustainable development needs to be smart in the present context. "Smart cities make urbanization more inclusive, bringing together formal and informal sectors, connecting urban cores with

[1] Brundtland Commission formerly known as World Commission on Environment and Development (WCED) was formed in 1983, chaired by Javier Pérez de Cuéllar, former Secretary General of the United Nations. It had the mission to unite countries to pursue sustainable development together. They released Brundtlant Report also called "Our Common Future" which was published by Oxford University Press in 1987, and talks about sustainable development.

peripheries, delivering services for the rich and the poor alike, and integrating the migrants and the poor into the city. Promoting smart cities is about rethinking cities as inclusive, integrated, and liveable." “Smart cities” can reconcile growth and sustainability, says Joshi-Ghani (urban sector manager at the World Bank.). Cities need to adopt green growth to improve the day-to-day lives of residents. Thus urbanization provides a great opportunity to make sustainable development. Sustainable growth needs to house the many generations to come (Greencitiesbysheila.blogspot.in, 2012).

7 URBANISATION AS AN OPPORTUNITY

With increasing urbanization there is a tremendous opportunity for economic development. Since cities offer opportunities they need to have environment to sustain development by having clean air and water, sustainable food choices, and carbon-neutral transportation and energy (UNDESA 2013). Due to scale and proximity and lower geographic foot prints of cities and mega cities-Urbanization provides an opportunity to deal with these problems in an effective way as well as it provides opportunity for urban planning, urbanization can be used for reducing green house gas emission, retrofitting and upgrading of facilities and network in exiting urban centres, delivering of high quality energy services, energy efficient transportation, enhanced electricity transmission. Urban densification in which policymakers working in growing cities and regions with policy options to accommodate population growth without vast urban sprawl. Even in Stockholm, Europe’s green capital in 2010, there are possibilities for policy improvements in shaping the urban form while accommodating population growth. For example, a continuation of current planning policies will require that Stockholm’s urban form is expanded by 155 km2 between 2000 and 2050 to accommodate the growth. But if the policies were intensified in a realistic way, this could be reduced to 65 km2 (NORDREGIO 2010). ‘Smart’ planning of the urban environment have significant potential to improve quality of life and to reduce the carbon footprint of cities (Falconer & Mitchell 2012). The step towards sustainable development starts with present, by planning cities more energy-smart, by renewal of ageing infrastructure (for ex. Inner-city redevelopments have been taken up in London's Docklands or Manchester's Salford Quays, to improve the physical environment of the area and improve the quality of housing). Reinventing the urban landscape by design and good planning, offers a powerful incentive to incorporate innovations in energy efficiency and renewable energy generation (Wgsi.org).

The concept of “Smart urbanisation” could make cities more efficient and reduce their overall carbon footprints. The expansion of cities provides an urban planning opportunity to pre-address social and environmental problems, including reduction of greenhouse gas emissions. Combined with the retrofitting and upgrading of facilities and networks in existing urban centres, as well as good planning and enlightened governance, many cities could deliver education, healthcare and high-quality energy services more efficiently and with less emissions than less densely settled regions, simply because of their advantages of scale, proximity and lower geographic footprints (Wagner.nyu.edu, 2014) (Falconer & Mitchell 2012). This is referred to as smart urbanisation. Smart urbanization is a set of smart strategies. Some have been discussed below.

8 STRATEGIES OF SMART URBANIZATION:

Smartness of urbanization begins with the strategic urban planning principles, where smart city planning will be a tool for managing and coping urbanization. Well-planned dense urban areas can alleviate population pressure on natural habitats and biodiversity. Experts estimate that as a consequence of urbanization over $40 trillion dollars will be invested in urban infrastructure over the next 20 years mainly in transport, housing, hospitals and other social amenities all of which will be consuming energy. This may also produce adverse impact on climate change due to increased CO2 emissions. The challenge for urban policy makers is - to meet the demand of growing energy and to go for alternative renewable sources for efficient energy generation as this will help in reducing the carbon footprint.

8.1 Use of renewable sources of energy:

The use of renewable resources like wind energy, thermal power energy, solar energy etc. are known for a long time, but needs a smart implementation to reduce our growing energy demands (Erec & Greenpeace 2010). Technologies can replace our reliance on the burning of fossil fuels to renewable sources for generating reliable ‘base-load’ power in electrical systems. This can be done by use of grid-scale battery

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storage to support renewable energy expansion; the developing enhanced geothermal power potential; and by accelerating the development of advanced nuclear power technologies. Reducing green house gas emissions is the wholesome need of sustainable development. Ex. According to New York Times 2011, the Federal Department of Energy financed a solar map of the city, an innovative approach which identified that two-thirds of New York City's rooftops are suitable for solar panels and that together they could generate 5,847 megawatts, enough energy to meet half the demand for electricity during peak periods and 14 percent of the city's annual electricity use . Another example is of China. The Chinese city of Rizhao, north of Shanghai, has pioneered another innovative way of deploying solar panels. By funding research and development instead of end-user subsidies the city's council was able to encourage the local solar industry to increase efficiency and lower unit costs. As a result, 99 percent of households in the central district purchase a solar water heater for no more than the cost of a conventional electric water heater, saving $120/year per household on running costs. Innovative business models have emerged to overcome concerns about prohibitive investment costs. SunEdison in the US owns, finances, installs, operates and maintains solar panels for customers and charges them for the power in return, just as a traditional power utility does. Conversely, community led schemes, such as One Block off the Grid and Energy Share, are becoming increasingly popular ways for residents to pool their knowledge and resources to help generate or source their own renewable energy.

8.2 Smart grid for a smarter city

Electricity is one the major energy consuming sectors and need to be stratified for smart urbanization (Iea 2009). To make electricity efficient, larger-scale use of smart grids and superconductors are needed for transmission and distribution of electricity in dense urban settings. This would reduce their overall carbon footprints. The challenge of grid technology is- to provide Energy storage solutions, which would allow excess power to be used in less favourable weather conditions, Power trading- as greater number of transmission interconnections across regions would help dissipate excesses and alleviate shortfalls in electricity supplies and to adopt Energy demand response mechanisms- advanced metering infrastructure and intelligent controls for buildings to help monitor and modulate energy demands reducing the strain on power networks (Ondrik 1999). Smart, information-rich energy network that uses superconductors for enhanced electricity transmission capacity and allows transportation needs to be met by multiple approaches not reliant on private vehicles. Widespread adoption of such technologies will make it easier to manage the unfolding urbanisation, and could have much positive impact on energy use and consumption. Ex.Stockholm, for example, construction has begun at the new Royal Seaport district, where a smart grid will link homes and offices as well as ships in the harbor to renewable energy (including solar and wind power) impacting many sectors with the joint ambition of creating a fossil fuel free district by 2030. The UK Power Networks, which supplies power to over eight million homes and businesses in the UK, has develop a dynamic energy storage solution powered by local wind power plant and also ensures that energy reserve to regulate power flow to compensate for the intermittence of wind power and to support power quality in the event of a fault. Together, these high-power density modules can store up to 200 kilowatt hours kWh of electrical energy (Abb-conversations.com, 2012).

8.3 Urban Planning - Smart growth

"Smart growth" is a collection of land use and development principles that ensure that growth is fiscally, environmentally and socially responsible. It preserve the natural environment, recognizes the connections between development and quality of life by placing priority on infill, redevelopment, and densification strategies."(Smartgrowth.bc.ca, 2014). There are 10 principles of smart growth- 1. Mix land uses- a mixture of homes, retail, business, and recreational opportunities; 2. Compact development design- where people choose to live, work, shop and play in close proximity; 3. Transportation choices - walking, cycling and transit, driving; 4. Create diverse housing opportunities-where People of life stages and income levels can afford a home in the neighbourhood of their choice; 5. Encourage growth in existing communities. Investments in infrastructure (such as roads and schools) are used efficiently, and developments do not take up new land; 6. Create walk able neighbourhoods; 7. Protect and enhance agricultural lands and Preserve open spaces, and environmentally sensitive areas; 8. Utilize smarter infrastructure and green buildings. They can save both money and the environment in the long run; 9. Foster distinctive, attractive communities with a strong sense of place-Places belong to those who live, work, and play there. 10. Encourage community and stakeholder collaboration in development decisions and citizens participating in community life and decision-making (Abb-conversations.com, 2012). Example: New York City is considered one of the top 3 global cities. With nearly 8.1 million people living in the city, walking the streets, the city still manages to make positive strides towards reducing the pollution and making the city "green". By offering alternative forms of transportation, Transit Orientated Developments, people are not subject to only driving their car, Central Park of New York City provides large efforts for the preservation of open space, farmland, and natural beauty, and it takes advantage of compact building designs by building several brownstones and skyscrapers throughout the city (Sustainability of New York, 2011).It meets almost all 10 Smart Growth Principles. Other cities need to learn this lesson.

8.4 Eco Cities for environment friendly cities;

"Eco cities" can be used to define new settlements adopting a sustainable approach to urban development or municipalities that have implemented regulations for restoration and further construction as part of integrated environment policy (Driversofchange.com, 2014). Ex: Tianjin Eco-City, China's blueprints for future urbanization. This is a project carried out by Chinese and Singapore government on an infertile, highly polluted wasteland in an attempt to create an environmentally sustainable and smart eco city. It has clear goals, strong political backup, absolute expertise and huge investments into it. Since last the planners have been putting all efforts to bring the clear water efficiently into the city and driving away its polluted and salty water by efficient means which included ways like monitoring pipeline leakage, harvesting rainfall and reusing the gray water by colleting, treating and sending this treated grey water back to families for flushing toilets. Tianjin city has been equipped to deal with GHG emissions. City planners have rejected carbon-intensive industries; The Dutch technology giant recently announced it will pilot its latest energy-saving lighting solutions in the city, General Motors electric cars will drive from the company's lab to the street of the city. Nearly half of Tianjin Eco-City's received investments in 2010 came from Singapore clean-tech companies who plan to manufacture green products and provide all sorts of environmentally friendly services, like recycling materials in urban waste, for instance. Other than this every building has double glass window to save energy. Almost one fifth of the city's power is emission-free, coming from solar, wind and geothermal sources. This is a role model for Eco cities (Whatsontianjin.com, 2014).

8.5 Intelligent cities:

This is a concept beyond Smart growth. Integrating Data and information technology with urban planning impact the way cities look, feel, and function. This can be notified from the history of technology and urban form, the telephone, the computer, mass media, and their impacts on human settlement and society (Secure2.convio.net, 2014). World Intelligent Cities Summit, September 2012 in turkey, discussed and notified by eminent professionals from sectors that the future development of cities require intelligent integration of communications technology, with changing behaviour in how we use this technology, to make our cities and regions smarter and more energy efficient. This will offer Turnkey opportunities for research, new job creation, increased competitiveness, with the added bonus of sustainable living (Wicsummit.com, 2014). Large concentrations of people can generate positive outcomes. They provide personal and professional opportunities, and stimulate local and national economies and enhance productivity. Accenture[2] argues for the need to develop intelligent cities that use sophisticated open technology platforms to deliver higher-quality services more consistently to citizens and businesses at reduced cost—and that can adapt to risks like climate change, growing populations and aging infrastructures (Accenture.com, 2014). There is a deep-rooted connection between technology and ever expanding cities (TIME.com, 2014a). Technology has always shaped the city, changing our relationship to time, space, nature and each other. Information communication technologies (ICT) such as smart-phones, tablet computers, and digital books, are changing the way we interact with the built environment and our fellow citizens. For Ex: New York City's Bryant Park sits behind the great main branch of the public library, has cafes, entertainment, a reading library, lawn games — all amenities tuned to contemporary urban life. A cloud of wifi over the park is making a place to share, read, write, gossip, and debate and communicate (TIME.com, 2014b).

[2] Accenture is a global management consulting, technology services and outsourcing company, with 257,000 people serving clients in more than 120 countries. Accenture collaborates with clients to help them become high-performance businesses and governments.

8.6 Smart urbanization efforts policy level:

The U.S. Green Building Council (USGBC), the Congress for the New Urbanism (CNU), and the Natural Resources Defense Council (NRDC)— have come together to develop a national set of standards for neighbourhood location and design based on the combined principles of smart growth, new urbanism, and green building. In 2009 LEED- rating system decided to certify development projects that perform well in terms of smart growth, new urbanism, and green building (Welch et al. 2011). Projects may constitute whole neighbourhoods, fractions of neighbourhoods, or multiple neighbourhoods. The goal of this partnership is to establish these standards for within the rating framework of the LEED (Leadership in Energy and Environmental Design) Green Building Rating System."(Ibm.com, 2014).

8.7 Smart transportation

Transportation- movement of people and goods from one place to another is the life force of economy. Cities would come to a halt without efficient transportation. It has been a leading driver behind globalization: shrinking distances, leading to the emergence of entire new economies and improving the quality of life for millions of people (Falconer & Mitchell 2012). As the present transportation system is inefficient for 21st century, we need to make it efficient, reducing its energy requirements, making it sustainable by integrating technology and intelligence into the physical transportation infrastructure. We can improve capacity, enhance the traveller experience and make our transportation systems more efficient, safe, and secure (TIME.com, 2014b). Example: Transport officials in Singapore, Brisbane and Stockholm are using smart systems to reduce both congestion and pollution. Public safety officials in major cities like New York are able not only to solve crimes and respond to emergencies, but to help prevent them. City managers in Albuquerque have achieved a 2,000% improvement in efficiency in sharing information across agencies, keeping citizens informed and providing critical municipal services, from residential and commercial development to water to public safety. Italy, Malta and Texas are applying smart meters and instrumentation to make the power grids in their cities more stable, efficient and ready to integrate renewable energy sources and electric vehicles. These solutions and many more, are making a real impact today. But they are just the first step toward a true smart city (Ibm.com, 2014). These are few major areas where the principles of smart urbanization play a key role. There are innumerable smaller strategies which form a part of the key strategies.

8.8 Inclusive and Liveable Cities

Regional inequalities are many a time is attributed because of rapid urbanization. Urban poor and marginalized people deprived of basic facilities are common characteristic of growing cities. Cities need to be more inclusive in terms of people's participation so that they can also contribute back to society. Cities need to create engaging public spaces activities and places with meaningful chances, making cities more cohesive and vibrant. The key ingredients of a successful economy include not only strong growth and job opportunities, but also a highly livable environment that is attractive. Cities need to optimize the development and use of all forms of "capital", including environmental and human capital. There is a need to overcome threats such as "hollow urbanization" – urbanization without vibrancy, caused by large, dense single-use developments being segregated from other parts of the city. Cities ought to create places to entice people to gather and stay and these do not necessarily need to be complicated e.g. in the Philippines, bringing people together around simple shared interests such as food and music.

8.9 Urban integration a Case of Ahmadabad BRTS

Well-integrated transit and land development create urban forms and spaces that reduce the need for travel by private motorized vehicles. Areas with good access to public transit and well-designed urban spaces that are walk able and bike able become highly attractive places for people to live, work, learn, play, and interact. Such environments enhance a city's economic competitiveness, reduce local pollution and global greenhouse gas emissions, and promote inclusive development. To promote integrated development in Ahmadabad metropolitan Bus Rapid Transit System (BRTS) was conceived as spine of the city in year 2007. Preliminary impacts of BRTS projects were very positive which included -Ahmadabad Plan 2005: Comprehensive urban mobility plan, including BRT implementation; parking meters in spaces along BRTS corridor; 9 PPP arrangements for BRTS, Financing schemes supporting integration. Approximately 18% two wheelers and 6% ridership change was noticed (Iuchi 2011).

9 CONCLUSION:

Our world is undergoing changes due to globalization, urbanization and technological advancements and it forces us to think and change our ways of living. Urbanization is a global phenomenon that is influencing all aspects of the world economy from power generation through to power consumption. New technologies designed to limit both the environmental and negative economic impact of this global trend are emerging with the potential to transform not only our electricity networks but also entire industries in the process. We need to adopt these and be adaptive in development. Since this built environment lasts a long time, strong infrastructure and services will sustain cities. Planning a city is not merely replicating past practices but needs to adapt based on evidence and analysis of sustainable growth of cities.

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Smartphonegestützte Bestandsaufnahme zur ökologischen Bewertung von Siedlungsräumen

Martin Fabisch, Sascha Henninger

(Dipl.-Ing. Martin Fabisch, Technische Universität Kaiserslautern, Lehr- und Forschungseinheit Physische Geographie, Pfaffenbergstr. 95, 67663 Kaiserslautern, martin.fabisch@ru.uni-kl.de)
(Univ.-Prof. Dr. rer. nat. Sascha Henninger, Technische Universität Kaiserslautern, Lehr- und Forschungseinheit Physische Geographie, Pfaffenbergstr. 95, 67663 Kaiserslautern, sascha.henninger@ru.uni-kl.de)

1 ABSTRACT

Der Mensch wird nicht nur durch den globalen Klimawandel beeinflusst, sondern ebenfalls durch lokale Veränderungen, die durch die anthropogene Überformung der Landschaft entstehen. Dieser „Stadtklimawandel“ ist nicht nur in großen Städten zu erkennen, sondern findet bereits auf kleinräumiger Ebene statt. Dabei können schon kleine Veränderungen (z.B.: Temperaturanstieg im Vergleich zum Umland) zu einer erheblichen Beeinträchtigung der Lebensqualität führen und bei Risikogruppen, wie kleinen Kindern oder Senioren, gesundheitliche Probleme hervorrufen.

Während meist große Städte die Finanzkraft besitzen diesen Stadtklimaeffekt durch empirische Erhebungen oder komplexe Modellierungen nachzuweisen und zu analysieren fehlen kleinen Gemeinden oft diese Mittel. Eine ökologisch ausgerichtete Siedlungsentwicklung ist allerdings nur unter zur Hilfenahme einer belastbaren Bestandsaufnahme der ökologischen Rahmenbedingungen möglich. Die Kosten von empirische Erhebungen und nummerischen Modellierungen können zwar durch eine Verringerung der räumlichen Auflösungen bzw. der Detaillierung reduziert werden, doch dabei wird die Belastbarkeit der Ergebnisse erheblich verschlechtert.

Die vorgestellte Matrixmethode beruht auf der Betrachtung von siedlungsökologisch relevanten Indikatoren (z.B. Versiegelungsgrad oder Grünflächenanteil). Diese werden allerdings nicht wie bisher üblich getrennt voneinander betrachtet, sondern in Bezug zueinander gesetzt, sodass die Wirkungszusammenhänge, die zur Ausprägung eines Stadtklimaphänomens führen, berücksichtigt werden. So kann beispielsweise eine Wiesenfläche als potenzielles Kaltluftentstehungsgebiet klassifiziert werden, doch erst eine Hangneigung, mit einer geringen Oberflächenrauigkeit, in Richtung des Siedlungsraums ermöglicht eine stadtklimarelevante Wirkung.

Die Bestandsaufnahme der Indikatoren erfolgt anhand eines Rasters mit einer Auflösung zwischen 50 und 100 Metern. Dazu wird ein Fragenkatalog entwickelt, mit dem in einer Smartphone- oder Tablet-App vor Ort zu jedem Raster die benötigten Indikatoren abgefragt werden können. Diese einfache Handhabung ermöglicht es auch Laien die Bestandsaufnahme durchzuführen, um so die Kosten zu reduzieren. Die so gewonnenen Ergebnisse werden in einer Datenbank gespeichert und im Anschluss mithilfe eines Geographischen Informationssystems ausgewertet werden.

Die verwendeten Matrizen erlauben eine Abschätzung der Eintrittswahrscheinlichkeit eines Stadtklimaphänomens aufgrund der verwendeten Indikatoren. Je nach Auswirkung des Phänomens auf den Menschen, kann diese Eintrittswahrscheinlichkeit als positiv oder negativ bewertet werden. Auf diese Weise können Risiko- und Potenzialkarten erstellt werden, die die Gemeinden dabei unterstützen können, eine siedlungsökologisch orientierte Gemeindeentwicklung voranzutreiben und gezielte Handlungsempfehlungen zu entwickeln.

2 PROBLEMSTELLUNG

Der globale Klimawandel hat sich in den letzten Jahren von einer wissenschaftlichen Theorie hin zu einem in den Medien stark vertretenen realem Phänomen entwickelt. Der erhöhte Ausstoß von anthropogenen Treibhausgasen führt zu dramatischen Veränderungen in der Atmosphäre [IPCC 2014, 1 f.]. Diese Veränderungen wirken sich negativ auf die natürliche Umwelt der Menschen aus. So kommt es durch den Klimawandel zu einer erheblichen Zunahme von Extremwetterereignissen wie beispielsweise Starkniederschläge, Überschwemmungen oder Hitzewellen [Osenberg 2013, 24].

Neben dem globalen Klimawandel kommt es auch auf lokaler Ebene zu Klimaveränderungen. Diese Veränderungen treten immer dann auf, wenn die ökologischen Gegebenheiten durch den Menschen verändert werden. Besonders ausgeprägt sind solche lokalen Klimamodifikationen in Städten. Neben der Beeinflussung des lokalen Windfelds, der Lufthygiene und des urbanen Wasserhaushalts kann eine urbane

Wärmeinsel entstehen, die in großen Städten bis zu 10 K betragen kann [Kuttler 2013, 213]. Die Vegetation in den Städten steht dabei immer in Wechselwirkung zur Atmosphäre. Auf der einen Seite beeinflusst die Vegetation die Atmosphäre u.a. durch Verschattungs- oder Verdunstungseffekte. Auf der anderen Seite passt sich die Vegetation an die veränderten Rahmenbedingungen durch andere Wachstumszyklen und eine Veränderung der Artenzusammensetzung an [Essl & Rabitsch 2013, 66 f.].

Um eine ökologische Siedlungsentwicklung betreiben zu können, müssen zunächst die lokalen Gegebenheiten analysiert werden. Doch der flächendeckende Nachweis dieses Stadtklimaeffekts ist nur durch aufwendige und in der Regel teure empirische Erhebungen oder aufwendige Modellierungen möglich. Für kleine Gemeinden, die oft ebenfalls von negativen Klimaveränderungen betroffen sind, sind diese Untersuchungsverfahren meist zu teuer, sodass die meisten Stadtklimagutachten in großen Städten durchgeführt werden [Schönwiese 2008, 340]. Die zurzeit üblicherweise verwendeten Verfahren (z.B.: einfache Simulationsverfahren oder kleinräumige empirische Erhebungen) können keine kostengünstige Lösung liefern, die hinsichtlich Detaillierung und Aktualität ausreichende Ergebnisse liefert.

3 DIE MATRIX-METHODE

Die Erfassung siedlungsökologisch relevanter Klimaparameter (z.B.: Lufttemperatur oder Windgeschwindigkeit) ist mit dem Smartphone aktuell nur im experimentellen Stadium möglich [Allbach et al. 2014, 63]. Aus diesem Grund werden bei der Matrix-Methode nicht die Parameter direkt gemessen, sondern siedlungsökologisch relevante Indikatoren (z.B.: Versiegelungsgrad oder Baudichte) vor Ort aufgenommen. So können bereits erste Anhaltspunkte für eine ökologische Siedlungsentwicklung erfasst werden. Viele dieser Indikatoren entfalten ihre Wirkung allerdings erst im Wechselspiel mit anderen Indikatoren [Adam & Grohé 1984, 122]. Um diese Wechselwirkungen zu erfassen und ein möglichst detailliertes und belastbares Ausgangsmaterial für siedlungsökologische Handlungsempfehlungen zu erhalten, werden unterschiedliche Indikatoren in einer Matrix gegenübergestellt. Je nach Ausprägungsintensität der Indikatoren kann so die Eintrittswahrscheinlichkeit eines Stadtklimaphänomens abgeschätzt werden (Abb. 1).

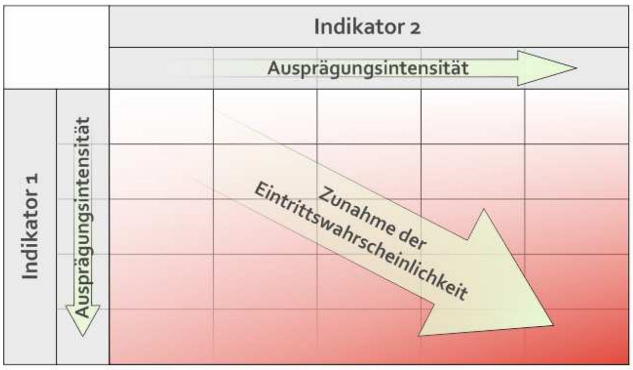

Abb. 1: Schematische Beispielmatrix [Eigene Darstellung, 2015]

Die flächendeckende Erfassung der Indikatoren erfolgt anhand eines vorher festgelegten Rasters. In der Praxis hat sich eine Kantenlänge von 50 Metern als optimaler Kompromiss zwischen Erfassungsaufwand und Detaillierungsgrad herausgestellt. Bei Kantenlängen deutlich über 50 Metern kann die Heterogenität innerhalb des Rasters zu groß werden und so die Ergebnisse verfälschen. Rastergrößen deutlich unter 50 Meter sind nur bei sehr kleinen Untersuchungsgebieten empfehlenswert, da der Erfassungsaufwand erheblich zunimmt.

Für die Methodenentwicklung ist es zunächst notwendig, eine Klassifizierung der stadtklimarelevanten Faktoren hinsichtlich ihrer Erfassbarkeit vorzunehmen. Zu diesem Zweck wird eine Unterteilung in „vor Ort“ - kartierbare, „ableitbare“ und „mess- bzw. recherchierbare“ Klimafaktoren vorgenommen. Dabei lassen sich die „vor Ort“-Faktoren sehr gut, auch von Nichtfachleuten, erfassen (z. B. Versiegelungsgrad). Die „ableitbaren“ Faktoren können durch die „vor Ort“-Faktoren deduziert werden, sodass keine gesonderte Erfassung notwendig ist. Die „mess- bzw. recherchierbaren“ Elemente hingegen können bei einer Ortsbegehung nicht ausreichend erfasst werden. Die zur flächendeckenden Erfassung benötigten empirischen Erhebungen würden einen erheblichen Mehraufwand bedeuten, der die Kosten einer solchen Untersuchung erheblich ansteigen lassen würde und darüber hinaus die Durchführbarkeit für Laien nicht mehr gewährleistet. Sollten diese Faktoren allerdings aus anderen Untersuchungen oder Quellen vorliegen, so können diese zur Reduzierung des Erfassungsaufwands und Verbesserung der Ergebnisse in die Matrizen integriert werden.

Die „vor Ort“ – kartierbaren Faktoren gehören in erster Linie zu den Oberflächeneigenschaften (Versiegelungsgrad des Bodens, Oberflächenfarbe, Oberflächenmaterialen) und der Stadtstruktur (Baudichte, Abstandsflächen, Anordnung der Gebäude zur Straße). Zusätzlich können vor Ort noch Vegetationseigenschaften wie die Vegetationsdichte und -form erfasst werden. Die Topographieeigenschaften können ebenfalls vor Ort erfasst werden, doch die meisten Gemeinden verfügen über digitale Geländemodelle, sodass in diesem Fall von einer Bestandsaufnahme vor Ort abgesehen werden kann.

Die „ableitbaren“ Klimafaktoren fallen fast vollständig unter die hydrologischen Oberflächeneigenschaften (Abflussverhalten, Infiltrationsvermögen, kapillarer Aufstieg, Versickerungsrate und Verdunstungspotenzial). Lediglich die beiden Faktoren „Höhenstruktur des Siedlungskörpers“ und die „Oberflächenrauigkeit“ sind dem Themenkomplex Stadtstruktur zuzuordnen.

Die größten Schwierigkeiten bei einer Erfassung vor Ort stellen die „mess- bzw. recherchierbaren“ Faktoren dar (Verkehrsaufkommen, Luftverschmutzung, Energieverbrauchsverhalten und solarer Strahlungseinfall). Diese können vor Ort nicht ohne weiteres beobachtet werden. Zwar können vereinzelt Anhaltspunkte erfasst werden, wie beispielsweise Schmutzspuren unter den Fensterbänken oder Zeigerpflanzen, die z. B. Rückschlüsse auf die Sonneneinstrahlung zulassen, doch diese Beobachtungen sind nicht hinreichend belastbar und oft nicht flächendeckend in der gesamten Siedlung vorhanden.

Die Bewertung stadtklimarelevanter Faktoren zeigt, dass mit dieser Erfassungsmethode nicht alle Stadtklimaphänomene abgedeckt werden können. Besonders der Wirkungskomplex der Lufthygiene kann nicht umfassend behandelt, sondern nur teilweise abgedeckt werden. Die Indikatoren, die den Bereichen Überwärmung, Wasserhaushalt und Windfeld zuzuordnen sind, lassen sich hingegen entweder gut vor Ort erfassen oder aus den erfassten Faktoren ableiten.

4 BESTANDSAUFNAHME

Die Auswahl der genutzten Indikatoren und Matrizen kann an den jeweiligen Untersuchungsraum angepasst werden. Die folgenden sechs Matrizen können als Grundlage für die meisten Siedlungsräume in Deutschland empfohlen werden (Abb. 2).

Urbane Überwärmung
Bebauungsdichte und Versiegelungsgrad
Oberflächenfarbe und Versiegelungsgrad
Oberflächenmaterial und Versiegelungsgrad
Urbanes Windfeld
Vegetationsform und Vegetationsdichte
Topographie und Oberflächenrauigkeit
Urbaner Wasserhaushalt
Vegetationsdichte und Topographie

Abb. 2: Empfohlene Basismatrizen [Eigene Darstellung, 2015]

Diese Matrizenauswahl ermöglicht die Betrachtung der drei wichtigsten Themenfeldern einer siedlungsökologischen Untersuchung. Darüber hinaus sind die Matrizen so ausgewählt, dass einzelne Indikatoren mehrfach verwendet werden können, um einen möglichst geringen Erfassungsaufwand zu gewährleisten. Neben der digitalen Bestandsaufnahme kann diese auch in einer analogen Tabelle erfolgen und im Anschluss digitalisiert werden.

Die smartphonegestützte Erfassung kann mit einer App durchgeführt werden. Dafür wird zunächst über einen Übersichtsplan das jeweilige Raster ausgewählt, in dem sich der Erfasser gerade befindet. In den nächsten Schritten werden die zuvor festgelegten Indikatoren Schritt für Schritt mit einem Fragebogen abgefragt und anschließend in einer Datenbank gespeichert (Abb. 3). So entsteht eine Tabelle mit der

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Rasterbewertung, die zur späteren Analyse und Visualisierung in einem Geographischen Informationssystem verwendet werden kann.

Abb. 3: Beispielhafte Darstellung einer Bestandsaufnahme per Smartphone [Eigene Darstellung, 2014]

4.1 Urbane Überwärmung

Die Urbane Überwärmung wird durch die anthropogene Überformung der Landschaft sowie der anthropogenen Energiezufuhr hervorgerufen. Von besonderer Bedeutung ist dabei der Versiegelungsgrad, da mit einem hohen Versiegelungsgrad in der Regel die anderen Indikatoren ebenfalls stark ausgeprägt sind.

4.1.1 Versiegelungsgrad und Baudichte

Als erste Matrix werden die beiden Faktoren Versiegelungsgrad und Baudichte gegenübergestellt (Abb. 4). Die Klassenunterteilung erfolgt jeweils in Prozentschritten. Der Versiegelungsgrad wird dafür in „25 Prozent- Klassen" unterteilt. Die erste Versiegelungsklasse (0-25 %) umfasst innerhalb der Siedlung üblicherweise Parks, Friedhöfe oder Kleingartenanlagen. Die anthropogene Überformung der Landschaft ist in dieser Klasse sehr gering, sodass die siedlungsökologischen Eigenschaften als positiv einzustufen sind. Die charakteristische Siedlungsstruktur für die zweite Versiegelungsklasse (26-50 %) sind Einzel-, Doppel-, und Reihenhäuser. Mit zunehmendem Versiegelungsgrad verschlechtern sich die siedlungsökologischen Eigenschaften der Fläche, da bei stärker versiegelten Flächen der Oberflächenabfluss deutlich zunimmt und die verwendeten Materialien sich stark aufheizen können [Henninger 2011, 128]. Die höchsten beiden Versiegelungsklassen werden in kleinen Siedlungen nur selten erreicht, da dort selten sehr dichte Wohnformen (51-75 %) oder extrem verdichtete Kernbereiche sowie Industriegebiete (76-100 %) zu finden sind. Die Baudichte wird in fünf Klassen unterteilt, die von den unterschiedlichen Bebauungsformen abgeleitet werden. Diese Bebauungstypen sind bebauungsfrei (0 %), Punktbebauung (1-25 %), aufgelockerte Bebauung (26-50 %), dichte Bebauung (51-75 %), sehr hohe Baudichte (76-100 %) [Blume et al. 2011, 156-158]. Der maßgebliche Faktor zur Bewertung der Baudichte ist neben der durch die Baumasse erhöhten Wärmespeicherkapazität die Zunahme der Oberflächenrauigkeit. Durch Zunahme der Oberflächenrauigkeit wird der Luftaustausch in diesen Gebieten behindert, was zur Bildung einer urbanen Wärmeinsel führen kann [Helbig 1999, 8ff].

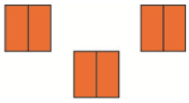
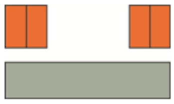
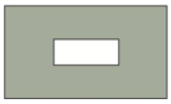
Baudichte in %-Flächenanteil		Versiegelungsgrad in %-Flächenanteil 0 – 25 %	26 – 50 %	51 – 75 %	76 – 100%
bebauungsfrei		++	+	~	-
Punktbebauung (1-25 %)		++	+	-	-
aufgelockerte Bebauung (26-50 %)			~	-	--
dichte Bebauung (51-75 %)				--	--
sehr hohe Baudichte (76-100 %)					--

Abb. 4: Bewertung der Matrix „Baudichte / Versiegelungsgrad“ [Eigene Darstellung, 2015]

4.1.2 Versiegelungsgrad und Oberflächenfarbe

Die zweite Matrix soll Aufschluss über das Erwärmungsverhalten des Untersuchungsgebietes liefern (Abb. 5). Als Faustformel lässt sich festhalten, dass helle Flächen eine deutlich höhere Albedo als dunkle Flächen aufweisen. Dunkle Flächen nehmen also einen größeren Teil der Sonneneinstrahlung auf und erwärmen sich dadurch stärker [Kappas 2009, 81]. Aus diesem Grund sind helle Oberflächenfarben als positiv, während dunkle Flächen hingegen als negativ zu bewerten sind.

Neben der Oberflächenfarbe ist das Material ein weiterer wichtiger Faktor bei der Erwärmung. Dabei stellen besonders Wasserflächen eine Ausnahme dar, da sie eine niedrige Albedo besitzen, sich aber trotzdem nur sehr langsam erwärmen. Des Weiteren wird bei dieser Matrix nur die überwiegende Oberflächenfarbe bewertet, sodass es an dieser Stelle zu einer Verfälschung der Ergebnisse kommen kann. Aus diesem Grund sind die Ergebnisse dieser Matrix nur ein Anhaltspunkt und benötigen bei der Feststellung von Belastungsbereichen einer detaillierteren Überprüfung vor Ort.

überwiegende Oberflächenfarbe		Versiegelungsgrad in %-Flächenanteil 0 – 25 %	26 – 50 %	51 – 75 %	76 – 100%
weiß		++	++	+	-
blau		++	+	~	-
braun		++	+	~	--
rot		+	~	-	--
grau		+	-	--	--
schwarz		+	-	--	--

Abb. 5: Bewertung der Matrix „Oberflächenfarbe / Versiegelungsgrad“ [Eigene Darstellung, 2015]

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4.1.3 Versiegelungsgrad und Oberflächenmaterial

Die dritte Matrix fällt sowohl in den Bereich der urbanen Überwärmung, sowie in den des urbanen Wasserhaushaltes (Abb. 6). Die verwendeten Materialien in Siedlungen unterscheiden sich stark hinsichtlich ihrer Wärmeleitfähigkeit, Wärmespeicherkapazität und dem Abflussverhalten bei Niederschlag [VDI 2003, 23]. Aufgrund der großen Vielfalt von verwendeten Materialien in den Siedlungen ist eine detaillierte Erfassung im Rahmen der Matrixmethode nicht durchführbar. Stattdessen werden die Materialien in fünf Klassen unterteilt, die wiederum Materialien mit ähnlichen Eigenschaften zusammenfassen. Die versickerungsfähigen Materialien weisen die besten siedlungsökologischen Eigenschaften auf, da diese sich meist nur langsam erwärmen, einen niedrigen Abflussbeiwert haben und eine hohe Versickerungs- und Verdunstungsrate ermöglichen. Schotter und Kiesflächen besitzen einen ähnlichen Abflussbeiwert wie die Materialien der ersten Klasse, können sich aber bei Sonneneinstrahlung aufgrund ihrer Materialeigenschaften stärker erwärmen. Die wassergebundenen Decken können sich stark hinsichtlich ihrer siedlungsökologischen Eigenschaften unterscheiden. Während locker verdichtete Flächen einen sehr hohen Versickerungsanteil haben nimmt mit zunehmender Verdichtung der Abflussbeiwert zu. Aus diesem Grund sollten diese Flächen einer näheren Untersuchung unterzogen weder, wenn dort negative hydrologische Effekte zu vermuten. Ähnliche Differenzen beim Versickerungsverhalten können in der Klasse Pflaster- und Plattenbeläge auftreten. Umso weniger Fugen und je älter die Platten bzw. das Pflaster ist, desto geringer sind die Auswirkungen auf das lokale Klima und den Wasserhaushalt. Beton- und Asphaltflächen besitzen von den fünf Materialklassen den höchsten Abflussbeiwert und die meist graue oder schwarze Farbe führt zusätzlich zu ungünstigen thermischen Eigenschaften [Illgen 2009, 65].

Die Bewertung des Versiegelungsgrades wird für diese Matrix im Vergleich zu den ersten beiden Matrizen angepasst. Flächen mit einem hohen Versiegelungsgrad werden nicht mehr generell als negativ bewertet, da die siedlungsökologischen Eigenschaften der ersten beiden Oberflächenmaterialklassen auch bei hohen Versiegelungsgraden durchaus positive Auswirkungen auf das Stadtklima haben können.

überwiegendes Oberflächenmaterial		**Versiegelungsgrad in %-Flächenanteil**			
		0 – 25 %	26 – 50 %	51 – 75 %	76 – 100%
versickerungsfähiges Material	z.B.: Rasengittersteine, Schotterrasen, Porenpflaster	++	++	+	~
Schotter- und Kiesflächen	z.B.: Schotterboden auf Parkplätzen	++	+	~	-
wassergebundene Decken	z.B.: Parkplätze, Stellplätze, Gehwege	+	~	-	--
Pflaster- und Plattenbeläge	z.B.: Kopfsteinpflaster, Gehwege, Einfahrten	+	-	--	--
Asphalt- und Betonflächen	z.B.: Fahrbahnen, Parkplätze, Gehwege	+	-	--	--

Abb. 6: Bewertung der Matrix „Oberflächenmaterial / Versiegelungsgrad“ [Eigene Darstellung, 2015]

4.2 Urbanes Windfeld

Das urbane Windfeld in Siedlungen stellt ein sehr komplexes Thema dar. Zum einen können durch lokale Luftdruckunterschiede Winde zwischen Siedlung und Umland (Flurwinde), aber auch innerhalb der Siedlung entstehen. Zum anderen führt die Bebauung zu einer Erhöhung der Oberflächenrauigkeit, was eine Verringerung der Windgeschwindigkeit zur Folge hat [Leser & Conradin 2008, 244 f.].

4.2.1 Vegetationsform und Vegetationsdichte

Von besonderer Bedeutung für die siedlungsökologische Situation einer Siedlung ist die Lage von Kalt- und Frischluftluftentstehungsgebieten. Eine umfangreiche Kaltluftuntersuchung kann mit den erfassten Indikatoren nicht durchgeführt werden, allerdings lassen sich Gebiete ableiten, die ein hohes Kaltluftentstehungspotenzial besitzen. Das Potenzial einer Fläche wird vor allem durch die thermischen

Stoffeigenschaften der Oberfläche (Wärmeleitfähigkeit und Wärmekapazität) sowie die vorhandene Vegetation bestimmt [Song 2003, 25].

Als Indikatoren werden in dieser Matrix die Vegetationsdichte sowie die Vegetationsform verwendet (Abb. 7). Die Vegetationsform wird in vier Klassen unterteilt, die hinsichtlich ihres Kaltluftpotenzials bewertet werden. Die Vegetationsform mit dem höchsten Kaltluftpotenzial sind dabei Freiflächen mit niedrigem Bewuchs (z.B. Rasen oder Wiesen). Etwas schlechter hinsichtlich ihrer Kaltluftproduktion können Freiflächen mit einzelnen Baum- oder Gehölzgruppen eingestuft werden. Waldflächen besitzen ein geringes Kaltluftpotenzial, da im Stammraum in der Nacht nur eine geringe Abkühlung der Luft stattfindet. Die Kaltluft, die in Waldgebieten gebildet wird, entsteht oberhalb des Kronendachs. Die schlechteste Vegetationsform zur Kaltluftproduktion stellen Einzelpflanzungen wie Straßenbegleitgrün dar [Song 2003, 25].

Vegetationsform		Vegetationsdichte in %-Flächenanteil			
		100 – 76 %	75 – 51 %	50 – 26 %	25 – 0%
Freifläche	Wiese, Rasen	++	++	+	~
Gehölzgruppen	Bäume, Sträucher, Stauden	+	+	~	-
Wald	Laub-. Nadel oder Mischwald	+	~	-	--
Einzelpflanzung	Bsp.: Straßenbegleitgrün			--	--

Abb. 7: Bewertung der Matrix „Vegetationsform / Vegetationsdichte" [Eigene Darstellung, 2015]

4.2.2 Topographie und Oberflächenrauigkeit

Kaltluftentstehungsgebiete besitzen einen positiven Effekt auf das Stadtklima. Ohne den entsprechenden Kaltluftabfluss ist ihre räumliche Wirkung jedoch deutlich eingeschränkt. Um eine optimale Versorgung der Siedlung mit der entstandenen Kaltluft sicherzustellen sind Kaltluftleitbahnen notwendig. Die optimalen Bedingungen für eine Kaltluftleitbahn sind Oberflächen, die in der Nacht nur wenig Wärme abgeben, ein Gefälle in Richtung Siedlung besitzen und eine möglichst geringe Oberflächenrauigkeit aufweisen, um den Kaltluftfluss nicht zu bremsen bzw. abzulenken [Weber 2004, 30]. In dieser Matrix werden die Topographie und Oberflächenrauigkeit gegenübergestellt, um Raster zu identifizieren, die als Kaltluftleitbahnen fungieren können (Abb. 8). Die Oberflächenrauigkeit wird in drei Klassen unterteilt (gering, mittel, hoch) und wird dabei aus den Vegetationsformen und der Baudichte abgeleitet. Auf Grund der Empfindlichkeit von Kaltluftströmen kann diese Untersuchungsmethode nur erste Anhaltspunkte liefern und Potenzialflächen für eine tiefergehende Analyse aufweisen.

Topographie		Oberflächenrauigkeit		
		gering	mittel	hoch
starkes Gefälle		++	~	--
leichtes Gefälle		++	-	--
bewegtes Gelände		+	--	--
ebenes Gelände		+	--	--

Abb. 8: Bewertung der Matrix „Topographie / Oberflächenrauigkeit" [Eigene Darstellung, 2015]

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4.3 Urbaner Wasserhaushalt

Der urbane Wasserhaushalt wird durch die anthropogene Überformung massiv beeinflusst. Erste Anhaltspunkte zu diesem Themenkomplex können bereits aus den ersten Matrizen gewonnen werden, da die Oberflächenmaterialien und der Versiegelungsgrad einen erheblichen Einfluss auf den Abflussbeiwert haben.

4.3.1 Vegetationsdichte und Topographie

Neben den künstlichen Oberflächenmaterialien wird das Abflussverhalten von Niederschlägen und dadurch auch der urbane Wasserhaushalt, durch die Vegetation und die Topographie beeinflusst. Bei Flächen mit demselben Oberflächenmaterial ist der Abflussbeiwert bei einer geneigten Fläche deutlich höher als bei einer ebenen Fläche [Leibundgut 2007, 143 f]. Die Topographie wird für die Matrix-Methode in vier Klassen unterteilt. Diese Klassen reichen von ebenem über bewegtes Gelände bis hin zu leichtem bzw. starkem Gefälle (Abb. 9).

Die Vegetation fungiert bei Niederschlagereignissen als Wasserspeicher und reduziert auf diese Weise einen oberflächigen Abfluss. Darüber hinaus beeinflussen die Pflanzen durch die Verdunstung über die Blätter das Stadtklima positiv [Henning 1994, 70]. Die Vegetationsdichte wird genau wie der Versiegelungsgrad in 25 Prozentschritten erfasst. Diese grobe Einteilung wird gewählt, da es in der Praxis in Abhängigkeit von Jahreszeiten und vorkommenden Pflanzenarten zu erheblichen Fehlabschätzungen kommen kann.

Topographie		Vegetationsdichte in %-Flächenanteil			
		100 – 76 %	75 – 51 %	50 – 26 %	25 – 0%
ebenes Gelände		++	+	~	--
bewegtes Gelände		++	+	~	--
leichtes Gefälle		+	~	-	--
starkes Gefälle		+	-	--	--

Abb. 9: Bewertung der Matrix „Topographie / Vegetationsdichte" [Eigene Darstellung, 2015]

4.4 Siedlungsökologische Gesamtbewertung

Die Ergebnisse der einzelnen Matrizen lassen nur die Bewertung eines einzelnen Untersuchungsgegenstands zu. Eine Gesamtbewertung mit den siedlungsökologischen Problem- bzw. Potenzialbereichen ist auf diese Weise nicht möglich. Um eine solche Gesamtbewertung für den kompletten Untersuchungsraum zu erhalten, können die Ergebnisse der Matrizenerstellung in ein Punktesystem übertragen werden. Das Punktesystem ist dabei an die fünf Bewertungsklassen für die siedlungsökologischen Rahmenbedingungen angelehnt und erstreckt sich von plus zwei (sehr gute ökologische Rahmenbedingungen) bis hin zu minus zwei (sehr schlechte siedlungsökologische Rahmenbedingungen) Punkten (Abb. 10). Bei Verwendung der sechs Matrizen liegt die maximale bzw. minimale Punktzahl für jedes Raster demnach bei +12 bzw. -12 Punkten.

Raster	Matrix 1	Matrix 2	Matrix 3	Matrix 4	Matrix 5	Matrix 6	Gesamtpunkzahl
1	++ (➔ +2)	+ (➔ +1)	++ (➔ +2)	~ (➔ 0)	+ (➔ +1)	++ (➔ +2)	8
2	+ (➔ +1)	- (➔ -1)	-- (➔ -2)	- (➔ -1)	~ (➔ 0)	~ (➔ 0)	-3
3	-- (➔ -2)	- (➔ -1)	- (➔ -1)	-- (➔ -1)	- (➔ -1)	-- (➔ -2)	-8

Abb. 10: Beispielrechnung zur siedlungsökologischen Gesamtbewertung [Eigene Darstellung, 2015]

5 VISUALISIERUNG

Durch die graphische Aufbereitung wird die Übersichtlichkeit und Interpretierbarkeit der Matrizen durch die Farbgebung und den räumlichen Bezug deutlich verbessert. Bei der analogen Bestandsaufnahme kann die Visualisierung in jedem CAD- oder Grafikprogramm erfolgen.

Für die mobile Bestandsaufnahme bieten Geographische Informationssysteme die optimale Visualisierungsmethode. Dazu wird zunächst die mobile Datenbank aus der App ausgelesen und in einem Tabellenkalkulationsprogramm aufbereitet. Im Anschluss kann diese Datenbank mit den Rastern in einem Geographischen Informationssystem verknüpft werden.

Dieses Verfahren ermöglicht dem Nutzer viele Vorteile. Die automatisierte Verknüpfung der Matrizen mit den einzelnen Rastern in einem GI-System ermöglicht eine schnelle und einfache Ergebnisvisualisierung. Darüber hinaus liegen weitere Vorteile in der Möglichkeit, verschiedene Datensätze zur Analyse miteinander zu verknüpfen, räumliche Analysen vorzunehmen und Abfragen gezielt nach einer Wertekombination durchzuführen. Mit solchen Maßnahmen/ Methoden können beispielsweise schnell Raster selektiert werden, die sowohl eine negative Bewertung in der Matrix „Vegetationsdichte und Topographie“, wie auch in der Matrix „Versiegelungsgrad und Oberflächenmaterial“ aufweisen, um so Bereiche mit kritischen Eigenschaften für den urbanen Wasserhaushalt gezielt hervorzuheben. Auf veränderte Rahmenbedingungen (z. B. Neubauten) kann durch eine Änderung in der GIS-Datenbank reagiert werden, sodass die Ergebnisdarstellung automatisch aktualisiert wird (Abb. 11).

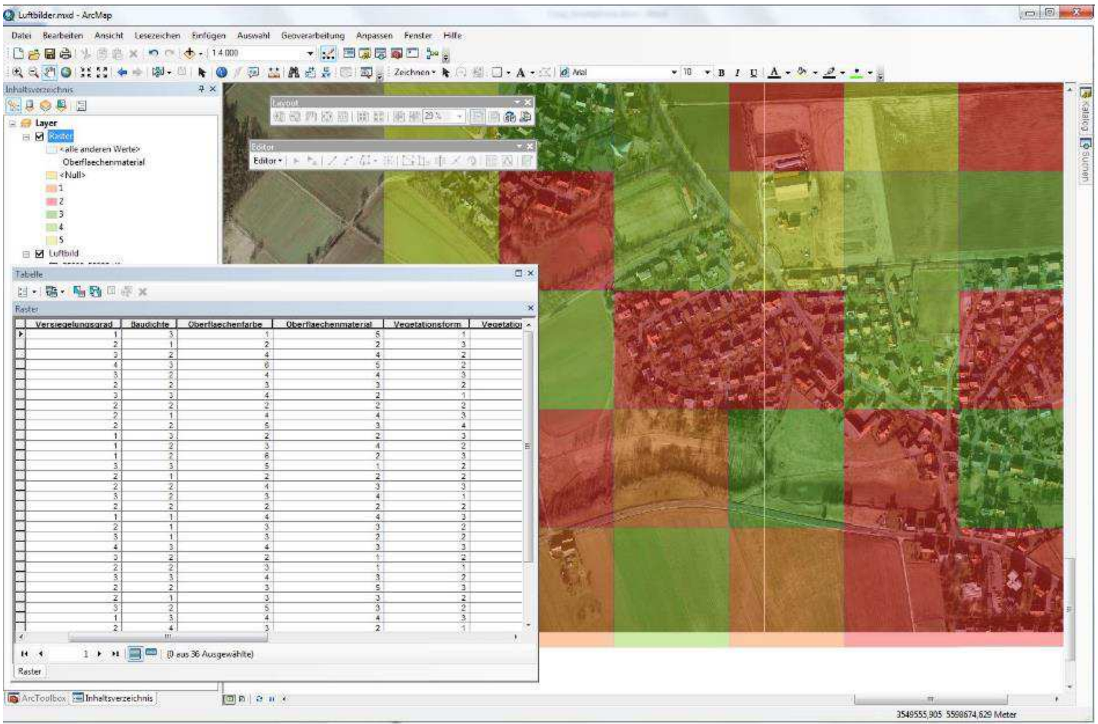

Abb. 11: Matrizenauswertung in ArcMap [Eigene Darstellung, 2015]

Als Kartengrundlage für die Visualisierung sollten grundsätzlich Luftbilder verwendet werden, da mit dieser Grundlage die Bestandsaufnahme vor Ort am besten nachvollzogen werden kann und die räumliche Orientierung gut möglich ist. Wenn in der entsprechenden Gemeindeverwaltung bereits ein gepflegtes GIS-System vorhanden ist, besteht die Möglichkeit für einzelne Fragestellungen die Kartengrundlage durch andere Pläne zu ersetzen (z. B. Bebauungsplan) oder durch weitere Informationen zu erweitern.

6 HANDLUNGSEMPFEHLUNGEN

Nachdem die Erfassung und Darstellung der siedlungsökologischen Problembereiche abgeschlossen ist, können aus diesen Ergebnissen Handlungsempfehlungen abgeleitet werden. Neben Bereichen, die sehr schlechte siedlungsökologische Rahmenbedingen aufweisen, werden in nahezu jeder Gemeinde auch Gebiete zu erkennen sein, die gute Rahmenbedingungen besitzen. Aus diesem Grund erfolgt eine Untergliederung in drei verschiedene Zonen.

Schutzzone

Als Schutzzone werden Gebiete abgegrenzt, die überwiegend gute bis sehr gute siedlungsökologische Rahmenbedingungen aufweisen und sich positiv auf das lokale Klima auswirken. Eingriffe, die die Rahmenbedingungen negativ beeinflussen können, sollten in diesen Zonen vermieden werden.

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Übergangszone

Die Übergangszonen besitzen weder einen deutlich negativen, noch einen starken positiven Effekt auf das Siedlungsklima. Da die Einstufung allerdings aufgrund der Gesamtbewertung erfolgt, können einzelne Untersuchungsgegenstände in diesen Zonen dennoch stark positiv bzw. negativ ausgeprägt sein. Eine differenzierte Betrachtung der einzelnen Untersuchungsgegenstände muss für diese Zonen durchgeführt werden, um mögliche negative Einflüsse zu identifizieren und durch gezielte Maßnahmen zu verbessern.

Sanierungszone

Der größte Handlungsbedarf besteht in den Sanierungszonen. Diese Zonen wurden in allen drei Hauptkategorien (Überwärmung, Wasserhaushalt und Windfeld) negativ bewertet. Es kann davon ausgegangen werden, dass von diesen Zonen eine erhebliche Verschlechterung des Siedlungsklimas ausgeht.

7 FAZIT

Die Matrix-Methode eignet sich gut, die siedlungsökologischen Rahmenbedingungen einer Siedlung zu analysieren. Besonders im Vergleich zu empirischen Erhebungen und aufwändigen Simulationsverfahren kann mit dieser Methode eine erhebliche Kostenreduzierung erreicht werden.

Die smartphonegestützte Matrix-Methode ermöglicht gegenüber der analogen Erfassung nochmals eine erhebliche Reduzierung des Arbeitsaufwands. Das ist in erster Linie auf die schnelle und einfache Bestandsaufnahme zurückzuführen, die ohne viele Vorkenntnisse von Laien durchgeführt werden kann. Zusätzlich trägt aber auch die Verwendung einer mobilen Datenbank zu einem verkürzten Verfahren bei, da so der Zeitaufwand der Nachbereitung (z.B. Digitalisierung) reduziert wird.

So bietet die Matrix-Methode eine kostengünstige Methode, die siedlungsökologischen Besonderheiten einer kleinen Siedlung zu erfassen. Die genaue Aufwand- und Zeitersparnis gegenüber aufwendigen Modellierungen oder empirischen Erhebungen lassen sich allerdings nur sehr schwer abschätzen, da die Einflussfaktoren sehr vielfältig sind.

Die Ergebnisse der Matrix-Methode können von den Gemeinden genutzt werden, um siedlungsökologische Problemfelder oder Potenzialbereiche innerhalb der Siedlung zu identifizieren. Die Ergebnisse der einzelnen Matrizen können, in Verbindung mit Geographischen Informationssystemen, dazu genutzt werden, diese Bereiche weiter zu konkretisieren. Bevor kostenintensive Maßnahmen ergriffen werden, sollten diese Gebiete allerdings noch einmal punktuell hinsichtlich der vermuteten Phänomene untersucht werden. Der zielgerichtete Einsatz von Messungen oder Modellierungen ist dabei deutlich kostengünstiger als eine ohne die Matrix-Methode durchgeführt großflächige Untersuchung des gesamten Siedlungsgebietes.

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Strategic Planning for Coastal Area of Pudong In Shanghai 2025 – Eastern Shanghai International Frontier Gateway District

Peng Wang, Yifan Wang

(Peng Wang, Beijing Municipal Institute of City Planning and Design, NO.60, Nan Lishi Road, Beijing, China, wpwp_wp@hotmail.com)

(Yifan Wang, Tsinghua University, School of Architecture, Tsinghua University, Hai Dian, Beijing, China, evan7128@gmail.com)

1 ABSTRACT

To be an international economic, financial, trade, shipping center and a global city is an ultimate goal and long-term task for Shanghai. In the past 30 years, Shanghai has got a great development. In the meanwhile, as the center of Yangtze River Delta, Shanghai has also contributed a lot to the development of the surrounding area, which is growing to be one important metropolitan area in the world. Nowadays,around Shanghai, there has been three other Shanghais. One Western Shanghai includes Suzhou, Kunshan, Hangzhou which are based on cultural tourism and manufacture of technology; one Southern Shanghai includes Ningbo which is based on marine equipment and chemical industry, and one Northern Shanghai includes Nantong which is also based on marine equipment and chemical industry.

In the future development, Shanghai and Yangtze River Delta will face more challeges and need to change the development path, laying more effort on improving the soft power in international service, scientific and technological innovation, cultural influence and livable ecology. In this paper, we have one envision for Shanghai 2025, that there will be one area playing the role of springboard for the transition,which need international ports and airports in the meantime, and land resources growing gradually. We believe that as the international gateway of Shanghai and Yangtze river delta, Coastal Area of Pudong including Jiuduansha wetland has a big chance to be the pivot, and the Eastern Shanghai in the near future. In this paper , we are going to depict the picture for Coastal Area of Pudong in 2025, and explain how it is going to be and why it can be.

2 BACKGROUND

2.1 Shanghai: A city where the East meets the West

Looking through Shanghai's history as a city where the East meets the West, Shanghai has always been playing a significant role in China's opening up for international cooperation. Nowadays, Shanghai is on its way towards a global city. However, compared with the leading cities such as London, New York in the world, Shanghai has shown some disadvantages. For instance, in the aspect of industrial economy, it lacks innovation, and the ability of international service is lower (the amount of international financial institutions and international organizations is low); in the aspect of spatial development, the pressure of population upon the limited land resource is high, as is the population density of downtown Shanghai (permanent population density is 29900 people/km2 in 2012[1]), and new town needs more time to attract population; in the aspect of ecological environment, ecological land has been eroded gradually (the percentage of urban development land is more than 40% all around Shanghai[2]), and urban environment quality needs to be improved. So, future development for Shanghai lies in the international service, scientific and technological innovation, cultural influence and livable ecology. Only by upgrading its soft power, can Shanghai be a rising cosmopolis.As the international gateway of Shanghai and Yangtze river delta, Coastal Area of Pudong is in a prominent strategic position and has a big chance to be the pivot for the transition.

2.2 Yangtze River Delta: A region leading economic development and opening up of China

The Yangtze River Delta, of which Shanghai is the core, is in the stage of rapid development. Among this metropolitan area, Western Shanghai District which is represented by Suzhou, Kunshan, Hangzhou, taking advantage of location, transportation, ecology, culture and so on, has got great development in the aspect of cultural tourism and manufacture of technology. In the spatial structure of Yangtze River Delta, Western Shanghai District has grown to be the sub-center, forming two development axes, namely Shanghai-Nanjing

[1] Shanghai sixth census in 2010.

[2] Shanghai Urban Planning and Land Resources Administration, Shanghai Urban Planning and Design Research Institute: Shanghai in Transformation Urban Planning Strategy. Shanghai, 2012.

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and Shanghai-Hangzhou. In contrast, Southern Shanghai District which is represented by Ningbo and Nouthern Shanghai District which is represented by Nantong started growing relatively late. Howerver, bringing the advantage of coastal cities into play, they have become a key manufacturing base and comprehensive logistics base, which is based on marine equipment and chemical industry.

To be the leading city group in the world and promote the international influence, Yangtze River Delta need more effort to optimize the functional structure. On the one hand, it need to strengthen the leading role of Shanghai in two sectors, which are international communication abroad and high-end service at home. On the other hand, it need to accelerate the development speed for coastal cities, narrowing the gap between Northern Zhejiang and Southern Jiangsu. Above all, as the core of coastal area, Pudong need to play a bigger role on regional development in the future to keep pace with international frontier.

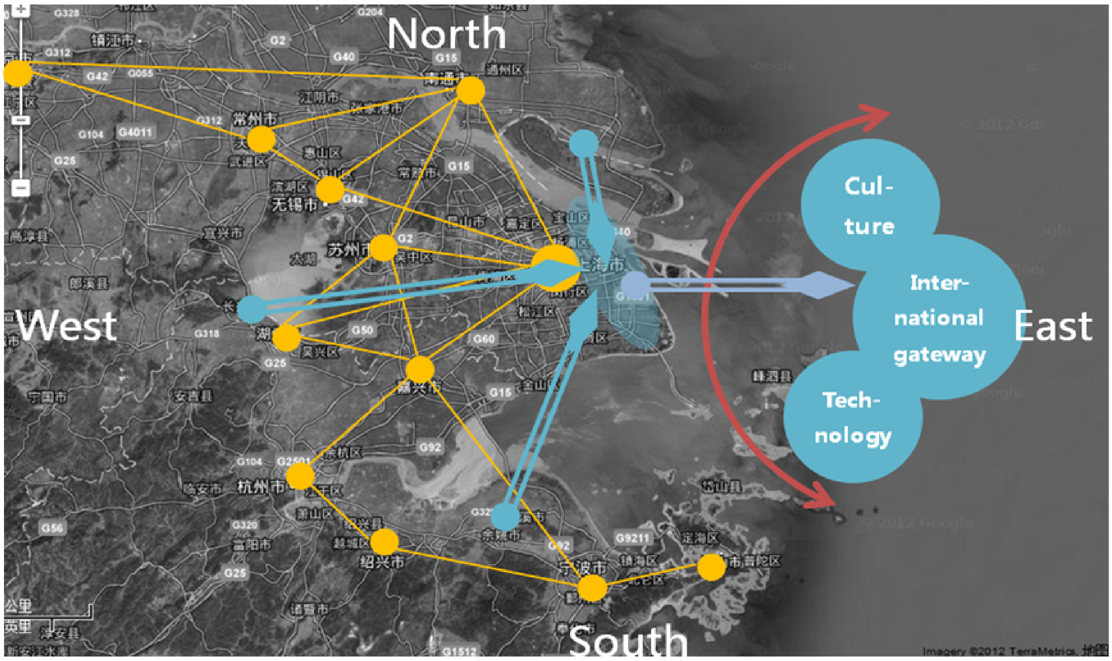

Fig. 1: The structure of Shanghai and its surrounding areas.

2.3 Coastal Area of Pudong: A place having conditions and opportunities

2.3.1 Conditions

Nowadys, downtown Shanghai is limited by space, overcrowded to accommodate newly increased needs, and need to build the city inwards in the future. By comparison, as the forefront of Shanghai, Coastal Area of Pudong has great advantages in location, transport, ecology, land space, culture, technology and so on, and is being a hub where global human resources, capitals, cultures and technologies are introduced. To summarize, it has a great chance to be a new strategic urban development space.(Figure.2)

2.3.2 Opportunities

From the point of view of Yangtze River Delta, a series of National Strategy like Development of Coastal Area in Jiangsu, Constrction of Coastal Thoroughfare, Zhoushan Archipelago New Area and so forth, means that the development path for Yangtze River Delta has turned from River Economy to Ocean Economy eventually.This will definitely bring good chance for the Coastal Area of Pudong that is in the core place.

From the point of view of Shanghai District, the government has reoriented the use of investment on major construction projects. Some projects as Waigaoqiao Cultural Free Trade Zone, Disneyland, and industrial park of equipment manufacturing and aircraft manufacturing have provided good chance for development transformation. Besides, expasion of Pudong International Airport will further enhance its international aviation hub status.

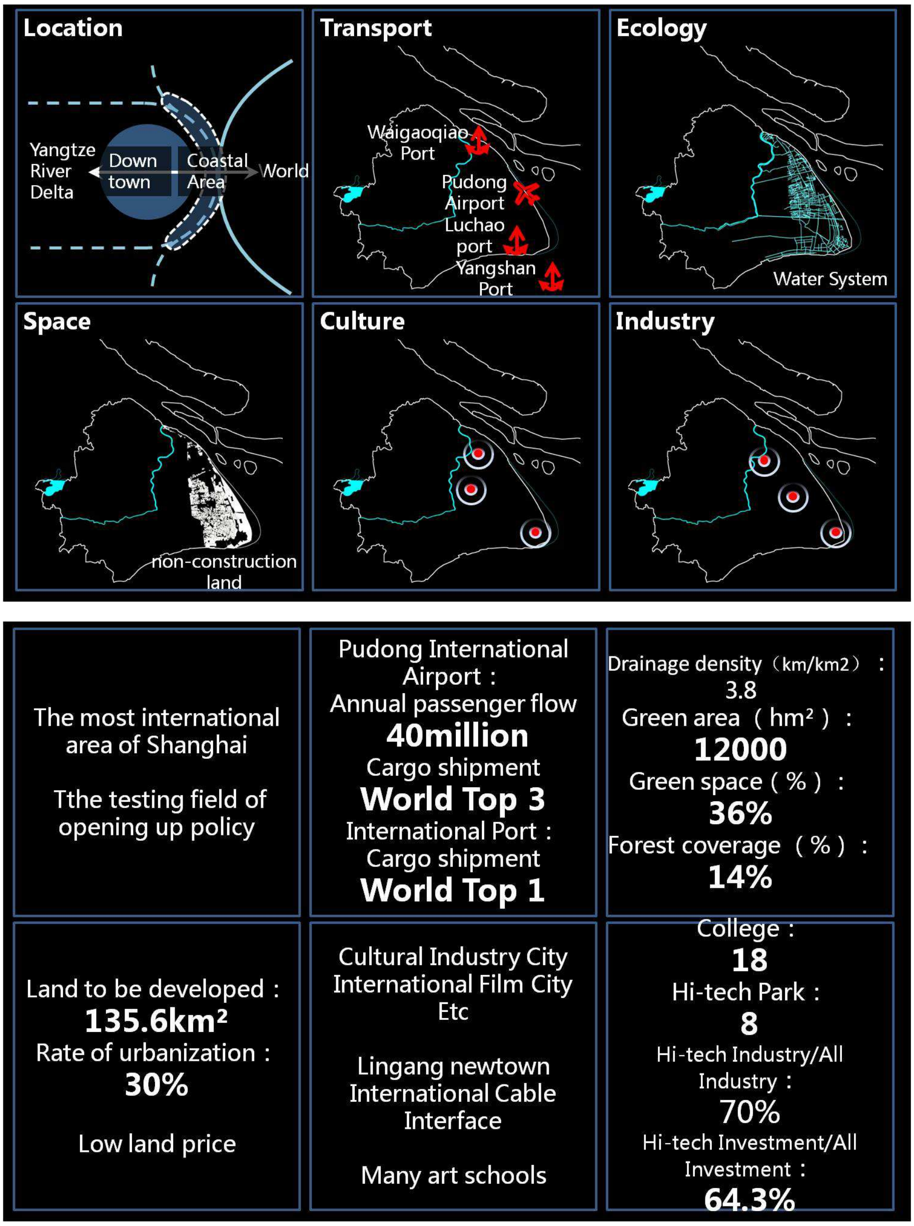

Fig. 2: The advantages of Coastal Area of Pudong.

3 STRATEGIC CONCEPTION

3.1 Object

Above all, based on regional structure and city development demand, in the meantime considering the advantages of Coastal Area of Pudong, we have one envision that Coastal Area of Pudong can be the Eastern Shanghai International Frontier Gateway District in the near future. The object contains three parts as Hub of International Communication, Base of High-tech Industry and Multi-culture City.

3.1.1 Hub of International Communication to collect talents and service communication

As passenger volume of Pudong International Airport increasing and air lines expanding, Coastal Area of Pudong is positioned as a hub collecting top talents at home and abroad.

3.1.2 Base of High-tech Industry to optimize industry and add value to research

Most of the Nine High-tech Industry in Shanghai located in Pudong, which lays a good foundation for Coastal Area.

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3.1.3 Multi-culture City to output innovation and become attractive

Pudong has got a good start in film making, online games, carton and so on. Besides, the projects of Waigaoqiao Cultural Free Trade Zone and Disneyland give a hopeful picture of the Coastal Area's future in opeing up policy. So, this area can be a Multi-culture City, which is complementary to the central city.

3.2 Strategies

3.2.1 Building a center: Eastern Shanghai International Frontier Gateway District

As discussed before, the development of Pudong relies on international communication, and it should attract more talents by providing pleasant living environment and swift transit services. So the airport area should develop a top urban center to encourage more global cooperation. For the northern and southern parts of Pudong, cultural and technological industries will be their incentives.

As a result, a new town would arise from eastern Shanghai, creating a global networking center in coastal Pudong. It would act as the motivation for a more globalized Shanghai. With a connection to the downtown, the eastern new town will become a complement of shanghai's main axis. It will help build a polycentric structure of Shanghai together with the northern and southern part of coastal area, which will eventually relate to the polycentric metropolitan of Shanghai and Yangtze River Delta.

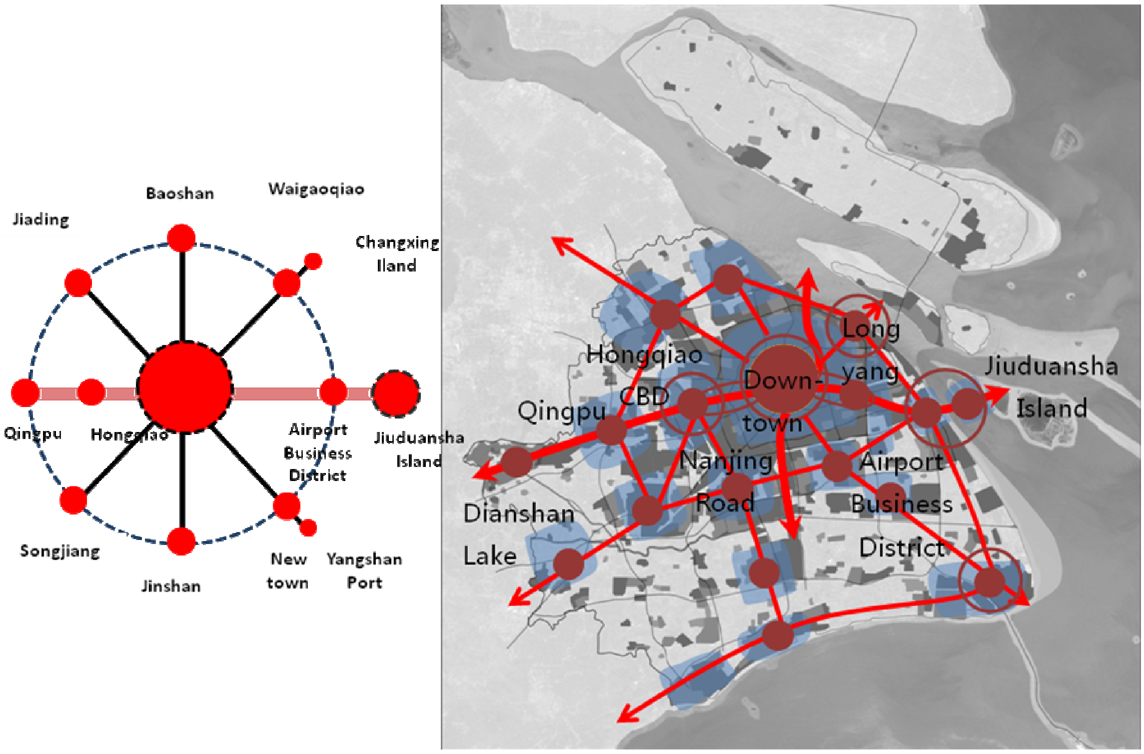

Fig. 3: The space structure of Shanghai in the future.

In the pattern of space, based on some case study about Two-Centre City, we conclude that the distance between new town and central city is usually within 40km. Considering the current situation, we place Eastern Shanghai International Frontier Gateway District mainly on Jiuduansha wetland, which is in the north of Pudong Airport. This district is near the Airport, having plenty of land resources that is growing gradually.Otherwise, being in the north of the Airport, this new district may get rid of the dependence on central city, taking advantage of the beautiful scenery in Jiuduansha wetland to satisfy the needs of high-end environmental requirements from senior people.

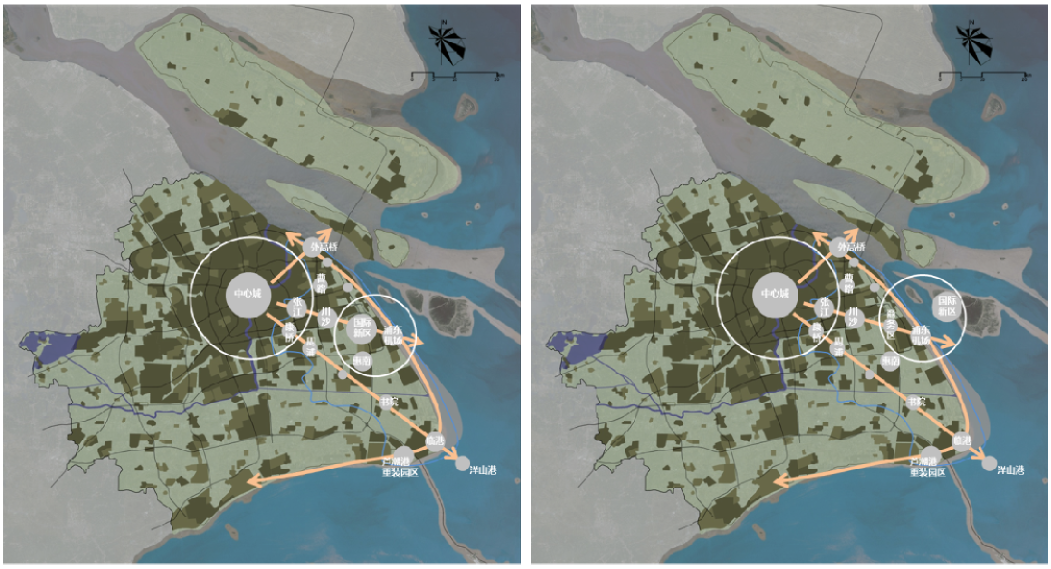

Fig. 4: Two plans about Two-Center City.

3.2.2 Constrcucting nine towns: nine economic parks in Coastal Area of Pudong

Since the globalization has brought scientific and cultural cooperation to an unprecedented level, the Eastern Shanghai should grasp this opportunity to adapt itself to the global trend, thus attracting international talents. Pudong will develop into a 9-pillars-city insisting of 9 clusters, each for a newly developed international function, that is to say, a convention center, a hi-tech park, a research laboratory, a cultural and creative zone, a media city, a recreation park, an airport business district, a global university town and an international summit conference center.

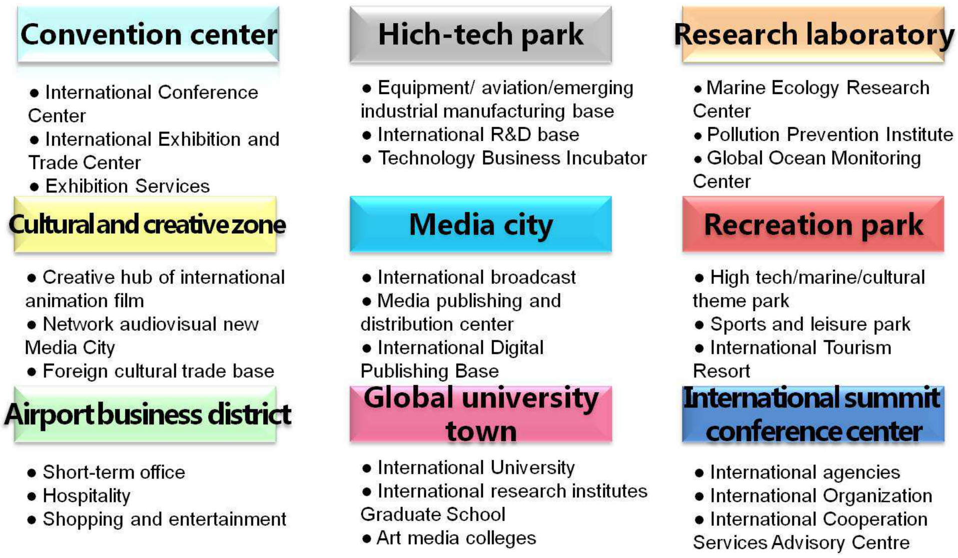

Fig. 5: Function strategy and 9-pillars-city.

4 SPATIAL PLANNING

4.1 Forecasting the scale of development

Learning from international practice, we arrive at a decision that the ratio of urban construction land is within 50%. In 2010, urban construction land of Shanghai is 2800 km2, and the ratio is near 50%. Considering the great advantage of Pudong in ecology, the constrcution land must be controled to balance the whole ratio of Shanghai. So, we conclude that 40% will be a good choice for Pudong.

Finally, on the basis of the site research, and through this ecological-capacity model for forecasting, we came to the conclusion that Pudong's population will reach 4.2 million, which would require a sum of 500 square kilometers' land.

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4.2 Space layouting

Based on a comparative study with Incheon, Korea, we forecast the land-use percentage for these 9 clusters and the area needed, then we choose appropriate locations for each cluster. As a result, 3 economic zones will be developed in Pudong. Firstly, the international hub containing airport business, international communication, and airline industry. Secondly, the creativity zone containing cultural trade port, financial services and the Disneyland. And finally, the industrial park accommodating port vicinity manufacture. To strengthen the transportation between downtown and eastern shanghai, the Middle ring road will extend to Jiuduansha wetland.

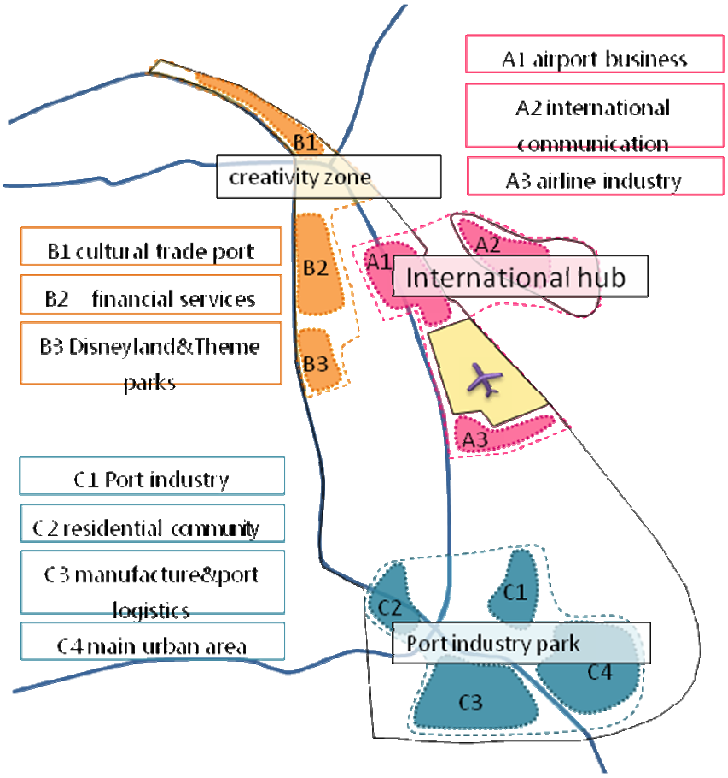

Fig. 6: 3 economic zones in Coastal Area of Pudong.

Fig. 7: Land use plan in Coastal Area of Pudong.

4.3 Detailed design for the core

From the aerial view of Eastern Shanghai, we can see there are two parts across the sea. To make these two parts correspond perfectly, we design a seaside park along the western side. And marinas are set on both sides to connect each other. On the western side, there will be an airport business district, a global university town and a convention center in the loop. On the eastern side, there will be an international summit conference center, a global climate laboratory and a CBD around the central wetlands. By preserving the pattern of the rivers and wetlands on the island, we would like to create a favorable environment on and off the island.

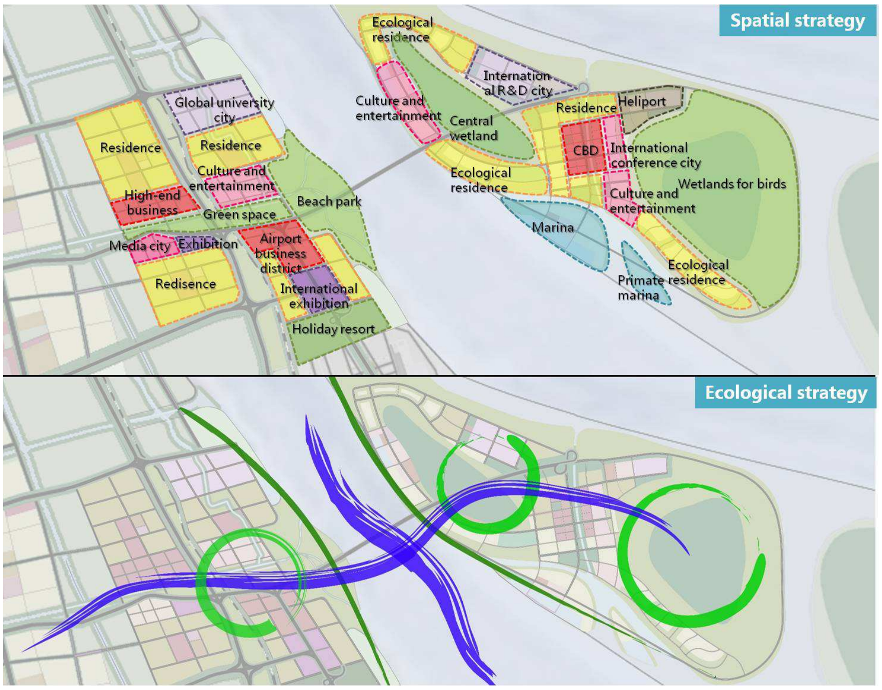

Fig. 8: Land use plan in the core of Coastal Area.

Fig. 9: Urban design renderings.

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When it comes to urban design, the parkway will serve as the main axis of the western site, connecting multiple functions along the way and creating a pleasant working environment. In order for environmental conservation, the eastern side adapts low density residence, with private heliport and marina. Combining various functions like international conference, research and institutions, Eastern Shanghai will be a convergence of the world's talents.

5 CONCLUSION

To summarize, we hope Eastern Shanghai will be a new pivot to motivate coastal area of Pudong to make a leap, and accelerate Shanghai's pace towards a cosmopolitan city.

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reviewed paper

Street Life! It's the Only Life I Know. Street Life, and there's a Thousand Parts to Play

Angelika Psenner

(DI Dr. Angelika Psenner, Vienna University of Technology, Dep. of Urban Design, 1040 Vienna, Karlsplatz 13, angelika.psenner@tuwien.ac.at)

Fig 1:current use of the Viennese street-level environment; © Psenner

1 ABSTRACT

Vienna's urban Stadtparterre(street-level environment) crisis is a key focal point of the city's urban research and for its administration: Although rapid population growth[1] has created an urgent need for additional (living) space, ground floor vacancies are still spreading. Furthermore the environmental impact generated by individual motorized traffic has reached a critical level.

TheStadtparterreconcept refers to the city's "parterre" as a holistic urban system: it covers both built-up and non-built-up areas. Thus street, ground floor and courtyard are treated as entity, so that interrelations are coming to light. Because we perfectly know that the potentials of ground floor use and the structure of the correlating public street space are directly related to each other.

Given this perspective the paper is therefore addressing the following issues:

- Which architectural, legal and structural interventions have had an impact on the functional change of the street-level environment?
- How was the Viennese ground level originally used? Which urban functions were located there?
- What are the (historical) interrelations between public space and the life inside buildings?

Thus the causes of the current Stadtparterre crisis is analysed from a historic and systemic perspective.

2 URBAN PUBLIC SPACE

2.1 Street Life!

Public space belongs to everyone. To secure this fundamental right, the use of public space needs regulation, and this—establishing a fair and balanced order—is where the challenge lies: who may use the street space and when? Who shall take precedence when it comes to settling disputes? And why would the car be con¬sidered as a "privileged road user" (RTRA)?

The use of public street space is organized by "numerous legal regulations." Aside from the Austrian Road Traffic Regulation Act (RTRA), Adensamer mentions, e.g., the Security Police Act (SPA), which "regulates the maintenance of public order by the police," as well as state legislation such as the "pro-tection of public decency" or the Road Police Act (RPA) (Adensamer 2012). However, it must be seen that the sphere of traffic-relevant legis¬lation is in fact much wider, since tax reliefs like the so-called "com¬muter deduction," Petroleum Excise Tax exemptions, or the fact that road traffic areas, particularly parking lots, are not subject to property tax, have an indirect but impactful influence on road use patterns. Public subsidization of "single-family home building" must eventually also be seen as generating additional car traffic (Psenner 2013, 132).

[1] At present Vienna's population is increasing by approximately 35.000 each year.

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However, we do possess historical photographs of our urban streets, which speak to a different, highly diver¬si¬fied structure of uses. For before the street turned into an exclusive traffic and parking area it also served a number of other purposes, from economic needs and necessities (trade, sales, transportation of goods) to cul¬tural purposes, private self-representation, and the manifestations of public life. Hence both movement and rest were considered as formative factors that defined the urban-design significance of the street as such (Walewa-Coen 1946, 97).

Today, the street space of European cities is mainly occupied by private cars, leaving little or virtually no room for non-traffic uses and thus rendering the goals for public space as set, for example, in Vienna's urban develop¬ment plan—"social interaction, communication and lingering in public space are to be enabled and facilitated" (STEP 2025, 49)—a distant vision.

This raises the question of what caused the breach in the historical development of street-space use patterns.

2.2 A genealogy of road-use regulation in Vienna

2.2.1 Historical development

In the early 19th century, road and bridge construction engineering still was a "department of hydraulic engi¬neer¬ing." Accordingly, the Imperial and Royal Court Commissariat for Road Affairs was manned by hydraulic engineers who also authored in this capacity a number of fundamental treatises about the role, purpose, and design of urban streets and country roads. The term traffic flow, which may sound a little nautical if referring to street space, takes its connotation from there. The flow metaphor rele¬gated other, less mobility-oriented functions of the street to the background: the main purpose of current road traffic regulations as defined by the RTRA is to "ensure the smooth flow of traffic" (Adensamer 2012, 43).

In his 1804 publication on road construction, C.F. Wiebeking, Imperial-Royal Hofrat for civil engineering affairs, attributed to roads, aside from economic, public-health, and war purposes, a highly relevant presentational function. Likewise, the Imperial-Royal Court Commissary for road affairs, J.M. Schemerl, notes in his three-volume work that the measure in all matters of urban street design is the pedestrian, the issue being to provide for "pedestrian comfort" through real or optical "spaciousness" of street layout (Schemerl 1819, 216). Urban planner James Hobrecht[2] saw the objective of any street design in giving preferential treatment to those traveling on foot:

What results from this is the necessity, in the laying out of streets, to give sidewalks the most ample width possible, and where the width of the entire street cannot be extended beyond a certain measure, even to allow for such sidewalk width at the expense of roadway width. Thus securing there the widest room possible for the needs of the future also gives a more pleasant aspect to streets in general. (Hobrecht 1890, 16)

The earliest specific legal directions are found toward the end of the 19th century: the safeguarding and regulation of traffic was first laid down in the General Roads Act[3] and separately – for Vienna and Lower Austria – in the Road Police Regulation of 1875. Clearly, the focus here still was on the individual so that parking in the street at night was simply prohibited at the time for safety reasons and, in case of violation, was punishable under section 422 of the General Roads Act with "imprisonment between 3 and 14 days." Special permits were issued by the authorities only for construction sites, though with the stipulation that enough lanterns had to be put up.[4] Adequate lighting also had to be provided to secure a broken-down vehicle.

This view of things survived over decades so that even in 1931 night parking in the public space was considered prohibited. Specifically, the Federal law on precepts of road police unless they relate to federal roads (Austrian Legal Gazette 438/1929) said the following:

This view of things survived over decades so that even in 1931 night parking in the public space was considered prohibited. Specifically, the Federal law on precepts of road police unless they relate to federal roads (Austrian Legal Gazette 438/1929) said the following:

[2] Hobrecht is the author of the 1862 urban expansion plan for Berlin. His writings were verifiably known in Vienna, too.
[3] General Roads Act, quoted in Freiherr von Hock 1897.
[4] Around 1875, Viennese streets already had lighting. From 1845, there were gas lamps, and from 1882, electric street lights were installed in the city. (Psenner 2013, 142).

§ 18. Halted Vehicles. (3) Unhitched carriages [and motor vehicles] must not be left out on the street in the dark or in heavy fog. If, for special reasons, their removal cannot be done, […] adequate lighting has to be provided.

The law also contained an explicit prohibition against molesting pedestrians and residents by splattering street mud. This clearly shows that street users on foot were given preferential treatment and that their safety and well-being was stipulated and protected by law. This specific provision was found both in the federal law and in the Viennese Road Police Regulation (§ 20):

§11. Driving speed. (1) The driver must choose his speed in such as manner as to cause no danger to persons or property. In built-up areas the driver must furthermore choose his speed so as not to molest other road users or residents by splattering street mud.

But legislation shifted away from this initial emphasis on protection of people and was over time amended to protect vehicle traffic, not least because car production as well as modern, fast, efficient goods and passenger traffic were seen as boosting the urgently needed economic recovery in the post-World War I and interwar period. Against these "economically convincing" arguments, the needs of pedestrian increasingly moved to the background. The economist Robert Reisch even went as far as referring to the concerns of "pedestrians, bicyclists, and residents" as "special wishes" and gave clear priority to the needs of motor traffic "because of its predominant status" (cf. Reisch 1938, 6). Pursuing along these lines, it was clear that road costs were to be borne jointly by the "three main parties involved, namely, the general public, road users, and land owners" (ibid. 27). Reisch wanted the success of the road construction program to be measured by the following factors: "Promotion of general traffic […] expansion of traffic facilities, creation of new sales possibilities, promotion of tourism, provision of jobs, saving of time, better use of the labor force, and finally, happier lives because of the improvements in traffic" (ibid., 31). Special emphasis was placed on the goal of "fighting unemployment."

The NS street ordinance of 1938 provided the most significant shift in the hierarchy of street users.[5] While this development was a response to the general increase of motorized traffic, the shift of emphasis was accomplished through legislative means.„The promotion of the motor vehicle is the goal set by the Reichs Chancellor and Führer", and the ordinance (StVO) is intended to serve this goal. "The ordinance wants to pave the way [...] for technical progress." (Gülde 1938, 105 and 108).[6]

In a summary of commentaries on street ordinances published by the Dresden lawyer Hermann Gülde the following entry appears under the title the Nature and Significance of Street Traffic:

Under the rule of liberal attitudes, road traffic experienced an all but total disorganization […] There was no coherence and no bond to a larger purpose and meaning.National Socialism alone restored an intellectual basis for a meaningful understanding of street traffic. Its turn towards the idea of a people's community […] provided street traffic with the right meaning [...] The will to power, expressing itself in an increase of street traffic […] only receives its proper meaning when understood as a service in the care and evolution of the people. (Gülde, 1938: 105-106)

Following Gülde's views, the 1937 Road Traffic Regulation Act moved "the National-Socialist principle of the traffic community" to the foreground, which places "community interest before individual interest," expressly "rejecting all special needs and special wishes" (ibid. 110), so that "the slower must give way to the faster" (ibid., 135). Gülde also advocated a driving speed which permitted "bringing the vehicle to a timely halt" (ibid. 138), while emphasizing that

The old judicial practice concerned with in how far the driver of a vehicle has to avoid splattering pedestrians with street mud is obsolete. […] [For] in road traffic, the needs of motorized fast traffic [come] before the needs of pedestrians. (ibid. 138)

[5] The German StVO 1937 (a revision of the ReichsStVO 1934) was implemented in Austria in the year 1938.

[6] Other Nazi regional planning legislation went in the same direction, like the Residential Settlement Act, the Decree for the Regulation of Developments or the Decree for the Admissibility of Time-Limited Construction Bans, as well as the Law for the Redesign of German Cities of October 4, 1937 (cf. also Buschmann, 2000, 155–159). The idea of the "automobilization of the people" was also supported by analytical urban studies like the one published 1939 by Gottfried Feder, formerly Reich Commissioner for Land Settlement and honorary professor at the Technische Hochschule Berlin, under the title ofThe New City: Attempt to Found a New Art of Urban Planning on the Social Structure of the Population.

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The motorisation of the „Volk“ was the over all goal andit comes as no surprise that from that date on parking in street space was approved (with minor restrictions—a situation not very different from today).

In 1947 the New Austrian Road Traffic Ordinance was passed, which amounted to little more than a renewal of the 1937 laws.[7] It maintained the unconditional attention to and privileging of motorized traffic. Presumably under the impression that accidents generated higher costs(Psenner 2013, 148), postwar regulations called for “care, caution, and attention” but nevertheless remained primarily fixed on the protection of traffic. It was not until 1960 that the so-called cautionary rule was rephrased, and the human being once again moved into the center, replacing traffic as the focus of attention. But the course had been set for rapid expansion of motorized individual transport and research of the time provided “compelling” arguments for the economical relevance of the car(cf.: Fantl 1969).

This historical and political shift in street-use rights must be borne in mind in any discussion regarding the legitimacy of the private vehicle’s occupation of public street space today. Cities with a significantly different cultural history and, consequently, a different approach to the issue offer alternative solutions. Tokyo, in spite of tremendous pressure regarding mobility (35 million inhabitants in the metropolitan area), has retained the public space character of its residential streets. That is, they are spaces to be used by everyone alike. Cars are parked only at interspersed, dedicated locations (cf. Psenner 2013, 152f; Psenner 2014, 138f).

Fig. 2: Tokyo City center; cars are parked only at interspersed locations; cars in little hide-aways. © Psenner

Street space not blocked up by parked cars is free space and remains available to all: it is engaged, occupied and enlivened by active diversified street use. Enlivened public space in turn brings additional security; its users develop a personal relationship with the place, interfering in it in all sorts of appropriative or aesthetically manipulative ways.

2.2.2 Current use situation in Vienna

The current traffic ordinance, and with it the rights of use of public street space, are rooted in a system of values that privileged the ideal of a Gesamtvolkssinn or ‘total interest of the people’ over the rights and the protection of individuals.

Fig. 3: Street primarily used as parking space. © Psenner

[7] cf. Wedl 1947. The new Austrian Road Traffic Regulation Act (RTRA)was not passed until 1960(Federal law of July 6, 1960) (Kaltenegger 2010, 228).

In spite of the shortage of free living space, Vienna's street-level environment has one primary user: the greatest part of both open and built-up space is occupied by moving and stationary traffic:

- The average „automobile“ is moving 40 minutes per day, the rest of the day timethe car stays parked in public space (Posch et al. 2008, 12).
- The average car owner covers only 44% of the costs he or she generates.[8]
- Sidewalks are considered an integral part of street space and as such are restricted to moving traffic; using these spaces for “purposes other than street traffic” requires permission. In urban areas it is additionally forbidden to “obstruct pedestrian traffic by stopping without cause”(§78 StVO)
- A wide range of laws are in favour of a car-centred economic and social life system: e.g. the Viennese parking space regulation(Stellplatzverpflichtung) requires new extensions or even minor restructurings to provide additional parking spaces—one parking space per 100m2.[9] Hence, cars are increasingly invading the basements of GZ apartment buildings.

Fig.4: ground floors of historic buildings are subsequently converted into garageswith Potemkin-façades. © Psenner

From an urbanist perspective these regulations are destructive, by rendering the goals for public space as set by Vienna's urban development plan a distant vision: “social interaction, communication and lingering in pubic space are to be enabled and facilitated” (STEP 2025, 49). Current law still defines street primarily as a transit space and as such reserves it for motorized vehicles.

The basic prerequisite for a calibrated and socially just transformation of the European city lies in recognizing the individual benefits that a reduction of automobility brings. This includes pointing to the (hidden) secondary consequences of the miserable traffic situation like, e.g., the ground-floor problem: vacancies and underuse of ground floors of buildings in Vienna are not least a result of surface-parking-ridden street spaces (Psenner 2012, 2011a, 2011b, 2005).

Although (traffic) science has, in view of the urgency of the ecological and economic situation, long been calling for substantial state intervention in the organization of urban individual traffic, policy-makers and the administration have not yet brought themselves to take the radical steps demanded of them.[10]

3 THE URBAN GROUND FLOOR

3.1 The Sidewalk

The holistic aspect of the term Stadtparterre(street-level environment)shows the primary function of the sidewalk in its true light: easily and directly accessible, the sidewalk is the most important area of interaction in public space, a place where people can meet and move among, or simply observe, each other relatively freely. Not least, it is the site of interactive integration between minorities and majorities in a diversified

[8] Cf. VCÖ/ FREY 2007.

[9] In 2014 the amendment of the actual building law will come into force: then one parking space has to be provided per every 100 m²flat space; whereas in Zürich, Switzerland every 120 m² require the amendment of a parking space.

[10] The usual suggestion to solve the problem of stationary traffic is introductionof a congestion charge or expansion of on-street parking pricing systems, which is the policy currently pursued by the city administration of Vienna. Sup¬por¬ting measures include models like the Smart City, regenerative, interoperable Mobility Cards, soft mobility, electric vehicle networks, mobility on demand, road pricing, and shared-space models. What they have in common is that they aim to curb private motor vehicle traffic and to promote the use of public transportation.

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society.[11] Clearly, it should be possible to engage this multi-functional urban space, adequately dimensioned as it should be, in all sorts of ways.[12] At present, however, the, on an average, 1.7 to 2.2 meters between building fronts and parked cars are reserved for flowing traffic—under § 78 RTRA, it even is expressly prohibited "to hinder pedestrian traffic by stopping for no reason," although no information is provided as to what might constitute an admissible reason to do so (Psenner 2004, 133; 2011a; 2011b; 2012). Also, using the sidewalk "for other purposes than those of street traffic" is still dependent on administrative approval.[13]

This lack-of-space problem also has to be seen as a consequence of the shifting of rights of use described above: while more and more space was assigned to cars, pedestrians found themselves reduced over time to increasingly narrow walking lanes. In the years after World War II, sidewalks were built with a minimum width of 1.25 meters (according to ÖFS standard specification sheets, 1956), whereas, in the Gründerzeit epoch, the trottoirs—"trotter" meaning to roam about in French—on both sides of the street had been assigned no less than one third (!) of the total street width (Kortz 1905, 174; Drexel 2000; 207 u. 209). On initiative of the city administration, these postwar sidewalks have been increasingly widened in recent years, with additional bulges added at street crossings, so that the hitherto narrow pavements are now offering a little more space to walk and stand, but this still is a far cry from the comfortable 4-meter sidewalks as are common in New York City. To make things worse, the clear width (unobstructed passageway) achieved at great cost was in many places drastically reduced again by signposts.

3.2 Structures of historical ground-floor use

3.2.1 Small (manufacturing) businesses on the Stadtparterre.

The economic, social, and urban-design structure of the city was characterized by a large number of small businesses, many of them manufacturing businesses or workshops, located in Gründerzeit townhouses and preferably accommodated there on ground floor level. Of the businesses registered in the Establishment Census of 1869, only few had more than ten workers—enterprises that employed a larger workforce were more or less all located in the suburbs (Bobek 1978, 36); a specific structural characteristic which also con¬tinued to subsist throughout and after the economic crisis caused by the stock-exchange crash of 1873.

By the time Vienna had an incredibly wide spectrum of business registrations: e.g. Pfaidlergewerbe (shirt sewer), Paramentenerzeuger (manufacturer of textiles used in liturgy), Banderzeuger(manufacturer ofribbons), Bettwarenerzeuger (manufacturer of linen), Naturblumenbinder (manufacturer of flower arrange¬ments), Konzessionierter Spirituosenschänker(liquor dealer), Brunnenmeister u. Brunnengräber(well diger), Büchsenmacherund Schwertfeger(gun and blade smith), Bürsten- und Pinselmacher (manufacturer of scrubber and brushes), Deichgräber(dike digger), Nadler Webkammmacher u. Drahtwarenerzeuger (manufacturer of wire products); Federnschmücker(feather decorateur); Flaschenbierfüller (bottling beer), Fragner u. Greisler(store owner), Hafner (potter), Kamm- u. Fächermacher (manufacturer of combs and fans), Gemischtwarenverschleißer (also called ‚Agent'and comparable to a local retailer), Kanal- und Senkgrubenräumer (sewage system cleaner), Kostgeber (landlord or landlady), Lohnfuhrwerker (carriage contructor), Sauerkraut- u. Saure Rübenverschleißer (pickled vegetables dealer), Seiden- Schön- u. Schwarzfärber (dye factory), Tuchscherer, Wirkwarenerzeuger(knittingfactory).

3.2.2 Historical development of ground-floor use in the street study

In the high decades of the Gründerzeit epoch (1890–1910), the following businesses, or business premises, were accommodated on the street-side ground floor of buildings along the 190-meter street stretch examined:

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[11] Integration is societal participation, both by members of minorities and the majority. It is not a static condition, but an ongoing interactive process that happens in everyday life through reciprocally oriented and interpreted actions (Psenner 2011, 203).

[12] Cf. (Schütz 2013); see also the artistic-scientific work of the "Gehsteig-Guerrilleros,"www.gehsteigguerrilleros.net, accessed Feb. 24, 2015.

[13] Sidewalks are part of the street space, which is why, under § 82 RTRA, approval is mandatory for any non-traffic use of streets: "(1) The use of streets, including the air space above them, insofar as it must be considered with respect to traffic safety, for purposes other than street traffic, e.g. for commercial activities or advertising, requires prior approval under this federal law, notwithstanding other applicable legal provisions. The same applies for activities that are likely to cause crowds to gather or impair the attention of vehicle drivers." Pursuant to the law, approval can only be granted if there is no "impairment whatsoever of the safety and easy flow of traffic" (§ 83 cl. 1).

1 farmacy

1 diary

1 barber (for men)

1television busines„Fernsehboutique“

2 shirt sewer Pfaidler(in)

1 printing house (of the Sonn- und Montagszeitung)

1 furniture factury / carpentry

1 synagogue;(after 1990: furniture store)

1 pharmaceutical company (Pharmakon);after 1964: advertising company

1 privat educational institution for sewing neckties

1 production of corc goods; after 1912: carpentry;after 1971: printing house

1 workshop for the production of frames and mouldings;after 1928: glass-cutting workshop

1 shop for celluloid goods;after 1970: installer

1 paper shop (Papierverschleißer);after 1911: locksmith;after 1970: installer and plumber

1 laudry blow room;after 1967: grocery store

1 installer display room

1 butchers shop and workshop;after 1999: video store

1 production of laudry and linen;after 2000: offices

1 carpentry;after 1942: butchers workshop and smokd meat production

1 production of laudry

7 restaurants/ coffee houses/ wine spirit shopsof which:

1 restaurant;after 1909: smokd meat production;after 1921: breakfast room;after 1960: patisserie

1 restaurant; after 1904: coffee roaster;after 1933: rest.;after 1970: Cafe; after 1981: vegetable shop

1 coffee roaster; after 1967: Cafe Alsergrund;after 1978 shop

1 restaurant;after 1970: Cafe

1 wine spirit shop;after 1993: painter shop

1 restaurant

1 coffee house

5 not specifically defined salesrooms (called Gassenlokale and ocasionally „Gewölbe“)

4 general store (Gemischtwarenverschleißer)

3 bakeries/ patisseries

3.2.3 Structural characteristics of use of the historical Viennese ground floor

Originally, the historical Viennese ground floor was a semipublic space. There was no clear-cut boundary between inside and out, rather, doors and windows were left open most of the time so that there were many places that gave access to the ground-floor premises. Original photos from the period attest to this theory: the ground-floor facades were permeable; semipublic or even private uses of the ground floor reached out to the street, and conversely, the premises were easily accessible to the “public flow.”

Fig. 5:Historical permeability of the façade; top left: 9. Hahngasse 11, 1905; right: Pramergasse 13, 1903, both: August Stauda (source: ÖNB www.bildarchivaustria.at)

The actual living areas were really small and mostly used by several residents in shifts. Many functions were therefore moved to the outside. This accounts for the relatively large number of taverns and coffee-houses. Only few apartments had real kitchens, and spaces that could be used to store foods were equally rare so that shopping for perishables had to be done on a day-to-day basis.[14]

Many of the ground-floor premises in this street (the study that this text is based upon had to be anonymized for data protection reasons) were connected with the basement floors or cellars underneath. The ground floor was thus extended; also, the (commercial) use of the street-facing premises in most cases included the use of the interior courtyard.[15]

- The historical Stadtparterre was ramified, varied, much-used and hence engaging space.
- The Viennese ground-floor zone originally was a semipublic space.
- Ground-floor facades were permeable: public and semipublic spaces on the Stadtparterrewere in inter¬active communication with one another.

4 THE ANALYSIS

As the cadastral map only shows building perimeters, it contains no information about the city’s internal structure. Street, ground-floor, and courtyard uses are not documented with the necessary clarity and com¬ple¬teness and can therefore not be objectively analyzed in a structural context. The Comprehensive Street-Level Environment Map (ZPA zusammenhängende Parterre-Aufnahme) recently compiled in a pilot study now provides precisely the kind of information that we see as prere¬qui¬site for an authentic morphological analysis.[16]

Fig. 6: left: official cadastral map of the street “Mehrzweckkarte”, right: comprehensive plan ZPA © Psenner

[14] In view of the shortage of resources and under the general heading of “scarcity,” urbanists today sometimes call for the down-slicingof our present-day apartment sizes.

[15] Today, interior courtyards mostly accommodate garbage cans or dumpsters. More intensive, diversified uses of this part of the Stadtparterreare rare (Psenner 2014c; Psenner 2014f).

[16] The pilot study surveys the exemplary Stadtparterreof a typical Gründerzeit ensemble in a street in Vienna’s 9th district.

Based on the ZPA and on building inspection data[17] (historical and present-day submission plans, rezoning procedures, trade licenses and operation permits), changes in the architecture and use of the historical Stadtparterrecan be identified. Also recorded in the survey are modifications of facade design with respect to buil¬ding apertures and the resultant permeability of the facade. Moreover, the ZPA enables an analysis of structural modifications of residential units or premises and of the type and quality of connecting pathways between built-up spaces, street, and courtyard.

The pilot study confirmed the hypothesis that, historically, the ground-floor area is a semipublic space and that the facade functioned as a permeable membrane, facilitating interchange between the public and semi¬public spheres. The following illustrations show the historical structure of uses around 1910 and the present-day ground-floor situation. The juxtaposition makes evident a significant reduction in semipublic ground-floor uses over the decades.

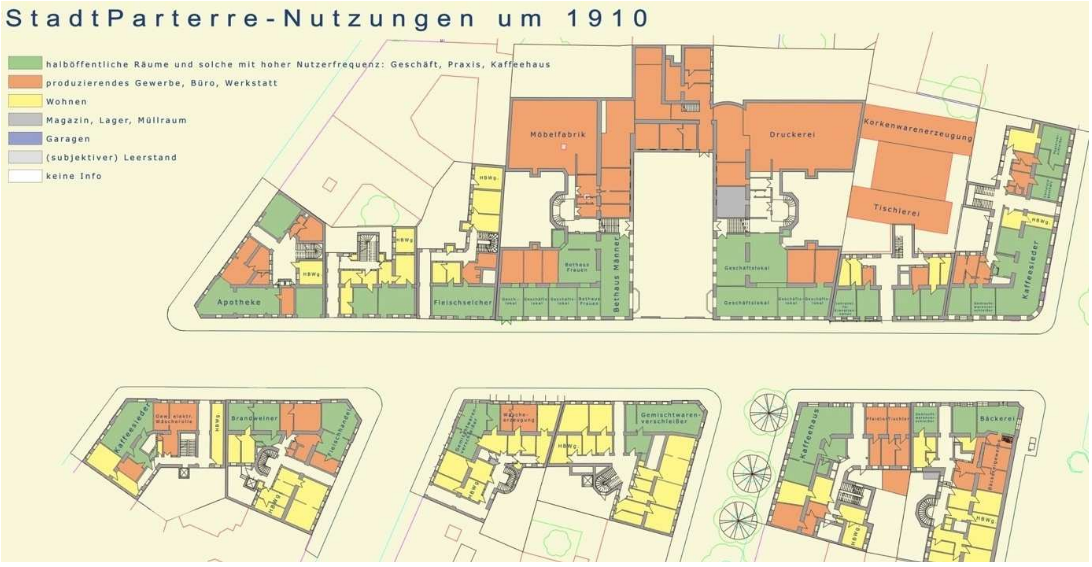

Fig. 7: The Stadtparterre as it was used around 1910; colour codes indicating different use: offices, workshops, dwelling, etc.; © Psenner

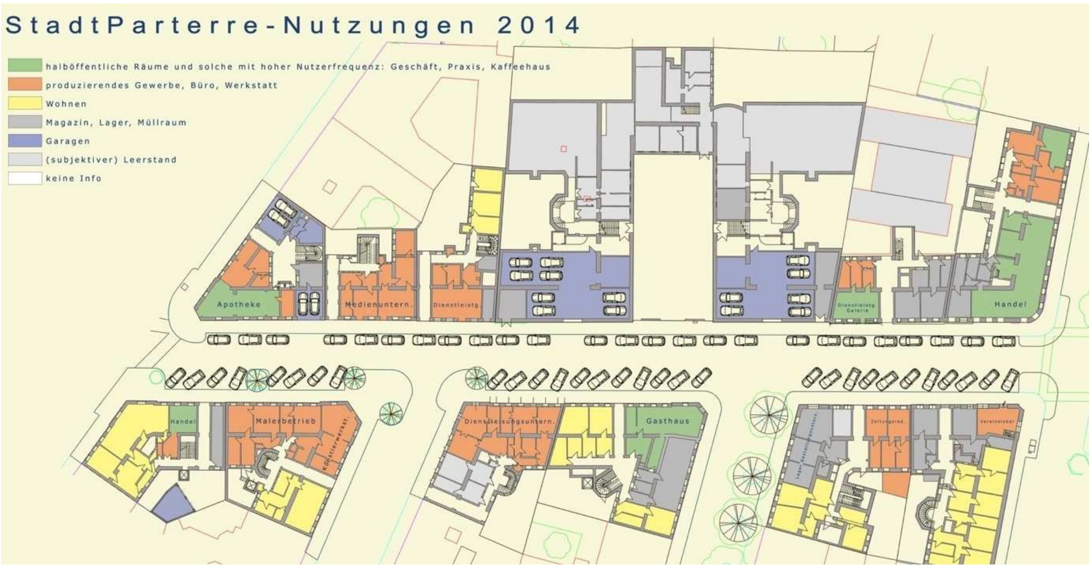

Fig. 8: The actual nowadays use of the Stadtparterre. 3D-ZPA, © Psenner

[17] The data is archived in the Städtische Magistratsabteilung MA 37, also called Baupolizei. In Vienna (unlike in other European cities) this kind of buliding data is considered to be privat data. As this legal situation is holding up valuable research, change is urgently needed.

5 CONCLUSION

Nazi legislation created conditions in Vienna that reduced urban street space to a public supply facility, a conveyor of traffic that does not invite lingering. Also, the separation of uses effected by urban planning in the name of classical Modernism led to a commensurate increase in traffic, so that today the prerogative of motorized individual traffic seems indelibly inscribed in public space.

The car-centered use of street space which increasingly affects adjacent ground floors of buildings entails another highly detrimental development: the Viennese Stadtparterreis becoming increasingly less attractive and, contrary to its original function, is being used only for storage or as a transit space or passageway. The (indirect) link between motorized individual traffic and urban-structure problems of ground-floor use has been pointed out here. What follows from this is:

- It is necessary to designate secondary consequences of our current automobility on urban structure: the bad state of the Stadtparterre, vacancies and underuse of ground floors in Vienna are not least a result of street spaces clogged with surface parking.
- Possession of cars comes at a high social cost. Considering the causal nexus stated above, tax reliefs and other measures that promote traffic and car possession need to be recalibrated.[18]

One significant prerequisite of successful regulatory measures in urban planning, administration, and economics is a solid and detailed knowledge of the actual architectural structure, current use—and potential use—of the street-level environment. When used on a larger scale ZPA will realize this information in an easily accessible and locally contextualized form. Thus, the potential of the street-level environment will be clearly identified and can successfully inform urban planning. Given the complex micro-analytical capability of the ZPA, it will be possible to document vacancies and street-use issues in various neighbourhoods and to analyse the contributing economic, traffic and social factors. In adition a systematic 3D-mapping of the built-up structure (cf.: Psenner 2014c; 2014f) and inventory of the historic, the actual and the potential ground floor uses will provide a basis for developing long-term views of Vienna’s street-levelenvironment, practical guidelines for future interventions in various neighbourhoods, and for the (re-)design of individual street complexes.

But—unlike in other European cities—in Vienna this kind of buliding data is considered to be privat data. As this legal situation is holding up valuable research, change is urgently needed.

Fig. 9: Street-space is traffic-space—it “belonges” to the car. © Psenner

[18] For the so-called “com¬muter deduction,” Petroleum Excise Tax exemptions, or the fact that road traffic areas, particu¬larly parking lots, are not subject to property tax, have a significant influence on street use behavior. Subsidizing “single family home-builders” does not only lead to urban sprawl and uncontrolled development on the outskirts or in the com¬muter belt of urban agglomerations, which in turn prompts an extension of the urban street system, but is also respon¬sible for an increase of commuter traffic.

Once the predominance of cars is broken—the arguments to do so have long been provided by social as well as economic research—the street can again be thought of, and planned, as a living space. And in the course of this, the Stadtparterrewill automatically develop, with residents being able again to use the street as if it belonged to them.[19] The functions of the house, or at least of the ground floor, will again extend to the street outside—and in turn, the street will reach into the ground floor again. The ground floor would again become a threshold space – a space that is both inside and outside –, which would induce new atmospheric qualities. If this means that the current sharp and apparently necessary demarcation between the public and the private spheres breaks down, space use regulations and policies may have to be renegotiated.

Fig. 10: „lived street"—a radical shift in usability and availability is needed; temporary(art)projects in Vienna2014, © Psenner

Amanda Burden, former director of the New York City Department of City Planning, knew "that the street is the barometer of the health of city life, and that every new development must have a dynamic connection with the street to ensure its vitality."[20] If the street is no longer considered just a supply facility, traffic spaces will again develop into attractive urban spaces affording users a quality urban experience and places to iden¬tify with. Restored to their proper urban functionality, they can become part of a coherent Stadtparterre again.

[19] Vestiges of this historical right are still present today in the fact that developers, upon completion of construction, have to provide at their own expense and in accordance with the specifications of the city administration a sidewalk, which is then made over to the city. Until today, the snow-clearing of sidewalks has also remained a responsibility ofbuilding owners.

[20] Nate Berg, "Interview: New York City Planning Director Amanda Burden," Oct. 6, 2006, http://www.planetizen.com/node/21476,February 28, 2015.

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reviewed paper

Study of the Relationship of Processes of Socio-Economic and Spatial Development of the City with the Help of Information and Analysis System Based on PROGNOZ Platform

Alexey Zavialov, Svetlana Maksimova, Kseniia Mezenina, Victoriya Petukhova, Didier Vancutsem

(Alexey Y. Zavialov, Perm National research polytechnic university, 109 Kuibysheva, Perm, Russia, gradcenter@mail.ru)
(Professor, Svetlana V. Maksimova, Perm National Research Polytechnic University, 109 Kuibysheva, Perm, Russia gradcenter@mail.ru)
(Kseniia O. Mezenina, Perm National research polytechnic university, 109 Kuibysheva, Perm, Russia, gradcenter@mail.ru)
(Victoriya Petukhova, Perm National Research Polytechnic University, 109 Kuibysheva, Perm, Russia, gradcenter@mail.ru)
(Professor, Didier Vancutsem, Universite Libre de Bruxelles, Chäftlarnstraße 10 Kontorhaus 2 - Büro 332, D - 81371 München, info@vancutsem.de)

1 ABSTRACT

Information technology has become the best direction in all branches of activity in developed and developing countries - from the optimization and automation of manufacturing industry to the electronic database for schools and universities, and urban planning sphere is no exception.

In Russia there is a comprehensive database of development areas – the information system for urban development (ISOGD). The main goal of ISOGD is to provide public authorities, local governments, individuals and legal entities with relevant and reliable information, necessary for the implementation of urban planning projects, investment and other economic activities. At the moment this data is not used for the analysis of urban areas and to support the adoption of urban planning decisions. In connection with this aspect, we have begun to develop a software product – information-analytical system (IAS). This analytical software combines overall socio-economic statistics, the data of the state cadastre of real estate, legal and regulatory framework of the federal and municipal level in the field of urban planning, GIS and PROGNOZ-PLATFORM software.

This article presents the results of research and practical work considering the case of Novye Lyady microdistrict, which represent a part of comprehensive test problem of functional development (public and residential functions) forecasting of the selected areas throughout urban territory.

Within this article the solution to the benchmark problem using the IAS and Perm ISOGD is shown: investigation the possibility of development consolidation taking into account the maximum feasible housing density.

2 INTRODUCTION

Looking at developed and developing countries today, information technology is best direction in all branches of activity - from the optimization and automation of manufacturing industry to the electronic database for schools and universities. Urban planning as a filed also has information support. In Russia, in Perm particularly, there is a comprehensive database of development areas – the information system for urban development (ISOGD). The objective of ISOGD is to provide public authorities, local governments, individuals and legal entities with relevant and reliable information, necessary for the implementation of urban planning projects, investment and other economic and general service activities, land-use system management.

ISOGD contains following information:

(1) Perm land use and development regulations;

(2) Regulation lines plans, boundary-setting plans and supporting data (the official title is «Area planning documentation»);

(3) State of exploration of natural and man-made conditions materials;

(4) The documents and materials of withdrawal and reservation of land for public use;

(5) Documents and materials about the built-up and prospective built-up plots;

(6) Geodetic and cartographic materials;

(7) The documents and materials on the provision of land for purposes not related to construction;

(8) Documents and materials of the state real estate cadastre;

(9) Documents monitoring processes of urban planning activities;

(10) Documents and materials of public hearings;

(11) Information and analysis materials on various aspects of the city of Perm and urban development activities [1].

Despite the fact that ISOGD is an extensive database of urban data, it is not used to analyze the built development, to justify urban planning decisions, to develop a strategy for the territory, due to the lack of analytical tools.

However, achievements of the last decade in the field of information technology in the world practice have contributed to the development of the urban environment analysis different methods integration (Space matrix, Space sintax, Mixed Use Index (MXI) [Y.Ye, A. Van Nes, 2014]) with geographic information systems to quantitatively describe and classify the spatial properties development and identify their relationship with the socio-economic processes.

Over the past two years, the author attempted to develop an analytical software tool - information-analytical system (IAS), which would allow the city to explore different processes in relation to the socio-economic development of the city [Maximova, Zavylov and other 2013].

The opportunities of BI-platform PROGNOZ-PLATFORM were applied as an analytical tool. The IAS database is formed to solve this complex problem and, together with the data of the municipal ISOGD includes federal, regional and municipal socio-economic statistics, the legal framework of the federal and municipal level in the field of urban development. Special software tool working with maps allows to analyze ARCGIS mapping data, contained in ISOGD.

This structure makes possible to collect and analyze data and to investigate the relationship of socio-economic and spatial development processes in the city.

Currently the IAS is tested through traditional town planning calculations, which are mandatory in accordance with federal and local regulations. This procedure will work to debug the IAS and verify the results received with its help. Data obtained with the help of the IAS is compared with calculations performed manually. Testing of the IAS is based on solving simple benchmark problems. First and the simpliest one, focusing on plot selection for the new school construction within Perm, was described in a study [5] based on approaches developed by A. Golovin [2013].

The problem considered in this paper is a part of comprehensive benchmark problem of functional development (public and residential functions) forecasting of the urban territory selected areas.

Fig. 1: General view of Novye Lyady

3 CASE STUDY

New Lyady – Perm remote residential area, was selected as an object of investigation area.

The area represents 40-50s development of the last century, therefore its layout was formed during the Soviet era with the fingerprints of the time: string development, 12 m fire spacing with number of storeys 1 to 5.

The bulk of the population lives in the multi-storey residential buildings neighborhood area, where all the schools, kindergardens, shops and the main objects of the cultural life of the village are located (Figure 1).

Currently, we plan to develop the area with an increase in the number of residents to 15 thousand people by 2020.

On the one hand New Lyady microdistrict has fairly simple and coherent types of layout, on the other – there is a real spatial development plan formed and approved for the area, so it was chosen as the most suitable for testing the IAS.

The verification was carried out on the multi-storey building typical '60s territory, where the buildings are located meridianally. Typology and building parameters for 5 quarters are shown in Table 1.

№ of block	**Number of buildings in the block**	**Building material**	**Number of floors (n)**	**Building height (H), m**	**Width of buildings (B), m**
1	5	Reinforced concrete panel	5	15,0	12,0
5	8	Brickwork	3	9,4	
17	4	Reinforced concrete panel	5	15,0	
22	1				
33	3				

Table 1: Typology and parameters of buildings in the blocks in Novye Lyady microdistrict

Fig. 2: The scheme of residential plots development marked in Table 3

The testing objective was to study the possibility of development consolidation within the block taking into account the maximum feasible density, established by the federal health standards. Method of calculation is set out N.S. Rusakova, V.A. Sosnowski [2006] and is based on a comparison of the maximum feasible current density and housing.

The maximum feasible density of housing (net) is determined by the conditions to ensure a standard insolation time for residential areas (not less than 2.5 hours per day from April 22 to August 22 for the northern zone (to the north of 58o north latitude), not less than 2 hours per day from 22 March to 22 September for the central zone (58o north latitude - 48o north latitude), not less than 1.5 hours per day from February 22 October 22 for the southern zone (to the south of 48o north latitude)) and ensure regulatory area of vegetation (the minimum area of open space should be not less than 6 meters per person).

Insolation is provided in compliance with the gaps (2H – between meridianal oriented buildings, H – between latitude oriented buildings), hence, if the building density P1 satisfies the inequation:

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$$P_1 \leq P_2 \quad (1)$$

$$P_2 = \frac{\sum BL}{\sum(B+2H)(L+1)}, \% \quad (2)$$

Where:

B – width of the building;

H - height of the building;

L – distance between the buildings;

Housing stock density P_1 is calculated according to the formula:

$$\Delta_{net} = \frac{10^4 \cdot m}{c + \frac{2m}{\alpha \cdot n}}, sq.\frac{m}{ha} \quad (3)$$

Where:

m – residential security rate (entered by the user or accepted by local regulations – 20 sq. m. for new development);

c - area occupied by vegetation (entered by the user or accepted by local regulations – 6 sq. m. per person);

α - coefficient characterizing the proportion of residential buildings of the total area of the square is taken, depending on the number of stores of the building;

n – number of stores.

The relation between n and α is given in Table. 2.

***n*, floors**	***α*, value**
2-5	0.59
6-30	0.53

Table 2: value of α

Limitary building density P_1:

$$P_1 = \frac{\Delta_{net}}{n \cdot \alpha \cdot 100}, \% \quad (4)$$

The values of the design parameters and target functions for the blocks indicated in Figure 1 are shown in Table. 3.

№ of block	Parameters							Values of the target functions for existing buildings	
	c	***m***	***α***	***n***	***B***	***H***	***S* *уч***	**P_1**	**P_2**
	sq.m/person	*sq.m/person*	-		*m*	*m*	*sq.m.*	%	%
1	6 (variable)	20	0.59	5	12	15	33553	34,66	35,71
5							16365	34,66	35,71
17							31932	34,66	35,71
22							16739	34,66	35,71
33				3		9.4	25195	39,51	45,98

Table 3: The values of blocks calculated parameters and target functions

With the use of ISOGD the IAS allows to determine the c value specifically for each quarter, which helps to accurately identify the reserves for construction consolidation or for open spaces land forming.

3.1 Algorithm of solving the test task

Parameters highlighted in Table 3 (c, m and α) are introduced into the calculation of the standard block of the IAS database tools.

Values c, B, H and Sq were obtained using carthographic data entered into the IAS from ISOGD. The boundaries of the districts were identified by the regulatory lines of Novye Lyady planning documentation. The IAS receives them from ISOGD database.

(1) Identification of existing and planned Δnet1 and Δneti density of housing, with variable values mi, ni, αi by the formula (3);

(2) Calculation of P1 (the formula (4) and P2 (2) at different values of parameters calculated;

(3) Comparison of objective functions according to the formula (1).

Using this algorithm Novye Lyady Area technical and economic indicators were defined in stages of development until 2030. The calculations have shown the possibility of consolidating buildings in some neighborhoods in the considered area for the planned by municipality main enterprise increase in the number of inhabitants in 2030 (Table 5).

Phase	№ of block	**Square of block**	**The volume of the existing residential development**, m^3	**The volume of the existing non-residential development**, m^3	**The volume of projected residential development**, m^3	**The volume of the projected social infrastructure**, m^3
1st phase	9	5975			14460	
	10	11862			20368	2036
	11	6340			14860	
	14	3789		100		1500
	15	52168				1000
	20	11571				
	21	2474				
	32	9396				
	35	1843				
1st phase sub-total		105418	0	100	49688	4536
2nd phase	6	4185				
	7	13923	11160			
	8	2888				
	16	33619		11508		15364
	17	31932	25315		12235	
	22	16739				
	31	6544		4509		1000
	34	17643	6605		10125	
	36	2596				
	38	41036		3100		1400
2nd phase sub-total		171105	43080	19117	22360	17764
3d phase (perspective development)	4	13997			20547	
	5*	16365	15048			
	12*	18629	18374			
	23	5558				
	25	19190	10210		7232	
	29	7222			2772	
	30	5363			5676	
	33	25193	23865		18085	
	37*	32195	22860			
3d phase sub-total		143712	60992		54312	

Table 5: Technical and economic parameters for projected residential and non-residential buildings. * Highlighted blocks are the blocks selected for verification.

The IAS interface for solving the village of Novye Lyady task shown in Fig. 3.

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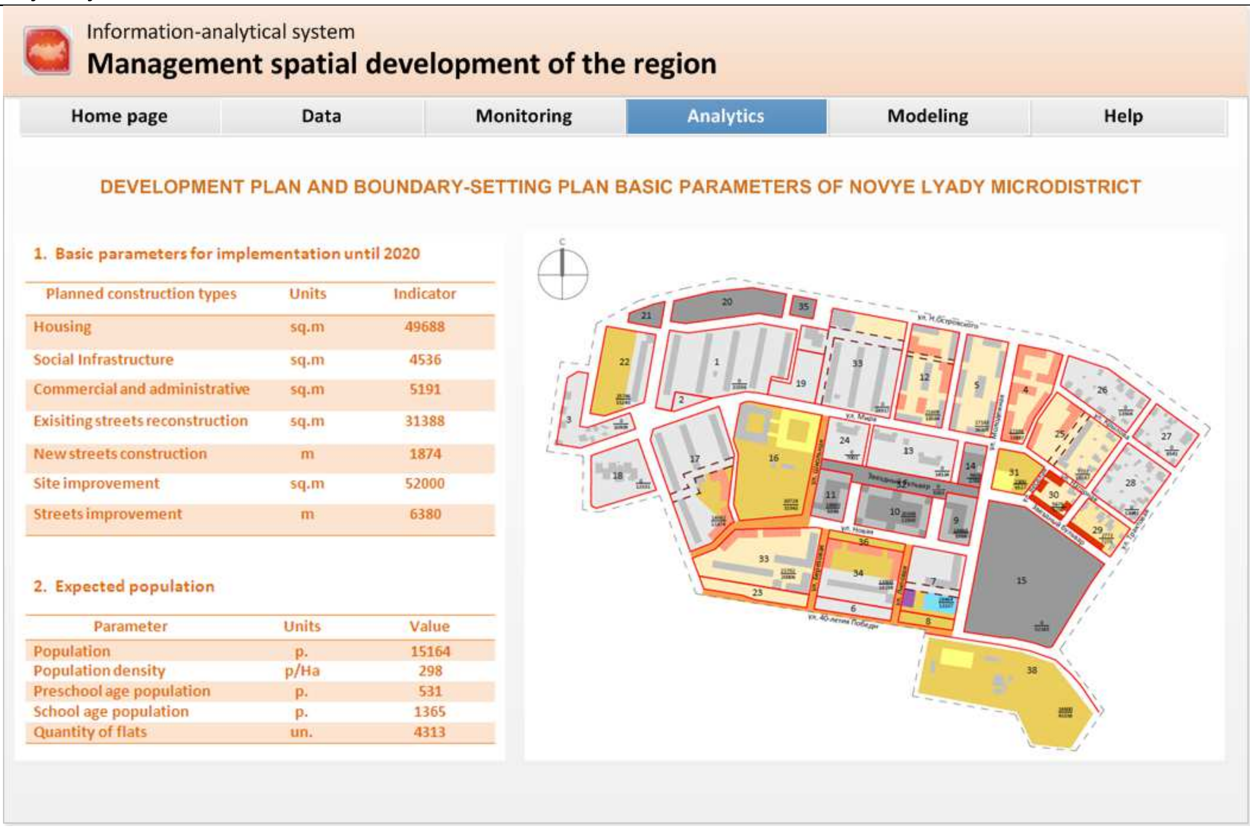

Fig. 3: Interface of technical and economic assessment in the IAS page

4 LIST OF ECONOMETRIC AND ADAPTIVE METHODS USED IN SOLVING THE TASK

1. Regression models:
1.1. Linear Regression (Instrumental Variables Estimation);
1.2. Nonlinear Regression (Nonlinear OLS Estimation);
1.3. Error Correction Model
2. Time Series Analysis:
2.1. Trend With Functional Dependency Estimation;
2.2. Smoothing Models (Median Smoothing, Exponential Smoothing);
2.3. X11;
2.4. ARIMA
3. Determinate Equation;
4. Panel Data Model;
5. System of Nonlinear Equations.

5 CONCLUSIONS

(1) The IAS is well compatible with ISOGD of Perm. The IAS decision subsystem has successfully used the built-in tools for test problem modeling to work with maps that support the following functions:

- Map scale change;
- Selecting an arbitrary region on the map;
- Map layers view;
- View information about objects on the map.

(2) Comparison of the results obtained in the IAS calculation and manually, showed a high reproducibility. The program works correctly and properly handles the data.

(3) Test problems showed the ability to analyze balance/imbalance function areas using the PROGNOZ-PLATFORM analytical framework.

(4) The practical result of the test problems solving is seen in the possibility for giving off land for the new housing allocation in the long term, as the sanitary quality of the old and new buildings is provided and there are reserves for consolidation the development.

(5) City planning documentation in chart form, as an integral part of ISOGD is good and, most importantly, affordable base for the comprehensive integrated platform of scientific planning of urban development creation. Created in the ArcGIS format, cartographic master plan materials (Land use and development regulations and Local standards of urban planning), if they represent an analytical tool like PROGNOZ-PLATFORM, can be used for spatial analysis and study of the interaction of processes of socio-economic and spatial development of the city.

6 ACKNOWLEDGMENTS

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The Role of Urban Gardening for European's Ageing Societies

Runrid Fox-Kämper

(Dipl.-Ing. Architect Runrid Fox-Kämper, ILS-Research Institute for Regional and Urban Development, Karmeliterstraße 6, 52064 Aachen, Germany, Runrid.fox-kaemper@ils-forschung.de)

1 ABSTRACT

This paper explores the functions of existing and emerging forms of urban gardening for European cities in times of social, economic, and climate changes with special emphasis on ageing societies. It is based on two research backgrounds: On the one hand it presents research results about living preferences of aged persons conducted by the ILS (Research Institute for Regional and Urban Development) and the IÖR (Leibniz Institute of Ecological Urban and Regional Development) in four German cities, thus exploring the needs of an ageing society where besides other factors the access to green space and the social functions of urban gardens can play an important role. On the other hand it presents results of a literature review about the social, economic and ecological functions of urban gardening in European cities and first results of the current COST (European Cooperation in Science and Technology) Action on the topic of "Urban Allotment Gardens in European Cities".

2 INTRODUCTION

European cities have to face relevant challenges such as societal, economic and last but not least climate change. Societal change in Europe is especially characterized by demographic changes, such as an ageing and shrinking population, a pluralisation of life-styles and an internationalisation of society. European Cities have to cope with these challenges in an integral approach. This paper connects the challenges for an ageing society with the revitalized phenomenon of urban gardening which is subject of an ongoing COST Action, titled "'Urban Allotment Gardens in European Cities". In this networking project scientists and stakeholders (e.g. members of garden associations or municipalities) from 30 European countries are co-working to improve the knowledge base about relevance of and challenges for urban gardening in Europe. Four research perspectives (urban development and policy, sociology, ecology, and urban design) are merged by an integral approach. Through cases studies presenting diverse types of existing and emerging urban gardens all over Europe central aspects are examined comprehensively, such as the spatial position of urban gardening between built environment and green infrastructure, its function within ecosystem services, or the role of urban gardening for social integration of people from different age groups, social status and ethnic origin.

The paper starts with an overview about major demographic trends in European cities, summing up empirical research about the future needs of the elderly population that gives strong evidence on required facilities to be provided in the proximate neighbourhood (section 3). Then it addresses the functions of urban gardening for future cities with relation to climate, economic and societal change and especially with reference to ageing societies, and illustrates the potential of urban gardening with examples from European cities (section 4). The conclusion (section 5) focusses on an integral approach which is crucial for the challenges of the European cities and points at open questions that need to be answered in further research.

3 WHAT DO WE KNOW ABOUT AGEING?

3.1 Major demographic trends in European cities

The world is growing, but Europe is in stagnation due to low fertility rates. The effects of low birth rates are clearly visible in peripheral rural areas like Northern Spain, SouthernItaly, in East Germany and in nearly all Eastern European countries. In some regions, this is compensated by a growing number of migrants from other European countries or from other regions in the world. While countries with higher fertility rates e.g. France, Ireland or Norway and sustained migration rate, continue to having enough inhabitants even in peripheral-rural areas. East Germany, Romania, Bulgaria and many other parts of Eastern Europe are going to be major population losers (Berlin Institute 2008).

What affects all European countries without exception is the ageing of their societies. The ageing quotient of many European countries will nearly double from 2013 to 2050 with an average rate around 50 by 2050 in Europe and countries like Greece, Portugal and Spain having to face a quotient higher than 60 (see Figure 1).

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From this perspective it is important to understand and foresee how this generation is willing to live and what their needs will be in years they are literally aged.

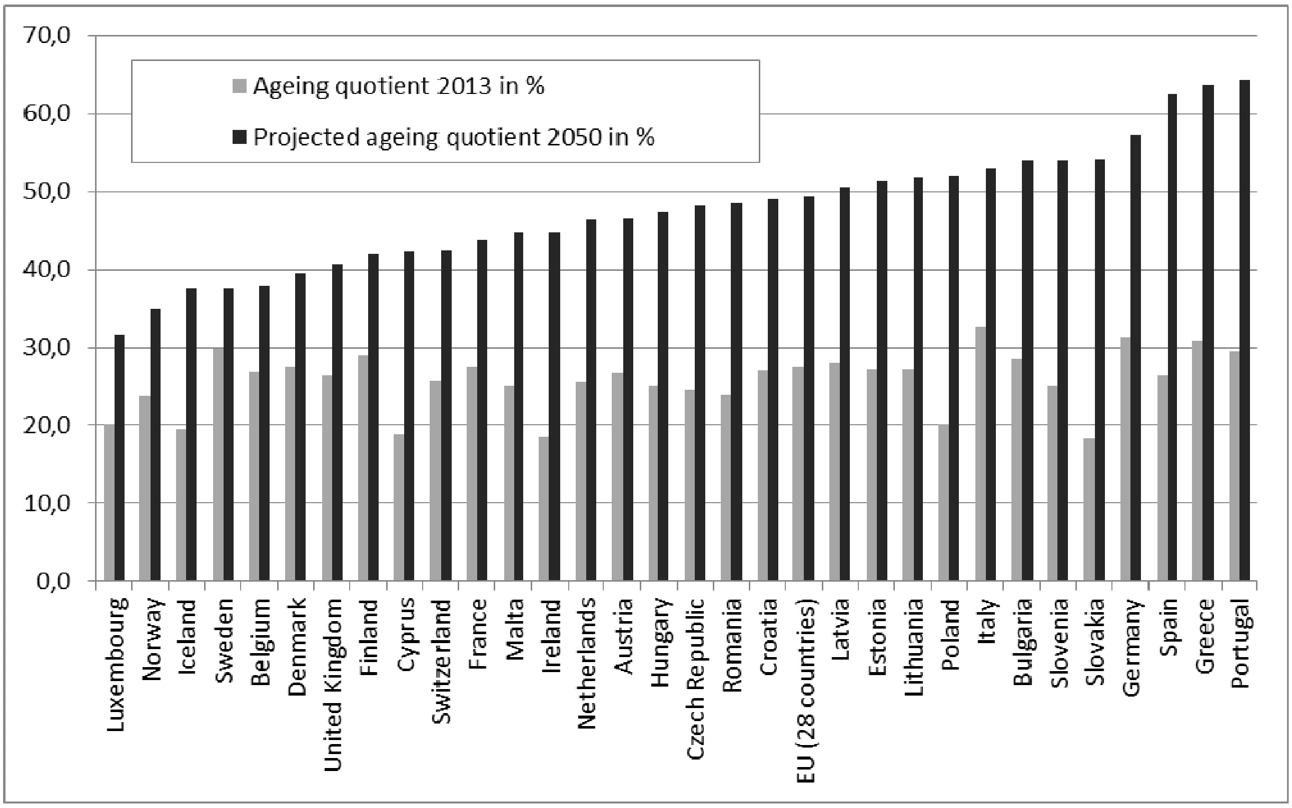

Figure 1: Ageing quotient in European countries in 2013 and projections for 2050. This indicator is defined as the projected number of persons aged 65 and over, expressed as a percentage of the projected number of persons aged between 15 and 64. Source: Author on the basis of Eurostat Population Projections 2010-based (Eurostat 2010)

3.2 Results from a survey about living preferences of aged persons

There is strong evidence that the most preferred form of living for elderly people is to stay in a familiar environment (Krings-Heckemeier et al. 2001; Kremer-Preiß et al. 2003). A survey conducted by the ILS (Research Institute for Regional and Urban Development) and the IÖR (Leibniz Institute of Ecological Urban and Regional Development) in four German cities (Dortmund, Dresden, Döbeln, Arnsberg) between 2007 and 2011 amongst persons aged 60 and older, confirmed this (Banse et al. 2014). In total 15,550 persons aged between 60 and 90 were asked to participate, and 4,769 evaluable questionnaires (round 30 %) were returned. Most of the respondants lived already for decades in their house or flat; in Dortmund on average since 28 years. 65 % of the respondents in Dortmund stated that they intended "not to move at all" (questionnaire) although on average only 3 % of the flats had barrier-free standards according to the evaluated answers of the respondents.

In the survey it was also asked which characteristics of the living situation were regarded as very important by aged persons (see Figure 2). It is quite interesting that the respondents claimed "safety in the house" as most important, followed by the characteristic that the "flat has got a balcony or terrace". This can be explained by the fact that older people increasingly reduce their radius of action. Quite astonishing is that many of the issues which were mostly addressed as being very important by a broad majority are not located within the flat but in the environment of it: "nearby medical support", "nearby shopping facilities", that the "house has green space", a "quiet house", a "quiet neighbourhood", "green space or park in walking distance". Items that refer to standards that are usually identified as age-friendly living ("care in case of illness", "SOS telephone", "elevator") were not chosen predominantly. Staying active when the person is aged obviously affords more than a barrier-free flat with an elevator.

Amenities offered in the neighbourhood and access to green space nearby seem to be important premises to age in place. Regarding the diversity of urban forms of living, suburban neighbourhoods - the most popular form in the last century – are predestinated to face severe problems in an ageing society. "The attributes of the single-family house are becoming obstacles to aging well in place, with the distance from shops and services and the lack of walkability" (Dunham-Jones 2012).

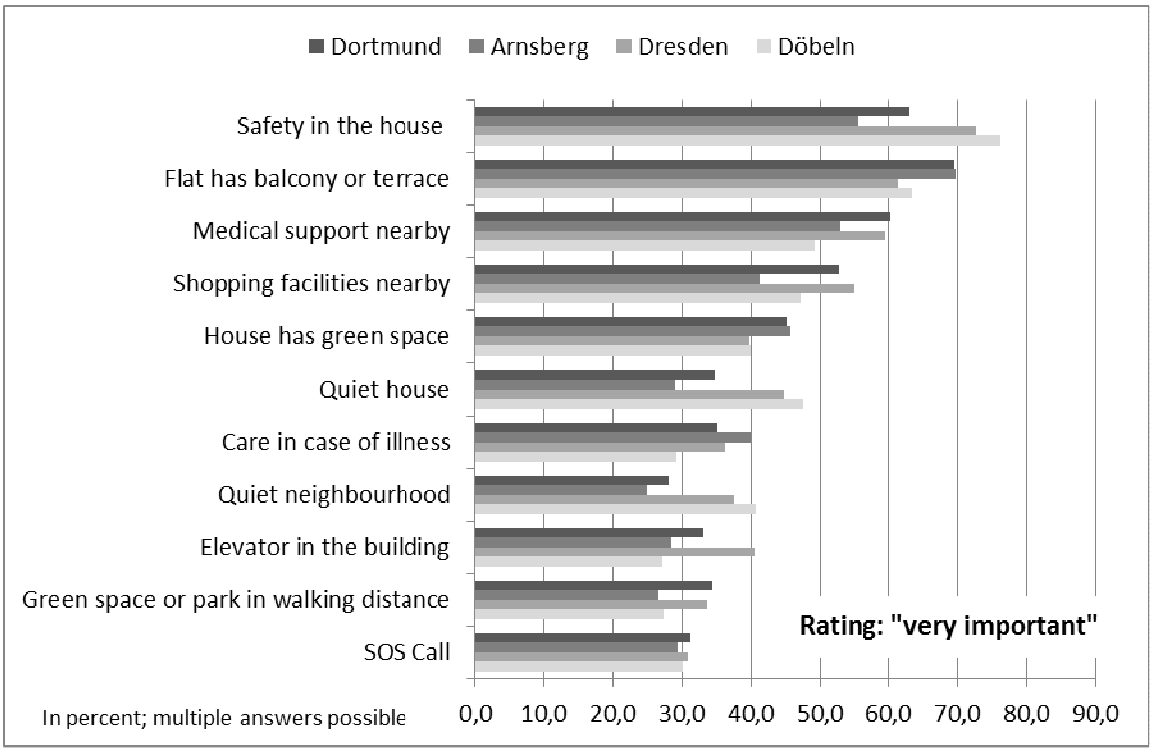

Figure 2: Results of a survey of persons aged 60 and over, conducted in Dortmund, Arnsberg, Dresden and Döbeln; Germany by ILS and IÖR; characteristics of living situation regarded as "very important"; Source: Author on the basis of Banse et al. 2014: 112)

This could be confirmed by a further research project carried out by ILS in cooperation with IREUS (Institute of Regional Development Planning, Stuttgart) and the Hochschule für Technik, Stuttgart which explored the future of mature single-family housing estates in Germany (Berndgen-Kaiser et al. 2012, Berndgen-Kaiser et al. 2014). Alongside other research methods a survey was conducted to get insights into the perception of residents on the advantages and disadvantages of living in a suburban neighbourhood (Berndgen-Kaiser and Fox-Kämper 2012a). The lack of public transport facilities, shopping opportunities and public areas for leisure were addressed as disadvantages especially by older residents in single-family housing areas.

Conclusions from these surveys are not easy to draw as the increasing differentiation of life-styles affects the older population also. In future, the elder population will consist of a diversity of cultures, ethnic origins, and living preferences, and in addition, different sub-groups of ageing have to be considered. In general, most people in their first years of retirement are still very active and able to care for themselves. However, from the age of 80 onwards, serious physical and mental diseases generally accumulate. Research on ageing sub groups refer to these different groups as the "young old," the "old", and the "old-old" groups (transgenerational.org). As a result, planning for age-friendly cities cannot follow a unique pathway but has to take into account diverse living preferences.

3.3 Age-friendly cities as cities for everyone

The World Health Organisation´s guide for global age-friendly cities has aims at engaging "cities to become more age-friendly so as to tap the potential that older people represent for humanity" (WHO 2007: 1). It identified eight topics that have to be addressed "to give a comprehensive picture of the city's age-friendliness" (ibid: 9): outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication and information, and community support and health. The report states that "the outside environment and public buildings have a major impact on the mobility, independence and quality of life of older people and affect the ability to age in place" (ibid: 12).

Taking into account that ageing is a life long process that starts from birth, that cities need to be attractive not only for aged persons, but for all generations such as young inhabitants and families with children, and being aware of the fact that the differentiation of life styles affects also the old generation, it can be stated that age-friendly cities are liveable cities for everyone if they meet all needs in integral approach. "Beyond the direct development of services for an ageing population, there is also a need to look at the mix of the whole population. The cities of tomorrow will have to not only ensure that the elderlies are well integrated in society, but also be attractive in terms of quality of life and opportunities for young people, not least young families." (European Commission 2011: 96). And this is where urban gardening can play an important role, as the importance of having access to green spaces is acknowledged as "one of the most commonly mentioned age-friendly features" (WHO 2007: 12).

The benefits of gardening for society and and for aged persons especially are highly acknowledged (e.g. Van den Berg et al 2010). Wang and Macmillian (2012) conclude after a review of publicatons and studies dealing with this issue that "gardening is enjoyable for older adults and that it benefits overall quality of life, physical ability, and activeness." (Wang and Macmillian 2012: 175). They emphasize the fact that gardening is a desirable activity for both: older adults who are healthy and older adults with functional or cognitive limitations, as "growing plants, fruits, and vegetables of one´s choice can be a way of allowing individuals to remain connected to their family, community, and cultures" (ibid: 179). Thus, gardening provides opportunities for social interaction, supports intergenerational exchange, and has the potential to meet the mentioned living preferences of all generations, but especially of aged persons, the more if the garden sites are located in proximity of residential areas.

4 THE ROLE OF URBAN GARDENING FOR FUTURE CHALLENGES IN EUROPEAN CITIES

4.1 What is urban gardening?

Before the role of urban gardening for future challenges in European cities and especially for the ageing society can be discussed in detail, it is necessary to explain what can be understood under the term "urban gardening". There is no unique definition available, but it can be stated from literature review that urban gardening does not exclusively focus on food production. It also includes the experience of horticultural activities and recreation. Urban gardening regularly is regarded as a part of urban agriculture as the broader term which encompasses all forms of food production within or in a narrow spatial and functional relation to cities (RUAF Foundation). Urban gardening occurs in different types according to objectives, function, spatial context, user groups, legal status, location, accessibility.

The classical form of urban gardening are *allotment gardens* (see Figure 3), which consist of privately managed garden plots, governed by allotment garden associations, often on land owned by the municipality. They "primarily originated as a response to food shortages during the transition from feudal agrarianism to uran industrialism" (Colding and Barthel 2013: 160). Today, in many countries allotment gardens are institutionalised, protected by planning law, and in addition, special laws.

Figure 3 (left): Typical plot in allotment garden in Poznan, Polan; photo: Author. Figure 4 (right): Community garden Palagino in Hannover, Germany; photo: Martin Sondermann

Community gardens (also called neighbourhood gardens, intercultural gardens) often were developed following examples of community gardening in New York in the 1970s. They often use derelict sites such as brownfields, or underused parks, and many of them emerge as bottom-up initiatives (see Figure 4). Usually no general framework exists, and their perspective as interim-use on vacant plots the perspective is short- or mid-term. Due to the poor quality of soil on the former brownfield, raised beds are quite common in community gardens. Other forms of urban gardening e.g. are *rooftop gardens* or the *edible city* concept.

4.2 The benefits of urban gardening

European cities have to face relevant challenges (summarised e.g. in European Commission (2011)). Climate change affects European cities with phenomena like urban heat islands or heavy rainfalls. Economic change goes together with globalisation and the international division of work that takes effect on spatial configurations. Societal change in Europe encompasses in particular the well-known demographic change with phenomena such as ageing, internationalisation and partly decline of population. Related to these challenges urban gardens can provide several benefits, such as water household regulation, enrichment of biodiversity and air quality improvement, urban generation of derelict areas and food production, social cohesion and education.

The *ecological functions of urban gardening* are highly acknowledged in literature (summed up in Lovell 2010). In many papers it is suggested that urban gardening reduces the carbon footprint, contributes to carbon storage and sustainable waste management through re-use and composting, It also is proposed that urban gardening contributes to tackling of climate change by regulating the water household and providing green space for temperature regulation, and that it protects and enriches the habitat (Gomez-Baggethun et. al 2013). It is obvious that urban gardens are part of the urban green infrastructure, thus research that highlights the role of green infrastructure for the eco-system in general can be assigned to urban gardens, although there is only few empirical evidence for the described manifold ecological benefits of urban gardening in particular. The importance of allotment gardens for the pollination of urban areas has been confirmed in some research according to which their specific management practices and social structures that are favorable for the growth of bumblebee populations (Andersson et al. 2007). Other research results suggest that the typical plant and soil characteristics in urban gardens support the water retention and thus retard floods after heavy rainfalls (Edmonson et al., 2014; Watts and Dexter, 1997).

Economic aspects of urban gardening are most commonly connected to food production. A retrospective consideration of the role of urban gardening in different European countries confirms that urban gardens served as source for food supply, especially in different contexts of economic crisis, for instance during the World Wars or in times of food shortages in East European countries (Colasanti et al. 2012). E.g. in the British history of allotments the “Dig for Victory” campaign in World War II played an important role to raise food production rates by providing allotment plots even in public parks (Hope and Ellis 2009). At times of economic growth the aspect of growing own food is getting less important. In UK, the number of allotment plots decreased from 1.4 million in the 1940s to an “insufficient supply of about 200,000 allotments” at present (Hope and Ellis 2009: 12). Research results in Germany (Buhtz et al. 2008; Breuste 2007) showed that in large cities there is a continuous high demand for allotment gardens with a simultaneous competition of other kinds of land use while in shrinking regions a declining demand and partly a vacancy of plots can be noted. Especially in cities with shrinking population urban gardening can contribute to urban regeneration. In contrast to countries with a long history of urban gardening, in most Southern European countries urban gardening had no tradition, is not regulated and not recognized in urban master plans. Here the recent financial crisis led to the emergence of urban gardening initiatives from 2008 onwards (see Figure 5).

Upcoming community-, guerrilla-, intercultural- or neighbourhood gardens in many countries are a response to recent urban crisis and an expression of a growing interest in “green activism” (Rosol 2010). To sum up economic benefits, it can be stated that urban gardening helps to transform abandoned urban sites, supports local identity and place-making, furthermore it can contribute to lower costs for municipalities and gardeners, as it reduces public maintenance costs, supports a healthy living and feeds people (Been and Voicu, 2006).

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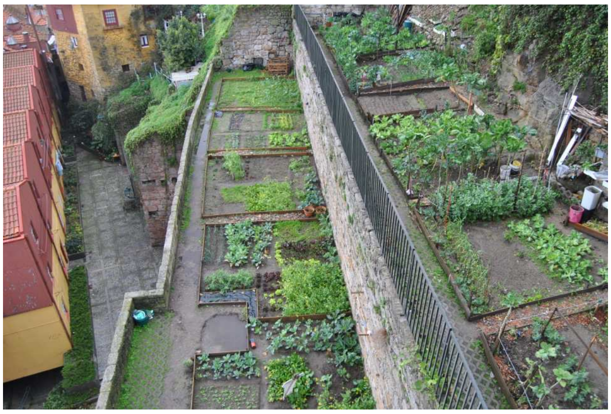

Figure 5 (left): Allotment plots on vacant land in the dense urban fabric of Porto, Portugal; photo: Sandra Costa. Figure 6 (right): Space for interaction in community garden "Prinzessinnengärten", Berlin, Germany; photo: ILS

Social cohesion, interaction and community building are often described in research findings about *social benefits of urban gardens* (Armstrong 2000; Guitart et. al. 2012). Research results highlight the importance of access to green infrastructure in the direct neighbourhood in general (Ferres and Townshend 2012; Grahn and Stigsdotter 2003, Ellaway et al. 2005, Martin and Marsden, 1999) and state that having or participating in an urban garden (Smit 1996; Stocker and Barnett, 1998) may improve the health of users and especially of aged persons. Van den Berg et al. (2010) who provided empirical evidence for health benefits of allotment gardens stress the potential contribution of urban gardening to an active, healthy lifestyle, especially among the elderly.

People have different reasons to practice urban gardening. For example the Capital Growth Strategy by which 2012 new community food growing spaces should be set up in London from 2008 up to 2012 (Capital Growth 2013) states in its assessment report that "Capital Growth spaces have helped to bring together different cultures and generations and contributed to bridging the divides between different ethnic, socio-economic and age groups" (Capital Growth 2013: 11). Assessment results pointed out that 71 % of people have made new friendship with someone in the neighbourhood and that in 66% of the sites people aged 60 and older are engaged (ibid). Especially in the developed societies of Europe urban gardening can be a catalyst for social amelioration. (Caputo 2012). Urban gardens allow recreational activities for different life-styles and, what is important especially for aged persons, they offer this often in the proximity of the dwellings. Being important space for interaction and communication and thus for integration of minority groups or people living alone, urban gardens offer a place to be (see Figure 6).

4.3 Implications for Practice

Although urban gardens are highly appreciated in public debate for their various contributions to social cohesion and a sustainable development of liveable urban environments, their position in cities is not always secured and local politicians and planning authorities still feel insecure how to support them. From the perspective of urban development the question arises how municipalities can use urban gardening as a tool to requalify deprived neighbourhoods and to meet needs of a changeing society. The following section demonstrates with examples from *France, Lisbon* and *Barcelona* how this is done practically.

As an answer to the decreasing demand of classical allotment plots and to approach new user groups, the *French Federation of Allotment Gardens* (FNJFC) developed two new approaches.

Firstly, they developed a concept to turn underused lawns between multi-storey family dwellings in suburban districts into so called open allotment gardens. One example is located in Aulnay-sur-Bois, in the North of Paris and is called *Les Jardins du Zéphyr*. In past times the open spaces between the dwelling blocks were degraded and covered with rubbish thrown from the windows. The requalification of the area began with the creation of a green space which included an allotment garden between the dwelling blocks. Individual small plots are cultivated by dwellers. living in the surrounding blocks. Neighbours can walk through the site where they can have a chat with the plot holders. There are benches along the alleys and playgrounds for the children. Residents are now taking advantage of a greener area, growing own food and enjoying the experience of nature (see Figure 7).

Figure 7 (left): Allotment garden “Les Jardins du Zephir” inserted in a social housing neighbourhood, Aulny-sur-Bois, France; photo: Town of Aulnay. Figure 8 (right): Raised beds and beds for persons in wheelchairs inside an allotment gardens site in Quetigny, France; photo: Hervé Bonnavaud

Secondly, the federation promotes the concept of *jardins partagé*s (shared gardens) in existing allotment sites, in which each member is given a small plot (20 - 30 m^2), and which includes plots for groups such as school children, or for disabled people, or unemployed people for which group gardening is used as a social therapy. Special emphasize is given to the provision of facilities for aged or disabled persons.Thus raised beds or special beds for persons in wheelchairs are provided that facilitate or enable gardening in a sitting position (see Figure 8)

Lisbon´s Green Masterplan of 2007 encompassed a wide range of measures and improvements to meet to constant loss of inhabitants by improving the ecological quality of the environment. Within this masterplan the city has developed a specific programme for promoting urban allotments as a new use for green parks and gardens replacing spontaneous and disorganized illegal land-use. On the whole the Urban Allotments Parks Programme intends to implement more than 20 urban allotment parks until 2017. Some of them seem to be of very large scale, such as Chelas Valley with almost 220 parcels (see Figure 9). It is located in a valley at the bottom of a social housing neighbourhood where most of the plot holders come from as the principal criterion for getting a contract is the proximity of the dwelling place. Many of the plot holders in the new urban allotment parks are aged persons (see Figure 10).

Figure 9 (left): New allotment park “Chelas Valley” in Lisbon, Portugal; photo: Author. Figure 10 (right): Leisure time in new allotment park “Granja” in Lisbon, Portugal, photo: Author

Although *Barcelona* is one of the the most densely populated cities in Europe urban gardening had a long tradition, but the fast developments of built infrastructure provoked a decline of gardens in the city since the mid twentieth century. Since the late 1990s, urban gardening has started to revive, through both: municipal (top-down) and informal (bottom-up) initiatives. Recently the Barcelona City Council has included urban gardens in its Barcelona green infrastructure and biodiversity plan 2020, and since 1997 it launches a programme that offers organic gardens especially to persons aged 65 and over. 14 garden sites have been developed since then. Parallel 13 “informal” gardens established through bottom-up processes by different social movement and associations, organized in a network of communitarian gardens (Calvet-Mir 2014).

These three examples demonstrate how public authorities or garden organisations managed to integrate urban gardening in planning processes. Examples from France show that classical form of allotments can be

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adapted to new and changeing user groups that need perhaps smaller plots, plots that are used commonly, or different kinds of beds that e.g. support gardening as aged persons. The examples from Lisbon and Barcelona give some evidence that urban gardening can be a successful part of programmes aiming at improving the liveability of the city for aged persons (but not only for them), if it is connected to other green infrastructure.

It is most important that urban planners or other stakeholders recognize urban gardening as an integral part of the city, the urban green infrastructure and urban neighbourhoods, and thus integrate it in urban planning. For meeting needs of bottom-up initiatives public authorities need an appropriate governance structure, which is based on a positive attitude towards civic gardening projects and open-mindedness.

5 CONCLUSION

Europe´s cities are affected by the ageing of their inhabitants. There is a rich body of research and practical guidelines aiming at the implementation of barrier-free standards in flats, buildings and other physical structures, and in addition, ICT technologies promise smart tools that enable ageing in place (ambient assisted living). The importance of barrier-free standards is acknowledged, but there is also some evidence that staying active as aged person affords more than a barrier-free flat with an elevator. The provision of amenities for daily living and social infrastructure in the neighbourhood and the access to green space are recognized as central aspects in empirical studies that reflect living preferences of aged persons (cf. section 3). This has to be considered by public authorities, urban planners, housing societies and others who want to enable a healthy ageing in place.

The ecological, economical and social benefits of urban gardening have been described manifold (cf. section 4). Especially in neighbourhoods with disadvantages urban gardening can improve local climate and enrich habitat, help to transform abandoned urban sites and thus support local identity and place-making. And, even more important, urban gardens in neighbourhoods are places for social cohesion, interaction, and for integration and thus provide space for different life styles, generations and ethnic groups. As urban allotment or community gardens often are located within or near residential areas, they allow recreational activities in proximity of flats, which is important especially for aged persons. In this respect both, existing classical form of allotment gardens as well as emerging forms, offer a lot of opportunities for the ageing society.

Albeit these benefits the potentials of urban gardening in general and the opportunites different form of urban gardening offer for the needs of an ageing society are not recognized enough by public authorities in many European countries. Local planners need both: a willingness to integrate urban gardening in urban planning (top-down) and an open mindedness to develop a positive attitude towards gardening projects (bottom-up). Although from a social perspective some encouraging examples can be studied regarding urban gardening areas successfully coping with downgrading neighbourhoods, it must be stated that the role and contribution of urban gardening for the regeneration of urban neighbourhoods on long-term and the development of supportive governance structures need further research.

Europe´s cities have to meet challenges arising from societal-, economic- and climate change. Concerns about the environment, uncertainties related to the economic development and the society in general trigger a new interest in gardening. The integration of urban gardening in urban neighbourhood and the green infrastructure of the city offers opportunities to meet these challenges, especially with regards to the ageing societies.

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Towards Interactive Geodata Analysis through a Combination of Domain-Specific Languages and 3D Geo Applications in a Web Portal Environment

Christian Malewski, Jens Dambruch, Michel Krämer

(Christian Malewski, Fraunhofer IGD, Fraunhoferstraße 5, 64283 Darmstadt, Germany, christian.malewski@igd.fraunhofer.de)
(Jens Dambruch, Fraunhofer IGD, Fraunhoferstraße 5, 64283 Darmstadt, Germany, jens.dambruch@igd.fraunhofer.de)
(Michel Krämer, Fraunhofer IGD, Fraunhoferstraße 5, 64283 Darmstadt, Germany, michel.kraemer@igd.fraunhofer.de)

1 ABSTRACT

Urban planning processes affect a wide range of stakeholders including decision makers, urban planners, business companies as well as citizens. ICT-enabled tools supporting urban planning are considered key to successful and sustainable urban management. Based on previous work in the areas of web-based participation tools for urban planning, rule-based geospatial processing as well as 3D virtual reality applications we present a tool that supports experts from municipalities in planning and decision making but also provides a way for the public to engage in urban planning processes. The main contribution of this work is in the combination of 3D visualization and interaction components with a new ontology-driven rule editor based on domain-specific languages. The 3D visualization, on the one hand, enables stakeholders to present and discuss urban plans. On the other hand, the rule editor particularly targets expert users who need to perform spatial analyses on urban data or want to configure the 3D scene according to custom rules. Compared to previous approaches we propose a portable and interactive solution. Our tool is web-based and uses HTML5 technology making it accessible by a broad audience.

2 INTRODUCTION

Involving stakeholders such as planners, architects, politicians, analysts, and citizens in urban planning is a challenging process. Today the demand from the public to influence major urban planning projects is growing. Internet-based communication facilities like social media or blogs are already popular for the discussion of urban planning projects by engaged citizens. Integrating these communication channels with a virtual reality application can help stakeholders to understand proposed actions as well as to illustrate anticipated impacts to a broader audience.

The idea to use 3D virtual reality for participation processes has been described before (Doyle et al. 1998, Al-Kodmany 2002, Zhang et al. 2007). However, broad application was not reached up to now due to the required specialized software and hardware such as costly 3D workstations and CAD expert software or CAVEs[1] for immersive virtual reality experiences, for example. 3D design and CAD software applications were mostly used to prepare printed posters or planning screenshots for special occasions. Albeit these techniques provide excellent visualization solutions they lack in portability and data interaction functionality, as it is common in GIS software.

With the availability of WebGL[2] technology it is possible to render 3D content in a web browser without the need for additional plugins. Based on this, technologies such as X3DOM (Behr et al. 2009) were developed to bring declarative 3D content to the browser and to manipulate it through a common JavaScript API. These features provide a new level of direct interaction with 3D geodata for analysis and feedback on planning proposals in a web browser.

Dambruch and Krämer (2014) report on an interactive web-based portal for public participation. Their solution can be customized with the mouse by dragging components on the screen or moving and rotating objects in the 3D visualization. Krämer and Stein (2014) describe a different approach based on a graphical rule editor allowing basic processing steps to be composed in order to automate geodata processing and in particular to customize 3D visualization. In this paper we combine these two approaches to provide a 3D web application that can be customized through a textual Domain-Specific Language (DSL). A DSL is a special textual programming language that is targeted to specific use cases or application domains. It aims at being easy to learn, understand and use for domain users. We use a DSL in a rule editor that allows users to perform spatial analyses and to customize the 3D web visualization through textual rules. The editor is

[1] CAVE: a cave automatic virtual environment, a highly immersive virtual reality 3D environment for people to step in
[2] https://www.khronos.org/webgl/

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ontology-driven and links concepts used in the geospatial data and the 3D scene to the urban planning application domain.

Our tool is customizable on two levels:

- The components in the web portal can be configured to target multiple applications. They can even be moved on the screen or hidden if they are not necessary for a specific use case.
- The rule editor enables customization and interaction with geospatial data and the 3D visualization.
- Altogether this enables municipalities to provide a tool that can be used in urban planning and public participation processes in multiple ways:
- The 3D visualization can be used to present urban plans to all stakeholders including decision makers and the public. In this case, our portal can be configured to hide complex components such as the rule editor to avoid confusion. Instead we rely on the interaction elements provided by the web portal to allow users to focus on urban plans, to discuss them, and to provide feedback.
- Similarly, our portal can be configured to target expert users such as urban planners who need to perform spatial analyses and who want to prepare the presentation of the urban plans to the public. In this case, the rule editor can be used to augment geospatial data with semantic metadata and to configure the 3D visualization based on this metadata.

The remainder of this paper is structured as follows. We first discuss related work and then describe our approach as well as an example use case. After this, we present technical details of our ontology-driven rule editor and domain-specific language. The paper concludes with a final discussion and gives some aspects for future work.

Since an approach for a 3D web portal for public participation has been described in detail by Dambruch and Krämer (2014) we particularly focus on the aspect of the rule editor and the DSL. We summarize their approach in section 2on related work.

3 RELATED WORK

As described above, virtual reality applications for public participation have been presented before. Al-Kodmany (2002), for example, evaluates eight visualization tools (four traditional and four computerized) for their fit for urban planning and public participation. Al-Kodmany concludes that traditional and digital tools are equally important, but the digital ones provide additional means, resources and information. Doyle et al. (1998) describe the possibilities of the World Wide Web (WWW) for visualization, modelling and analysis of urban environments. Their idea is that the WWW provides a platform for a wide range of users including planners, infrastructure managers, and citizens to access and discuss urban designs, local plans, etc. A similar approach is taken by Zhang et al. (2007) who present a Distributed Virtual Geographic Environment which is a web-based collaborative platform including a 2D and 3D visualization of geospatial data.

Although the usefulness of virtual reality and web-based visualization has been recognized, previous work has typically required special 3D hardware and software such as browser plugins or Java3D. These requirements have prevented broad application. In order to eliminate these issues Dambruch and Krämer (2014) present a web-based portal for public participation (see Figure 1). Their solution consists of a 2D map, a 3D visualization as well as other components necessary for public participation such as a forum, a feedback panel, and a questionnaire component. Their web portal is highly configurable and can be adapted to different use cases. Dambruch and Krämer specifically focus on urban planning scenarios and demonstrate how their tools can be used to present construction plans (e.g. new buildings or refurbishments) to the public, to allow stakeholders for commenting plans and to vote for different variants. Dambruch and Krämer describe each component of their portal in detail and put major focus on portability and interactivity. For example, their portal includes tools to interactively place new buildings in the 3D scene, to move and rotate them, and to create textual annotations in a 3D scene. Their solution is particularly targeted to decision makers and stakeholders from the public. However, it lacks advanced GIS functionality required by expert users such as urban planners.

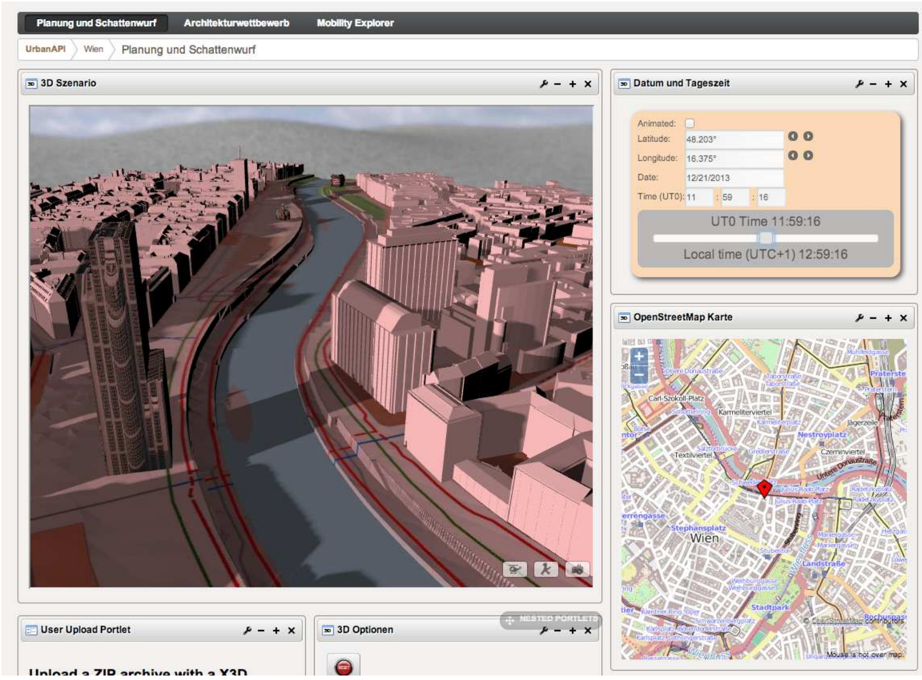

Figure 1: Screenshot of Dambruch and Krämer's web portal for public participation

Krämer and Stein (2014) target the issue from another point of view and describe a graphical rule editor that is embedded in a desktop 3D GIS application. Their editor provides basic geospatial functions that can be arranged by expert users to form complex spatial processing workflows. Krämer and Stein make use of an ontology-based domain analysis method to identify necessary functions. In doing so, they create a graphical DSL that is targeted to the 3D geospatial domain. Krämer and Stein demonstrate that they can use their DSL for the processing of spatial data (in particular 3D city models) and to customize the 3D visualization.

In this work we build on the previous work and combine the web portal presented by Dambruch and Krämer with the means to annotate spatial data and customize the 3D visualization through a DSL based on the idea by Krämer and Stein. In the following section we describe our approach for using micro-ontologies as basis for DSLs and how this approach has been applied within the context of a research project.

4 OUR APPROACH

In the urbanAPI project[3] several ICT applications were developed addressing urban planning issues, in particular a 3D scenario creator application which makes (3D) geodata available in a web portal environment. urbanAPI was an international research project running from October 2011 to November 2014 funded by the European Commission from the 7th Framework Programme. In urbanAPI the CityServer3D[4] technology was used to prepare, fuse and maintain datasets for the use in the portal. The portal itself is based on Liferay[5], an open source JavaEE portal software and X3DOM[6] for displaying and interacting with 3D data.

The web portal is the framework to provide the set of applications. In addition to that, a development model allows for creation of several reusable components that can be configured to fit in an intended use case context. In Figure 1 an example of such a component arrangement is given: a 3D visualisation component displays a 3D city model and provides direct interaction with the model. To the lower right a 2D map display provides better orientation and is synchronised with the position in the 3D scene. Additional components can be placed on the page as needed for example to do shadow analysis on the 3D model. The direct interaction happens through mouse clicks and dragging in the scene, for example placing annotations or moving objects.

During the course of the urbanAPI project several challenges were identified, especially regarding geodata analysis for different target groups. For GIS expert users analysis tasks on geospatial data are common and

[3] http://www.urbanapi.eu
[4] http://www.cityserver3d.de
[5] http://www.liferay.com
[6] http://www.x3dom.org

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straightforward but they need to deal with a lot of issues on the technical level. They are fluent with both, the technology driven vocabulary, which uses terms like Feature, TerrainGrid, Layer, etc., and the user vocabulary, which may use terms like Street, Quarter, River, etc. Decoupling the user vocabulary from the technical vocabulary allows for focussing on the use case rather than working on a technical level. Further on, analysis tasks become manageable by users with less GIS experience. In order to formulate textual rules a language specification is required. We define our language based on the concept of DSLs (Fowler 2010). DSLs have been applied successfully within the urbanAPI project for data preparation and policy modelling (Krämer, Ludlow, Khan 2013).

Figure 2 sketches the resulting prototype that builds upon the urbanAPI framework with the textual editor on the left and the 3D scene on the right. It interprets the specified rule statements and executes them on the underlying geodata. The users work with their vocabulary and do not have to take care about the technical data models. The following sections describe the application use case and detail requirements on the data and the implementation.

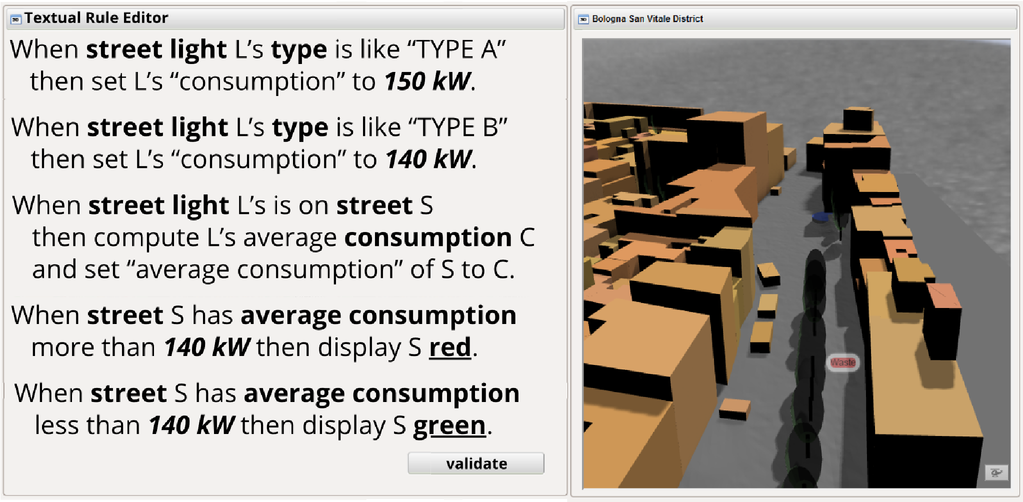

Figure 2: Combination of textual rule editor component with the 3D visualization component

4.1 Application use case

As a working example consider the following use case from the urban planning domain: in a city district street lights should be analysed by their energy consumption. In the city there are three different street light types installed. The street light type is stored to the data. Streets with a high energy consumption average should be highlighted. The following rules written in our DSL describe the analysis steps:

(1) When street light L's type is like "TYPE A" then set L's "consumption" to 150 kW.

(2) When street light L's type is like "TYPE B" then set L's "consumption" to 100 kW.

(3) When street light L's is on street S then compute L's average consumption C and "average consumption" of S to C.

(4) When street S has average consumption more than 140 kW display S red.

(5) When street S has average consumption less than 140 kW display S green.

In the first two statements the consumption of street lights of a particular type are set to their respective values. Statement 3 computes the average energy consumption of lights on a street and adds it as an attribute to the respective street. The last two statements categorise streets by their average consumption and colourize them accordingly (Figure 3).

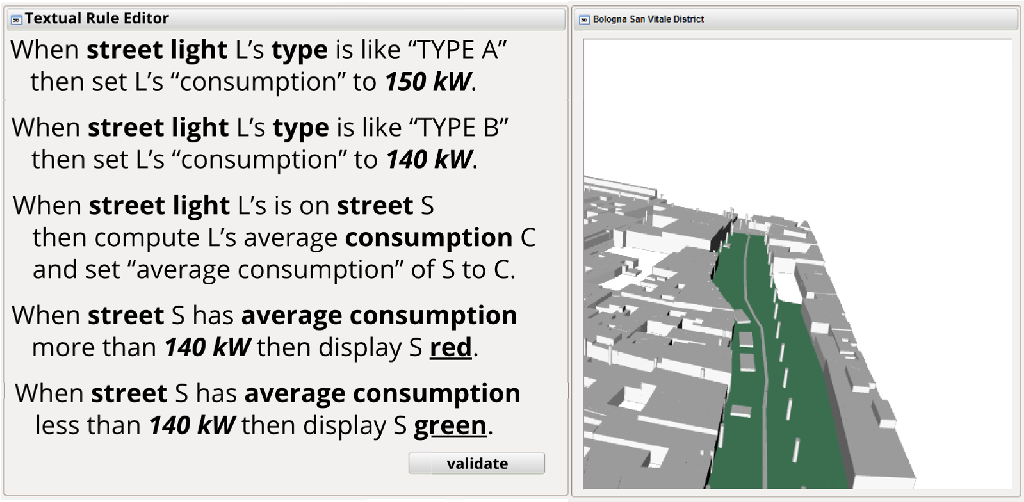

Figure 3: Result of the executed rules in the 3D scene. Buildings and background is simplified to focus on the colourised streets.

4.2 Implementation concept

This section details the process of data preparation and the rule editor's execution process. The rule editor allows for analytic interaction with the 3D scene. Therefore it combines a DSL with the rule language pattern. The DSL is injected with an extendable micro-ontology (Janowicz and Hitzler 2013) that has been specified by the domain group, responsible to work on a problem, beforehand.

The single rules are formatted in a when-statement-then-action pattern. Three steps are necessary to execute a rule:

(1) Automatic lexical interpretation and semantic annotation of rule terms.

(2) Automatic syntactic rearrangement to achieve formal rules.

(3) Injection of geofeatures and rules into a rule engine.

The first step of lexical interpretation and semantic annotation of rule terms is realized through an extension of the JavaScript parser generator PEG.JS.[7] The DSL expressions are classified to six categories:

- general rule expressions (when, then, less),
- user vocabulary expressions (street, type),
- individuals (L, S, C),
- colour expressions (red, green),
- action expressions (set, display),
- physical quantity expressions (combination of number and unit, e.g. 1 m).

After annotation of the terms, an intermediate reasoning step identifies whether the user vocabulary expressions have to be interpreted as geofeatures or attributes and whether their relations have to be interpreted as topological relations or as common attribute patterns.

We used the JavaScript rule engine library NOOLS.JS[8] for rule interpretation and execution. Therefore, the rule phrases must be reformatted in the second step to match the NOOLS.JS rule description pattern. PEG.JS detects triple patterns and rearranges such patterns to fit into the rule description language of NOOLS.JS. Four triple patterns are known to the system:

- possession with apostroph and s ('s): street lamp's type
- possession with has: street has average consumption
- topological relation: street lamp is on street
- possession with of: average consumption of street

[7] http://pegjs.org/
[8] http://c2fo.github.io/nools/

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Listing 1 shows the resulting NOOLS.JS rule. Lines 2 and 3 filter all available geofeatures by their type. Lines 4 and 5 compare the attribute average_consumption to a physical quantity, namely 140 kilowatts. Line 8 calls a function that interacts with the 3D scene framework.

```
1  when {
2     A : GeoFeature
3     A.type == http://www.sig3d.org/codelists/standard/.../LandUse_function.xml#2010'
4         && A.compareProperty('average_consumption', '>', 140,
5             http://purl.oclc.org/NET/ssnx/qu/unit#kiloWatts");
6  }
7  then {
8     ruleExecutor.display (A, 'red');
9  }
```

Listing 1: rule as interpreted by the NOOLS.JS rule engine

During the third step the specified rules are added in their order of occurrence to the rule engine. Consequently the available geofeatures with their corresponding attributes but without geometrical information are injected into the rule engine at runtime. The interactive functions are added to the rules and therefore executed from the rule engine when implemented.

4.3 Data preparation

Figure 4 illustrates the micro-ontology for the use case. It defines ten concepts and connects them through another ten relations. The concepts contain a set of attributes along with a native language label. Three vocabularies are used additionally and form the knowledge base of the system: the QUDT[9] – Quantities, Units, Dimensions and Data Types Ontologies, the colour knowledge base of dbPedia[10] and GeoSparql[11] as reference ontology for geofeatures and topological relations.

The double lined concepts in Figure 4 are geofeatures and connected with a spatial representation. Interrelations among geofeatures that are either prepositions or has are interpreted as topological relations from the region connection calculus (Renz 2002). As an example Street is in District is interpreted as Street isContainedIn District.

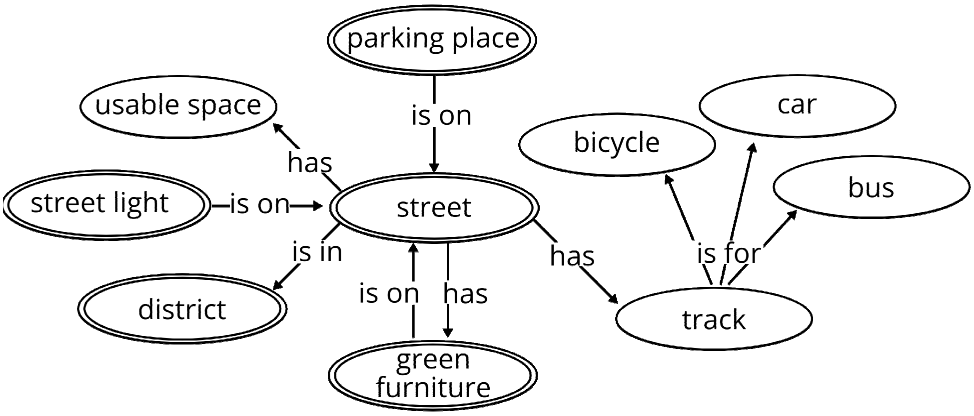

Figure 4: Micro-ontology modelling core parts in a city district

The geodata to be analysed is injected with semantic annotations during pre-processed step. Semantic annotations are unified resource identifiers that link to a source on the web, where the meaning and connection to further related resources is described. For example, in CityGML the expression road is accessible through a URI.[12] This URI is ensured to be added to the geodata descriptions as shown in Listing 2 line 2.

[9] QUDT ontologies are accessible at http://www.qudt.org/. An alternative ontology is NASA's SWEET ontology (Raskin & Pan, 2005)
[10] http://dbpedia.org/
[11] http://www.opengeospatial.org/standards/geosparql
[12] http://www.sig3d.org/codelists/standard/landuse/2.0/LandUse_function.xml#2010

```
<MetadataSet containerField='value' name='Feature_1382'>
  <MetadataString containerField='value' name='type'
value='"http://www.sig3d.org/codelists/standard/landuse/2.0/LandUse_function.xml#2010
"'/>
</MetadataSet>
```

Listing 2: Semantic Annotation in X3D. The type attribute's value of Feature_1382 is specified through a URI.

In order to link the user vocabulary (target vocabulary) with the data source (source vocabulary) a mapping table is created. Therefore either a concept of the target vocabulary is linked (I) one to one with a semantic annotation type or (II) triple patterns are linked one directional to a concept of the source vocabulary's semantic annotation as shown in the following.

(I) ex:Street –> cml_lu:2010

(II) ex:Track ex:isFor ex:Bicycle. –> cml_ta:3

The suffix ex: represents the ontology from Figure 3; the suffix cml_lu: represents the land use function schema of CityGML; the suffix cgm_ta: represents the traffic area schema[13] of CityGML. We have chosen the straightforward form of a mapping table and avoid terms from the Semantic Web (e.g. owl:sameAs) that have been discussed as semantically error-prone (Halpin et al. 2010). We argue that an objective mapping level among two concepts as introduced in the SKOS ontology is not possible. The level of mapping between two concepts is only possible per use case.

Given the prerequisites of semantically annotated geodata sources and a mapping table the user is now able to analyse the scene with their very own fit-for-purpose vocabulary by scripting rules in a near natural language speaking mode into the editor field as depicted in Figure 3.

5 CONCLUSION

In this paper we have shown the combination the web portal for public participation in the urban planning process with a DSL based rule editor. This combination has two major advantages. On the one hand it enables users to work in their language level without the need to have strong geodata and technology domain knowledge. It eases the analysis process for those users that are not experienced in GIS but require spatial data for solving their issues. On the other hand a DSL rule editor in combination with a visualization component offers a base, based on which GIS experts can communicate their analysis process and results to non-experts.

The urbanAPI evaluation sessions revealed a lot of potential for the application of declarative rules. A prominent example from the urban planning domain is a pliancy indicator for placing objects in the 3D scene. At the moment there are no constraints where users can place objects, so trees can be put in the middle of the road or houses in a river. A rule which forbids to place trees directly on streets and communicates this fact to the user, for example through colourize conflicting objects in red would be very helpful. These types of rules will be investigated further in the future. Also the possibility to combine various rules to achieve different goals leads to more flexible ways of analysis. Especially if several steps are involved a lot of work can be saved compared to a graphic user interface that offers no scripting.

However the major prerequisite to apply the approach given is semantically annotated data. Klien (2006) defines the goal of semantic annotation as making the meaning of data explicit. This means that the data structures given (for example entries in GIS file formats) are associated to already known concepts given by ontologies or likewise, which enables to use the data in the particular context. As an example the objects in the 3D scene representing streets, bicycle lanes or street lights were annotated as such along with other properties such as the energy consumption, as discussed in the sections above. For the use with our prototype and within the project this was done mostly manually, which is a laborious work and not reasonable for the intended target audience. Herein we have to elaborate, how automatic mapping algorithms or schema mapping tools, such as HALE (Reitz and Templer 2012) can help. In the daily workflow the amounts of new data are growing and it is clear that an additional step involving intense manual intervention for semantic annotation is not appropriate. There are already several approaches for automated annotation. Lutz and Klien

[13] http://www.sig3d.org/codelists/standard/transportation/2.0/TrafficArea_function.xml#3

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(2005) show how the spatial relations in data sets can be used to create semantic annotations automatically. Upcoming prototypes need to address this issue to be usable on a wider scale.

In summary we think that an interaction with geodata through a DSL with interchangeable core vocabulary is a powerful approach to break the complexity of GIS analysis down to casual users. It gives an enormous amount of flexibility and allows for verbal interaction tailored for both, differing target audiences and use cases.

6 ACKNOWLEDGEMENTS

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reviewed paper

Towards Livable Urban Environments by Addressing Health from a Spatial Perspective: Exploration by Mapping Environmental Noise and Air Pollution in the Northern Fringe of Brussels

Peter Vervoort, Thomas Verbeek

(M.Sc. Peter Vervoort, Spatial Development Department Flanders, Flemish Government, Koning Albert II-laan 19/12, 1210, Brussels, Belgium, peter.vervoort@rwo.vlaanderen.be)
(Drs. Thomas Verbeek, Centre for Mobility and Spatial Planning, Ghent University, Vrijdagmarkt 10/301, 9000, Ghent, Belgium, thomas.verbeek@ugent.be)

1 ABSTRACT

Although a growing societal awareness for the impact of the built environment on health and well-being urges spatial planners to take health aspirations into account, the issue is mostly addressed very late in the planning process.This results in a rather short term perspective of possible solutions and a mainly local focus on measures to mitigate environmental nuisance. The article starts from the existing gap between the requisite technical expertise concerning enviromnental nuisance and the daily spatial planning practice, preventing a substantial shift to incorporating public health concernsin spatial policy initiatives or interventions. Therefore opportunities to positively affect health and well-being through enhancing environmental liveabilty conditions are missed.

The article focuses on environmental noise and air pollution in relation to human health in the Northern Fringe of Brussels. Useful data sources are explored and selected indicators are processed by GISanalysis to establish a comprehensible mapping method for evidence informed spatial policy,showing spatial varation of environmental health issues in the area.

2 INTRODUCTION

Modern urban planning originated in the nineteenthcentury addressing the lack of sanitation, absence of potable water and the general poor quality of housing in the emerging industrial cities(Verbeek & Boelens, 2013). Despite of these strong historic ties spatial planning and health have lost connection in the last century(Levy, 2014).On the one hand alot of health criteria are converted in legislation, leaving the issue of enviromnental health to the environmental department, on the other public health today tends to be associated with individual human behavior rather than be affiliated with environmental conditions.Health however is not only associated with individual human behavior, but is also affected by environmental, social and economic conditions(de Hollander & Staatsen, 2003).Needless to point out that spatial planning practice plays an important role in shaping these conditions(Jackson, 2003).Furthermore a growing societal awareness for the impact of the built environment on health and well-being urges spatial practitioners and policy makers to take public health concerns into account. Consequently, the assurance of liveable urban environments as a precondition for spatial development in Flanders, is cited in the policy statement of the Minister of Environment(Flemish Government, 2014). The same policy goal is included in the Green Paper for the Spatial Policy Plan Flanders, whichaims to develop a diverse living environment with quality of life, health and identity as core values(Flemish Government, 2012).

The commitment to assure or maintain urban liveability when developing or transforming certain areas, or making spatial policy decisions, requires an insight in public health from a specific spatial perspective.Thisis not obvious sinceknowledge ofenvironmental nuisance and associated health impacts is fragmented over various fields of expertise. Moreover, spatial planning requires a generalist view, since it has to address a combination of very diverse challenges. Thus, even though mapping of nuisance indicators is more and more widely available, it is difficult to incorporate it in spatial planning practice because of thelack of expertise to comprehend, combine, interpret and use the evidence for spatial planning purposes.Therefore inplanning practice public health concerns are often considered very late in the planning process which results in a rather short term perspective of possible solutions and a mainly very local focus on measures to mitigate nuisance. Facing the issue earlier in the process and from a broader perspective could provide more sustainable and long term solutions for enhancing environmental liveabilty conditions. Indeed exposure can be achieved by a consistent proactive spatial planning strategy which transforms or adapts existing living environments or prevents the exposure to nuisance forfuture developments.Actions can be taken on a programmatic level by guiding social functions to less exposed areas or prohibitingcertain developments in overexposed environments, and can involve the evaluationof new locations of services for vulnerable social groups such as infants or senior citizens. Furthermore, spatial interventions or urban design can enhance liveabilty on a neighbourhood level by buffering emmission sources, providing greenery and parks to reduce exposure to certain pollutants or taking measurements to ensure sufficient flows of fresh air. But also at a building level measures can be taken in terms of insulation or alignment of windows.Our research hypothesis suggests that incorporation of health concernsin spatial policy initiatives or interventions is problematic due to the gap between the requisite technical expertise concerning nuisance and health topics and the spatial planning practice. The research aims to clarify and frame the existing technical evidence for spatial planning purposes, opening the pathway for more sustainable and long term solutions to profoundly enhance environmental liveabilty conditions.

The analysis is restricted to the environmental impacts of air pollution and noise. According torecent research issued by WHO, these form the first and third largest environmental burdens on health in Europe (with second hand smoke the second largest)(Hänninen et al., 2014). In Flanders, they are the two major environmental conditions affecting human health (Flemish Environmental Agency, 2013).For air pollution in general, residential exposure to high traffic has been related to asthma (e.g. Morgenstern et al., 2008), deficits in lung development (e.g. Gauderman et al., 2007) and allergy development (e.g. Nordling et al., 2008) in children; and a higher mortality risk (e.g. Finkelstein, Jerrett, & Sears, 2004) and coronary disease (e.g. Hoffman et al., 2007) for the whole population. For traffic-related noise exposure, conclusive associations have been found with sleep disturbance (e.g. Miedema & Vos, 2007), cognitive development of children (e.g. Stansfeld et al., 2005), (slightly) increased risk of hypertension (e.g. Babisch, 2006) and coronary heart disease (e.g. Gan, Davies, Koehoorn, & Brauer, 2012).

Following research questions are formulated: Which indicators concerning environmental noise and air pollution can provide insight in human health from a spatial perspective? Which thresholds are to be taken into account when evaluating or estimating the impact on human health? How can existing nuisance data be framed in order to establish comprehensible insights for spatial planning practice?

3 INDICATORS AND DATA FOR ENVIRONMENTAL NOISE AND AIR POLLUTION

3.1 Air Pollution

3.1.1 Indicators and standards

To assess air pollution several standard indicators are used. Depending on the aim of theanalysis other indicators come into view. For some indicators the WHO and the EU have respectively set guidelines or binding threshold values. A summary is given in Table 1.

- Fine dust, fine particles or particulate matter (PM): Two general indicators are in use, PM_{10} and $PM_{2,5}$, consisting of the concentration of particles with a diameter of 10/2,5 micrometer or less. They reflect all kinds of air pollution, both industrial, household and traffic-related air pollution. As such they donot give that much variation on a local scale and rather reflect urban background concentration. As indicator for traffic-related air pollution recent research proves that they are not very efficient (Berghmans et al., 2009; Fischer, Marra, Wesseling, & Cassee, 2007; Ibald-Mulli, Wichmann, Kreyling, & Peters, 2002; Zhu, Hinds, Seongheon, Shen, & Sioutas, 2002).
- Ultrafine particles (UFP): Because research increasingly suggests that the finest particles ($PM_{0,1}$: fraction of particles smaller than 0,1 micrometer) are most related with traffic and most harmful, there is a need for more monitoring, guidelines and policy concerning ultrafine particles. However, until today this does not exist. Only specific components like NO_2 and elementary carbon or soot (EC) are measured and monitored.
- NO_2:NO_2 is a gas that is produced for the biggest part by road traffic. Therefore it is a major indicator for traffic-related air pollution and has a lot of local spatial variation. It is not very likely that the reported health effects are caused by NO_2 in itself. Probably the presence of NO_2 is correlated with a specific mix of fine particles which is typical for traffic-related air pollution and the related health effects. NO_2 can thus be seen as a proxy indicator and therefore threshold values are set by WHO and EU.

- Elementary carbon (EC) or soot: EC is one of the fractions of particulate matter, and is a combination of carbon and carbon compounds. This fraction seems to cause the most environmental and public health damage. EC is especially emitted from the combustion of fossil fuels (e.g. diesel engines) and organic material. Both the WHO and the EU do not have threshold values. However, the indicator is often measured, modeled and monitored by government departments.

Indicator	WHO Air Quality Guidelines – Global Update 2005	EU Air Quality Standards (legally binding) (2008/50/EC)
PM_{10} annual mean level	20 µg/m³	40 µg/m³
PM_{10} 24-hour mean	50 µg/m³ (3 exceedences permitted/year)	50 µg/m³ (35 exceedences permitted/year)
$PM_{2,5}$ annual mean level	10 µg/m³	25 µg/m³
$PM_{2,5}$ 24-hour mean	25 µg/m³ (3 exceedences permitted/year)	-
UFP	-	-
NO_2 annual mean level	40 µg/m³	40 µg/m³
NO_2 mean daily one hour maximum	200 µg/m³ (18 exceedences permitted/year)	200 µg/m³
EC	-	-

Table 1: WHO Air Quality Guidelines and EU Air Quality Standards

3.1.2 Available data

To gain insight in the local variation in air pollution in Flanders and Brussels, there are two possibilities. On the one hand there are fixed monitoring stations, which measure specific indicators of air quality at fixed locations, on the other hand there is the RIO-IFDM model, which models several indicators of traffic-related air pollution.

Air quality monitoring stations

Both Flanders and Brusselsmaintain a telemetric monitoring network for air quality. The data is collected by IRCEL-CELINE (Belgian Interregional Environment Agency) for each measuring station (11 in the Brussels Capital Region and 75 in the Flemish Region) and can be retrieved at http://www.irceline.be. The stations monitor different kinds of pollutants (PM_{10}, $PM_{2,5}$, NO_2, O_3, EC), however not all pollutants are being measured in every station. The data can only give insights in air quality at a specific local level, which is notsufficientfor elaborate spatial analysis.

RIO-IDFM model

The RIO-IFDM model is used by ATMOSYS, an Environment Policy and Governance project co-financed by the European Commission, facilitating an air quality modeling system. On the project website (http://www.atmosys.eu) 'annual air quality' maps for traffic-related air pollution can be consulted by the public. On request also the rasterized source data can be retrieved. Maps are provided for several indicators (PM10, PM2,5, NO2, O3, EC), and different years.The model is conceived for Flanders but can be deployed in other regions aswell.

These maps are the result of the combination of two data sources: the spatial interpolation of air quality measurements and the calculation of air pollutant concentrations based on meteorological data and the emissions of air pollutants (Lefebvre et al., 2013). Although some validation tests gave reliable results, both data sources have limitations and uncertainties. Most importantly, the model does not take into account the effect of obstacles alongside roads (buildings, continuous urban fabric, trees, …) which can cause the so called street canyon effect. This means that in narrow inner city streets, with a lot of traffic, where the dispersion of polluted air goes slower, the model will probably underestimate the concentrations.

3.2 Environmental Noise

3.2.1 Indicators and standards

To assess environmental noise several standard harmonized indicators exist, that are also proposed in the European Union Environmental Noise Directive (EU2002/49/EC). The most used are L_{den} and L_{night}, in some situations also L_{day} and $L_{evening}$ can be useful.

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- L_{den} is the average long term sound level over a 24h period, with a penalty added for noise during the nighttime hours of 23:00 to 07:00. During the nighttime period 10 dB is added to reflect the impact of the noise.
- L_{night} is the average long term sound level during the night hours (23:00 to 07:00).
- L_{day} is the average long term sound level during the day hours (07:00 to 19:00).
- $L_{evening}$ is the average long term sound level during the evening hours (19:00 to 23:00).

In Flanders there are no fixed legal threshold values, which is in line with the European Enviromental Noise Directive that does not set binding limit values as well. However there are some guidelines issued by the World Health Organization. In 1999 they published Guidelines for Community noise (WHO, 1999), in which a threshold of 55 dB was determined for Lden, corresponding to serious annoyance. Further, they stated that moderate annoyance already occurs at 50 dB and that for new developments 40 dB should be the aim. For sleep disturbance at night (Lnight) they determined a threshold value of 45 dB.

For 24h noise exposure, their guidelines still are in force. For night noise the WHO published new guidelines in 2009 (WHO, 2009), in which they set an interim target for night noise (L_{night}) of 55 dB, and a guideline of 40 dB – which is the LOAEL or Lowest Observed Adverse Effect Level.

3.2.2 Available data

One of the binding decisions in the EU Environmental Noise Directive was the obligation of the member states to monitor the environmental problem of noise through the drawing up of ‘strategic noise maps’. This should be the base for drawing up ‘action plans’, developing a long-term EU strategy and informing and consulting the public. The ‘strategic noise maps’ had to be drawn up for all major roads, railways, airport and agglomerations, using the harmonized noise indicators of L_{den} and L_{night}. In Flanders these maps were drawn up in 2006, and updated in 2011, for airports, road traffic and railway traffic. For agglomerations with more than 250.000 inhabitants (Antwerp, Bruges, Brussels and Ghent), more detailed noise maps were created, including the noise effect of industrial plants.

These noise maps can be consulted as pdf on the websites of the Flemish Department of Environment, Nature and Energy (LNE - http://www.lne.be), and the Brussels Capital Region Department of Environment and Energy (BIM - http://www.leefmilieu.brussels.be). Disposing of the original high resolution, rasterized data however requires a lot of communicational effort.

4 PRESENTING DATA FOR EVIDENCE INFORMED SPATIAL POLICY

4.1 Selection of indicators for Air Pollution and Environmental Noise

For a comprehensible and relevant mapping two indicators were determined, one to assess air pollution and one to assess noise. For air pollution, the average yearly concentration of NO_2 (2013) was chosen, as it is known to be a good indicator of urban traffic generated pollution, showing more spatial variation than other modeled pollutants (Goodman, Wilkinson, Stafford, & Tonne, 2011). For noise, L_{den} (2006 for Brussels and 2011 for Flanders) is used as proxy variable for environmental noise. In Europe, it is the most standard harmonised noise indicator for assessing annoyance and sleep disturbance (cfr. EU Environmental Noise Directive).

4.2 Methods for aggregation or interpreting environmental pollution

In literature and planning policy or practice several methods to aggregate or interpret environmental pollution are used. To give inspiration, some are presented here.

DALY

The metric of DALY or Disabiliy Adjusted Life Year is the unity which is used by the WHO to define the environmental burden of disease of a certain environmental impact (Prüss-Ustün, Mathers, Corvalán, & Woodward, 2003). DALYs are a measure for the number of potentially lost healthy life years and were first described by Murray and Lopez (1996). Using DALYs, more or less serious diseases can be compared and weighed. The specific disability weight of a certain disease is determined by a team of medical experts. In general DALYs are the sum of the years of life lost (YLL) by premature mortality and the number of life years living with a serious disease or disability (Years Lived with Disability or YLD). DALY is a relative and not an absolute indicator for the disease burden. Several factors like lifestyle, smoking habits, diet, genetic predisposition can contribute to a disease. For Flanders as a whole DALYs were already calculated for environmental pollution (Torfs, 2003).

Partially because of its relative character, it is a good metric to estimate the environmental burden of disease for a region like Flanders, but it seems not to be the best way to translate local environmental pollution data to spatial planners. Chances are high that these DALYs do not meet the requirements of comprehensibility and easy data interpretation.

GES

A GES or Health Effect Screening (in Dutch: Gezondheidseffectscreening) is an instrument which gives insight in the different environmental factors that have on impact on the health of (future) residents (Fast, van den Hazel, & van de Weerdt, 2012). It can give an idea of the health related challenges and opportunities in urban development projects or other planning processes. A major advantage of the method is that also exposure below the legal thresholds is taken into account, leading to a nuanced view on the quality of planning towards environment and public health.

Concretely, the GES method considers the health effects of exposure to air pollution, noise, odour, external safety and electromagnetic fields. All relevant sources (industrial plants, roads, railways, shipping, air traffic and high tension lines) are included. Also land contamination is considered. Based on a dose-response relationship for each environmental factor the exposure is expressed in a GES-score which gives an idea of the environmental health quality. Scores vary from 0 (very good) to 8 (extremely insufficient). For each impact a score of 6 corresponds to the maximum acceptable risk. The different GES-scores are mapped per environmental impact, making use of the same colour scale. In a table or graph the number of inhabitants with a certain GES score for a specific impact is calculated. In this way planners and policymakers can have a comprehensible view on the public health effects of urban development plans and contribute to justified and evidence-based policy choices.

Kruize & Bouwman’s three approaches

In a study on environmental (in)equity in the Rijnmond region in the Netherlands, Kruize and Bouwman (2004) propose three different approaches to make environmental indicators operational and interpretable. In their study, this operationalization had to assess the socio-economic distribution of environmental quality. They think these disparities can be considered in several ways.

- A first approach starts from the basic ‘protection of general human rights’ and the equality of all citizens. Consequently, no disparities should exist between income categories in environmental quality. This leads to comparing the distributions, means or percentages of each socio-economic category with each other to see if there are differences.
- A second approach takes a minimum local environmental quality as a starting point. Environmental laws and standards may define this minimum quality. Levels above this standard could be defined as environmental ‘bad’. To analyse disparities, one might compare how often ‘bads’ are present for different socio-economic categories, i.e. how many households are exposed to pollution above a certain limit value.
- A third approach starts from the idea of a ‘nice and pleasant’ type of local environment, which is not only a guarantee for protection of health, but also a comfortable and liveable environment. For each impact target values can be decided on, based on expert judgment or on e.g. surveys on satisfaction or annoyance. Disparities could then be analysed by comparing how often the level of an environmental indicator is below the target value, or the amount of people being satisfied or not annoyed.

4.3 Case area and used methodology

4.3.1 Case area Northern Fringe of Brussels

The case studyfocuses on the Northern Fringe of Brussels, an area which is intersected by two of the most heavily used highways in Belgium, furthermore containing the international airport of Brussels, a major

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European aviation hub. It is self-evident that environmental health issues are to be expected in this area. Moreover recent forecasts predict a strong demographic growth (Schockaert, 2015) in the Northern fringe due to an influx of inhabitants from the capital to the adjacent municipalities (Schillebeeckx, De Decker, & Oosterlynck, 2015).

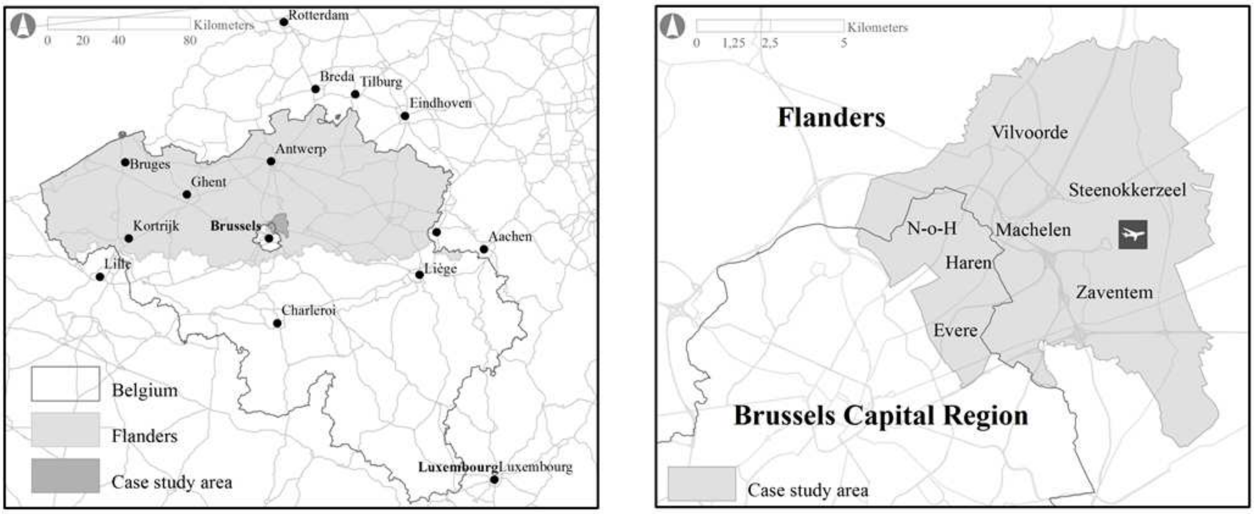


Figure1: Location ofthecasearea at the Northern fringeofBrussels, Belgium (source: ownmap)

This increase in the number of inhabitants will result in even more acute problems associated with urbanisation, including health issues, which are to be addressed by spatial planners in pursuit of a sustainable development of this area.Therefore, our research will specifically focus on current and future housing issues, although similar excersises could be performed regarding other socio-economic functions like attraction poles of employment, education or recreation.

Fortheextentof this research the study area consists of the municipalities of Vilvoorde, Zaventem, Steenokkerzeel and Machelen – which are situated in the Flemish region – and the municipalities of Evere, Haren andpartsofNeder-over-Heembeek -whichbelongtotheBrussels Capital region (figure 1). The areaispopulatedby approximately 147.000 inhabitants and is a central fragment of a mutual territorial development program, in which Flanders and the Brussels Capital region gather spatial partners to define and implement common goals for short and medium term development.Better knowledge about environmental health issues can help toclarifythechallengestobeaddressed in the program.

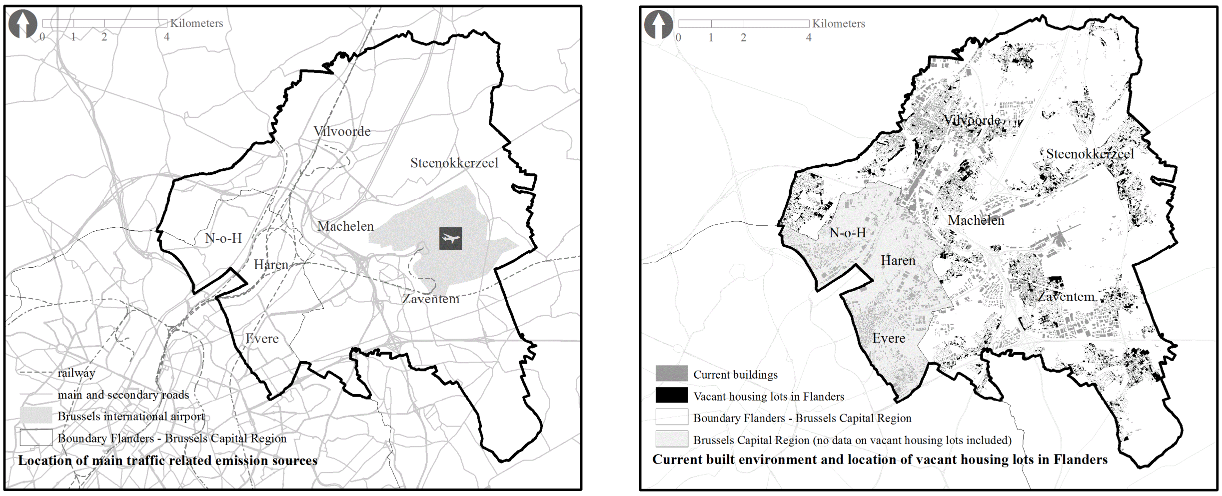


Figure2: left: Location oftrafficrelatedemissionsoures - (source: ownmap). right: Currentbuiltenvironmentandlocationofvacant lots in theFlemishpartofthecasearea(source: ownmap)

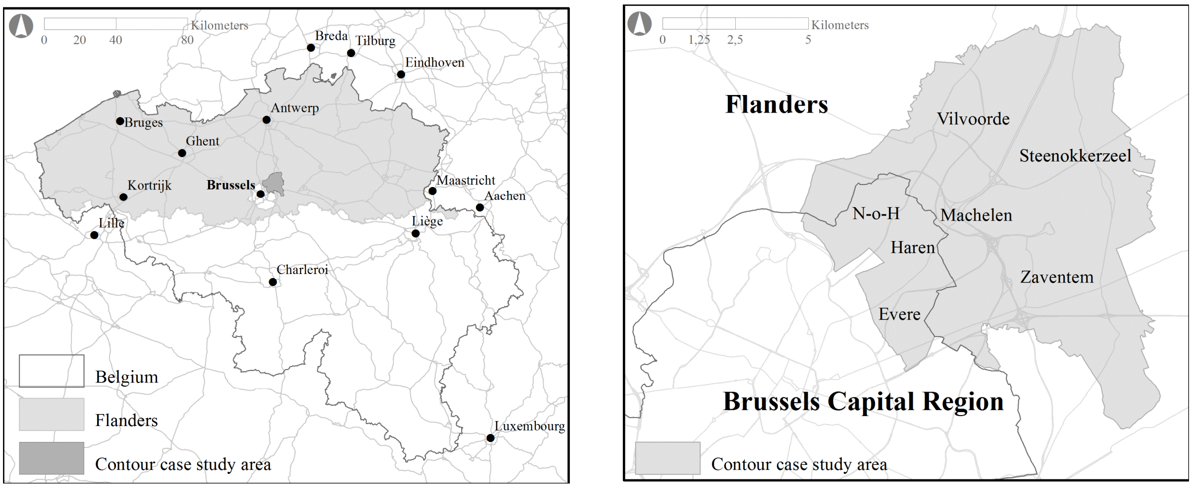
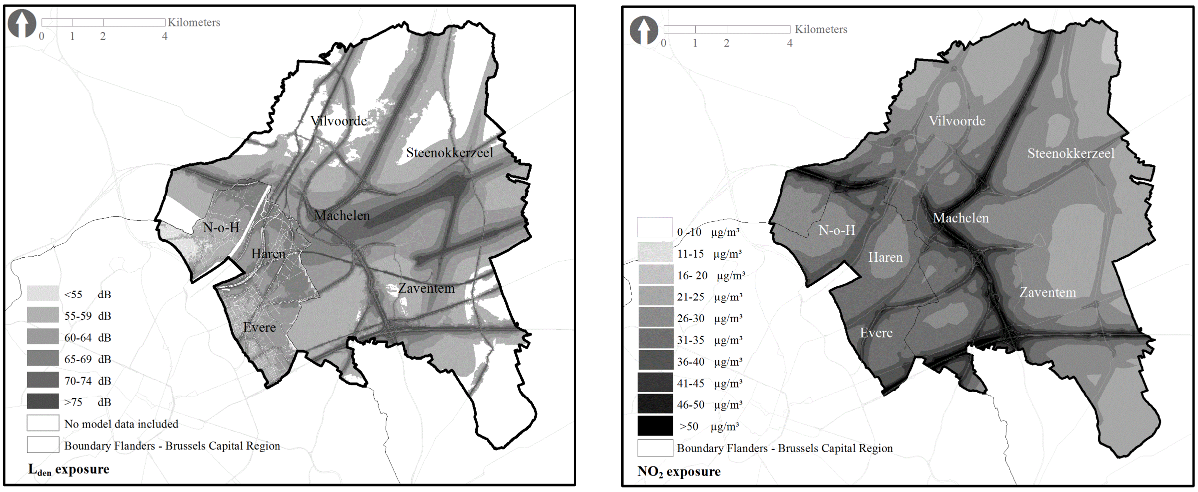


Figure3: left:ModdeledtrafficrelatedLdenexposure. ownprocessingasexplained in thearticle(source: noisemapsissuedby LNE 2013 Aand BIM 2006). right:ModdeledtrafficrelatedNO2exposure (source: RIO-IFDM data 2013 issuedbyIRCEL-CELINE)



4.3.2 Spatial scale of the output

In order to establish significant output it is presented on the level of statistical sectors, a subdivision of municipalities in Belgium, representing distinct neighborhoods, which is widely used for scientific research and collectionof statistical data. This subdivision ensures both the suitability of the produced data for possible further research and, being an intermediate spatial scale, provides appropriate evidence for spatial policy.

4.3.3 Methodology for mapping NO_2

The basis for the mapping of exposure to NO_2 in our research is a raster data set issued by IRCEL-CELINE (Belgian Interregional Environment Agency) which was produced by using the ATMOSYS RIO-IFDM-model for the year 2013. The dataset contains the modelled average yearly exposure of NO_2 in our case area, with a resolution of ten by ten meters. Two sets of maps were made; a first set giving insight in the current residential exposure, a second set clarifying the exposure of possible new housingdevelopments.

To map the current exposure per statistical sector firstly the exposure per person was calculated by IRCEL-CELINE making use of a recent data set (2008) containing population data per address. Theaverage exposure was calculated per statistical sector, giving insight in the general level of exposure within the sector. Also the percentage of inhabitants exposed to a yearly average NO_2 concentration exceeding 40µg/m³ was calculated, corresponding to the WHO and EU threshold.

To give insight in possible nuisance innew spatial developments the research firstly analysed the vacant lots for development. Because of data availability and limited time our mapping of this aspect only included the areas within the Flemish region. In Flanders every municipality is obliged by decree to set up and maintain a register containing information on vacant building lots as a useful instrument for local spatial policy. Due to

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a lack of recent data in the registers of the involved municipalities this data set couldnot be used for the extent of our research, necessitating a different approach. By making use of the Flemish register of zoning plans all possible lots legally allowed to be built on for housing were selected for the case area, all lots containing constructions according to the most recent dataset of the Belgian land register (2014) were deducted and all remaining lotswith a minor surface area to develop (a 150m² threshold was used) excluded. This methodology allowed to distinguish all vacant lots in the Flemish part of our case area but it did not exclude lotswith a morphology that prevents development (e.g. lots being too narrow)nor did it take possible spatial context avoiding development into account, as assessed in the municipal registers.The mapping of the exposure of available residential lots per statistical sector was done by assigning a level of exposure to every vacant lot using the centre of the lot as a reference. A weighted average was calculated per statistical sector by taking the areaof the exposed lots into account. In this way wider lots have a larger influence on the calculated average, since they allow more possible new development. In analogy to the mapping of existent exposure also a percentage of areaexposed to a yearly average amount of NO_2 exceeding 40µg/m³ was calculated per sector. Similar to the mapping of existent exposure two maps were established.

4.3.4 Methodologyfor mapping L_{den}

The basis for the mapping of exposure to L_{den} in our research are the mentioned noise maps for Brussels and the Flemish Region. Due to the different methodology, noise maps in both regions are difficult to compare and the calculation of averages per statistical sector would make no sense. Furthermore the data is not available as a raster data set making thesecalculations even impossible. For the extent of our research we made othermethodological choices to produce sensible maps for assessing exposure to L_{den} per statistical sector.

Firstly a combined noise map for the Flemish part of our research area was assembled by withholding only the highest levels of exposure when overlaying the different noise maps for aviation, roads and railways. Since there are no official standards for L_{den} exposure and the noise maps show an overall high exposure in the case area, an arbitrary threshold of 65dB was selected for assessing the variation in exposure betweenstatistical sectors. Clearly in less exposed areasa 55dB threshold as recommended by the WHO should be considered, but in our case this would not allow for enough spatial variation.Secondly, per statistical sector the percentage of inhabitants exposed to Lden exceeding 65dB was calculated by IRCEL-CELINE making use of the data set containing population data per address. To make sure exposure levels at the façade of buildings were taken into account a buffer of 10m was used in the calculation. The mapping of the exposure of available area for development per statistical sector was done similar to the mapping of NO_2 by calculating the area percentageof vacant lots being exposed to L_{den} exceeding 65dB.

5 RESULTS AND DISCUSSION

The research intended to establish a mapping method of environmental noise and air pollution useful for developing spatial planning policy and strategies that contribute to sustainable and long term solutions for the enhancement of environmental liveability conditions.Two (sets of) maps were created for both nuisances in the Northern Fringe of Brussels, gaining insight in the current level of exposure of inhabitants in the different districts onthe one hand and the level of exposure for potential housing development in those areason the other. Because of the focus on current and future housing, based on exposure at current addressess and the location of vacant building lots, the established maps will not give insights into exposure of other social functions (especially those which are spatially separated from housing like large poles of employment and industry). Additional mapping excercises can be performed to clarify health issues for other socio-economic functions, based on other parameters.

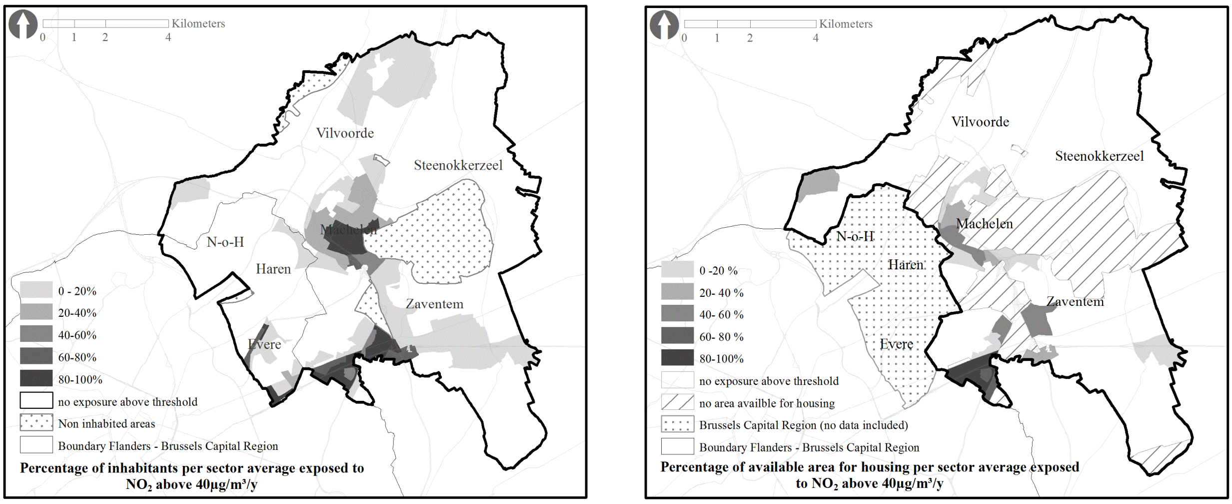

Figure4 : Currentand potentialexposureto NO_2> 40 µg/m³/year (source: ownmapbased on RIO-IFDM data 2013issuedby IRCEL)

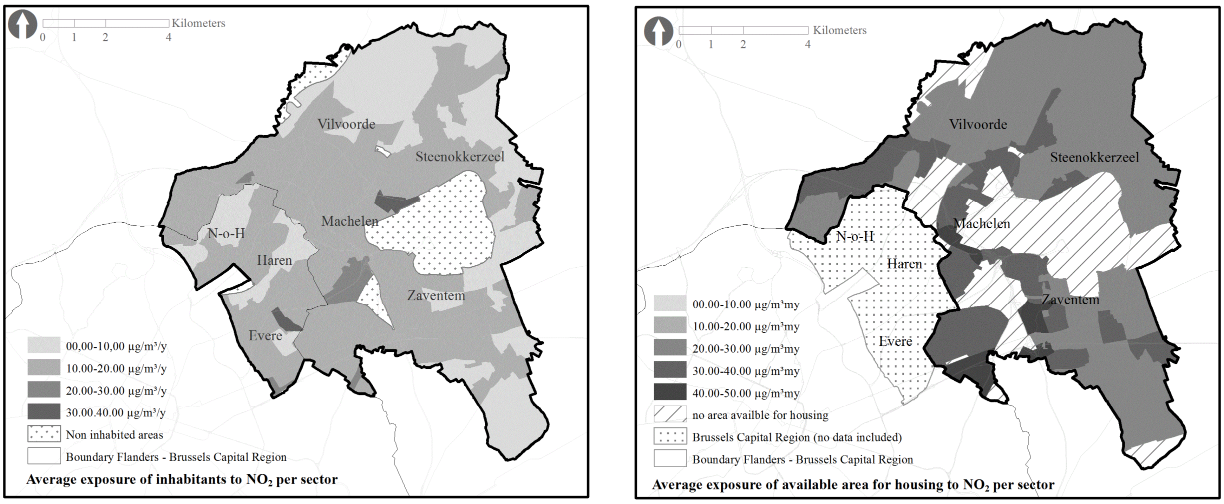

Figure5: Currentand potential average exposure to NO_2 per sector (source: own map based on RIO-IFDM data (2013) issued by IRCEL)

In our case study area the set of maps show no current average exposure above 40µg/m³/y per sector (figure 4, left map), although a large percentage of peope are in fact living in an overexposed area (figure 5, left map) especially in Machelen and around border of Evere and Zaventem. Observing the maps incating potential exposure for future development the percentage of potential new housingexposed above the 40µg/m³/y-threshold (figure 4, right map is generally lowerin comparison to the percentage of currently exposed inhabitants, except for some areas in Zaventem and southwest of Vilvoorde, but clearly the average percentage of vacant lots exposed to NO_2 is much higher (figure 5, right map). In Machelen and southwest of Zaventem even averages above the WHO and EU threshold are figured in available areas for housing development.

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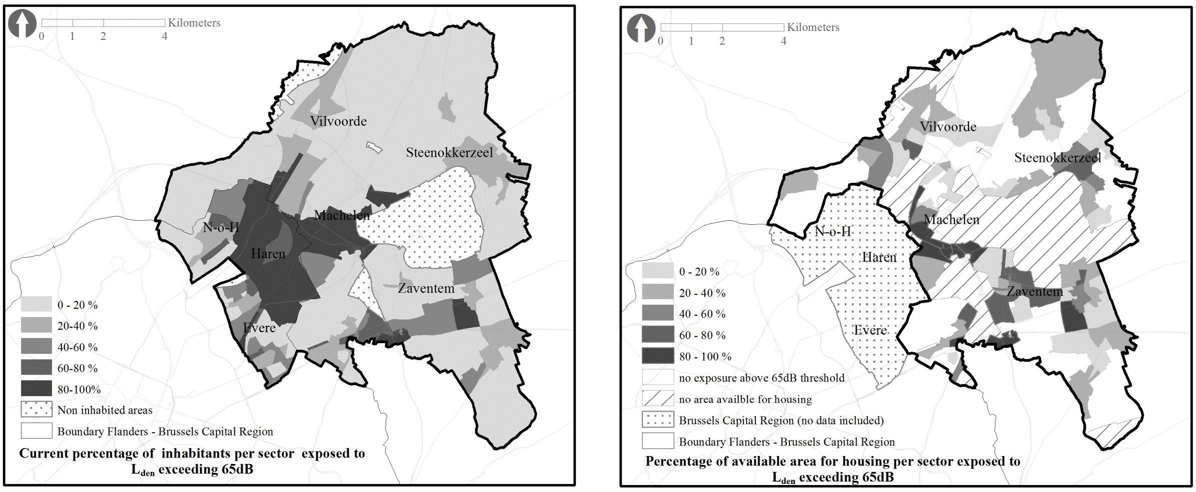

Figure6: Currentand potential exposure to Lden > 65dB (source: own map based on noise maps issued by LNE 2013 and BIM 2006)

As mentioned almost the entire case area is exposed to environmental noise above 55dB L_{den}, observing the established maps for exceendences of 65dB $L_{den}$the percentages of exposed inhabitants are high in Machelen and Haren and along the highway in Zaventem. (figure 6 – left map). Mapping of exposure for potential housing confirms high levels of exposure in Machelen, but also new areas like the Zaventem and Steenokkerzeel emerge (figure 6 – right map). The map for potential housing is clearly more fragmented. While some areas seem to manage staying under the threshold (figure 6 – right map), other areas have to deal with an increased relative exposure in comparison to the current situation. The latter is presumably a result of the relatively large acreages of available housinglotsclose to the sources of noise in those areas.

When comparing the maps for L_{den} and NO_2a more nuanced view emerges with indicated (potential) areas that have to deal witha variety of both nuisances, (potential) areas with a rather clear main nuisance and (potential) areas that are less exposed in general.High levels of environmental noise and airpollution areas expected revealed in Machelen en Haren, being close to the highway junctions and aviation routes, but still even there the mapping excersise shows local differences and spatial variation in levels of nuisance for (potential) inhabitants, moreover also variation regarding less exposed areas which might not had been noticed at first glance, is possible.

Being based on calculated data and long-term averages the maps are reliable for strategic planning purposes giving general information about the variation in exposure in a specific area, but less or not suitable as a basis for harsh local measures since the evidence does not include local or temporal peak exposures nor takes subjective annoyance into account. Furthermore mapping was based ononly one indicator for each nuisance.Including other indicators or a different mapping methodology could lead to different insights. The goal of the mapping exercise however was not to elaborate and extensively assess the environmental health conditions of an area, but rather to gain general insights as a basis for spatial policy which can positively affect health and well-being through enhancing environmental liveabilty conditions or to determine preconditions for future development. In that regard an important note is to be pointed out when using the (set of) maps for spatial planning purposes, since the calculated values for both NO_2 as for L_{den} are based on current traffic emissions. A differential spatial development, favourising certain areas, will inherently increase traffic intensity in those neighbourhoods thus influencing the spatial distribution of environmental health conditions. Regular updates of the modelling and mapping can overcome this issue.

The presentedmapping method combines the nuanced view of the GES-methodology, by mapping the average exposure in a district, with the attention for minimum local quality of the Kruize & Bouwman's approaches, by expressing the percentage of exposure above acknowledged thresholds. Furthermore it is able to clarify possible differences in the current and possible future exposure. When using the resulting maps attention should be paid to possible large disparities in terms of population or vacant lots between districts, since the presented maps illustrate the percentage of exposure per total of the statistical sector, not per total of the entire case area. In our case for instance differences in population lie in the range of 1 to 3829 inhabitants per sector.

The research encountered several data issues to be tackled, some as a result of the difficulties obtaining data in original high resolution, other because of differences in modeling and presenting the calculated data at each side of the regional borders, but also the lack of recent data concerning vacant building lots was a burden.In that regard especially the unabilty to produce average noise maps is an unfortunate shortcoming of our results in terms of nuanced understanding.

In our opinion the presented mapping method frames the existing evidence in a comprehensible way for spatial planning practioners to be used in order to enhance environmental liveability conditions and to determine preconditions for future developments. To begin with, it is useful on aprogrammatic level in terms of general assessment for locating or relocating social functions.Furthermore, by indicating districts in need of more attention concerning air pollution and/or environmental noise, it is helpfulas a basis for further clarification and prioritisation of possible local spatial policy measures. Giving insight in the nature, level and distribution of the nuisance, the maps show different aspects of the evidence which are to be combined when assessing transformation or adaption strategies in existing living environments or avoiding the exposure to nuisance of future developments.

6 CONCLUSION

By presenting a methodology to establish a set of comprehensive maps concerning environmental noise and air pollution our research made an effort to bridge the gap between the requisite technical expertise concerning nuisance and health topics and the spatial planning practice. Accordingly it contributes to the more profound incorporation of public health concernsin spatial policy initiatives or interventions in order to establish enhanced environmental liveabilty conditions.

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Transition Pioneers – Urban Planners as a Source of Momentum for Sustainable Cities and Regions?

Marie Malchow, Maximilian Rohland, Matthias Wilkens, Nora Buhl, Linn Holthey, Jasmin Jacob-Funck, Katharina Klindworth, Jörg Knieling, Christian Lesem, Hrachya Matinyan, Victoria Mutzek, Franziska Unger

(Marie Malchow B.A., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, marie.malchow@hcu-hamburg.de)
(Maximilian Rohland B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, maximilian.rohland@hcu-hamburg.de)
(Matthias Wilkens B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, matthias.wilkens01@hcu-hamburg.de)
(Nora Buhl B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, nora.buhl@hcu-hamburg.de)
(Linn Holthey B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, linn.holthey@hcu-hamburg.de)
(Jasmin Jacob-Funck B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, jasmin.jacob@hcu-hamburg.de)
(Katharina Klindworth M.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, katharina.klindworth@hcu-hamburg.de)
(Prof. Dr.-Ing. Jörg Knieling, M.A., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, joerg.knieling@hcu-hamburg.de)
(Christian Lesem B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, Christian.lesem@hcu-hamburg.de)
(Hrachya Matinyan B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, hrachya.matinyan@hcu-hamburg.de)
(Victoria Mutzek B.A., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, victoria.mutzek@hcu-hamburg.de)
(Franziska Unger B.Sc., HafenCity University Hamburg, Institute of Urban Planning and Regional Development, Überseeallee 16, 20457 Hamburg, Germany, franziska.unger@hcu-hamburg.de)

1 ABSTRACT

Sustainability as a guiding, normative concept for spatial development faces various challenges when it comes to planning practice. Spatial planners have to contribute to comprehensive societal changes that are necessary in order to transform society to sustainability. This fundamental societal change has been framed as "Great Transformation" by the German Advisory Council on Global Change (WBGU). Urban planners as one of the key actors for sustainable urban and regional development are faced with the challenge of contributing to societal transformation processes towards sustainability. Based on the theoretical background of transition theory and the Multi-Level-Perspective this paper identifies innovative planners as pioneers for sustainable urban development. It examines the role of these innovative planners in their specific context and asks what role they play on the way towards a "Great Transformation". The paper is based on guideline-based expert interviews with innovative urban planners across the whole of Germany. By examining the career patterns of planning practitioners of different areas the existence of personal beliefs relating to sustainability becomes clear. In order to fulfil their beliefs pioneers find themselves in varying positions ranging from communicators, developers and multiplier of alternative ideas and projects of sustainable urban development. They perform their role on niche level as well as on the regime level and are able to connect actors of the both. Applying unorthodox methods and planning tools and being involved in local, regional as well as global actor networks, the selected pioneers contribute to the sustainability transformation.

2 SUSTAINABLE DEVELOPMENT CHALLENGING URBAN PLANNERS

In 2013, 26 years after the Brundtland-report was published, its most famous agent Gro Brundtland received the German Sustainability Prize for initiating the global dialog on sustainability in the late 1980ies (SCHULZE-HAUSMANN 2015). Brundtland as the former chairman of the World Commission on Environment and Development is seen as an essential actor in demanding and supporting a shift from a growth-oriented society to a sustainable development on multiple layers (UN 2015). Even if the Brundtland-report is almost 30 years old, LOORBACH and ROTMANS (2010: 9) state, that we are still far away from realizing a sustainable society. Today, the desired transformation process is tremendously important for urban areas, since 66 percent of the worlds population will live in cities and their surrounding areas by 2050 (UN-HABITAT 2014, RAHO 2014). These agglomerations will have to be resilient in order to accommodate the anticipated growth and resulting resource consumption of a growing urban population.

Besides being a risk for a sustainable development due to the cities' high consumption patterns the hybrid urban spaces can form a hub of socio-technological progress (WBGU 2011). In order to create resilient, sustainable cities and regions "consumption patterns and lifestyles must be changed in such a way that […] low-carbon societies can develop" (ibid.: 5).

Urban planners as designers of future cities (BAYER et al. 2010) have the power to play an important role within that transformation process. Today, there are various innovative approaches in urban and regional planning that bear the potential of accelerating the transformation towards sustainability. One can find different projects at different spatial levels such as the "transition town movement" as well as small size initiatives within cities (e.g. urban gardening, sharing communities). The aim of this paper is to identify innovative planners within such approaches as pioneers for sustainable urban development and to examine the role of these planners in their specific context.What role do they play (or can they play) on the way towards a so called "Great Transformation" (WBGU 2011)? How and why do planners become pioneers for sustainable urban and regional development? How do they realize their innovative ideas and projects? Which instruments and methods do they use? How do they overcome challenges? Within which actor networks do they act? These guiding questions are reflected based on eight interviews with identified pioneers.

3 METHODICAL APPROACH AND PIONEER INTRODUCTION

In order to answer the questions above, the project searched for suitable interview partners. The aim was to identify persons who simultaneously hold a degree in urban planning and are pioneers by taking new directions towards sustainable urban and regional development in their professional work.

The definition of a pioneer was specified using the description of the WBGU (2011: 243). Pioneers were thus defined as initiators and designers of processes of change regarding the above mentioned „Treat Transformation". Within the transition process these individuals can hold varying positions and exercise different functions such as communicator among various different actors, shaper of alternative goals and paths for development, investor and entrepreneur, developer of new concepts, mediator among conflict parties, distributor of alternative ideas, etc. (WBGU 2011: 242-246).

Endowments, networks (e.g. alumni), professional journals and internet searches were used for the identification.[1] After establishing contacts guided interviews were conducted based on a semi-structured interview-guide. The results were transcribed and qualitatively interpreted to retrace the different careers. The outcome are individual development pathways showing important steps in professional life and revealing key factors that define a transition pioneer and their instruments, methods and networks. Hence, the selected agents must not be seen as a generally valid synopsis of the whole group of planning pioneers within Germany.

Within the case study the theoretical concept of transition theory functions as the theoretical basis to guide the analysis of the practice of German planning practitioners dealing with the challenge of sustainable development in innovative ways (e.g. GRIN, ROTMANS, SCHOT 2010). The transition theory offers analytical elements that were useful for interpreting the empirical material.In December 2014 eight interviews were held with the following potential pioneers:

Interview A // head of international projects of German association for sustainable building and construction

Interview B // municipal employee responsible for climate mitigation in middle-sized German city

Interview C // employee of German architectural and urban planning office

Interview D // freelancer as urban planner, urban researcher and teacher

Interview E // founder of agency focusing on conversion of buildings and plots in urban spaces

Interview F // researcher of research institution focusing on urban design, urban infrastructure, strategic planning and technology management

Interview G // member of interdisciplinary association focusing on urban development, conversion of buildings and plots in urban space and creative economy

[1] It has to be noted that, when trying to identify actors working in niche segments from an external point of view, those who do not participate in public networks etc. will rather stay unnoticed.

Interview H // founder of agency focusing on communication, participation and visualization in urban development

4 TRANSITION THEORY

Scientists within the scope of sustainability currently are trying to identify methods that lead to a sustainable society. A major component in this research field consists of the experience of the interdependency between society and environment (MICHELSEN, ADOMSSENT 2014). The science of sustainability is not a solitaire phenomenon; it is rather a combination of various sciences that strive for knowledge in terms of sustainability. Within the last 20 years there have been strong efforts on the level of politics as well as in sociological fundamental research to deepen the knowledge about transition processes. Within this field of research the WBGU, founded in 1992 as a scientific advisory council for the German federal government, plays a stimulating role. MARKARD et al. (2012: 111) state that so far four theoretical frameworks exist within the sustainability transition research. Namely, these include transition management (KERN, SMITH 2008; LOORBACH 2010; ROTMANS et al. 2001), strategic niche management (KEMP et al. 1998; RAVEN, GEELS 2010; SMITH 2007), the Multi-Level-Perspective on socio-technical transitions (GEELS 2002; GEELS, SCHOT 2007), and technological innovation systems (JACOBSSON, JOHNSON 2000; HEKKERT et al. 2007).

Transition theory (GEELS 2005; GRIN, ROTMANS, SCHOT 2010; ROTMANS, KEMP, VAN ASSELT 2001) applies a socio-technical systems perspective and provides an explanation for processes of societal change within these systems. Transition theory suggests that dealing with persistent problems which result from a system’s unsustainability, such as climate change and the need for climate change mitigation and energy transition, requires “fundamental changes in the societal system and its subsystems” (FRANTZESKAKI, LOORBACH, MEADOWCROFT 2012: 21), so called transitions.

Transitions itself can be defined as “radical, structural changes of a societal (sub)system.” as well as “shifts between equilibrium states of societal systems (energy, mobility, water, agriculture, health care, etc.) and […] the result of a co-evolution of economic, cultural, technological, ecological and institutional developments at different levels.“ (Transition Academy, 2015). Within this paper, the definition of transition is based on the Multi-Level-Perspective (MLP) because it allows to analyse the transformation process as a whole as well as to zoom in on specific activities of unique actors in order to understand their role, responsibility and interactions. It views transition as an interaction between three levels of analysis (GEELS 2002):

The regime level describes the dominating thought patterns within different subsystems of a society, e.g. generally excepted cultural norms that determine the way of interacting in public spaces or attitudes that control the pursuit ff economical growth. The socio-technical regime patterns are represented by regime actors leading society (e.g. politicians). Laws, rules and regulations help to stabilize the paradigms agreed to by the majority. (GEELS, SCHOT 2007: 399)

The landscape level represents the exogenous environment. It influences the society levels via changes, that differ in their amplitudes. VAN DRIEL and SCHOT (2005: 54) categorize three kinds of landscape changes, namely very slow changes (e.g. the climate), longterm changes (e.g. the German industrialisation in 19th century) and sudden shocks (e.g. a rapid crisis, war). This diverse set of factors can be combined in the landscape level because “they form an external context that actors cannot influence in the short term”. (GEELS, SCHOT 2007: 403)

The third level of the MLP combines niche innovations. Within this level, radical innovations are generated by microlevel actors (GEELS, SCHOT 2007: 400). The niche provides a protected space for these at first unstable and unoriented innovations and allows them to prepare their ascent towards the regime.

Within the transition process, the possibility for niches to compete against the existing regime arises with the pressure coming from the landscape level (i.e. climate change), which weakens the deeply-rooted regime structures (mind-sets, laws, values, etc.) and creates flexibility on the regime level that allows new developments at the niche level (see Figure 1) (GEELS, KEMP 2005: 13; GEELS, SCHOT 2007: 400).

The project used the transition theory as a theoretical structure to describe the efforts of urban planners to contribute to sustainable urban development (e.g. GRIN, ROTMANS, SCHOT 2010). To analyse unique transition pathways of selected pioneers the MLP on transition theory served as theoretical basis. It was used

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under the assumption that pioneers who take unorthodox paths often act in niches only ascending to the regime level under certain conditions mentioned above.

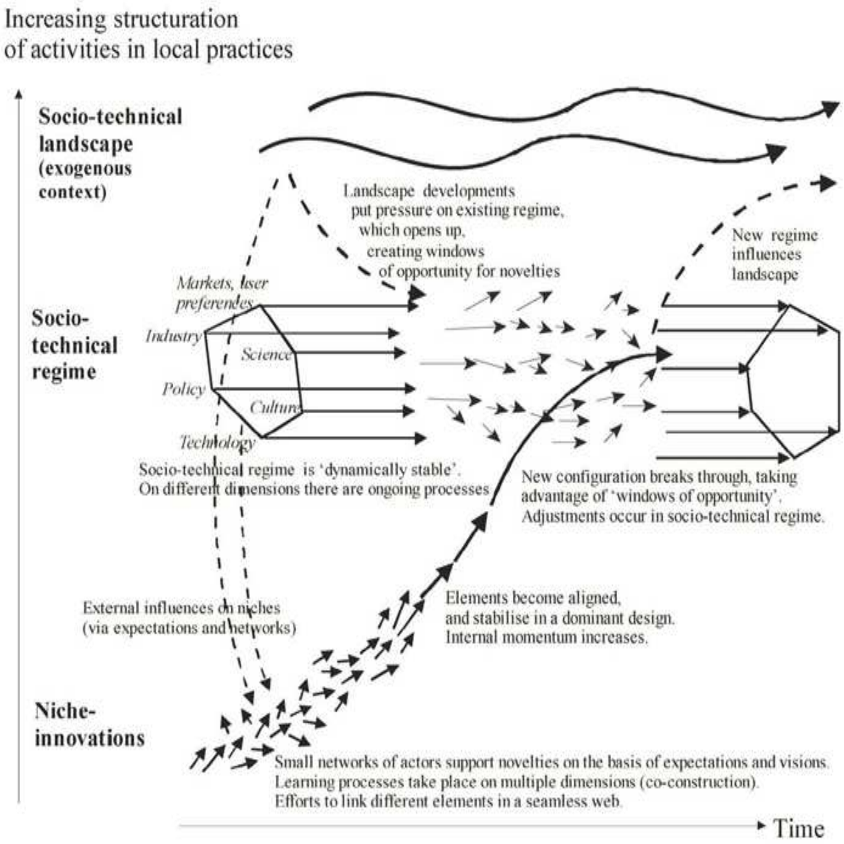

Figure 1: Model of MLP (Source: GEELS, SCHOT 2007: 401; figure adapted from GEELS 2002: 1263)

5 RESULTS

Analysing the interviews and taking into consideration the theory explained above, the following conclusions were achieved regarding the instruments, methods, approaches as well as actor networks of transition pioneers. They will be explained with the help of selected career pathways of the urban planners that were interviewed.

(1) Which instruments and methods do transition pioneers use to promote sustainable urban development?

The instruments and methods of transition pioneers in urban planning are characterized by interdisciplinartiy, communication and cooperation. These are key attributes of the projects and approaches of the interviewed pioneers. The ability of urban planners to communicate and cooperate with different actors across disciplinary boundaries is considered highly important (Interviews A, B, C, E, G, H). On the one hand, planning pioneers use their communication skills to form coalitions with like-minded people of different disciplines, mutual support and inspiration (Interviews A, E, G). On the other hand, planning pioneers may function as intermediary parties between niche actors, citizens and regime actors. As such they help to integrate the views and opinions of underrepresented population groups in urban development processes by developing new tools for public participation (Interviews H) and designing and implementing cooperative projects at the interface of niche and regime level (Interviews E, G). In line with this role transition pioneers facilitate the access of niche actors, vies and ideas to the regime level and vice versa.

Furthermore, planning pioneers often work at the interface of different disciplines and combine the knowledge of different disciplines (Interviews D, E, H). For example, interviewee E (see figure 2) holds degrees in urban planning and architecture and uses the techniques of both disciplines to combine skills in urban and building design with concept development on a bigger spatial scale to create new ideas for the (temporary) conversation of vacant properties. His projects are often co-developed by local initiatives, protest movements and artists – groups which may be difficult to reach by established regime actors and formal urban planning processes and actors.

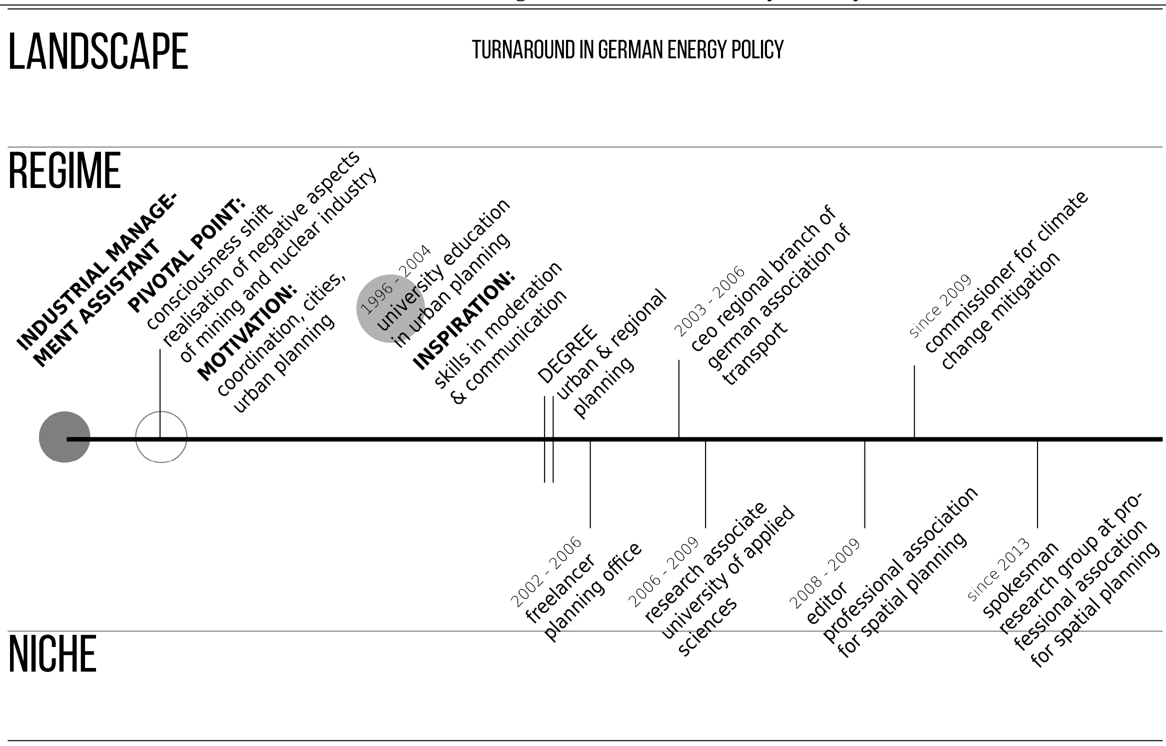

Figure 2: Pathway of interviewee E - Chose to become an urban planner in order to have a holistic impact on cities. Initiated and supported several unconventional projects since then.

Moreover, transition pioneers emphazise the need for constant learning in view of real-life problems and the need to develop new and adequate tools and methods to practically deal with challenges of sustainable urban development. Planning pioneers do not use "hard skills" often focused on in planning education (such as tools of land-use planning) but tend to question these: "The idea is to leave the academic boundaries and work on real projects in public space instead"[2] (Interview A). Often, the experiences of problems resulting from the lack of sustainability of current practices caused transition pioneers to break the boundaries of disciplines and approaches thought in planning education (Interviews B, E). Thus, they developed communicative and cooperative methods promote the implementation of projects which correspond with their ideas of sustainable urban development (Interviews B, D, E, G, H).

Unorthodox actions are often taken into consideration which may inspire planning pioneers to new original ideas, like interviewee E who occupied empty buildings in order to raise awareness on problems in housing policy and housing shortage in urban centres. Another example illustrates interviewee D who utilizes its artistic interventions in urban and rural areas to question recent phenomenons such as climate change or the issue of land consumption.

In summary, flexibility and experimental use of new techniques are recurring aspects when analyzing the instruments and methods used by innovative planning practitioners. Nevertheless, universal assertions on how projects are realized or developed are hard to make because the transition pioneers also emphazise that each project demands a unique set of actions.

(2) Within which actor networks do pioneers act?

As mentioned above, cooperation, communication and exchange are crucial for the activities of planning pioneers. Linked to this is the importance of actor networks for practical work of innovative planners. All interviewed pioneers are involved in different formal and informal networks from local to regional and global scales. Also, many of the interviewees knew each other ether personally or by hearsay. Also, ideas and approaches sometimes are transferred and replicated by different actors in different cities or regions (Interviews E, G).

[2] Original quote: "Die Idee dahinter ist nicht, im stillen Kämmerlein etwas zu erforschen und dann einen Endbericht zu verfassen, sondern konkrete Projekte im öffentlichen Raum umzusetzen im Rahmen dieses Projektes."

While interviewee C acknowledged to be highly influenced by the local network of Kreuzberg/Berlin, which constitutes his personal living environment, interviewee G mainly relies on regional partners for cooperation. In contrast to this, the projects and activities of interviewee A and H are embedded in international networks with project ideas being developed and transferred across national boundaries. Overall, the spatial focus of the supporters of the transition pioneers differs depending on the specific field of activities: Pioneers can rely on a dense network of local, regional or even international actors. This shows that networks created by the pioneers support different aspects of their work: On the one hand, they are evidently fundamental when collecting and passing on information and ideas. On the other hand, they are crucial when initiating new projects, because pioneers as single persons rely on external support and are aware of the fact that networks are vital for idea development and project implementation. Thus, pioneering can be seen as a social process where innovators co-exist and co-create within a broader range of partners, followers and supporters.

As mentioned above, depending on specific tasks and goals transition pioneers team up with a variety of different types of partners. These range from members of the public administration, to experts in related professions up to more distant professions like artists (Interviews A, B, E, G). Some of the pioneers interviewed formed more institutionalized forms of cooperations through establishing or joining associations (Intereviews A, G). Often, these resulted from contacts made during their university studies. The associations are used to bundle resources and establish constant organizational structures as basis for their work.

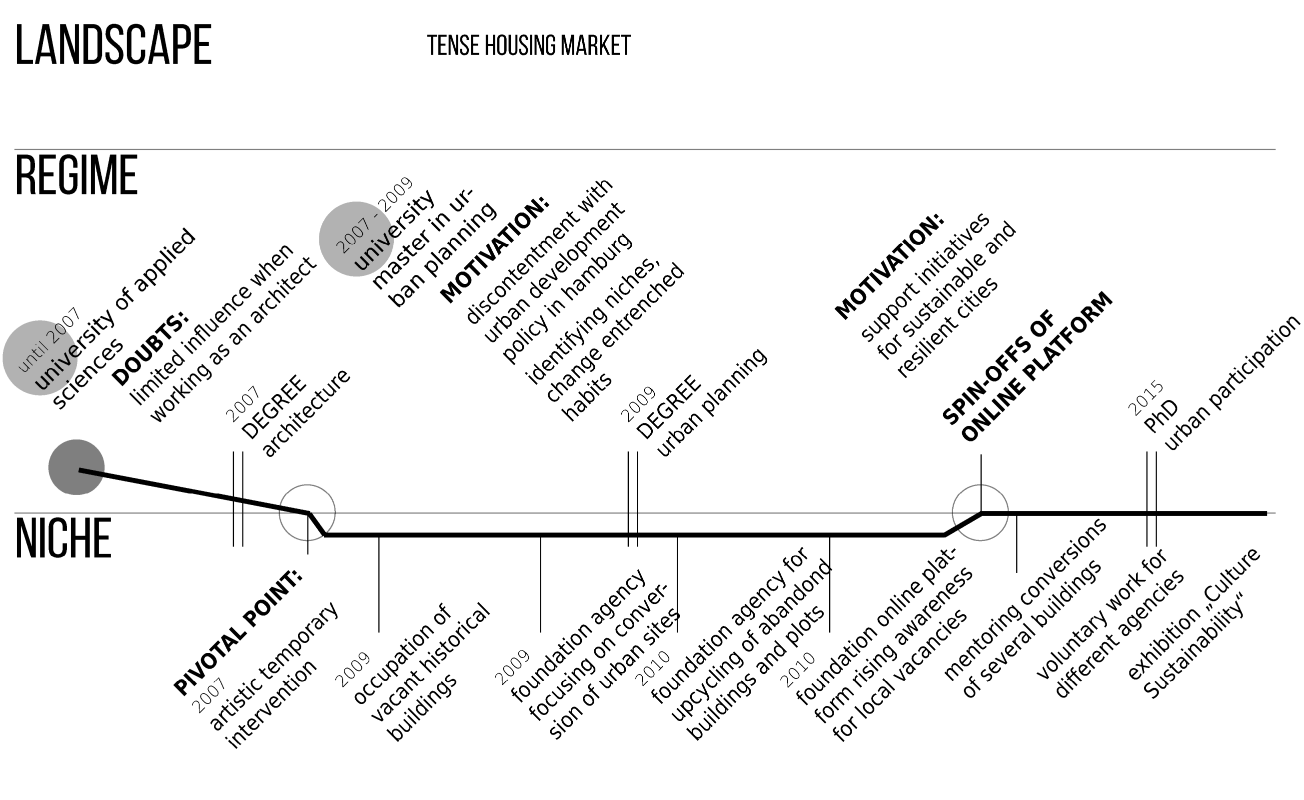

Figure 3: Pathway of interviewee B - Started a career in the industrial sector, switched to the field of climate change mitigation but continues to act within the regime level and pursues the transition from this position.

The transition pioneers use the cooperation with like-minded persons to create scope for action to develop and implement projects which support their idea of sustainable urban development (Interview G). Other transition pioneers founded or joined urban planning offices (Interviews C, H). These may be more strongly dependent on market acceptance to finance their projects. While other pioneers deliberately avoid the establishment of institutional structures to support their activities in order to keep up their independence. They prefer the work as freelancers, which allows the selection of projects only based on individual beliefs and independent of other persons (Interviews D, E).

Transition pioneers also establish, promote and work within actor networks on regime level. For example, interviewee B is responsible for climate mitigation and energy efficiency measures and their organization and coordination across the city. In order to achieve his goals he cooperates with different actors within the city administration as well as professionals from the private sector implementing the construction measures.

He takes the role as interlinking party and contact point for public and private actors as well as citizens. Thus, he spreads his topics and ideas across these three realms and actively promotes the cooperation of different actors. As actor of the regime level he promotes the institutionally embedded topic of climate mitigation through communicative and cooperative approaches and acts as a facilitator of public-private cooperation on regime level. He can also function as an entry point for niche actors to existing networks and regime institutions.

Of course, the exact extent of individual networks could not be explored by a simple interview and is certainly even wider than described above. Pioneers can be seen as hubs of widespread networks. These allow them to adapt specific new partnerships for each of their projects.

(3) How do transition pioneers overcome challenges in planning practice?

Financial obstacles are one of the key challenges for implementing innovative projects of sustainable urban development. The interviewed pioneers overcome this challenges in different ways. E.g. interviewee G (see figure 4) co-founded a registered association, which allows them to collect donations and use them for social projects. Correspondingly, the personal financial benefits of the persons involved are marginal: “we worked for free and even paid extra for it” (Interview G)[3]. This also illustrates the strong idealism and believe in independent ideas which guides the work of all transition pioneers identified.

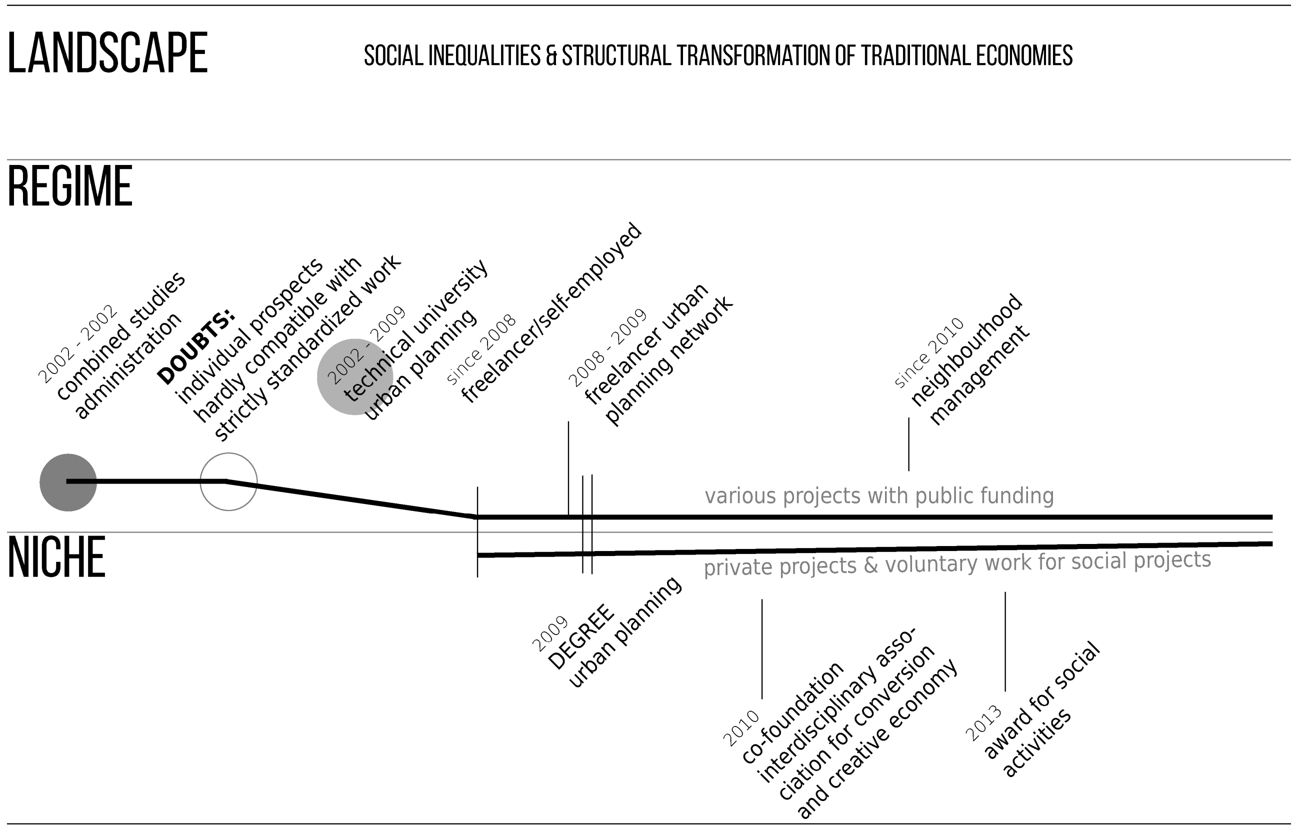

Figure 4: Pathway of interviewee G – Intended to work for the public administration body but later decided to change fields in order to work independently and in accordance with personal beliefs. Ascending towards the regime due to rising publicity.

When following their innovative ideas, pioneers quite often are not focused on gaining financial advantages for themselves. Interviewee D claimed to prioritize its beliefs over financial advantages: “If you don’t like the guy or the task, just say no”[4] (Interview D). Noticeable in all paths (see figure 2-4) pioneers used different paths, activities and jobs to fund their unconventional ideas and allow themselves to pursue their beliefs over a longer period of time. Thus, their work is characterized by strong persistence. Often the groundwork for the later pioneer path was already laid during their university studies. For example, together with a fellow student interviewee H already created an online participation platform while he was still

[3] Original quote: “Wir arbeiteten anfangs kostenlos und zahlten noch drauf.“
[4] Original quote: “Wenn der Typ dir nicht gefällt, wenn der Auftrag dir nicht gefällt, einfach ‘Nein‘ sagen.“

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studying. He kept working on its ideas and steadily expended its activities while eventually gaining success after several years.

The interviews also illustrate that pioneers use outside-the-box thinking and creativity in order to follow their moral beliefs. An example is interviewee E, who participated in an alternative project together with various other professionals to create a temporary art fair (see figure 2) by revitalizing an abandoned building. Interviewee C chose to explore new approaches of imparting knowledge by creating a board game about shrinking cities, which was part of an exhibition in the late 2000s. This shows an openness towards new and creative approaches to communicate abstract problems and challenges of sustainable urban development.

All in all, all persons interviewed had to overcome challenges. Overcoming financial constraints is one key challenge of innovative planning practice. Another challenge becomes relevant when looking at pioneers working together with regime actors or even in the regime: certain interviewees (Interview B, C, E) described a lack of openness towards unknown methods and strategies in administrational bodies. This observation corresponds with a notion stated in transition theory: the regime only changes cautiously due to a high number of existing regulations and routines. Hence, it takes a high amount of self-assertion as well as adaptation for a pioneer to work in the regime trying to change it from within.

The transition pioneers continued working on their ideas without losing their focus. They overcome challenges with creativity, outside-the-box thinking, idealism and persistence. Also, mutual support in networks of like-minded people turned out to be highly important.

6 CONCLUSION

The research showed that pioneers spoken with shared the opinion that a strong iconic belief in a sustainable future was the reason for unconventional decisions in their professional life: The pioneers stressed these beliefs and made it the main reason for their choice of job, working in sustainable urban and regional development. Anyhow, they excercised a range of different functions within the understanding of change agents, e.g. focusing on communication, development or optimizing. Generally, they followed alternative pathways and often found themselves in niche-positions from where they pursued their ideas and trying to implement them into the mainstream or, corresponding with the transition theory (see figure 1), the regime.

However, the question yet to answer is whether urban planners can be seen as a source of momentum for sustainable cities and regions. Regarding this aspect the theory has to be recalled. As explained in chapter 4 landscape pressure such as drastic climate changes can lead to a de-orientation of regime structures. This creates a possibility or a “momentum” for niche actors to ascent towards the regime and transform the whole system towards sustainability. If this so called “window of opportunity” opens up, niche actors have to be well prepared to be able to contribute to a change. Today, with a number of natural desasters and famines around the globe one can say that the global awareness (and thus the landscape pressure) for a much needed sustainable development is rising. Pioneers as experts in networking and actors of the niche as well as the regime can be seen as mediators between those two levels. They have the power to improve the exchange and the mutual understanding and thus simplify the ascent from the niche to the regime.

Landscape pressure can be seen as a rather passive cause while in reaction to this urban planners actively make use of the momentum to strengthen the path to more sustainability by promoting a value shift in the regime. The interviewees can be seen as niche-actors or with close relations towards the niche-level.

The interviews gave insights on how the pioneers work and interact within different levels of the Multi-Level-Perspective. In contrast to the assumption that pioneering always starts in the niche it was possible to trace pathways starting in the regime without an “ascent” from the niche (see figure 3). Thus, being a pioneer does not necessarily imply to work in the niche. However, most pioneers are rather situated in the niche level, either steadily developing towards the regime or temporarily co-operating with regime actors.

This case study only examined a few individual paths. Nevertheless, this paper can only be seen as a starting point for further discussion and research. The work and experiences of a higher amount of pioneers needs to be analysed and compared within an international scope to be able to prove and broaden these first findings. A deeper understanding of the pioneers’ values, their emergence and development in context with educational institutions is yet to be analysed.

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reviewed paper

Urban Development and Infrastructure Cost Modelling for Managing Urban Growth in Latin American Cities

Ernst Gebetsroither-Geringer, Wolfgang Loibl

(Dr. Ernst Gebetsroither-Geringer, AIT Austrian Institute of Technology, Giefinggasse 2, 1210 Vienna, ernst.gebetsroither@ait.ac.at)
(Dr. Wolfgang Loibl, MSc, AIT Austrian Institute of Technology, Giefinggasse 2, 1210 Vienna, wolfgang.loibl@ait.ac.at)

1 ABSTRACT

Rapid urban growth presents considerable challenges to cities in Latin America and calls for tools and mechanisms that can help identify priority areas of work and enable integrated responses for urban sustainability, especially with regard to access and delivery of infrastructure services.

The concentration of population, however, generates high demand for services. When the expansion of the supply of services is inadequate, significant deficits emerge in the coverage and quality of infrastructure and services, including housing. These problems are compounded by weak urban governance. (IDB, 2015)

Thus solutions are required to secure sustainable urban development considering financing limits of cities authorities as well quality of life and environment. Infrastructure planning can either respond to urban growth providing supply by following the demand or it can pro-actively shape urban development in a resource efficient way by providing supply directing the demand. Thus appropriate infrastructure design can serve as an instrument for “soft” urban growth management.

AIT (Austrian Institute of Technology) has been contracted by the IDB (Inter-American Development Bank) to develop a tool (model) to simulate urban expansion triggered by infrastructure development and to estimate related infrastructure costs. The tool allows simulating different urban development scenarios based on different assumption on population behaviour and criteria triggering this behaviour. The tool called UIDS (Urban and Infrastructure Development Simulator) allows testing infrastructure networks extensions and estimates the expected infrastructure costs to assist cities in resource efficient as well as cost efficient infrastructure design.

Backbone of the tool is a spatially explicit micro-simulation of urban expansion conducted through an agent-based model (ABM) as well as AIT’s MASGISmo simulation platform making use of the RePastJ environment for ABM modeling and R-statistics as well as a PostgreSQL/PostGis database and a GeoServer for Web Map Services (WMS). Single agents representing households of different socioeconomic classes trigger land cover and land use change within an area by moving to certain places. To model dwelling suitability for the agent classes the urban-region landscape is described through attractiveness layers representing different characteristics increasing (or decreasing) the suitability of potential urban expansion areas. The additional infrastructure costs for road network, water- and sanitation network, electricity and gas network, are estimated based on costs per unit (e.g. km pipeline, area covered etc.) and the related supply ratio. Based on the new dwelling allocations the infrastructure costs related to water and sanitation, transportation, and energy are calculated as distribution and connection costs and aggregated to total costs for the city, which are compared between different urban development scenarios.

2 INTRODUCTION - URBAN DEVELOPMENT OF LATIN AMERICAN CITIES

In the industrialized world - above all in Europe and the United States - urban development trends are - when compared against emerging countries and cities - rather static with population growth of a few percent within a decade. But there is still growth, emerging as concentration but more often as urban sprawl. (Panebianco, 2003),

In Latin America the main challenge for urban planning has been for long time the speed of the urban growth – acknowledged as the fastest urban growth in history (Barros, 2012). During 1950 to 1980 Latin American countries went from being predominantly rural to predominantly urban in a few decades, with high concentrations of urban population in cities with more than one million inhabitants (UN-Habitat, 1996). This urbanization produced a lot of social problems, linked to a lack of housing, since the governments of these countries did not manage to provide enough housing and related infrastructure to accommodate the rural migrants moving to the cities. Peripheral growth, termed as ‘peripherisation’ by Latin American researchers and planners, can be characterized massive development of low-income residential areas beyond the city borders. These areas are later incorporated to the city by a long-term process of expansion in which some of

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the low-income areas are then merged with the urban system and occupied by higher income groups, while new low-income settlers arrive, occupying new areas to build new informal housing in the urban fringe.

The bulk of the housing stock in the peripheral ring of Latin American cities consists mostly of upgraded (or in the process of upgrading) low-income residential areas, with a large number of emerging spontaneous settlements (Barros, 2012). These spontaneous settlements usually lack urban services of any kind. As such, peripherisation is not only a problem of urban growth. It is a problem of (extreme) social inequalities as well as service provision inequalities in the city. Thus peripherisation has strong effects in social, economic and infrastructure provision terms, which cannot be solved without strong planning action. (Barros, 2012)

But urban planning in Latin America has to consider a different planning culture as well as a different kind of property perception. Urban development control by city-wide zoning plans is no appropriate solution for Latin American cities. The right for dwelling is seen as a human right. Zoning plans and building regulations outside the very centres of the cities are not accepted - neither by the “old” residents living still longer in the cities nor by the new dwellers approaching from rural areas, perceiving that who has “cultivated” land by clearing the area and building a house has the right to stay and live there. But not limiting or controlling dwelling area expansion would cause severe environmental and budgetary problems for the city administration. Uncontrolled accelerated urban expansion is causing increasing traffic and related air pollution and is requiring high infrastructure investments, not affordable by many cities.

Therefore solutions are required to secure sustainable urban development considering the financing limits of city authorities as well as quality of life and environment. Infrastructure planning can either respond to urban growth providing supply by following the demand or it can pro-actively shape urban development in a resource efficient way by providing supply to shape the demand. Thus appropriate infrastructure design can serve as an instrument for “soft” urban growth management which calls for tools and mechanisms that can help identify priority development areas to foster new dwellings to be built in appropriate areas with regard to access to infrastructure services. To cope better with these peripherisation effects, spatial planning requires reliable scenario results for decision makers to foresee the effects of alternative urban planning strategies. Multi agent system (MAS) models which consider the spatial behaviour of individuals lead to very detailed results at the local scale. So such models allow ex ante assessment of future land-use change consequences with suspect to planning strategies.

3 METHODOLOGICAL BACKGROUND

3.1 Agent-based modelling and land use change simulation

Agent-based models (ABM), also called multi-agent systems modelling (MAS), have gained increasing importance in the studies of social and economic systems. It has often been used to improve the understanding of a wide range of problems and to help forecast the effects of top-down decisions on the micro-level. Applications include the emergence of cooperation (Holland & Miller 1991) and the influence of expectations, e.g. on the stock market (Axelrod 1997a and 1997b).

ABMs have been applied for urban development research and planning since nearly two decades. A famous early example of ABM used in urban modelling concerned the emergence of racial segregation in cities. However, over the last ten to fifteen years has ABM been receiving increased attention from the spatial development modelling community (land-use modelling as well as urban planning). It has been recognized that ABM offers a way of incorporating the influence of human decision making on land-use in a formal and spatially explicit way, taking into account social interaction, adaptation, and decision-making on different spatial and (or) hierarchical levels (Matthews et al. 2007).

Building blocks of MAS and in particular the concept of agents itself are not always clearly defined. However, it is argued by Jennings et al. (1998) that ABM uses three key terms: (i)‘situatedness’, (ii)‘autonomy’, and (iii)‘flexibility’. Here, ‘situatedness’ means that an agent receives information about the environment from sensors and, subsequently, can perform actions, which, in turn, can influence the environment. ‘Autonomy’ means that an agent can act solely based upon its objectives and the system’s internal state, without any direct external influence. ‘Flexibility’ means that the agent has the ability to change its behaviour, for instance when it needs to adapt or learn from others. Hence, in summary we can say that agents are situated in and interacting with their environment and are capable of changing their behaviour to reach their individual objectives.

MAS-based land-use change models are frequently market- and neighborhood-oriented (see Portugali 2000, Wadell, 2002). AIT's approach does not follow explicit economic market aspects, but considers suitability for settlement establishment or the probability of households in which region and where to settle, based on attractiveness criteria (Loibl et al., 2001, 2004). This approach does better meet the needs of cities in emerging countries' like those in Latin America, with urban development triggered by large shares of - explicitly non-market driven - informal settlement growth as addressed by Barros (2012) and recently by Mc Guirk (2014). AIT's first ABM model development to simulate land use change has started around 2000 and has been improved (for different spatial scales and purposes) 2003 and 2004 (Loibl et al., 2001, 2003, 2004, 2007). Since 2007 more interactive control has been added to the model: e.g. parameter adjustment for 'on-the-fly' model run adaptation and for easy the exchange of input and output data, Gebetsroither et al., 2007, 2009 and 2014).

The agent's decisions to select a new housing area are driven by regional attractiveness or repulsion criteria. Attractiveness patterns may deviate for different agent classes, depending on their preferences and constraints related to income range socio-economic power and affordability of places to be selected (if market criteria are considered). Regional attractiveness influences agents' housing area choice resulting in different development patterns for different agent classes (Loibl et al., 2001, 2004). Thus the attractiveness pattern mirrors the probability to move to a certain place. A probability function where to settle can be estimated based on prior urban immigration distribution to be explained through attractiveness layers based on regression analysis, if enough data is available. If no detailed population change pattern is available, no probability function can be generated and must be replaced by local expert judgment on the influence (and thus weights) of different attractiveness layers on settling pattern to derive a common attractiveness layer (see section 4.2.). Several projects within the last years have shown that this information about detailed population change patterns is most often missing. The kind of attractiveness or unattractiveness criteria is described later – there can be a wide range of criteria included ranging from standard market oriented ones like lot prices, or distance to the city and accessibility by public transport, to availability of social infrastructure and green space (environmental condition), area with crime rates or natural risks.

3.2 The MASGISmo simulation framework

MASGISmo is the current simulation framework building the UIDS used and developed by AIT. MASGISmo, the so called Multimethod Agent-based (ABM) System dynamics (SD), GIS modelling platform was originally developed within several projects to combine a bottom up simulation method (ABM) with a top down method (SD) and the input, the analysis as well as output of GIS data (Gebetsroither, 2007, 2009, 2014). The platform is programmed in JAVA connected to several external tools as a PostgreSQL (PostGIS)[1] database, Vensim[2] a (SD) tool and uses RepastJ[3] as core ABM tool. Several other connections (e.g. R-Statistics[4], GAMS (TIMES) are integrated, but not fully elaborated and applied in every model built with MASGISmo – depending on the purpose). A Graphical User Interface and the flexibility by JAVA programming enables to generate user defined interfaces to steer and analyse the developed models. In the beginning of ABM, spatial modelling of an agent did not include geographic information. The same was the case in the beginning of combined SD modelling and ABM (Gebetsroither, 2009). Geographic information is, however, important in the simulation of, e.g., regional development, especially if local stakeholders are involved in the discussion of the result: Geographic information may enable local stakeholders to intensify their engagement in the discussion of simulation results. Therefore, especially when local stakeholders (e.g., within a participatory urban planning process using modelling) are involved, the inclusion of data from Geographic Information Systems (GIS) represents a major advancement. Nowadays, people are used to easily accessible geographic data, thanks to ubiquitous services such as Google Maps or Open Street Maps.

Today, multimethod modelling including GIS data is possible through specifically designed software tools like Anylogic, Netlogo or Repast Symphony. MASGISmo however makes use of GIS data for complex spatial analyses, while the other software tools use their GIS functionality mainly for obtaining information about the agent's location. MASGISmo in turn enables users to analyse the environment of an agent in

[1] http://www.postgresql.org/
[2] http://vensim.com/
[3] http://repast.sourceforge.net/
[4] http://www.r-project.org/

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manifold ways within the platform, e.g., the location can be used to estimate its influence on the agent's behaviour.

The development of the simulation platform MASGISmo is predominantly determined by the requirements of the projects it serves, i.e., the objects to be modelled and the modelling purposes. Almost with every model built up with MASGISmo, new functionalities for the platform are developed, serving other future modelling purposes. The core module of the Urban Infrastructure Development Simulator (UIDS), built with MASGISmo is embedded in a complex simulation environment enabling different functionalities provided by different open source applications. Three main parts characterize MASGISmo's graphial user interface (GUI): first the general simulation controls on the top, second the interactive controls (tic boxes, buttons, sliders etc.) to adress different additional features, third the mapping and diagram frames, presenting the dynamic maps and cost results, the interactiv GIS layer legend and an overview map.

The focus in this project was to develop a tool prototype as simple as possible to be also used by non-modelers. This GUI was explicitly designed for a specific purpose - the simulation of different urban development scenarios with changing assumptions. Thus some features of MASGISmo are not used in this tool, as the client prefered a more simple user interface. Figures 2 and 3 show screenshots of the GUI. The enhancement of the tool, carried out within this project, was mainly the link of R-statistic functionality to the tool, to generate attractiveness layers by calculating distance surfaces and in the connection to the GeoServer to publish simulation results enabling to visualize them via Web Map Service (WMS, see section 5).

The core UIDS module, programmed in JAVA, with connections to other open source software like PostgreSQL/PostGIS Database, the GeoServer[5], R-statistics and a in Java-Script programmed Web interface using OpenLayers[6] and Ext JS steeres the whole tool. A 64-bit enviroment was used, enabling to load all the necessary GIS data within MASGISmo as ESRI-ASCII grids into the RAM (Random Access Memory). This turned out to be a very powerfull way to perform fast geospatial operations.

3.3 Infrastructure cost estimation

The additional infrastructure costs for road network, water- and sanitation network, electricity and gas network, bus-network are estimated based on costs per unit (e.g. km pipeline, area covered etc.). The following figure 1 depicts the calculation principle: the length of the new network branches are calculated sequentially for each new allocated housing area requiring a new connection to the network. The costs are estimated through the number of connections for new customers (represented by the agents) and the length of the network extensions to connect the new customers with the current network.

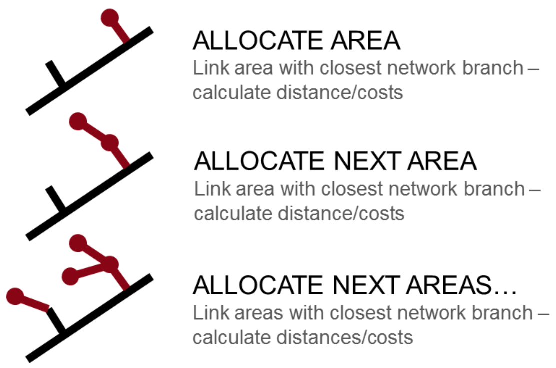

Fig. 1: Cost by distance calculation principle

Based on the new dwelling allocations the infrastructure costs related to water and sanitation, transportation, and energy are calculated as distribution and connection costs and aggregated to total costs for the city, which are compared between different urban development scenarios. The infrastructure cost types are (i) facility investment costs (to secure supply capacity), (ii) transmission costs: distance from supply to demand and (iii) distribution costs: area covered (lateral network) and connection costs: entities - houses. Maintenance costs have been included considering the regular repair work.

[5] http://geoserver.org/
[6] http://openlayers.org/

4 URBAN INFRASTRUCTURE COST DEVELOPMENT SIMULATOR

The Urban Infrastructure Development Simulator (UIDS) is built on earlier tool version (Gebetsroither et al., 2007, 2014). The functionality of the tool was extended by an infrastructure cost calculation feature, developed in close cooperation with the IDB. The 1st tool application has been carried for two cities, selected by IDB: for Mar del Plata, a city in Argentina with around 600.000 inhabitants with some 8 million tourists during summer, selected because of rather good data availability, and for Cuenca, a mountain city in Ecuador with 300.000 inhabitants, known as architectural world heritage, to demonstrate the tools usability for a city with weak data availability.

The project target was to develop the generic tool starting with Mar del Plata as example, but to be flexible enough allowing tool applications for various cities in Latin America with low adaptation requirements.

The UIDS shall thus enable urban planners to estimate the impact on infratructure costs for e.g. road or water in relation to the land use changes (growth patterns) within the city-region. It visualizes spatial changes through dynamic maps depicting the results of the simulations and calculates infrastructure costs for extending the current infrastructure networks. It is based on the analysis of geospatial data and uses an Agent-based model approach to simulate the development in the city-region.

4.1 Graphical user interface of the core UIDS

MASGISmo provides a standard user interface (Gebetsroither, 2009), but it is flexible and the GUI developed for the UIDS was adapted for the needs of the client. The most specific interface is the 'Management tab' which is shown in the figure 2 below.

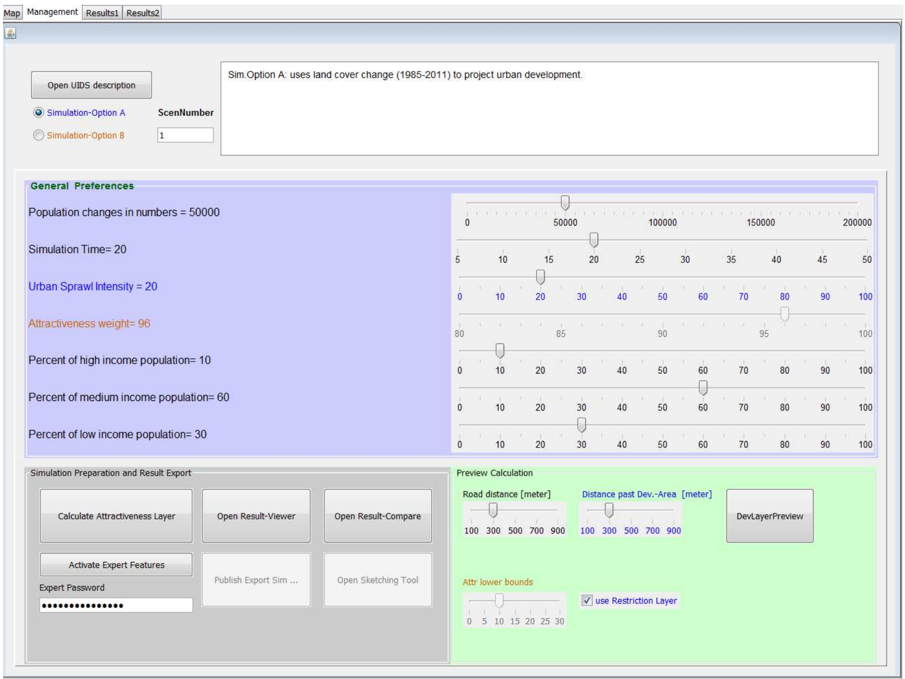

Fig. 2: UIDS major control panel, © AIT

The UIDS enables to create different scenarios based on two main simulation Options. Option A analyses the data from the past using the land cover changes to calculate trend scenarios based on the former development. The data for Mar del Plata allows to extract areas where recently, between 1985 and 2011, new land was occupied as residential area, and already built-up area which shows low to medium development and can be intensified to high developed areas. Scenarios with different population numbers and time periods as well as urban expansion intensities can be compared. Population growth scenarios can either be based on a literature study or expert judgement. Currently population growth is an exogenous parameter, because not enough data was available to extract a function to make it endogenous. Within a future version of the tool can this be adapted e.g. for a city with good population statistics. A scenario with a high urban expansion intensity therefore would lead to a development using more non-urbanized areas, whereas within a scenario of low expansion intensity the low to medium developed areas would be mainly used (densification). Thus lower infrastructure development costs occur for these scenarios. As an example the figure 3 below shows a result of a trend simulation option with 50.000 new inhabitants and urban expansion intensity of 80, meaning about 80% of the new occupied areas are former non-urbanized areas.

This simulation option is based on the analysis of land cover changes from the past. The project has shown that this kind of data is not available for many cities the UIDS is supposed to be used (about 20 cities in Latin America), or at least not in the same detailed structure as available for Mar del Plata. Mainly because of the lack of data a second simulation option (Option B in figure 2) was developed in which a fexible combination of different spatial information can be used to calculate the attractiveness of different areas of the city (see sections 4.2. below).

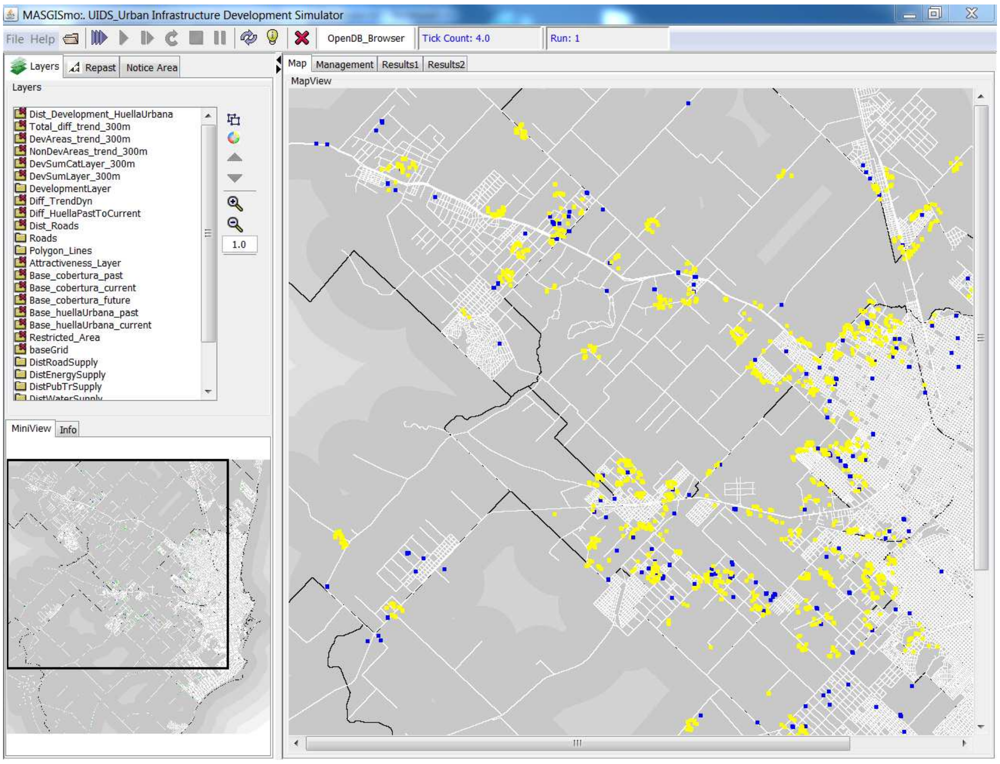

Fig. 3: UIDS Map Screen, © AIT (new development areas yellow, densified areas in blue)

Abbreviation	Name	Description
EnSup_	Energy Supply	area with current energy supply network
PubTr_	Public Transport	area with public transport network
WatSup_	Water Supply	area with the current water supply network
WaWat_	Waste Water	area with the current waste water network
Road_	Road	roads in the city
PubServ_	Public Services	public services which are important for the city (e.g. schools, administrative buildings, etc.)
Dev_Ar	Development Area	area where the city should develop (master plan for the city)
RecAr_	Recreation Area	area for recreation, relaxation (e.g. parks, public places)
PoIAr_	Points of Interest	remarkable areas/points for the city (e.g. schools, etc.)
RepAr_	"Repulsion" Area	unattractive areas to live in
RepAr2_	"Repulsion" Area 2	unattractive areas to live in
ResAr_	Restriction Area	restricted areas for (further) occupation (e.g. already developed areas, water, steep slop areas, etc.)
RisAr_	Risk Area	unsafe areas to live in (e.g. flood zones, etc.)

Table 1: Input Layer-Categories for the Attractiveness calculation

4.2 Attractiveness Layer Calculation

The calculation of local attractiveness is performed within the tool as a preparation step on a cell by cell basis. Most layers are created using raster GIS functionality to estimate the Euclidean distance to those places or areas which are more or less attractive. The calculation of such distance layers is carried out by using the software R-statistics . Interfaces have been developed to read and write raster cell layers based on ESRI's ASCII raster format and to draw maps depicting the distance pattern through color codes.

Raster layers to model urban development include the following: (i) land-use layers of prior and current land use (e.g. 1985, 2011) representing built-up area, urban green and traffic areas and open space classes, (ii) zoning regulations: nature conservation areas and (iii) distance to closest residential area, to roads, to bus route network, to social infrastructure (schools, kindergarten, hospitals…) or to critical areas (e.g. areas with high crime rates, natural risk areas). The latter may serve as a barrier indicating not-attractive zones normally not selected for housing. Table 1 lists the different layer types which can be combined.

Input data for these attributes can be provided as ESRI-shape files, which are converted into ASCII grid files for raster-cell-based distance calculation. The figure 4 presents a collection of these attractiveness layers to give an impression how the different layers can, through selection and weighing of a subset of layers, contribute to a common attractiveness layer.

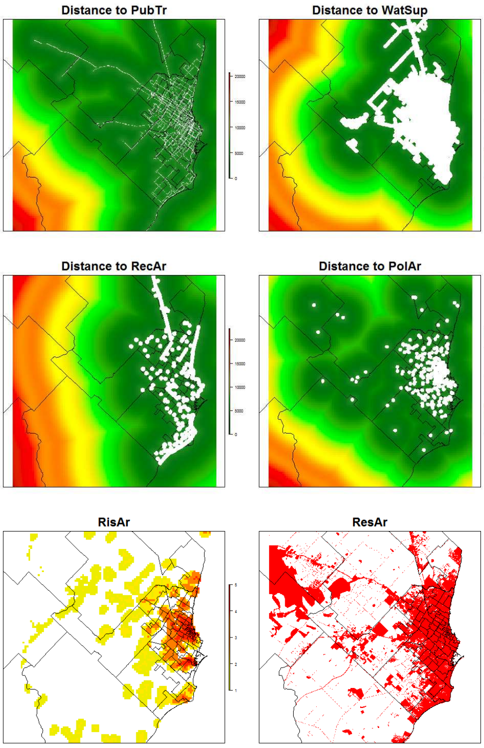

Fig. 4: Attractiveness Calculation: Single attribute attractiveness © AIT (Details on prefix (e.g. PubTr) can be found in Table 1)

The calculation procedure is embedded in a user interface where urban planers can use their expert knowledge about the most important criterias for the development within the city (see figure 5). The single attractiveness layers will be weighted and combined to a common (integrated) attractiveness layer. Weights are defined individually for each layer (set through sliders – top left in figure 5). Currently the weights are defined by the user, e.g. urban planners or other experts. A data analysis to calculate the weights for the different input layers for Mar del Plata and Cuenca was performed, but did not lead to reliable results, because not enough population data on high spatial resolution was available. For others cities enough data might be availalbe and thus could be used to calculate the weights to derive the overall attractiveness layer. The top image shows either one of the selected attractiveness criteria[7] or as in the case of figure 5 the currently calculated common (integrated) attractiveness layer. The bottom image (in figure 5) depicts the common attractiveness layer currently in use in the simulation, containing the selected and weighted single attractiveness layers. The new attractiveness layer can be imported to be used into the tool by clicking the ImportNewLayer Button (figure 5).

[7] this changes via Mouse Over input for the different criteria

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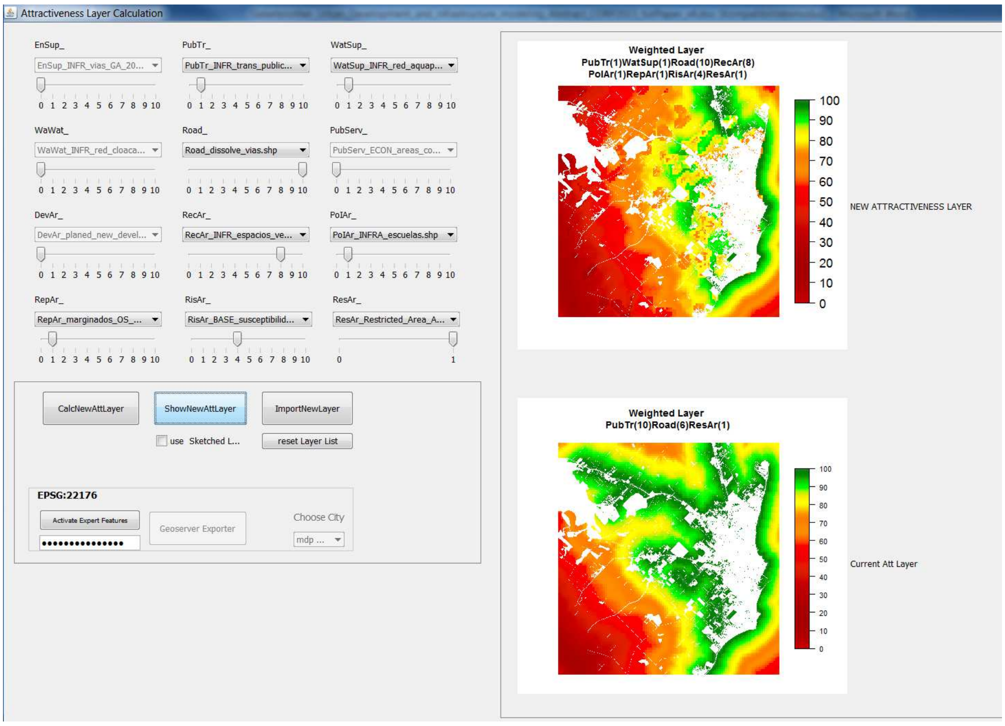

Fig. 5: Attractiveness Calculation: UI © AIT (green areas with high, red areas with low attractiveness)

5 WEB VISUALISATION INTERFACE

The web visualisation interface was developed to enalbe analysing the simulation results independently from the creation via internet. This mean the Java-Script programmed interface using the GeoServer and OpenLayers is an independent application. Simulation results which should be available to access within this interface can be published by authorized users via a single click on a button in the UIDS core user interface shown ind figure 2.

The map and diagram viewer as part of this interface allows to show single to multiple maps to display the published scenario results. To explore each scenario the users can select individual combinations of base maps and all used thematic maps (using different layer styles, legends). Base maps (Open Street Map, Google Maps) serve as orientation to navigate within the scenario maps. Thematic maps provide information about population change, emission values as well as different cost categories, such as energy supply costs , water supply costs, etc. (see figure 6.).

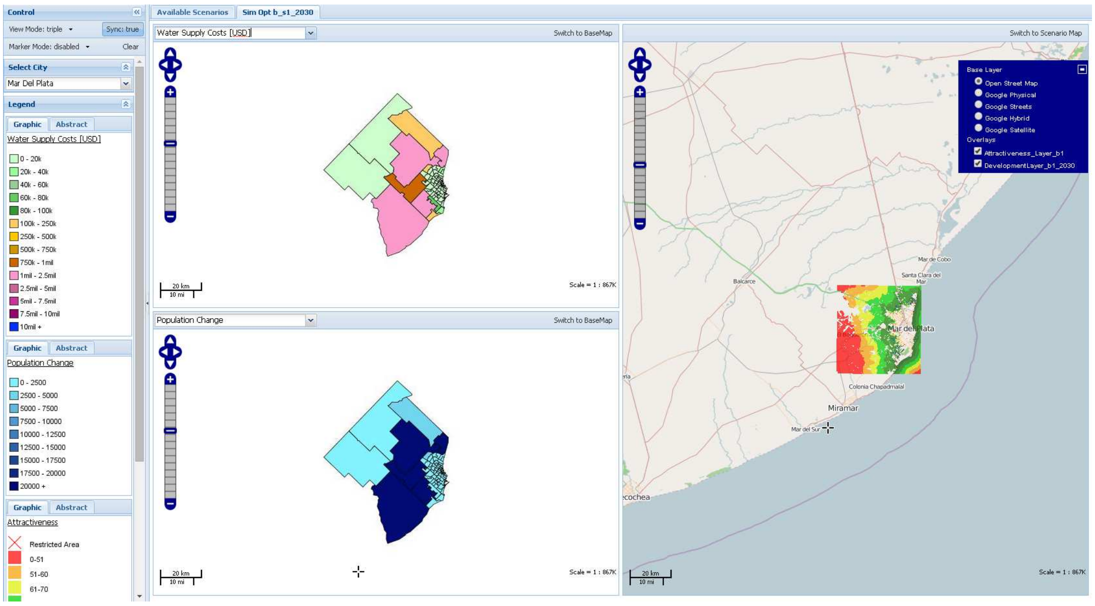

Fig. 6: UIDS Web Interface: Single Scenario result viewer © AIT

The compare application allows to display different simulation results (scenarios) side-by-side, to be selcted from the selection of already published scenarios. The application enables the users to compare different simulation runs or to compare results of one scenario over time by selecting consecutive timestamps of a specific simulation run. For up to three scenarios, the user can compare attributes, such as population change, CO2 emissions or costs (energy supply costs, water supply costs, etc.). The results are shown as maps, as bar charts and as tables (see figure 7 below).

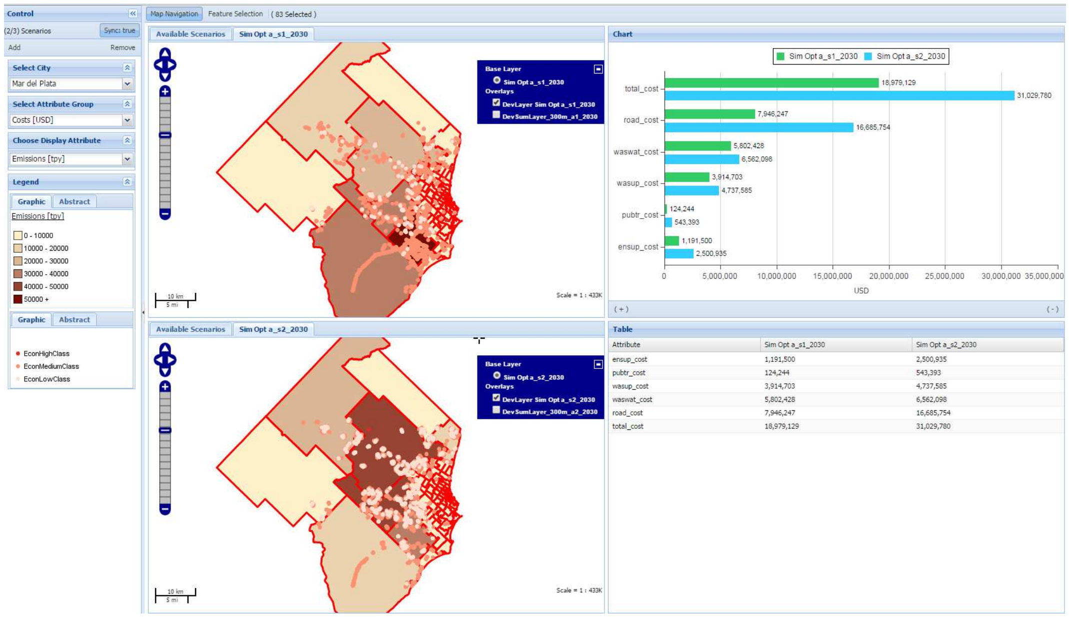

Fig. 7: UIDS Web Interface: Scenario result compare © AIT

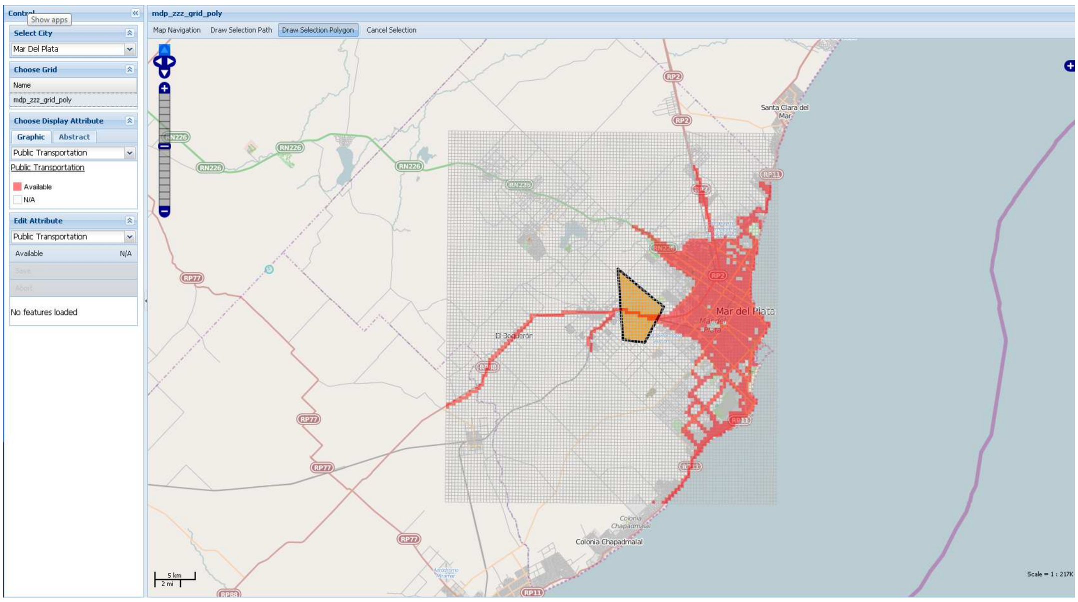

Fig. 8: UIDS Web Interface: Sketching tool © AIT, showing a selected area (orange) and the current public transport system (red).

5.1 The sketching feature to draft individual layers

As mentioned above was one of the main targets to develop a tool which can be used for different cities in Latin America. The early stage of the current project has shown that the good data situation, which was the case for Mar del Plata, is more or less an exception and that most often important information like the current infrastructure situation (e.g. supply areas) are missing, at least in the form of spatial maps. Thus within the project an in Java-Script programmed application was developed which enables to reduce this information gap. As a result additional layers can be "drafted" through a sketching feature allowing a simple interactive map creation – e.g. to show the current infrastructure situation or to allocate future development areas, future road network. With this application at least coarse spatial information, if maps as listed in table 1 cannot be made available, can be created from the local expert of the respective cities. The local experts normally know

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there city very well, whereas this information is not always available as georeferenced maps. The layer creation is done by interactively marking cells in a regular grid, certain attributes (as shown in table 1) can be set to either 'available' or 'not available', with the visual help of a background map (from Open Street Map, Google Maps, see figure 8 below). Within the core UIDS (Java) interface this information can afterwards be used for the attractiveness layer calculation. This sketching capability has been very helpful for the implementation of the city Cuenca into the tool, as many data has been missing for the city.

6 CONCLUSION

The tool has been developed as prototype of a generic simulation framework to be applied for different cities in Latin America. The application has been conducted until now for the two test cases Mar del Plata and Cuenca. Both test cases show the usability of the tool in cases of different data availability, whereas the test case Cuenca has demonstrated that only the sketching capabilities enabled to implement the city at all. To acquire appropriate data is always a challenge and needs a lot of resources for exploration, compilation and harmonization. The complex simulation environment enabled to create a very flexible tool, which can be updated with new data in the form of spatial maps or cost assumptions (e.g. U$ per km road, water pipe lines) with a minimum of effort. New and different data could be used e.g. currently for the two Cities no information about land ownership and land prices were available, but this kind of information can be introduced later on e.g. as restricted areas or only for the high income people affordable areas.

Nevertheless the complexity and flexibility has its drawbacks, as the engagement with the tool is not as easy as hoped. Online trainings and video tutorials have been developed to provide sufficient (remote) support for users applying the simulation tool. The web visualization allows analyzing and comparing scenarios. Thus instead of working with the complex simulation framework to support urban planners' work, the web based result visualization can be applied as standalone application to allow ex ante assessment of different scenarios (created by UIDS experts) to discuss alternative urban development directions and infrastructure budget requirements. These UIDS experts will enable, working in close collaboration with the cities as data and knowledge providers, to develop successful applications.

7 ACKNOWLEDGMENT

The authors want to thank the Inter-American Development Bank (IDB) in Washington, specially Horacio Terraza and Patricio Zambrano-Barragan from IDB's Emerging and Sustainable Cities Initiative, for their trust in our work, for the support in providing data and local contacts and - not at least - for the contract to push along the MASGISmo tool for modelling urban development of Latin American cities to be extended with the estimation of infrastructure costs, as a generic planning instrument. We would further thank the Students Sarah Becker, Romana Stollnberger and Wolfgang Schranz for their work during the development of the UIDS.

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Urban Form and Urban Security: Insights from a Southern Italian Neighbourhood

Carmelina Bevilacqua, Claudia Trillo, Pasquale Pizzimenti, Carla Maione

(Carmelina Bevilacqua, Università degli Studi Mediterranea di Reggio Calabria, cbevilac@unirc.it)
(Claudia Trillo, Università degli Studi Mediterranea di Reggio Calabria, C.Trillo1@salford.ac.uk)
(Pasquale Pizzimenti, Università degli Studi Mediterranea di Reggio Calabria, pasquale.pizzimenti@unirc.it)
(Carla Maione, Università degli Studi Mediterranea di Reggio Calabria, carla.maione@unirc.it)

1 ABSTRACT

Contemporary cities are affected by several challenges. Rapid urbanisation processes combined with unstable economic conditions, uncontrolled physical development and social exclusion, political instability make difficult the understanding of “security and safety” dynamics, often interconnected with a combination of factors. A mix of social, economic and physical decay often contribute to create appealing conditions for criminal activities. This paper discusses how urban safety and security dynamics are related with urban planning and its implementation, by drawing insights from an urban area belonging to a Southern Italian city, Reggio Calabria. More in general, it will be emphasized the relationships between urban planning and related implementation and urban security in bligthed neighbourhoods. Evidences from the case study show that the status of decay of the urban environment, often consequence of implementation gaps inurban policies and lack of management capabilities, contribute to enhance the isolation from the rest of the city. The researchers conclude that integrated urban regeneration initiatives, aimed by nature at improving both people and places, might improve urban safety conditions in thiskind of neighborhoods.The case study has been developed within a wider research project granted under the 7th European Research Framework.

2 URBAN SAFETY AND SECURITY: A RISING CHALLENGE FOR CITIES

Contemporary cities are affected by several challenges in the social, economic, institutional, political and environmental spheres. Rapid urbanisation processes combined with unstable economic conditions, uncontrolled physical development and social exclusion, political instability make difficult the understanding of “security and safety” dynamics, affecting planning and governance effectiveness. The problem of crime and violence in cities is considered a growing and serious challenge worldwide. Social, economic and physical decays are often combined and contribute to create appealing conditions for criminal activities (UN-Habitat, 2007). The literature recognise that urban planning and design play a significant role in managing urban safety and security issues. In planning theory, over the years several authors approached this topicunder very different perspectives. The body of knowledge was grounded betweenthe 1960s and 1970s, when Jane Jacobs published the seminal book “The death and life of great American cities” (1961) and Oscar Newman set the basis for relating physical environment and criminal behaviour in his work “Defensible space” (1972).

Since then, the way of considering “secure” and “safe” a city encompassed several changes. Indeed, recent socio-economic changes deeply influenced thistopic, by modifying the perception of safety and security in the cities and adding further factors of complexity related with multiculturalism and global dynamics (Bauman, 2003; Amendola, 2003). Moreover, nowadays urban safety and security are severly challenged also by physical factors, particularly in the last years, because of the climate change. Extreme weather conditions are enhancing the vulnerability of cities, as underlined by the report published by the United Nations- UN-Habitat “Enhancing urban safety and security: Global Report on Human Settlements 2007”. Ensuring citizens’ safety and security remains a major societal contemporary challenge. To sum up, as suggested by Bonss (2011), the meaning of security changes according with specific contexts and can refer to all forms of stable social conditions at city or neighbourhood level (Bonss, 2011).

As anticipated, the concept of safe and secure environment in planning theory evolved over the years. Jacobs (1961) emphasized the positive aspects of organically developed neighborhoods. In her view, “dense population and mixed commercial and residential land use serve to promote ongoing and spatially distributed street activity” (Browing and Jackson, 2013, p.1010).This approach highligths the close link between urban form and security. A milestone in the understanding of the relationship between physical environment and security is represented by the so called CPTED approach, acronym from "Crime Prevention Through Environmental Design". This concept was both coined by a criminologist and an architect, this latter already mentioned above (Oscar Newman).

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Although the link between poorly designed urban spaces and criminal behaviour was clearly stated in these and numerous subsequent studies, still monofunctional high rise buildings built in isolation were the rule for many years, particularly in the construction of Western public estates for social housing. Between the 1970s and 1980s the link between economic crisis, social problems (also crime) and urban blightened areas dramatically emerged. In the early 1980s, the1970s crisis of the industrial cities translated in a social, physical and environmental decay that in many cases brought to the increase of crime activities in some isolated areas and the raise of the urban security problems. The nexus between physical environment and antisocial behaviour became central in the famous "Theory of broken windows" coined in 1982. As summarized by Macdonald et al.(2013, p.628),"Wilson and Kelling's (1982) broken windows theory explains that physical signs of decay and disorder, like graffiti and loitering, send a signal that people do not care about neighborhood". According to Hypp and Yates (2011, pp.956), "William Julius Wilson (1987) argued in one of the more influential ecological theories of the twentieth century that a recent emergenge of extremely disadvantaged neighborhoods containing concentrated poverty are vulnerable to a spike in levels of crime and disorder resulting from the breakdown in social norms prescribing delinquent behaviour".

As Burgess and others have shown in the case of the American city, it has always been the fate of poor recent immigrants to occupy the most marginal spaces of the city, while radical urbanists such as Harvey, Castells and Sassen share the view that globalisation is creating a great deal of suffering and exploitation, increasingly concentrated in the marginal spaces of cities around the world (Parker, 2004). Cities cannot aim at being socially sustainable without considering their citizens' security concerns seriously. It means that a set of public policies oriented to the social inclusion of marginalised groups in isolated neighborhoods have to be implemented. Particularly, at local level, social policies shoud be combined with urban policies in order to mitigate the negative effects of the past ineffective public choices (Ceccato, 2012).

As briefly highlighted by the literature review, a major contemporary societal challenge is to enhance in policy makers and planners the level of understanding in tackling safety and security issues in cities. As noticed by Kreager et al. (2011, p. 615) "Although productive, urban studies continue to offer little help in understanding changes in crime and shifts in city landscape". The paper aims at contributing to fill this gap in the knowledge, by discussing urban safety and security dynamics of a blighted urban area in a Southern Italian city, Reggio Calabria.After a brief introduction on the socio-economic features of the area, an analysis of the urban plans implemented will be discussed in order to understand how urban form and urban security are related and to suggest what strategy might reduce problems affecting this and similar marginalised areas.

3 SETTING THE CONTEXT FOR A FIELD INVESTIGATION IN A SOUTHERN ITALIAN NEIGHBORHOOD: ARGHILLA', REGGIO CALABRIA

Despite it beautiful location as a terrace on the Strait of Messina, Reggio Calabria is affected by several problems that hinder the quality of life. Organized crime and corruption generate negative effects on public services provisions and land use control, thus determining a widespread status of illegality and antisocial behaviors. Arghillà is one of the neighbourhoods of the city where these socio-economic and environmental dynamics are particularly visible. This complex neighbourhood captured the researchers'attention, thus becoming a real and proper case study, because of its socio-economic poor indicators and the state of decay of the physical environment, coupled by the citizens' perception of a low level of safety and security confirmed by criminal activities' indicators.

Arghillà is a recent urban settlement. The first building built on the plans of Arghillà dates back to the late 1980s. The district is inhabited by families from different backgrounds; the social structure is characterised by weakness and fragility. A preliminary investigation on micro-crime rates corroborated this perception and confirmed the correct selection of Arghillà as interesting case to investigate the link between physical environment and urban safety. The following table provides readers with a snapshot on the principal indicators and related local and national benchmarks, thus setting the general context for the case study of Arghillà.

	Italy	Calabria	Reggio Calabria
Unemployment (2014)	12,70 %	23,40 %	19,20 %
Micro Criminality Index (2011)	12,41 %	9,98 %	14,84 %

Table 1: Principal socio- economic and criminality indicators (Source: Istat.it)

According to the last Census (ISTAT 2011), residents in Arghillà are 2.281. However, this number increases up to 4.000 by considering the further population illegally living in the occupied buildings. Until the 1980s the area was mainly used for agriculture and production of wine. It is located up 160 mt, in a strategic position both for its location, well connected to the urban core by the highway and for the stunning and breath-taking view on the strait that represent a high potential for tourism. Data in Table 2 show a the gender inequality in the area of Arghillà. In some sub areas of the neighborhood the level of employment for male is close the 100% while in the same areas the female employment is up to the 6-8%.

	Employed	Unemployed	Retired	Housewives
Male	68 %	17 %	15 %	-
Female	21,3 %	6,6 %	9 %	63%

Table 2: Employment status per sex in Arghillà 2012(Source: CEFCOM, 2012)

Table 3 shows the educational level in Arghillà. The percentage of graduated people is low.

	Elementary School	Second Grade	High School	Graduate
Arghillà	13%	26,6 %	52 %	8,3%

Table 3: Educational attainment in Arghillà 2012 (Source: CEFCOM, 2012)

Arghillà is geographically divided into two main parts: Southern and Northern Arghillà (Fig 1). Although built 30 years ago by a private cooperative, the former has been provided by the city with services only in 2008, and is still lacking schools and health services, while the latter is a public estate built for social housing purposes, planned according to a functionalist approach and still missing the majority of the public spaces and services originally designed.

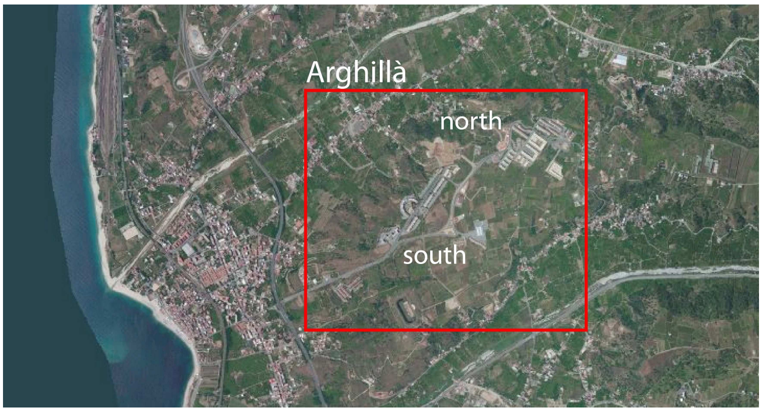

Fig. 1: Arghillà, City of Reggio Calabria – Northern and Southern areas of the neighbourhood

The two areas are very different from each other. In the Southern part most of the Italian families that were originally given public social housies by the municipality decided to leave away because of the social issues and low level of safety if the neighbourhood. The Northern part is mostly occupied by Roma minorities and low-income families, often dealing with micro-crime or illegal activities. The state of physical abandonment and decay both affects and aggravates the socio-economic condition of the neighborhood. Social deprivation is widespread, due to the presence of Roma immigrants and people living below poverty threshold. The researchers gathered about hundreds local newspapers articles and e-magazines, that in the last years reported acts of micro-criminality, violence towards minors, prostitution, drug dealing. Such a small area, both because its ethnic composition and the social pressure, has become a “ghetto”. All these phenomena further enhanced the isolation of the area from the city.By in depth field work, the researchers found that the status of decay of the urban environment is partly consequence of: 1)a mismatch between urban planning and design and its implementationdue to a lack of management capabilities; 2) uncorrect approach in the implementation of public policites aimed at tackling immigration issues. A gap in the implementation of the planned public facilities that should have been coupled the residential estates has determined the creation of a spatially fragmented urban form, characterised by huge and anonymous empty spaces. This fragile context was not the best precondition to successfully absorbe the massive introduction of a close- knitted Roma community, decided in the late 1990s by the city of Arghillà to “solve” the issue of their segregation in unhealthyand squalid camps. The spatial isolation of Arghillà, jointly with strong social exclusion dynamics, mostly due to the presence of Roma minorities, characterizes the neighborhood as a “ghetto”. The socio-economic isolation indeed, boosted by the physical detachment and the visible decay of the built environment, contributed to increase the feelings of insecurity in the area.

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4 URBAN PLANNING AND GOVERNANCE PROCESS: A BROKEN NEXUS?

As any other Italian city, during the 1960s, Reggio Calabria experiencedan economic and demographic boom. Common phenomenon was that the post II World War general plans did not allow local governments to cope with the dramatic increase in the so called “urban expansion” age, thus leading to uncontrolled urban growth. The original General Urban Plan for the city of Reggio Calabria, drawn up by Prof. Ludovico Quaroni at the end of 1960s, provided a northward residential expansion for the city -that included Arghillà- and an industrial southward expansion driven by the presence of the airport. According to the Quaroni’s general plan, both expansions counted on a sufficient provision in related services. The analysis of the general plan’s implementation shows that the plan’s prescriptions were disregarded and ignored, while at the same time informal settlements were let spreading out without any rule nor logic. The city scatterly expanded towards the hills, without anylong-term strategy for its economic development. The national minimum thresholds for services established by law have been respected only in few areas situated in the Southern part of the city. Paradoxically, at present the updating phase for the general plan-in the future, “Plan of the urban structure”- is happening under the general provisions of the never effectively implemented Quaroni’s general plan.The neighbourhood of Arghillà reflects this general mismatch between planning and implementation. More in details, in Arghillà the general plan is far to have been implemented as designed.As a matter of fact, “too many plans are not realistic, do not take enough consideration of limited possibilities for implementation, lack of financial resources, weak institutional support, or the low steering power of the plane” (Larsson 2010: 52). As stated by Haywood (1979) “in a society where a plan cannot simply be imposed, if the plan does not consider the process and problems of implementation, if there is no feedback from implementation to plan-making, then the plan can be too rigid, too detailed to respond to the social and economic situation of the real world”. Within the Arghillà neighbourhood, a specific site design for public housing was also produced by the city; however, public facilities were built with a serious delay. Arghillà was originally conceived as aresidential expansion located in the Northern part of Reggio Calabria, mid-way between the city centre and Villa San Giovanni, that is a strategic hub for Sicily, as showed by Fig. 2.

Fig. 2: The geographical context of Arghillà (Source: google map)

Following the general plan’s provisions[1], in the early 1970s the city of Reggio Calabria came up with a site design according to the 1972 national law n.167, on public housing and planning (Fig. 3). According to this latter and related regulations, designated areas were selected in order to host public housing estates coupled by public services and facilities for the community.

[1] Specific Urban Tool to implement the general prescriptions of the General Plan of the City of Reggio Calabria – “Relazione al Consiglio Comunale sullo stato di attuazione del P.R.G. 21.aprile.2006 –Comune di Reggio Calabria - Settore Urbanistica e Pianificazione Territoriale”

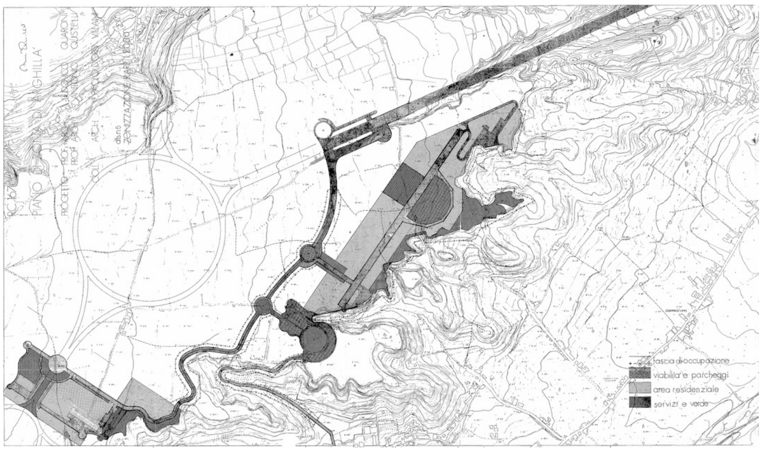

Fig. 3: Arghillà Site Plan (Law no. 167/1972) – Site design for the area includingresidential estates, public facilities and roads (Source: City of Reggio Calabria, Dept. of Planning)

This first siteplanex Law no. 167/1972 (Fig. 4) relates to the Southern part of the neighborhood, characterised by the presence of residential units originally intended for hosting the local middle-income class. This initiative was mainly public, while in other cases, such as in the neighborhood of Catona, a few kilometers far from Arghillà, residential developments were built also thanks to private investors.

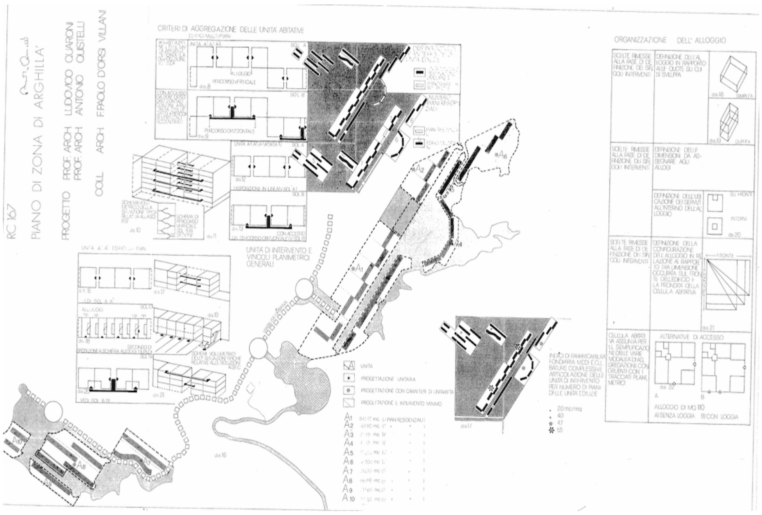

Fig. 4: Arghillà Specific Plan (Law no. 167/1972) – Residential units' site design. (Source: City of Reggio Calabria, Dept. of Planning)

As shown in Fig. 4, the site plan pays great attention to the design of residential typologies and units. A series of horizontal and vertical pathways were provided in order to increase the relationship between units and related social network. Within the above detailed project is possible to notice the presence of generous public spaces and buildings dedicated to the community. Although the plan has not been entirely built as designed because of financial constraints and some parts of it are still uncomplete, the public spaces originally designed for this area generally match what is nowadays on site.

Between the end of the 1970s and the beginning of the 1980s, another site plan was approved for the development of the Northern part of the neighborhood. It was aimed at connecting the existing urban environment with the new one, by giving the public space a central role in the urban design process. Following this concept, the highest buildings have been designed around the main plaza. To increase the centrality of the role of the "public", a net of interconnected public spaces was organised, including a square, pedestrian pathways, commercial areas, spacesfor handcraft production and community services. The purpose of the urban designers' team was to enhance the social cohesion within the city by realizing a well connected spatial system in which activities tend to be integrated, thus avoiding the "ghetto" effect. A further key- element in this plan was the connection between the neighborhood and the city. The relevance of this connection was conceived as strategic in order to empower the metropolitan conception of the city of Reggio Calabria. Arghillà was supposed to be a residential neighborhood with an high presence of public spaces and community services, very far from what it has become today. The mismatch between planning and implementation phase is responsible for many contemporary problems in Arghillà. The following pictures (Fig. 6 a, b, c) show the state and abandonment of the public spaces and the physical decay of the buildings.

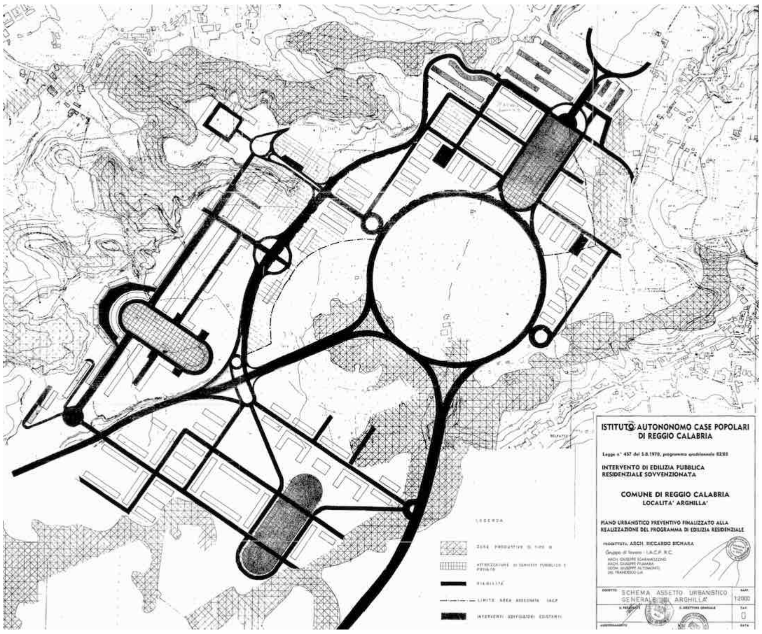

Fig. 5: Arghillà site plan ex Law n. 457/1978: design of the area, Institute for Public Housing. (Source: City of Reggio Calabria, Dept. of Planning)

Fig. 6: Arghillà public spaces in decay (a), (b) and buildings (c) (Source: authors' photographs)

This findings are supported by an in depth analysis of the planning history and the current situation of the neighbourhood. In order to investigate the reasons of the actual state of marginalisation and insecurity of the area of Arghillà, the researchers analysed the development of the area in a time perspective both by discussing secondary data such as planning documents and reports and by interviewing key informants on the current social issues (five semi-structured interviews with city planners and people involved in local development projects). The planning documents (land use plan, site design, planning reports…) were tested against the actual developments, in order to assess how far the expected results have been hindered by planning implementation mismatches. An in depth field work supported the analysis. This latter was both conducted through a site reconnaisance technique, by walking in the area and recording notes and taking photographs, and by informally talking with local people. The researchers focused on the following major features of the area: 1) accessibility, both in terms of physical connection to the city center and in terms of public transport services, and 2) public facilities and spaces, particularly on the differences between planning and implementation phases. These analysis were supported by the development of technical maps, following field data gathering on: land use, use of the ground level of the buildings, security devices in the area (CCTV).

The following maps are elaborated by the researchers on the basis of both technical maps and field records.Fig. 7 shows the spatial fragmentation of the neighbourhood determined by the massive presence of empy spaces, following the gap in the completion of the planned buildings. The Fig. 8 focuses on the usage of the ground level, putting in evidence the monofunctional character of the area, that should have been provided with a backbone of community spaces for productive and commercial uses. The Fig. 9 reports the existing public facilities and the presence of CCTV.

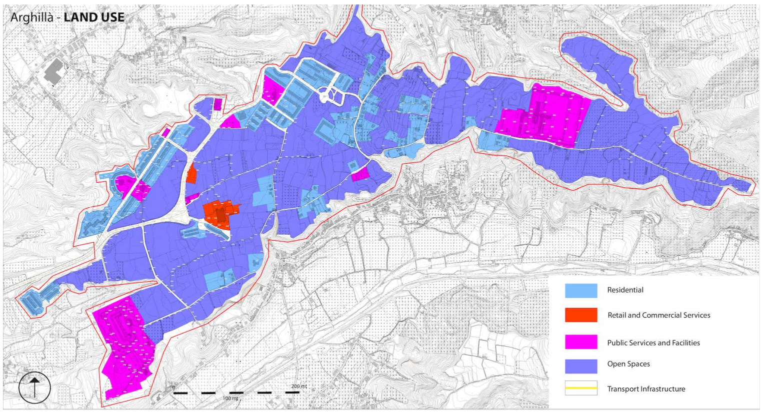

Fig. 7: Land use map (Source: authors' elaboration)

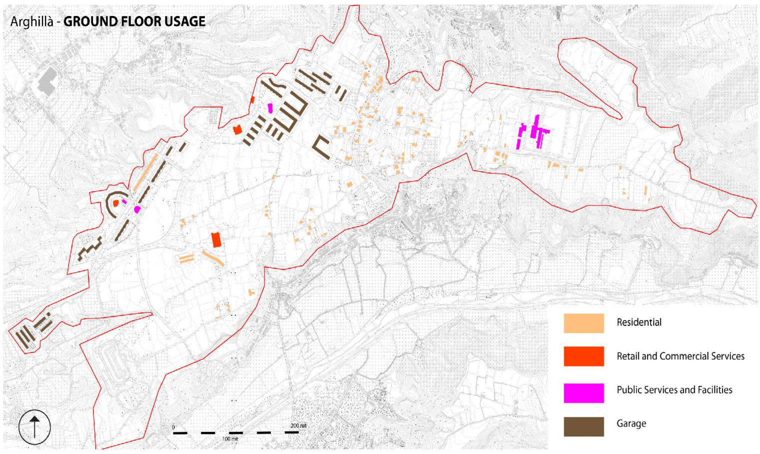

Fig. 8: Ground floor usages (Source: authors' elaboration)

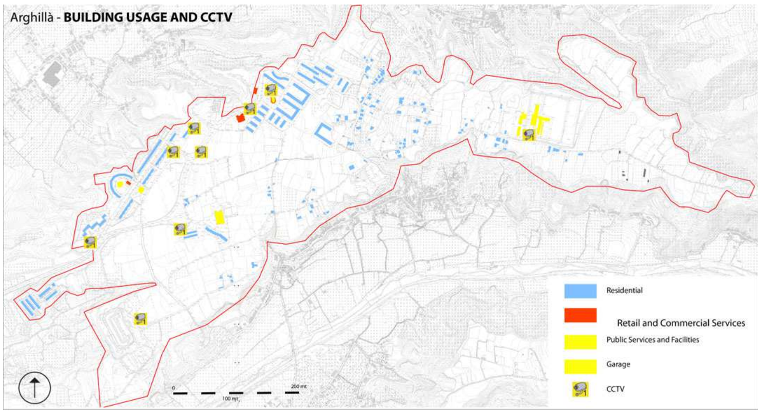

Fig. 9: Building Use and presence of CCTV (Source: authors' elaboration)

5 TOWARDS AN INTEGRATED AND NEIGHBOURHOOD- BASED APPROACH

As discussed in the previous section, the planning and design provisions have been only partially turned in real spaces. During the 1980s, the area was developed mainly focusing on the development of residential units and not on public facilities. This mismatch between planning and implementation phase happened because the need for financial resources for the development of the entire area was underestimated (interview with the technical staff of the City of Reggio Calabria, December the 10th 2014).At the end of the 1990s, urban unsafety and unsecurity furtherly worsened when the city relocated to Arghillà a huge part of the Roma community living in squalid and unhealthy camps in the city centre. The spatial isolation of the area, together with the lack of public facilities and the concentration of low-income families and ethnic minorities in thepublic estates, created the conditions for attracting criminal activities. Some Roma families became involved in criminal activies and the fact to be isolated from the rest of the city, the lack of control from the State, the high level of social exclusion and the decay of the built environment has contributed to make Arghillà their fortress.

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The two specific plans implemented in the area of Arghillà aimed to develop a new residential areas with an high level of public spaces and services. However, during the last three decades the percentage of open spaces in the area remained really high (54,80 % of the total) due to the gap in the construction of the planned public facilities and public spaces. Nowadays the area is well- equipped in terms of transportation facilities (22%, although the public transport offers only a a low frequence service with one single line) but not in terms of public facilities (9,20 %). As shown in the Fig. 10, many residential units are empty, not finished or underused and in bad status of maintenance.In this situation it is easy for deviated subjects to use these apartments for criminal activities or for their illegal occupation.

Fig. 10: Arghillà – A public facilities still to be finished (a) and a blightedaffordable housingunit (b)

The gaps in the construction of public spaces and facilities were mainly due the lack of economical resources for the implementation of the site plan. Unfortunately this was one of the big issue related to the implementation of specific plans all around Southern Italy, where the presence of private developers is more rare than the Northern Italy. Furthermore, the lack of connection between urban planning tools and economic development measures to implement at local level, combined with a weak urban governance, brought to the failure of the original purposes of the plan with the consequent increase of spatial marginalisation of the area and the increase of the urban environment decay and micro crime.

Despite these problems,a significant initiative has been put forward succefully: “Ecolandia”, a leisure infrastructure managed by a Consortium composed by Profit and Non Profit associations. This park for kids is located on the rest of ancient fortress built between the I and II World War to control the Strait of Messina. Actually it is used for exhibitions, shows, kids entairtenment and educational activities aimed to increase the sensitiveness of the population on sustainability and local environment care. During the last years several art festivals and theatral pieces have been organised with a series of temporary exibhitions thanks to the exploitation of the renovated ancient fortress spaces (Fig. 11).Thanks to the natural characteristics of the area, the Park is visited not only by schools for educational visits but also by citizens that have the possibility to enjoy a natural area of almost 20 ha. The Park has also a positive effect in terms of local community involvement. Many of the associations of the Consortium are located in Arghillà and are involved according to the type of activity to organize. A further positive impact stems from the potential in terms of job creation. Part of the employed people are direct employees of the Consurtium, the others are employed by the associations involved and part of them belong to the local community of Arghillà (interview with the technical staff of the Ecolandia Park, March the 1st 2015).

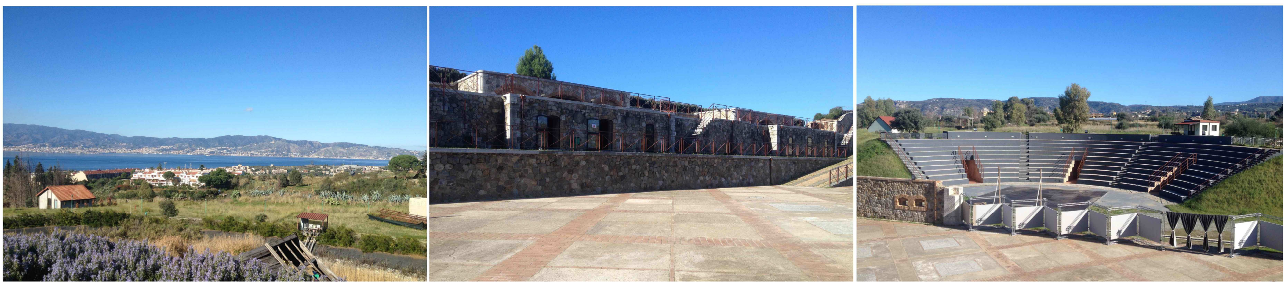

Fig. 11 Arghillà – Ecolandia Park: a) Strait of Messina from Ecolandia ; b) The inside of the Ancient Fortress; c) The Theatre of the Park.

6 URBAN REGENERATION AND URBAN SAFETY: A FRUITFUL NEXUS

As shown in the discussion of the case of Arghillà, failures in effectively deliver a planning process can severly affect the urban safety of a neighbourhood. It is therefore paramount: 1) to pay great attention to the planning governance, in order to ensure effective management throughout the whole planning process, as demonstrated by the problems derived by a mismatch between planning and implementation in Arghillà; 2) to carefully manage planning policies through a comprehensive perception of all the factors affecting the context, including spatial fragility, as shown by the issues related to the massive presence of Roma minorities in a socially and spatially weak context; 3) to activate a virtous process of urban regeneration by including in blighted areas catalyst for urban regeneration, such as the Ecolandia park above illustrated.

The researchers suggest that integrated urban regeneration initiatives, aimed by nature at improving both people and places can improve urban safety conditions in these neighbourhoods. An integrated approach should work on the causes for crime attraction and settlement, by acting on: the built- environment amelioration, the improvement in the quality of public spaces as enhancers of “sense of place”, the community participation, the build-up of aggregation centres, symbols of positive civic behaviors, the job creation and local economy enhancement.Urban regeneration, that is neighborhood based in its essence and stems from an integrated approach, holds the potential of contributing to the reduction of crime in blighted areas. As stated by Couch and Fraser (2003, p. 2), “Urban “Regeneration is concerned with the regrowth of economic activity where it has been lost; the restoration of social function where there has been dysfunction, or social inclusion where there has beenexclusion; and the restoration of environmental quality or ecological balance where it has been lost. Thusurban regeneration is an aspect of the management and planning of existing urban areas rather than the planning anddevelopment of new urbanisation”.Further research could focus on the exploitation of urban regeneration initiatives in areas challenged by safety and security issues, in order to unveil the potential of specific urban regeneration tools with respects to antisocial behaviour indicators, thus sharpening the effectiveness of integrated and locally- based urban policies.

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Urban Metabolism and Quality of Life in Informal Areas

SaharAttia, Heba Allah E. Khalil

(Professor Dr. Sahar Attia, Cairo University, Faculty of Engineering, Department of Architecture, GametAlQahera Street , Giza, Cairo, Egypt, sahar.attia@gmail.com)
(Associate Professor Dr. Heba Allah E. Khalil, Cairo University, Faculty of Engineering, Department of Architecture, GametAlQahera Street , Giza, Cairo, Egypt, hebatallah.khalil@gmail.com)

1 ABSTRACT

The 21st century is known as the century of urbanization. Numerous debates are currently taking place to definecities and what they should aspire to be. A number of terms have appeared in this arena,such as sustainable city, eco-city and green city to name a few. However, the main question remains how to measure the performance of a city in regards tothese aims. In addition, it is vital to note that major urbanization activities take part in cities of the developing world, where informalization is synonym to urbanization, thus necessitating a profound study of informal areas and their potential role in achieving sustainable cities. This paper studies how acity performs in terms of consuming and producing resources and how they flow through its various systems, described as urban metabolism. The paper particularly discusses how informal areas perform regarding their metabolism, focusing on water flow through these areas as a priority identified by the residents. Imbaba district, one of the largest informal areas in Cairo, is investigated as a case study to determine the actual quality of life of local residents and their ecological footprint and to providepractical insights. The whole process depends on a multidisciplinary participatory research where the citizens and local community based organization are the focal point. In addition, the process depends on open source data and data sharing as a way to empower local communities to identify their needs and issues and hence their appropriate interventions. This is conducted through questionnaires and interviews to identify what the current conditions and processes in informal areas provide for the residents. The paper concludes with identifying points of leakages in the resources flows and the possible interventions to improve the quality of life in the area while maintaining an efficient use of local resources and minimizing the impact of urbanization of the ecological footprint of cities. This will assist cities to become more resilient in the face of water scarcity, and provide a more vibrant life for its residents.

2 INTRODUCTION

Since 2007, more people are living in cities than in the countryside. (GlobeScan and MRC Mclean Hazel, 2007) Some studies estimate that by the middle of the century 70% of world's population will reside in cities. This current process of urbanization is seen by many scientists to be one of the reasons for climate change, where most of the CO2 emissions from the built environment come and where the highest consumers live resulting in very high ecological footprints. The recent report by Working Group I Contribution to the IPCC Fifth Assessment Report: Climate Change 2013 states that "it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century. (IPCC WGI AR5, 2013)This rapid urbanization is mainly taking place in the developing countries where more than 70 % of the world's urban population currently live and is lead by Asian cities then African ones. (UN- HABITAT, 2012)

Over the past 50 years, cities have rapidly expanded onto their surrounding land at a rapid rate. Highways and transport systems have been built in tandem to support this physical growth. Valuable farmland has been eaten up and car dependency has increased. There are numerous theories and debates to how to manage such growth both to provide an adequate quality of life for the city dwellers and to efficiently use the limited resources within a global economic and environmental crisis. These include the terms eco-city, sustainable city, green city and the most recent addition the resilient city. However, it is vital to note that most of the urbanization that is taking place in developing countries cities is takes the form of informal development. Most of the added areas to the city are basically built with no prior planning by professionals.

This paper aims addressing the issue of urban metabolism; cities consumption and production of resources and how the various resources flow through urban districts. It studies how particularly informal areas perform regarding their metabolism, focusing on water flow through these areas as a priority identified by the residents. Through the use of different methods including GIS, Urban Metabolism Information System

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UMIS and crowdsourcing data, the paper calculates water flow and its consequential interventions to improve metabolism and respond to resource scarcity increasing the resilience of the city.

3 QUALITY OF LIFE AND ECO-RESPONSIVE CITIES

Quality of life has been the domain of development discourse for the past decade. It has been widely recognized that measuring progress in terms of GDP is not sufficient. There have been many attempts to address the issue. However, diverse "objective" and "subjective" indicators across a range of disciplines and scales, and recent work on subjective well-being (SWB) surveys and the psychology of happiness have spurred renewed interest.(Costanza, et al., 2008). In addition, developing eco-responsive cities has dominated the study and practice of urban development as a response to climate change and resources limitations.

3.1 Quality of life indicators

It is widely accepted now that seeking better quality of life should be the ultimate goal of development plans and not just economic progress. According to the Economist Intelligence Unit (2005), it has been accepted that material wellbeing, as measured by GDP per person, cannot alone explain the broader quality of life in a country. One strand of the literature has tried to adjust GDP by quantifying facets that are omitted by the GDP measure—various non-market activities and social ills such as environmental pollution. However, the approach has faced insurmountable difficulties in assigning monetary values to the various factors and intangibles that comprise a wider measure of socio-economic wellbeing.(The Economist Intelligence Unit EIU, 2007) Currently, there are a number of indices proposed and used by different organizations to score and rate cities and countries according to their quality of life. These organizations vary in nature and interests and thus in focus and methodology. (Khalil H. E., 2012) The most important indices are Quality of Living by Mercer consultants[1] (Mercer, 2011), Quality of Life index by The Economist Intelligence Unit (The Economist Intelligence Unit EIU[2], 2007), and YOUR BETTER LIFE INDEX by The Organization for Economic Cooperation and Development (OECD). (Organization for Economic Cooperation and Development OECD, 2011) It is apparent that these different indices focus on a number of common aspects as the main core of quality of life, namely: Housing, Income, Jobs, Community, Education, Environment, Governance, Health, Life Satisfaction, Safety and Work-life balance.

Despite these various efforts, an important aspect is still missing in most indices. It is sustainability, which could identify whether this level of quality of life can be sustained or not, whether it is affecting the ability of future generations to attain such levels or not and how this quality of life uses various resources. This notion is still underscored, as it is complex to assess.(Khalil H. E., 2012)

3.2 Green rating indices

One of the most common indices to assess sustainability is the ecological footprint EF. (Wackernagel & Rees, 1996) It requires quantitative procedures for assessing total flows in an area and compares it to the faced constraints imposed by the planetary ecosystem (carrying capacity). EF converts flows into the area ofproductive ecosystems required to sustain such flows. However, the limitation of this index lies in its dependency on standardized and rigorous methods for environmentalaccounting, especially when comparing locations or over time or formulating backcast and forecasting scenarios. (Moffatt & Kohler, 2008)

Worldwide, tools for evaluating cities are not as widely available as they are for buildings. There is a growing demand for tools to evaluate measures and activities on the scale of a city or society as a whole. Currently there are a number of indices to rate urban agglomerations varying in scale and thus the criteria or indicators they monitor or rate. Among these indices related to the urban scale are CASBEE for urban development and CASBEE for cities in Japan, LEED for neighbourhoods in the U.S. and Green City Index developed by The Economist Intelligence Unit and Siemens. This Index measures the current environmental performance of major cities in different continents, as well as their commitment to reducing their future environmental impact by way of ongoing initiatives and objectives. The Economist Intelligence Unit in cooperation with Siemens developed the methodology. (The Economist Intelligence Unit, 2009) It scores cities across eight categories: CO2 emissions, energy, buildings, transport, water, waste and land use, air

[1] Global leaders for trusted HR and related financial advice, products and services
[2] The business information arm of The Economist Group, publisher of The Economist

quality and environmental governance and 30 individual indicators. Sixteen of the index's 30 indicators are derived from quantitative data and aim to measure how a city is currently performing while the other 14 indicators are qualitative assessments of cities' aspirations or ambitions. Currently this index covers areas: Europe, Latin America, Asia, US and Canada, Germany and Africa.(Green City Index, 2012)

Other indices related to assessing the sustainability of settlements tailored local circumstances include: megacity sustainability indicators in Brazil (Leite & Tello, 2011), The Sustainability Cities Index rating the biggest 20 cities in the United Kingdom(Forum for The Future; General Electric GE, 2010) and The Freiburg Charter for Sustainable Urbanism (The Academy of Urbanism, 2010).

City prosperity index CPI has attempted to fill the gap in assessment indices. It comprises five different dimensions: productivity, infrastructure development, quality of life, equity and social inclusion and environmental sustainability. (UN- HABITAT, 2012) It addresses both issues of quality of life and sustainability. However, the indicators that constitute quality of life in CPI is just a part of the overall indicators comprising the notion of quality of life as viewed by other indices. Table 1 shows a comparison between indicators of different indices.

Sector	Quality of Life Indices			City Prosperity Index
	Mercer	EIU	OECD	
Political	Political & Social Environment	Political stability & security	Safety	laws, regulations & institutions, urban planning,
		Political freedom		Civil society, trade associations, special agencies
Governance			Governance	
Economic	Economic Environment	Material wellbeing	Income	Productivity
	Consumer Goods	Job security	Jobs	Capital investment, formal/informal employment, inflation, trade, savings, export/import & household income/ consumption.
				city product
Infrastructure	Public Services & Transport			Infrastructure Infrastructure proper
House	Housing		Housing	Housing
Social Serv.	Medical & Health Considerations	Health	Health	Quality of life
	Schools & Education		Education	Education, health sub-index.
Socio-Cultural	Socio-Cultural Environment	Family life	Community	Public space
	Recreation	Community life	Work-life balance	
			Life Satisfaction	
Environment	Natural Environment	Climate & geography	Environment	Environmental Sustainability: protection of urban environment and natural assets, energy efficiency, minimize pressure on surrounding land & natural resources, minimize environmental losses
Equity		Gender equality		Equity: reduces poverty & the incidence of slums, rights of minority & vulnerable groups, gender equality, civic participation

Table 1: Comparing Quality of Life Indices and City Prosperity Index, (Khalil H. , 2014)

A recent addition to the list is the International EcocityFramework and Standards developed by the ECOCITY builders and the BCIT, Canada. (International Ecocity Framework and Standards, 2011)It is still

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under development but has some similar categories and indicators as the Green City Index. It is comprised of 15 universal conditions for healthy cities and a civilization in balance with earth systems organized through 4 fundamental urban arenas: urban design (access by Proximity, safe housing and green building, affordable housing, environmentally friendly transport), bio-geo-physical conditions (clean air, healthy soil, clean and safe water, responsible resources/materials, clean and renewable energy, healthy and accessible food), ecological imperatives (healthy biodiversity, live within earth's carrying capacityand ecological linkages) and socio-cultural conditions (eco-friendly culture, community capacity and governance, healthy and equitable economy, lifelong education, well being – quality of life). Moreover, it depends on more qualitative assessment rather than quantitative assessment, which can serve better when using participatory evaluation of environmental performance of districts and cities. This framework is the base for the quality of life questionnaire used in this research.

Despite all these studies, informalization as the currently most prominent feature of urbanization remains a surmountable challenge. As major urbanization, activities are taking place in the developing world and mostly outside the legal and formal regulations. It is estimated that more than 60 % of Cairo is informal areas with more areas added daily. Thus, the issue of creating and sustaining prosperous cities becomes crucial. The city might be productive but not equitable and with low quality of life. Therefore, it is vital to highlight the debate between fulfilling needs and achieving overall prosperity and using resources in an ever-growing resource scarcity.

4 URBAN METABOLISM

Wolman (1965) first developed urban metabolism where, according to White (2002), he used national data on water, food and fuel use, production rates of sewage, waste and air pollutants to determine per capita inflow and outflow rates for a hypothetical American city of one million people. Through this study, he helped focus attention on system-wide impacts of goods consumption and waste generation within urban areas. (Decker, Elliott, Smith, Blake, & Sherwood Rowland, 2000). It can be defined as "the sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste" (Kennedy, Cuddihy, & Engel Yan, The changing metabolism of cities, 2007). Urban metabolism is based on an analogy with organisms' metabolism and as resembling ecosystems. However, cities are more complex than single organism that consume resources from its surroundings and excrete wastes. Thus, it can be more congruent with ecosystems, where achieving a natural ecosystem is the ultimate goal of developing sustainable cities. (Kennedy, Pincetl, & Bunje, 2011) However, current urban practices have resulted in much less sustainable development that follows a linear metabolism with high through flows of energy and materials and few loops and recycling of resources. There is a growing need to convert existing cites and urban development into more cyclical metabolism where resources are conserved and efficiently deployed, a similar process as natural ecosystems. (Gerardet, 2008; Newman & Jennings, 2008)

Study of Urban Metabolism, although started in 1965, has seen a period of low interest during the 1980s and then remerged to attract significant interest in the past decade. Two main approaches guiding the study of urban metabolism can be identified. The first is based on the work of Odum (Odum, 1983) that aims to describe urban metabolism in terms of energy equivalents and mainly solar energy equivalent or emergy. A number of studies followed this approach to calculate the urban metabolism for cities as Miami (Zucchetto, 1975), 1850s Paris (Odum, 1983), Taipei (Huang S. , 1998; Huang & Hsu, 2003) and Beijing (Zhang, Yang, & Yu, 2009).

The otherapproach follows a broader approach expressing the different resources flows through the city: water, materials and nutrients, in terms of mass fluxes. It follows the progress done in the 1990s in the development of the method of material flow analysis (MFA), where MFA reports stocks and flows of resources in terms of mass. In essence, the two approaches are not that far apart; they quantify the same items, but just use different units. (Kennedy, Pincetl, & Bunje, 2011)

One of the first researchers to identify the key link between urban metabolism and the sustainable development of cities was Girardet (1992). This paper follows the second approach regarding the study of urban metabolism and although there are many uses for it, this research uses urban metabolism as a tool for sustainable urban design and planning.

4.1 Resource flows through the city

Few studies seriously attempt to move beyond analysis into re/designing the city to be more sustainable/ resource efficient. Oswald and Baccini (2003) demonstrated in their work in Netzstadt how a combination of morphological and physiological tools can be used in the "long process of reconstructing the city". John Fernandez and students in MIT's School of Architecture have used the perspective of urban metabolism regarding material flow analysis in considering redesign of New Orleans after Hurricane Katrina. (Quinn & Fernandez, 2007)

In University of Toronto, Civil Engineering students studied the urban metabolism in order to design infrastructure for sustainable cities. They faced many challenges regarding the integration of various infrastructure. (Codoban & Kennedy, 2008; Engel Yan, Kennedy, Saiz, & Pressnail, 2005; Kennedy C. , 2007). However, they traced the flows of water, energy, nutrients and materials and attempted to design the city/ neighbourhood to close loops and reduce resource consumption. They have proposed ideas such as the use of grey water for toilets and outdoor use; using sludge from wastewater on community gardens for food production. Powering buildings and providing light rail systems with energy from municipal waste and recycling fly-ash from the waste gasification plant as building material were also proposed. These measures have significantly reduced the input of energy, water, materials, and nutrients. (Kennedy, Pincetl, & Bunje, 2011)

Resources that were investigated as part of the urban metabolism process in cities included: nutrients (nitrogen and phosphorus) with a focus on individual substances (Færge, Magid, & Penning de Vries, 2001; Burstrom, Frostell, & Mohlander, 2003), water issues (Hermanowicz & Asano, 1999; Gandy, 2004; Thériault & Laroche, 2009; Sahely & Kennedy, 2007; Baker, 2009), urban material stocks and flows (Niza, Rosado, & Ferrão, 2009; Schulz, 2007; Barrett, Vallack, Jones, & Haq, 2002) and specific metals in relation to their environmental burden and potential future resource (Sörme, Bergbäck, & Lohm, 2001; Svidén & Jonsson, 2001; Obernosterer, 2002; Obernosterer & Brunner, 2001).

Other related methods to quantify the flow of materials include Life Cycle Assessment LCA, which provide a cradle-to-grave assessment of a process or larger system including direct, indirect, and supply chain effects, and analyse the associated environmental impacts from extraction to final disposal. (Solli, Reenaas, Stromman, & Hertwich, 2009; Chester, et al., 2010) The International Standards Organization (ISO) defines LCA as the complication and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. (International Standards Organization (ISO), 1997) It is widely applied in industry to measure and compare the lifetime environmental impacts of materials and processes from the product design/development, followed by resource extraction, production, use/consumption and end of life activities. (Holmes & Pincetl, 2012). According to (Moffatt & Kohler, 2008), LCA differs from most other environmental costing and assessment by extending time scales both forward and backwards as product's life cycle starts when raw materials are extracted from Earth, and ends with waste management including recycling and final disposal.Moreover, life-cycle analysis (LCA) and materialflow analysis (MFA) have been refined and standardizedand a common framework of sorts has beeninitiated through building information models (BIM)and stock aggregation methods. However, LCA widespread application in the built environment has faced a challenge of intensive data requirements and the risk of beingincomplete. In addition, this method assumes a frozen future with no change in technology, no new environmental constraints or new demand on building materials and landuse. (Moffatt & Kohler, 2008)

There is aneed for a complementary information structure based upon parcels and flows, where a parcel may consist of a residential building, or a park, a road, a shopping mall, or even a sewage treatment plant. Each parcel can be treated the same way regarding information structure as each has the possibility of resource demand and supply. At any time it can become a source of surplus water, energy, peak power, organic material, …etc.

Moffat & Kohler (2008) propose a combination of methods based on system-ecological and thermodynamic modelling encompassing various flows of mass, energy, financial and information to be able to successfully calculate Urban Metabolism. They stress on the importance of aggregation for MFA, where information is collected on the local scale of a parcel then aggregated to bigger scales. Similar approaches have been successful with bottom up LCA where products can be aggregated into assemblies, and assemblies into buildings, and buildings into stock at various urban scales. (Kohler, 2006)

4.2 Linking the flow to the QOL indicators

It is vital to note that most of the studies of urban metabolism have focused on the materials flow with few or no integration of social metabolism. Among the few scholars was Newman's work on Sydney, where he included liveability measures: indicators of health, employment, income, education, housing, leisure and community activities. (Newman P. , 1999; Newman, et al., 1996) Other scholars have attempted to link urban metabolism and Quality of Life. (Stimson, Western, Mullins, & Simpson, 1999; Lennox & Turner, 2004)There is a growing awareness for the need for extending Urban Metabolism to cover socio- ecological systems. This perspective considers the built environment and the ecosphere as complex, dynamic self-producing systems, where the built environment should be defined not as an object but rather as social-ecological system. (Moffatt & Kohler, 2008; Rees, 2002; Walker, et al., 2006)

It is vital to consider a closed material realm, where all flows from nature and built environment must be balanced over long-term. This can be tracked by environmental accounting, where the question is how to live within fixed rates of flows either by reducing demands or by achieving greater service value from any resource inputs. (Moffatt & Kohler, 2008)An advantage of MFA in this aspect is that it helps to focus on the most significant flows, and on the most obvious opportunities for ecological design (looping and cascading).

In addition, different economies have different flow pattern. In pre-industrial economies there are a variety of inputs but with a low level of flow. While there are fewer inputs in industrial economies, larger flow quantities, with greater use of import/export and storage to balance the flows. It is interesting to note that in resource-efficient economies, there is a diversity of inputs, but there is extensive looping and cascading in the flow pathways to extract added value from the inputs. (Moffatt & Kohler, 2008)

This case study developed in this paper adopted the MFA as a tool to calculate the urban metabolism for urban areas. It has followed a methodology combining the calculation of resource flows and a questionnaire to determine the Quality of Life of local residents in addition to their ecological footprint based on their personal consumption. Thus, the net performance can be measured in terms of combined natural, social and cultural capital.

In the same sense, ecological footprint can be used on the national and regional level to direct policies and development strategies. While collecting information on the parcel level help design tailored solutions that address specific situations and are more resource efficient and better relate to local actors. What will be passed on to the bigger scale/ level would be the services that cannot be successfully satisfied on the local scale (due to economic, technical or other practical reasons). This would help create a self-organizing and self- reliant properties to the built environment similar to natural ecologies (which can be found to a great extent in the informal/ self built urban areas)

5 INFORMAL GROWTH AS A REACTION TO UNAVAILABILITY OF AFFORDABLE FORMAL OPTIONS

Informal growth is the dominating pattern in the urbanization process all over the developing world. It is the way how people supply their needs where their governments fail to do. Informalizationcan be defined as "a process which is unregulated by the institutions of society in a legal and social environment in which similar activities are regulated".(Oldham, Shorter, & Tekce, 1994, p. 10)There are mainly two types of informal areas: squatter areas and informal subdivisions. Squatter areas are mainly chaotic, unplanned and marginal, while informal subdivisions are subdivided land with legal ownership but lack infrastructure and areas for public services and uses. (Imperato & Ruster, 2003)

A study in 2007 defined informal areas in Egypt as "all what is self-built, whether single or multi storey buildings or shacks, in the absence of law and urban regulations enforcement. They are areas built on land not allocated for construction as specified in the city urban plan. Despite the buildings' conditions may be good, they might be unsafe environmentally and socially, and or lacking basic infrastructure and services." (GOPP & UNDP, 2007) However, in Egypt, the term used for these areas since 2008 is either unsafe areas developed by the Informal Settlement Development Facility ISDF (ISDF, 2011)which are similar to slums as defined by the UN-Habitat indicators and unplanned areas defined by the unified building law 119 for the year 2008.

Moreover, the general classification of informal areas, in Egypt, includes informal areas built on agricultural land (comprising the majority of informal development in Egyptian urban areas). They are illegal as they are built on agricultural land, not allocated for construction, and they defy the banning of mixed uses as specified by law. Their general characteristics are: (a) narrow long streets with width no more than 4-5 meters, some even with dead ends; (b) regular block shapes according to agricultural basins subdivisions and; (c) housing units having constant depth but with different street frontage. Heights are according to owner's affordability. The other apparent type is areas built on desert land (which suffer more deteriorated living conditions), in addition to shacks and environmentally unsafe areas.They appear on vacant land on city fringes, where the land is publicly owned, making the buildings there illegal. Their general characteristics are: (a) curved, uneven streets; (b) temporary houses made of primitive materials such as tin, carton or straw and; (c) insecure tenure.

According to(Khalil H. E., 2010) informal areas do possess many aspects defined by sustainable urbanism theories. They have defined edges that separate them from their surrounding areas, a railroad, canal or ring road. They have a distinct urban pattern, especially those following agricultural basins subdivisions. Secondary streets act as recreational spaces where children play due to the prevailing sense of security. As for the quality of architecture, in some areas, it can be poor but can be upgraded to promote local character and sense of place. However, the prevailing visual image is homogeneous, due to buildingusingthe same materials, bricks and concrete, and following the same urban pattern. Informal areas are compact with high densities, e.g. 890 person/hectare in Boulaq Aldakrour district, Cairo exceeding other formal areas due to the privately development mechanism. Thus, providing a perfect setting for walkability and energy efficiency. The buildings are stacked together with usually only one free façade, which minimizes thermal loads, maximizes space use and enhances energy efficiency. They are characterized by narrow streets, which are mainly pedestrian. Services which are mainly community built are usually within less than 10 minutes walking distance. However, government provided services might not exist in close proximity. Streets are interconnected; however, they advocate pedestrians to vehicles, as they are narrow. Although there is a network of wider streets, due to increased traffic load, they are usually congested specially at market places and area entrance points. Moreover, streets can be too long without crossings, which decrease connectivity.

These areas have a variety of uses that make them complete and independent for daily needs. They can be considered as a separate identity and provide lifelong utilities for many residents. Residents can spend their life working, living in an informal area without having to go outside except for some higher educational and health services. Despite that mixed uses in informal areas is seen by the formal authorities as incorrect, it is the mixed uses that give the area its richness, liveliness and advantage of availability of needs within the area, an advantage sought by the new urban trends plans. These areas also offer uses and utilities for a diverse spectrum of groups, ages and incomes. There is a variety of housing opportunities in informal areas since they are community built and are driven by their needs. Different sizes are available and in some areas there is a variety of standards, especially in informal areas built on private lands. This diversity and community driven development pattern adds to the area's sense of place, as opposed to the identical blocks in publicly developed projects.

Informal areas have their own transportation network and modes that might be exclusive to them, which explainswhy entrances to these areas are always considered as transportation nodes. They rely on private transportation modes, ranging from microbuses, pickup trucks, and recently autorickshaws (toktok). These are usually in bad condition, and driven by unlicensed drivers, thus posing threat to passengers' lives and to the environment. However, sometimes these areas are built beside railways, underground metro or transportation stations and can benefit from such facilities. Despite this drawback in transportation in informal areas, people use bicycles a lot or walk, thus adding to the area's green advantages.

Land uses are distributed according to needs, where commercial uses and other services are distributed along the main streets, leaving the narrower streets for residential and recreational uses. Informal areas were self built by the community and its informal sector. Almost all development decisions are community directed. The community has succeeded in providing housing and basic services through collaborative efforts. Other services, such as child care facilities, medical centers, training centers, etc., are usually provided through community based organizations. Thus, these efforts provide a solid ground for further participation.

What these areas lack is an overall urban vision as they are built incrementally. Moreover, where the land is privately owned, open spaces are usually overlooked as they have little or no economic revenue. They do not provide access to nature. On the contrary they are a threat to nature. This can be overcome by preserving whatever vacant land that still exists inside the informal areas, and belting the whole area to prevent its further encroachment on green fields. Moreover, when there is an open space it is not taken care of unless there is a strong sense of community between residents. Although high density is favoured by sustainable urbanism theories, it is vital to note that existing high density does not pose a threat to human living conditions. The UN-HABITAT suggests a maximum crowdness indicator of 2persons/room.

The people's way of developing is "smart", however their settlements need a more comprehensive approach to insure the provision of needs; housing and services, in a more environmentally responsive pattern.

6 INVESTIGATING THE RESPONSIVENESS OF INFORMAL AREAS

As mentioned before, it is estimated that more than 60 % of Cairo built up area is informal ,and still increasing daily. Imbaba district as part of the north sector in Giza,(Greater Cairo Region) on the west bank of the Nile, as shown in Figure 1, is one of the largest districts that grew in an informal unplanned pattern. It was previously agricultural land that was subdivided illegally to accommodate housing needs of the ever growing urban population of Cairo. Currently it has more than one million inhabitants with a density ranging around 650 persons/ha. It is considered as a center for displaced people from the countryside to Cairo, especially people coming from Upper Egypt because of its proximity to services, low rents and affordability.

Figure 1 Location of Imbaba within the Northern Sector of Giza, Greater Cairo Region, Egypt.

6.1 Defining the district and pilot area

On the macro scale, urban prosperity in Imbaba scores low in a number of indicators as seen in Table 2. It is evident that the quality of life in such areas is not acceptable. This is mainly due to a number of factors. First, Imaba lacks adequate services including education and health facilities that can support a good quality of life. Second, the street network that resulted from the unplanned growth resulted in incompatibility with traffic especially when the area grows extensively as Imbaba. The dependence on microbuses, pickups and autorickshaws as the primary mode of transportation has made things worse, with their induced pollution and increased CO_2 emissions; especially given their usual bad conditions. Third, Imbaba lacks open spaces that promote civic activities, alternatively civic interaction takes place in streets as the major open spaces in the area. Informal areas consume less energy due to their compact design. However, this compactness and extensive use of bricks, concrete and asphalt increases the effect of urban heat island in the area, thus reducing comfort in outdoor spaces and increasing thermal loads on buildings. Regarding green spaces or vegetation, they are scarce in Imbaba, (except for the newly opened park on the site of a relocated airport) as they require land, which is privately owned and developed according to the maximum economic profit available. The area provides a prototype for informal areas that constitute most of Cairo.

Sector	City Prosperity Index	Imbaba
Governance	laws, regulations and institutions, urban planning,	Originally informal, illegal, unplanned but now is under the jurisdiction of Urban Law 119
	Civil society, trade associations, special agencies	Many civil societies are active
Economic	Productivity	Informal economic sectors strives in the area
	Capital investment, formal/informal employment, inflation, trade, savings, export/import and household income/ consumption.	
	city product	
Infrastructure	Infrastructure Infrastructure proper	There is adequate water network and sanitation Transportation is insufficient depending on privately operated microbuses and autorickshaws
Housing	Housing	There is a variety of housing units but all occupied

Social Serv.	Quality of life	Health services are not enough
	Education, health sub-index.	Overcrowdness of pupils in school classes
Socio- Cultural	Public space	There are no public spaces in the area
Environment	Environmental Sustainability: protection of urban environment and natural assets, energy efficiency, minimize pressure on surrounding land and natural resources, minimize environmental losses	There is continuous encroachment on agro land. Regarding energy efficiency buildings perform well, however the outdoor spaces suffer from the effects of urban heat island.
Equity	Equity: reduces poverty and the incidence of slums, rights of minority and vulnerable groups, gender equality, civic participation	There has been a project to plan the whole district ensuring equity and improving connectivity and quality of life but it is still in its first phase.

Table 2: Imbaba area performance according to the criteria of prosperity developed by UN-Habitat, source: (Khalil H. , 2014)

The study area as shown in Figure 2 is a typical mixed use area. It has both retail and residential uses along with some workshops. The prevailing building height is 4 storey high and the buildings are attached on 3 sides leaving only one façade free. The area is one of the oldest in the district with some buildings dating from the 1960s, which implies the consolidation state of both the built and the social environment.

Figure 2Imbaba district and the study area, Cairo

6.2 The methodology and process

The field study in this paper is part of the Ecocitizen World Map Project (EWMP), which is comprised of three distinct yet interwoven components: the Partnership, the Platform and the Pedagogy. (Khalil & Ron, 2015) The Partnership is led by US NGO Ecocity Builders and joined by Esri, the Association of American Geographers, Eye on Earth (a partnership of UNEP and ADGEDI Abu Dhabi Global Environmental Data Initiative), Cairo University, Mundiapolis University, University of California at Berkeley, local NGOs and community partners. This project uses new concepts of crowdsourcing and crowd mapping. It aims to calculate the ecological footprint and the urban metabolism of a typical neighbourhood (in Imbaba district) and encourages residents to participate in data gathering with the help of the team and local Community Based Organizations CBOs.

The Platform[3] of EWMP provides the incentive and understanding for communities to crowd-source urban data and holistically assess the condition of their neighbourhoods. This promotes more democratic and grassroots leadership in proposing and planning interventions that directly enhance the sustainability and equitability of cities. Geographic information systems (GIS) and urban metabolism information systems (UMIS) are the two primary methods employed for organizing and displaying data through the Platform. UMIS describes a system, along with all of its components, to account for and analyse resource flows as they move from the natural environment (i.e. a source) through the built environment (i.e. a city) back to the natural environment (i.e. a sink). Sankey diagrams are a means to represent this whereby the width of arrows in a linear flow is proportional to their quantity. The Platform displays data in visually accessible ways that communities can customize and interact with directly; specifically, spatially dynamic online maps with multiple dataset layers and Sankey diagrams.

[3] www.ecocitizenworldmap.org

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The Pedagogy of EWMP is defined through a research justice framework, breaking down existing structural barriers between the researcher and the researched, and includes a training-of-trainers (TOT) methodology to support capacity-building among students and citizens. These trainers then engage in knowledge-transfer activities with citizens, facilitating bottom-up data collection, analysis and publication to the Platform.

The Project's piloting in Cairo, established in early 2014, has been led in part by El-Balad and Household development organization, both local community-based organizations (CBO) in the neighbourhood of Imbaba. The CBOs mobilized citizens, through their existing networks,worked with the students at Cairo University who were trained on adapting and applying public participation techniques, GIS and UMIS, by academic faculty and the EWMP Partnership.

The students engaged in labs, lectures and group activities that touched on these topics. A community roundtable invited elders, youth and leadership from the selected study area to a presentation on the EWMP, where a discussion took place concerning refining the purpose, scope, preferred decision-making models, study area boundaries, data-reporting standards and ownership of research outcomes. At the Imbaba roundtable, the community prioritized concerns around access and quality of potable water supply.

The field work started withfield visits and transect walks to identify various issues, resources and potentials that ran in parallel with the community roundtable activities. A complete urban survey was conducted to the study area including: land use, building heights, building conditions, construction materials and building age producing GIS maps. This would be the base for choosing the samples for conducting the parcel audits based on identifying the existing archetypes. This way the data collected from these sample parcels could be entered into the UMIS to aggregate the results into a single Sankey diagram showing the water flow into the area.

An intensive training was held as a two-day TOT event where the CBOs and students facilitated workshops and initiated the citizen-led collection of data. Teams were arranged according tothree different collection methods. First, environmental assessments of air and water quality tests were conducted to sample units, including 10 components measuring the level of PH, copper, iron, nitrate, phosphate, chloride, chlorine, lead, chrome, ammonia, and coliform. Second, quality of life (based on the International Ecocity Framework and Standards IEFS) and ecological footprint questionnaires were asked to residents on street and in different shops.Third, parcel audits of resource management starting with water demand were conducted to sample units. At the designated workstations set up within the study area, one of the CBOs quarters, data was digitized, samples were tested against established baselines, and results were analysed. The data collected from parcels concerning water consumption was aggregated to the whole study area, in order to have a concrete idea about the water consumption in the area. If urban survey data is available for the whole Imbaba district, an aggregate for water consumption in the district is possible. A number of flyers and posters were designed by the students to inform local residents about the project and its aims and activities. In addition, a workshop and project presentation on street was conducted to engage local residents into the activities and reach out for their interest and participation. (Figure 3)

Figure 3 workshop and presentation on the street to engage local residents and youth, authors

In order to complete the water flow study, the students along with the CBOs have investigated water quality and flow from upstream, the potable water facility with its intake from the Nile, and the downstream where wastewater goes through the water treatment facility and, in most cases, back to the Nile. Acomplete Sankey diagram was developed based on the complete information collected. After finishing the data analysis, another workshop and presentation was conducted on the street to demonstrate the study findings to local residents and ensure project transparency.

7 DISCUSSION OF THE OUTCOMES

All produced data for Imbaba was published through the Platform[4] and has demonstrated quality, access and management issues. In terms of the former, the quality of life questionnaire results showed a lack in health care services; and when existing are inefficient. The Employment opportunities are always found in the commercial career. There are no entertainment facilities or green areas in the area. While regarding the ecological footprint questionnaire, the results revealed that 75 % of the citizens consume very high environmental resources due to behaviour where no garbage reuse/ recycling exists in the area, high usage of electricity and water based on personal conduct and consumption of large quantities of fossil fuels daily.

The water quality testing as shown in Figure 4 has revealed an increase in the percentage of coliform bacteria as a result of broken piping infrastructure mixing potable water and sanitary streams and the former existance of an irrigation canal that was filled up without proper treatment. Moreover, there was an increase in copper traces due to old piping infrastructure and minimal storage maintenance. In addition, traces of phosphate were detected in many samples due to the former history of the area as anagricultural land and the infiltration into the old pipes. The samples from the potable water facility and the Nile intake into the station were of good quality. This in turn has proven that the water quality problem is caused by local problems in Imbaba area due to the low quality of the piping system and the high infiltration of both sewage water and contaminated underground water in the area.

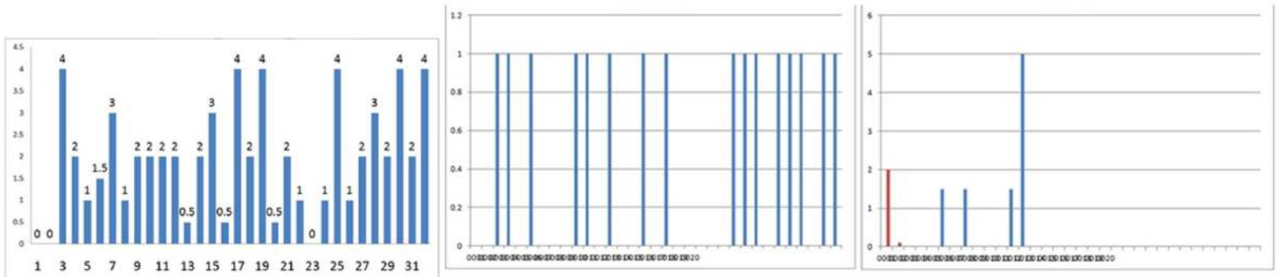

Figure 4 Water quality testing sample results for phosphates, coliform and copper; the red bars are WHO accepted ratios, zero for phosphates and coliform, authors

In terms of management, parcel audits have shown poor water flow from the main supply lines and the disproportionate use of water demand according to building archetypes. In addition, the existing low water pressure in the water network (due to old pipes that could not withstand higher pressures) necessitates the dependence on electric water pumps (with their contribution in increasing costs of electric bills) and high water consumption and consequently unaffordable water bills, which in part is due to behaviour but also due to leakages in the water pipes.The Sankey diagram produced for the water flow in the area (Figure 5) presented citizens with visual guides to suggest areas for conservation (e.g. minimizing use in cooking), efficiency (e.g. low-flow shower heads), cascading (e.g. grey water use for rooftop gardens), and advocating for municipal upgrades of infrastructure upstream (e.g. retrofitting crumbling concrete plumbing with more enduring materials to minimize water loss). A series of printed materials and awareness events, organized by El-Balad CBO and the students, disseminated the pilot study results and ensured transparent flow of data to the local community.

Therefore, a number of interventions have been proposed which are divided into three groups. First, on the neighbourhood level, changing the water network in the area, which is rather a governmental responsibility. Second, on the buildings and units' level, replacing deteriorated water pipes, adding water filter and installing grey water system. Third, on the individual level, promoting efficient use of water through behavioural awareness and education. A feasibility study was conducted based on low cost solutions to provide buildings with better water quality and reduce consumption through replacing deteriorated water pipes on the building level (to prevent water pollution resulting from these pipes as iron & copper and prevent leakages), adding water filter (to improve water quality and reduce deseases as liver & kidney failures and diarrhoea) and installing grey water treatment system for each apartment building (to be used in toilet flushing, cleaning surfaces, on street car washing ...etc.). In addition, if the treated grey water quality permits, it can be used in roof planting. This will need accurate testing of the treated water to ensure

[4] http://ecocitizenworldmap.org/pilots/cairo

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adequacy. Moreover, participants formed an advocacy group to mobilize funds for household interventions and to push for governmental financing of upgrades to the area's water network.

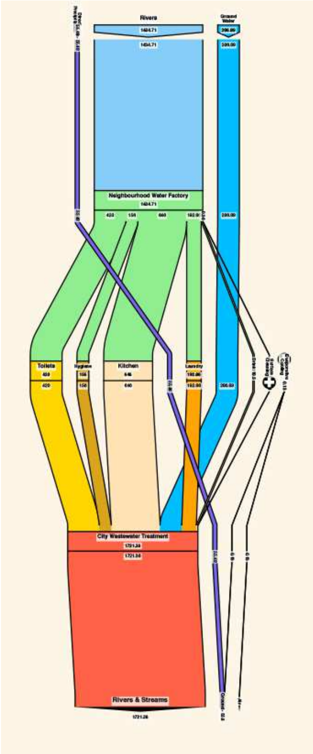

Figure 5 Sankey diagram showing the water flow into the study area from source (the Nile) to the potable water facility into the area and different uses in the parcels, downstream to the wastewater treatment facility and onto the sink (the Nile)

The team have also undertaken the same study for Energy flow through the area and is currently studying of material flow. This is essential to ensure the efficient use of local resources and the adequate intervention to reduce the residents' vulnerability to climate change.Moreover, the project continues to build the capacities of both the CBOs and local residents through conducting the same investigation but for other resources to enhance the awareness of the issue of resource efficiency and to enable them to contribute independently to the data gathering and assessing their needs and priorities. In addition, the technical capacities gained through the process has enabled the group to approach other informal and formal areas.

8 CONCLUSION

Urban metabolism is becoming not only a quantifying, or analyzing tool, it has the potential to influencethe sustainability of districts an neighborhoods. It can expand to reach multiple parameters such as mobility, employment,education,..and many other that could bring innovation in the field of urban systems.This would definitly imply new approaches, methodologies, and techniques while dealing with new factors that were not tackled in the current state of the art. The study in Imbaba demonstrated the moderate living conditions in informal areas which mainly suffer from lack of health services, entertainment opportunities and green spaces. There is big problem in consumption of resources, mainly water in the case of Imbaba. This necessitates a prompt response from various stakeholders on different levels. Water scarcity is a growing global problem, but it accentuated in Egypt given its limited water resources and diminishing share of the Nile water. If the results of the field study are aggregated to encompass informal areas in Cairo, the water consumption/depletion would be alarming. There is aneed to address this issue both on the policy level and on the local level of district plans. Personal behaviour is vital in this issue, where common practices of water over consumption and illegal encroachment on the water network should be reconsidered. The problem was easily communicated through the tools used including GIS, UMIS and the produced maps, charts and Sankey diagrams. Moreover, the partnership between different stakeholders can provide an adequate platform for promoting the methodology and the results onto tailoring locally appropriate solutions that are both affordable and require minimum technological capacities for maintenance and upkeeping. The study of other resources would also provide insights to minimize consumption and promote looping and cascading to maximise the value added of limited available resources, guiding autorities, NGos, and the citizens themselves since it does not rely on predictions, it reflects facts in daily life, behavioural patterns, and related societal norms that affect the form and function of the built environment. Studies in urban metabilism would also assist in providing design and planning guidelines for developing more responsive vibrant communities that address local needs and foster better quality of life.

9 ACKNOWLEDGEMENT

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Urban Railway within the Linear Urban Structure: the Case Study of Perm, Russia

Piotr Lorens, Svetlana Maksimova, Ekaterina Saveleva

(Dr hab. arch. Piotr Lorens, Gdansk University of Technology, ul. Narutowicza 11/12, Gdansk, Poland, plorens@pg.gda.pl))
(Dr Svetlana V. Maksimova, Perm National Research Polytechnic University, 109 Kuibysheva, Perm, Russia, gradcenter@mail.ru)
(MSc Ekaterina Saveleva, Perm National Research Polytechnic University, 109 Kuibysheva, Perm, Russia, gradcenter@mail.ru)

1 ABSTRACT

Perm is a city of slightly under one million inhabitants situated on the banks of the Kama River, in the European part of Russia. Being the 4th largest city in Russia in its area and only 13th in terms of population Perm stretches for over 80 kilometres along the river. Largely due to the city's linearly extended urban structure a significant part of its population experience serious commuting problems. Most of the remote areas of the city are not well integrated into its central part and suffer from poor connectivity and accessibility. The latter is the feature shared by many other cities and other post-Soviet states, so the experience of Perm may also be instructive and useful to other cities.

When it comes to improving the connectivity between different areas of the city, metro railway is one of the commonly used type of contemporary urban interventions. In 2004 the project "Urban Train" was launched in Perm with an ambitious aspiration to become "a "skeleton of the city transport system". The new route was set up using the existing railway lines. It has a total length of 51 km and includes 22 stations on both sides of the Kama River. All other modes of transport, namely buses, trams and trolleybuses, were to be connected with this newly established route. The project was funded by the regional budget.

Despite the fact that Urban train has obviously failed to become city's principal mode it did provided several remote areas of the city with comparatively fast and convenient way to get to the city centre. In the years 2004-2008 the number of passengers was stable at around 1 mln people annually but starting from 2009, when several trains were removed from the timetable, the number of passengers dropped significantly every year reaching around 0,6 mln in 2013. After that the question of the abolition of funding for the project was raised. The service is still in place but the question of financing remains open. Nevertheless, the company managing the project has plans of further infrastructure investment.

The paper analyses the ten years' experience of Perm to develop its system of the urban train trying to reveal the reasons for its modest performance and decline in the passenger traffic. The authors show how the Urban Train fits within the city urban structure and evaluate the potential of the Urban Train to become a feasible solution to the problem of connecting the periphery with the city centre. Furthermore, the paper tries to answer the question whether the proposed further development of the project, including the formation of the transport hubs, is worth implementing in terms of increasing efficiency and volume of passenger traffic. Finally, the authors make some general conclusions on the feasibility of projects of this type in the context characteristic of post-socialist cities in Russia and beyond.

2 INTRODUCTION

Like many other Russian cities, Perm - a city of slightly under one million inhabitants in the European part of Russia - suffers from sprawl, inadequate transportation system and consequent mobility problems.

Urban mobility is one of the most critical issues for all post-socialist cities. Current mess is the result of the lack of effective planning and short-sighted and uncoordinated policies on land use and transportation. Starting from the 1960s many socialist cities adopted the pattern of massive residential development at the periphery of cities resulted in longer commuting distances (Becker et al, 2012). The problem was further exaggerated during the transition period characterized by suburbanization of housing, retail, and jobs. At the same time, the system of public transport was completely devastated during the 1990s and was not longer able to cope with this growing demand (Engel, 2007). While the socialist cities generally possessed highly developed and efficient public transport network, the transition period was characterised by the heavy reliance on the private automobile and the fact that public transportation system was largely neglected and underfinanced.

The majority of public policies adopted during the transition period have been aimed at accommodating the growing number of automobiles at the expense of undermining all other modes of transportation. Thus, most of the public financing for improvements in the transportation system has been directed to expanding the

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vehicle carrying capacity of streets by adding new traffic lanes and building multi-level intersections, with the main purpose of moving more cars faster. Such policies have achieved little but induce more automobile use, thereby considerably aggravating the existing traffic and transport problems, and eroding the quality of public space (Stanilov, 2007). The poor coordination between development plans and urban transportation systems has led to chaotic and inefficient traffic patterns, which have generated bottlenecks in the existing street network.

In Russian cities these negative trends still persists today (Vuchic, 2011). Dispersed urban structure coupled with an ill- conceived approach to transport planning cause serious mobility problems. The city of Perm shares the problems of other post-socialist cities but also has its own specific features aggravating the situation.

3 CASE STUDY

Since the date of Perm's foundation in 1723 as a settlement attached to a copper-smelting plant, the nature and pattern of its urban growth was largely linear. Urban forms of linear character are the result of settlement's development along either natural boundaries or artificial boundaries such as transportation routes. In case of Perm the river set the direction of development and served as the city's structural axis:

Today Perm stretches for over 80 kilometres along the Kama river. It is the 4th largest city in Russia in its area (almost 800 sq.km) being only 13th in terms of population. The area of the city is unreasonably big with low average density (Appenzeller and Gietema, 2010). In accordance with the recommendations of national planning rules Perm with its current population should occupy a built-up area of only 56 sq. km, the existing buildings occupy only about 118 sq. km - seven times less than its current area (Generalnyi Plan Permi, 2010). This is the result of the city's extensive growth during the Soviet period. A number of surrounding villages were included in the territory of Perm in 1920s and later in 1938. Such settlements as Zakamsk, , Kuria, Gaiva, Levshino and others became the city's new remote areas while the space between them and the old centre remained vacant and often not exploited. Transport links between them remained poor (in some cases one still has to pass through the city centre in order get from one remote area to another).

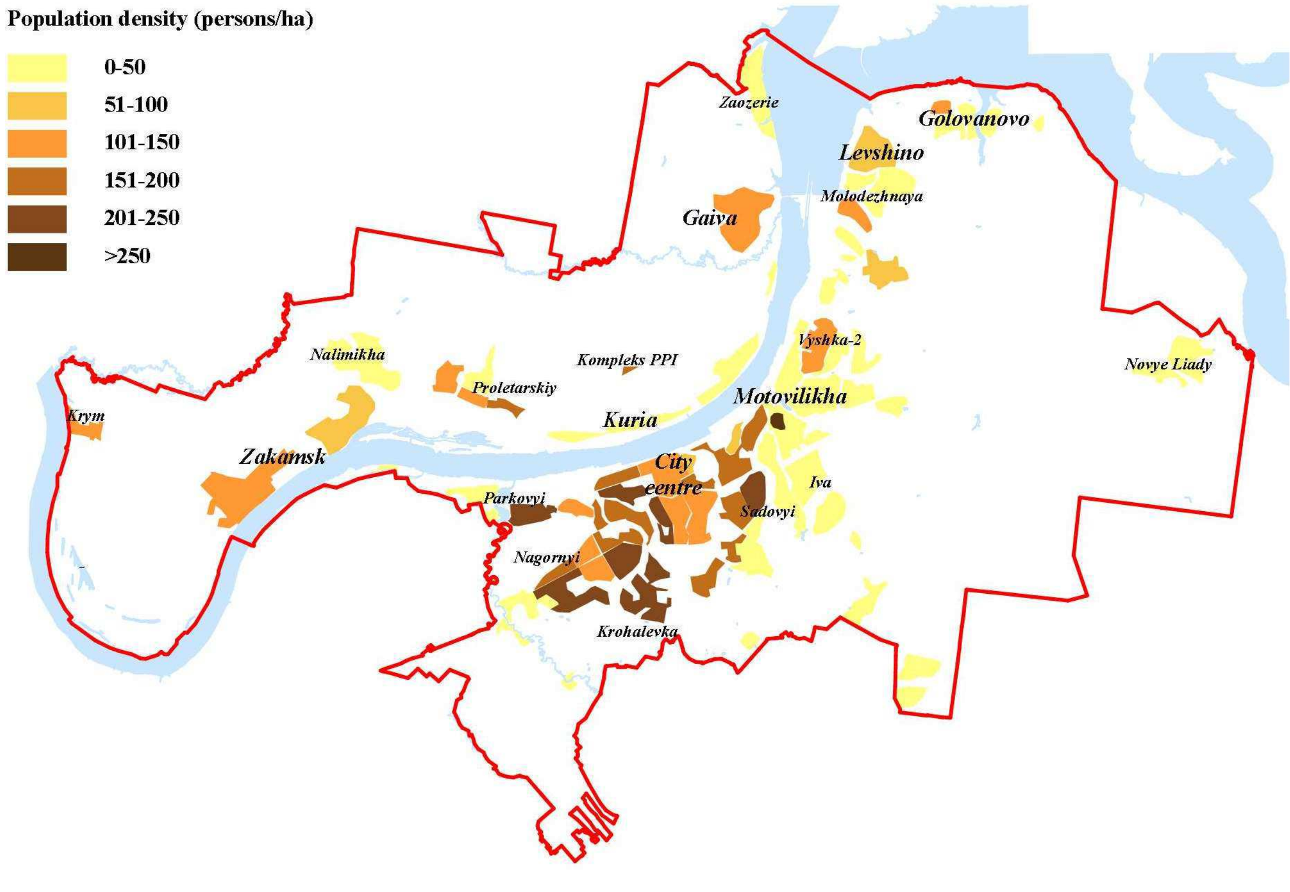

Fig. 1: Distribution of population across the city. Adapted from Generalnyi Plan Permi, 2010

Spatial structure and urban form of the city greatly affects the operation of its transportation system. The following are the problems characteristic of the cities with the linear urban structure and the dispersed low-density development:

- Increased length of transport communications;
- Increased level of transport dependency;
- Relatively low efficiency together with the high cost of public transport;
- Intense transport use leading to the negative environmental impacts.

Thus, transportation problems shared by most post-socialist cities, in Perm are worsened by the its historically formed linear shape. Largely due to the Perm’s linearly extended urban structure a significant part of its population experience serious commuting problems. Such remote areas of the city as Zakamsk, Gaiva, Kuria, Levshino, Golovanovo and others are not well integrated into its central part and suffer from poor connectivity and accessibility.

4 URBAN RAIL TRANSIT FOR PERM: A PANACEA?

When it comes to improving the connectivity between different areas of the city, urban railway is one of the commonly used types of contemporary urban interventions.

Starting from 1970s many cities around the world have introduced different rail transit systems and the most popular one is Light Rail Transit (Topp, 1999). LRT along with tramway and metro belongs to a rail transit family of transport modes providing fast and convenient service to large masses of people. Being a high capacity transport mode LRT at the same time requires much lower investment cost than underground metro (Vuchic, 2002). Depending on the city's structure and its transportation system LRT may function as a suburban feeder to metro or serve as the principal transport mode. In any case rail modes of transport are in most cases superior to motor transport in terms of stability, speed, comfort and environmental impact (Morozov, 2010).

In Russia there are no systems that fully comply with the concept of LRT in the conventional sense. To date seven Russian cities have underground metro systems, and most major cities have one or another kind of electric rail transport, be it a tram, commuter rail, or light metro. There are also dozens of unrealised projects, some of which date back to the Soviet era.

The idea of introducing some kind of rapid railway system in Perm also has a long-standing tradition. Soviet norms required that any city of 1 million people be equipped with metro. The first official project of Perm metro was published in 1982. However, construction has not begun due to the financial constraints. Since then Perm authorities have come back to this issue repeatedly. The in-depth analysis of the feasibility of the project was performed in the Integrated Transport Scheme of Perm (KTS, 2008) commissioned by the Department of Planning and Development of Perm. At that time the transportation planners have concluded that the efficiency of metro in Perm will be very low due to "the lack of sufficient volume of passenger traffic concentrated in one direction" (Petrovich, 2010). In the KTS (2008) it was proposed to make greater use of intracity sections of the Trans-Siberian railway and the further development of the existing tram network.

Being one of the hubs of the Trans-Siberian railway Perm has more than 100 km of railway lines. In 2004 the authorities of Perm region seeking to improve the connectivity between different areas of the city decided to employ the existing infrastructure to launch the new project named “Perm Urban Train”. The new route was set up using the existing railway lines including intracity sections of the Trans-Siberian railway. It had a total length of 51 km and included 8 stations and 14 stopping points on both sides of the Kama River (Fig 2): Golovanovo, Bannaya Gora, Levshino, KamGES, Molodezhnaya, Kislotnyi, Balmoshnaya, Ubileynaya, Yazovaya, Motovilikha, Slavyanova, Perm I, Dzerzhinskaya, Perm II, Perm-Sortirovochnaya, Komsomolskaya, Zheleznodorozhnaya, PromUchastok, Kuria, and three stations outside the city - Las'va, Mysy, Overyata.

The Perm Urban Train project was the first attempt to develop LRT-like system in Perm. As stated in the project's official description (PPK, 2013) the project pursued the following goals:

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- Provision of the higher level of service at the rates equal to the rates of alternative modes of public transport (mostly buses) within the city limits;
- Increase in the number of passengers transported by rail and subsequent road transport load reduction in the same direction;
- Improving the environmental situation by reducing the number of bus routes;
- Ensuring the timely delivery of workers to the industrial sites with introducing the train timetable linked to work shifts schedule;

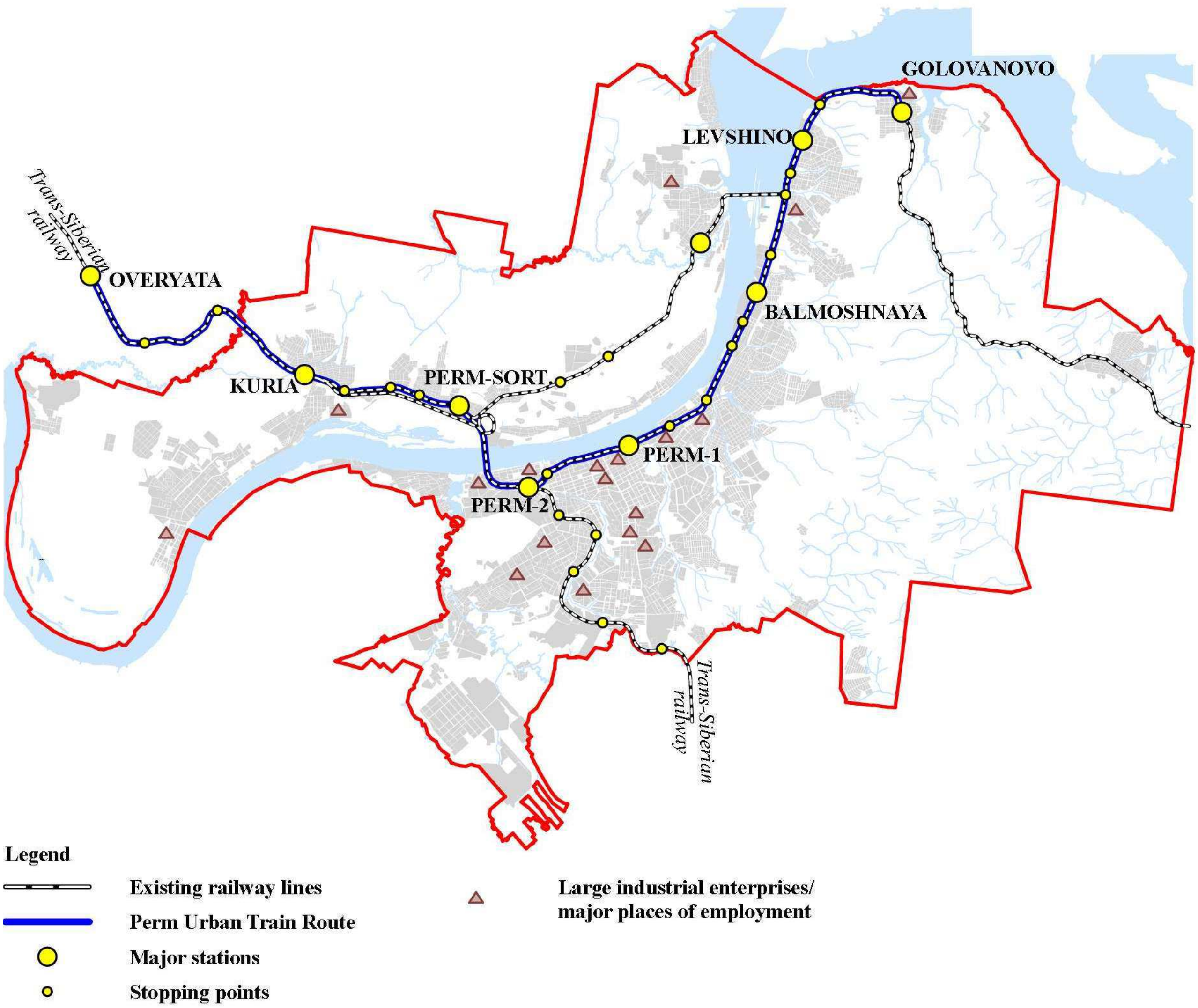

Fig. 2: Railway network of Perm and the Perm Urban Train route

Among the remote areas served by the Urban Railway are Golovanovo, Levshino, Molodezhnaya, Motovilikha and others, with the total population of 16,5 thousand people within the radius of pedestrian accessibility from stations. Large industrial enterprises such as LLC "Galogen", the Kirov Plant, the Dzerzhinsky engineering plant and others fall within the coverage area of the Urban Train. Hence the Urban train can serve as a 'suburban feeder' to the transit network of the city formed by trams as it was recommended in the KTS (2008).

And, indeed, according to the official documents (PPK, 2014) the project was started with an ambitious aspiration to become a “skeleton of the city transport system”. All other modes of transport, namely buses, trams and trolleybuses, were to be connected with this newly established route. The Urban Train was to become Perm's version of LRT resolving the mobility problems without much effort and investment on the part of the city.

Thus, at the moment of its launch the project has presented a quite feasible solution to the problem of connecting the periphery with the city centre and seemed like a perfect fit to the city's linear urban structure. If implemented properly it could potentially become the basic network for the city's new more comfortable and efficient transportation system.

5 2004-2014

A decade has passed since the project launch and it is possible to draw some conclusions.

The total number of passengers of the Perm Urban Train from 2004 to 2013 amounted to more than 8 million passengers. In the years 2004-2008 the number of passengers was stable at around 1 mln people annually but starting from 2009, when several trains were removed from the timetable, the number of passengers dropped significantly every year reaching around 0,6 mln in 2013.

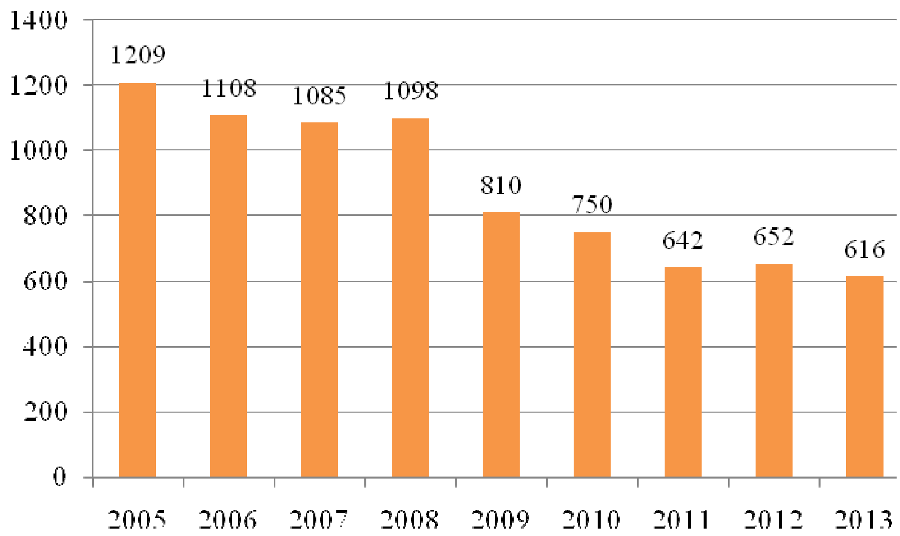

Fig. 3: The number of passengers of the Perm Urban Train from 2004 to 2013, thousand people. Source: PPK, 2013

Apart from the Perm Urban Train there are also several regional trains, which pass the same route "Golovanovo - Overyata". However, in 2010 the share of passengers who chose rail transport to get to the city centre in the morning rush hour was only about 12%. And only 2 % of all commuters used the Perm Urban Train (Generalnyi Plan Permi, 2010). Trains also run half-empty during the day: according to the annual report for 2013 (PPK, 2013a) the average carriage occupancy rate was 22 out of 110 seats.

Despite the fact that the Urban Train has obviously failed to become city's principal mode it did provided several remote areas of the city with comparatively fast and convenient way to get to the city centre. Perm Urban Train is the fastest means of public transport to the city centre from many areas. For example, it takes 38 minutes to get to the terminal station Golovanovo by train while the same trip by bus may last between 60 and 120 minutes depending on the time of the day. The table of comparison between travel times to some other stations by train and by bus is presented below.

Points of departure and arrival	Travel time by bus, min	Travel time by train, min	Reduction
Perm I - Golovanovo	90	38	58%
Perm II - Levshino	60	39	35%
Kuria - Perm II	90	23	74%

Table 1 Comparison of travel times by bus and by train. Source: personal observations

If this train does provide faster access to the city centre and backwards, what are the reasons for its low popularity and the constant decline in the passenger traffic? The reduction in the number of passengers is due to the fact that a significant portion of them opt for alternative modes of public transport. The preferences of passengers were determined by the following factors:

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- cancellation of a number of trains and simultaneous increase in the number of bus services, taxis, parallel to the route of the Perm Urban Train: there were 32 trains per day when the project was launched in 2004 and only 9 trains per day were running by the end of 2014 ;
- poor accessibility resulting in long travel times to the railway stations;
- high non-competitive price: by the end of 2014 the cost of the journey (regardless of the distance) was 21 roubles, while the trip by bus cost only 13 roubles;
- poor quality of station infrastructure.

The factor having the greatest influence on the popularity of the Perm Urban Train is its irregular timetable. There is no regular interval timetable and there can be gaps up to 2-4 hours outside the rush hours. Yet the need to increase the number of trains and to reduce the intervals of their movement is an issue that cannot be easily resolved. The factors impeding the solution of this problem will be mentioned in the next section.

Fig. 4: Perm II and Golovanovo stations

6 PROPOSED INFRASTRUCTURE DEVELOPMENTS

Several propositions aimed at increasing the efficiency of the Urban Train were made in the Perm Strategic Masterplan (2010) and the General Plan of Perm (Generalnyi Plan Permi, 2010). Some of them included both physical improvements of the current infrastructure and its further development.

Looking for the ways to make the train intervals competitive with buses the authors of the General plan emphasize two main factors impeding this: 1. an insufficient capacity of rolling stock and 2. an insufficient capacity of railway lines in some sections. According to the General Plan the left bank section of the Perm Urban Train line (Perm II-Golovanovo) has an excess capacity and the main problem with the capacity of the railway network is related to the Trans-Siberian Railway. The latter is already running at its capacity while the two-track railway bridge over the Kama creates a real bottleneck.

The solution presented in the General Plan is to build a by-pass track to the south of the city. The proposed track would remove the burden of immense freight traffic from the Trans-sib section going right through the city centre. However, the construction of the by-pass demands such amount of investment that is not currently available to the city. Increase in the number of trains will also require considerable investment.

Proposals for the development of rail transport include the reconstruction of seven stations on the line Golovanovo - Perm II: Perm II, Perm I, Motovilikha, Ubileynaya, Molodezhnaya, Levshino, Golovanovo and two completely new stations. The reconstruction project of Perm II implies turning it into a major travel hub with redevelopment of adjacent area and reorganization of transport and pedestrian links with the city centre.

Although the current infrastructure leaves much to be desired, this issue cannot be considered as a priority. According to passenger survey held in 2013 the renovation of stations' and stopping points' infrastructure is only 5th in the list of improvements needed (UralINSO, 2013).

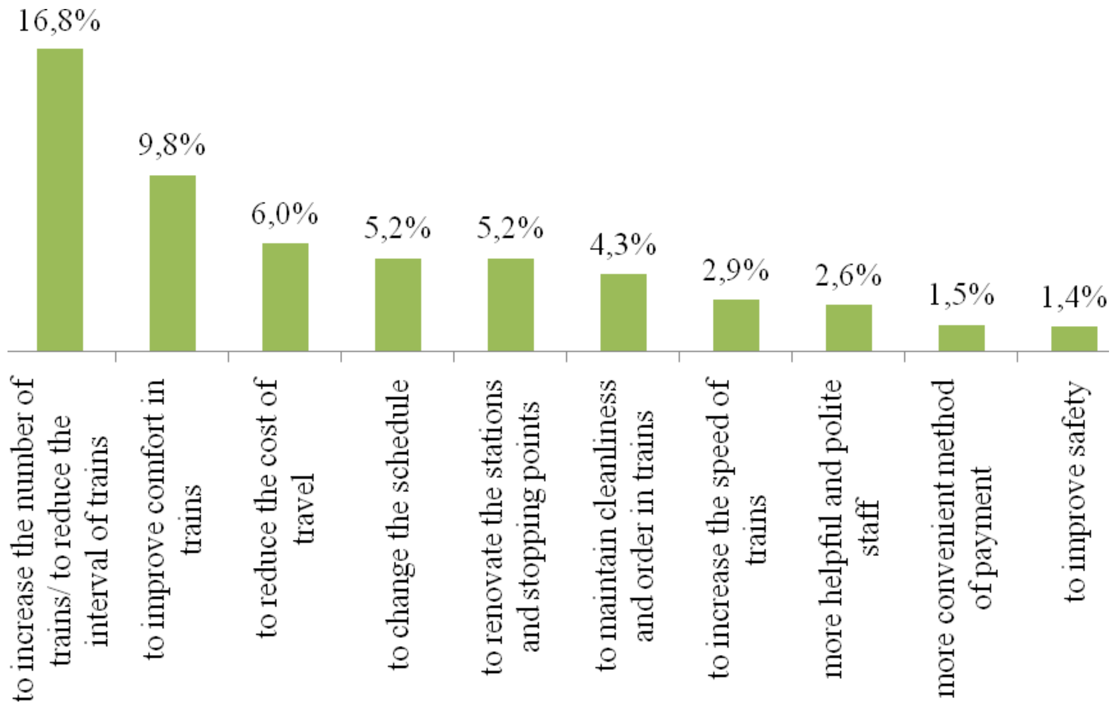

Fig. 5: Suggestions for improving passenger rail transport. Adapted from UralINSO, 2013

As far as the proposed extension of the route along the right bank of the river with two additional stations Kabel'naya (existing) and Gaiva (planned), this proposition seems to be reasonable in terms of increasing efficiency and volume of passenger traffic. Two stations may generate almost 13 thousand more passengers daily in addition to 16,5 thousand living in the area of pedestrian accessibility of existing stations (Generalnyi Plan Permi, 2010).

Further development is also proposed by the Perm Suburban Company that runs the Perm Urban Train project (PPK, 2013). Their plan is to connect stations on both sides of the river into a circular route (using existing rail lines) with movement organised both clockwise and counter-clockwise. Although the proposal seems promising in terms of expanding the area and correspondingly the proportion of the population served by the Urban Train, it is not clear what source of funding the Perm Suburban Company was intended to use for such a large-scale development.

Apart from the big infrastructure developments there are ways to increase the effectiveness of the existing system of rail transit in Perm which does not require as much capital investment but strong political will and organisational reforms.

7 POSSIBLE ORGANIZATIONAL IMPROVEMENTS

To cover the operating costs of the route it is necessary to increase the number of potential passengers. The following reforms are suggested in order to improve the service and to encourage rail transit ridership:

1. Reducing the intervals of the train, as already mentioned, is the most needed step towards attracting more passengers since the inconvenience of the current schedule for many passengers outweigh all the advantages of the Urban Train over alternative means of transport. This may achieved either by rearrangement of the existing fleet, e.g. splitting longer trains into two on the routes running with intervals, or by investment into new rolling stock, thus improving both the intervals and the level of comfort.

2. Improved coordination among modes and integration of the Urban Train into the city's public transport system is a foreground transformation that may be beneficial not only for rail transport system, but also for the city's public transport network as a whole.

This can be achieved in several ways. The first and most obvious step is to introduce a single (and simple-to-use/understand) ticketing system compatible with other modes of public transport. Such systems are in place in most cities with developed public transit since the mid 2000s.

Better modal integration on stations and stopping points is also a very important step towards attracting the new passengers. Possible developments in this field include turning at least the major stations into proper transportation hubs with exchange opportunities from train to buses, trams and other modes of transport with simultaneous harmonization of their schedules. Other ways of modal integration include:

- Arrangement of near-station parking lots allowing car users to leave their vehicles safely and change to train;
- Organisation of short bus routes between places of residence and train stations as a feeder service to the Urban Train;
- Improving pedestrian accessibility and approaches to the stations and stopping points.

3. Finally, it is important to make the use of the Urban Train clearer and easier. Improved availability of passenger information combined with various marketing programs aimed at popularisation of the Urban Train and rail public transit in general will make a significant contribution to the development of the project. One petty nuisance inherited from the Soviet times, which may be easily disposed, is that railway schedules are published in Moscow time (time difference 2 hours).

However, the implementation of the above innovations requires monitoring by a locally based transport company capable to coordinate the full range of issues related to the functioning of the urban transport system. The fragmentation of urban administration, which is evident both in post-socialist and developing countries, hampers the success of policy planning and implementation. Many authors call for organisational change and for better co-ordination of structural units of administration having urban transport responsibility as a crucial element of efficient performance of city's transportation system (Cervero, 1998; Dimitriou, 1990; Stanilov, 2007).

8 PROPOSED ADMINISTRATIVE REFORM

Today the Perm Urban Train project is run by the Perm Suburban Company, which is a subsidiary of Russian Railways (51 percent owned by Russian Railways and 49 percent by Perm region). Around 58 percent of operating costs are covered by transportation fees, the rest is subsidised by the regional budget. In 2014 the regional government raised the question of the abolition of funding for the project since it was not ready to subsidy intra-urban public transport. The city budget also does not have the necessary funds. The service is still in place but the question of financing remains open.

Meanwhile, the problem is not unique for Perm. Many other Russian regions have similar Suburban companies operating commuter rail transportation. During their creation in the early 2000s the rolling stock was not included in their authorized capital. As a result the rental payment for the carriages and locomotives accounts for almost 70% of their operating costs. This rental payment and the tariff for the use of railway infrastructure are charged in favour of Russian Railways. Many regions consider the pricing policy of Russian Railways as opaque and refuse to subsidy the Suburban companies (Terentyeva, 2015). This issue, however, lies beyond the scope of the current study.

Coming back to the question of the management of urban transport systems. Today regional and municipal carriers (urban train, trams, trolleybuses) are put in conditions of uncontrolled competition with private carriers (buses) that offer services of low quality often delivered by obsolete fleets but at affordable rates. Such a policy not only adversely affects the performance of the Urban Train and electric transport operated by the city but inevitably leads to the overall ridership losses and forces passengers to switch to private automobiles. In order to facilitate integration of all modes of transport in one efficient system an intermodal transportation company may be established in cooperation with the Government of the Perm region. This will increase the level of coordination and co-operation between all public transport providers and allow to put into action integrated ticketing and tariff system controlled by the city.

9 CONCLUSIONS

To sum up, it may be argued that at the time of its establishment the Urban Train Project presented an innovative but ready-to-use solution to the Perm's issue of low connectivity raised from its historically fragmented urban fabric.

Taking into account the linear urban structure of Perm and the existing railway lines along its structural axis, some semblance of Light Rail Transit embodied in the Perm Urban Train appeared to be an obvious solution. And indeed rail systems successfully function as primary connecting mode in linear cities and agglomerations in Russia and beyond, i.e. Volgograd Metrotram, Russia or SKM in Tricity of Gdansk, Gdynia and Sopot, Poland.

However, the project has not received due attention from the regional authorities who initiated the project nor it has attracted enough support from the authorities of the city. The Perm Urban Train was not integrated into the city's network of public transport leading to the competition with other modes and the gradual loss of passenger volume.

Planning and developing of effective transport system requires an integrated approach based on the best practices in transport planning but also concerning city's specific features. Among the developments and the reforms described above the creation of the intermodal transportation company or the local government body managing the whole transport system seems to be a most urgently needed one. In Perm as well as in all other Russian cities it is necessary to ensure a higher level of coordination between the different modes of transport and facilitate mixed-mode commuting.

Apart from those already mentioned one of the feasible perspectives of mode integration in Perm is the formation of the tram-train system. The basis for such system will be the left bank section of the railway and the well-developed tram network in the south part of the city. As for infrastructure developments the most important and cost-effective proposals include the redevelopment of the Perm II station, the addition of two new stations Kabel'naya and Gaiva, the construction of intermodal node Levshino. The possible developments of secondary importance may include creating several other intermodal nodes of varying significance and extension of the route in two directions: 1) to Zakamsk with the construction of new railway lines (around 8 km); 2) to Ferma using the existing lines (see Figure 6).

The development of the efficient transportation system with the rail transit as a backbone presupposes the abandonment of the current overreliance on private automobile transport and adopting a new systematic approach to transportation planning. Overcoming chaotic and inefficient traffic patterns characteristic of most Russian cities requires sufficient political will and civic drive to give the priority to more sustainable modes such as rail transit and to allocate needed resources. Subsidies in the system of public transport should be evaluated against the costs associated with road traffic: capital investment into road construction, the cost of road maintenance, road safety, organization and construction of parking spaces and so on. The investment into urban rail systems in the long term may be the most cost-effective solution improving mobility at a lower total cost, including costs to government, consumers losing time in traffic jams and the city's environment.

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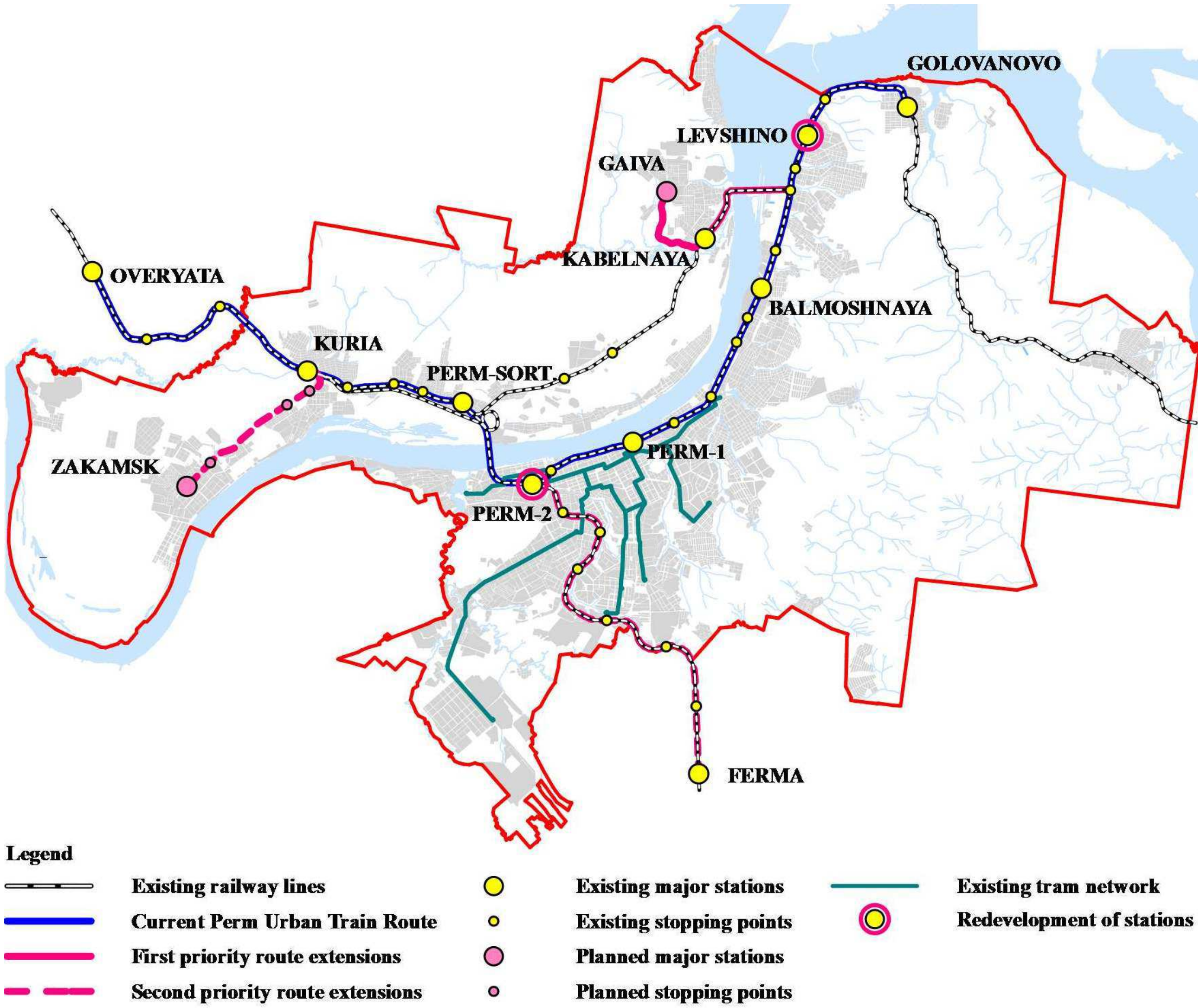

Fig. 6: The proposed development of rail transit in Perm

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reviewed paper

Vis-à-vis Communication? Digital and Physical Spaces of Interaction in the Contemporary City

Aleksandra Stupar, Aleksandra Đukić

(Associate Professor Dr Aleksandra Stupar, University of Belgrade - Faculty of Architecture, Bulevar kralja Aleksandra 73/2, 11 000 Belgrade, Serbia, stupar@afrodita.rcub.bg.ac.rs)
(Associate Professor Dr Aleksandra Đukić, University of Belgrade - Faculty of Architecture, Bulevar kralja Aleksandra 73/2, 11 000 Belgrade, Serbia, adjukic@afrodita.rcub.bg.ac.rs)

1 ABSTRACT

ICT is an important social medium which influences the concepts of space and place. It allows creative participation of users who act as consumers of places, active contributors in the process of urban design or critics. The first phase of the ICT development in cities was focused on providing and assuring low-cost Internet access which would enable free connectivity within a community, at home or work (Loader and Keeble, 2004). Gradually, the relationship between ICT, community and cities has been continuously analyzed and elaborated emphasizing new topics and targeting design and meaningful application of ICT within communities. Simultaneously, the role of digital networks and flows has been recognized in many fields of urban reality, fostering civic engagement (Pigg, 2001) and supporting a sustainable social, cultural or economic development of cities and their spaces.

Nowadays, people interact in both physical and virtual realm, gathering formally or informally in order to exchange information and knowledge, disseminate practice and experiences, or erase different kinds of limitations. While the main role of open public spaces is to provide social contacts between people, remaining the place where they can rest, recreate and enjoy the environment, e-networks have opened additional channels of communication and diffusion. Allowing an extended (spatial and temporal) community upgrading and interchange, the digital surrounding has become a new tool and a setting for contemporary activities demanding continuous development and synchronization with global challenges and needs.

Considering the ambiguous nature of modern cities and their public spaces, the paper will tackle several questions. What is the future of open public spaces? Can virtual space take on the role of the physical one? Could we use social networks as additional and dynamic tools for fulfilling the main tasks of open public spaces? What are the recent innovations introduced into cities in order to support increasing number of communication modes? How they affect urban modelling - both on the physical and the virtual level of urban life?

2 INTRODUCTION

During the second part of the 20th century, the role and importance of open public space became a focus of attention for urban theoreticians and practitioners. Furthermore, its neglected role of a social driver was significantly emphasized during the 1990s in a number of regeneration projects in contemporary cities. In general, open public spaces could be defined as central places of community in civilized society, which are dependent on a certain level of shared experiences and expectations of users (Crawford, 2000). Crouch (1998) describes open public spaces as links connecting nodes of activities and events, which stimulate experiences and memories. They could be very diverse - depending on users and their needs and backgrounds, but even different roles and meanings of public spaces connect people, especially during large events (celebrations, demonstrations, parades etc.). Therefore, one of the aims, which should be achieved by designing a 'successful' open space, is to establish a framework that stimulates gathering of people, their contacts and communication. At the same time, a public space could be described as a place where one observes other people while being observed by others. In the digital era, this interpretation has slightly changed and adjusted to an increasing interaction between people and technology. Consequently, Chen (2009) underlines the fact that "if you are not seeing data, you are not seeing", while architectural theorist Anthony Vidler (1992) describes contemporary city as a concentration of data transfer and information, which is more important than a number of inhabitants. Adriana de Souza e Silva (2006) gives another insight into urban reality of the 21st century, pointing out that contemporary cities represent hybrid spaces where borders between urban physical and digital space are blurred by ICT. Obviously, the role of ICT and importance of their networks should be reconsidered since they have become indispensable ingredients of urban life. Creating an autonomous realm, information networks are included in all urban performances,

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acting a unique drive for further development. Nowadays, information exchange is diverse and multiple - from a perception of the environment and improvement of urban performances, to communication and movement of individuals, groups and goods. The digital form enables better (and instant) detection of changes, increases the efficiency of data transmission and analyses, and provides a better understanding of urban processes, their potentials and setbacks. The role of ICT networks has been recognized in the process of climate adaptation and mitigation too, providing new channels of knowledge and exchange, as well as new models of behaviour. For example, Mitchell (2000) envisioned the development path of a green city with smart elements which follows several basic principles applicable at different scales - dematerialization, demobilization, mass customization, intelligent operation and soft transformation. His concept of e-topia proposes life with a minimized production of waste, all enabled by ICT networks. E-reinforcement also leads to an intelligent adaptation, automated personalization and the creation of efficient, responsive markets for available resources, while soft transformation influences remodelling/adaptation of existing spatial structures.

The duality of public spaces has become a reality causing numerous changes in urban typology and redefining spatial, social and technological demands. Nowadays, public space should provide a safe and secure environment for spontaneous manifestations of social life, especially for citizens within local community (Rossi, 1982). On the other hand, the nature of digital space gives an illusion of freedom and safety, because its user can choose a preferred 'group', define and establish 'borders', select a 'protection' and express her/his opinion.

Fig. 1: Augmented reality of urban space. (Source: http://mashable.com/2011/05/10/lg-optimus-3d-augmented-reality/)

3 CREATING A CYBER-CITY?

Searching for the best and most efficient solutions which would allow us to synchronize and totally utilize physical and digital realm of our existence, the concept of cyber-parks has appeared, providing the overlapping of real and virtual spaces. In general, a cyber-park represents an open public space where people spend free time and which provides numerous social interactions. However, in order to fulfil that role in a contemporary urban environment, such a place should be covered with ICT networks. Creating an intelligent environment, it provides interactions between users of physical space and their digital portals (mobile phones, laptops, tablets) through wireless network. Consequently, a virtual relationship between physical space, its augmented reality, other users and applications becomes a necessity (Figure 1). Defined as three-dimensional, real-time and interactive technology that mixes real and virtual environment, the augmented reality changes the user's view of material world (Azuma, 1997). Information could be accessed without leaving the place and they could be also overlaid three-dimensionally on real place, enabling manipulation, examining physical objects and/or receiving additional information about them.

There are numerous cases which successfully use this principle. For example, the BlocParc in Paris has applied digital space into physical one through intelligent urban furniture projects. The digital upgrading of open public spaces started during 2014 and continued in 2015. The urban furniture is made of large blocks of reinforced concrete which could be used as tables, planters and straight, curved or connected benches. Designed as a meeting place, urban furniture also acts as a communication medium, providing a digital link with the user, without a need to download an application. One of the aims emphasized by the local community which implemented the project was to develop the 'connected urban furniture' for enhancing residents' interactions. As a result, three out of seven BlocParc blocks have NFC chips embedded in them. Passing pedestrians can hold their smartphones close to a chip to automatically activate their browsers and open preferred web/information pages (Figure 2). Each bench has six tags: emergency card, intelligent and multimedia entertainment, transport, social and local information. They can be customized and have a diverse and unlimited content defined by a person who uses the furniture. Pedestrians can use geo-location or get targeted promotional offers or they can approach information about culture of the place, local interest, historical items, event animations, as well as games and videos.

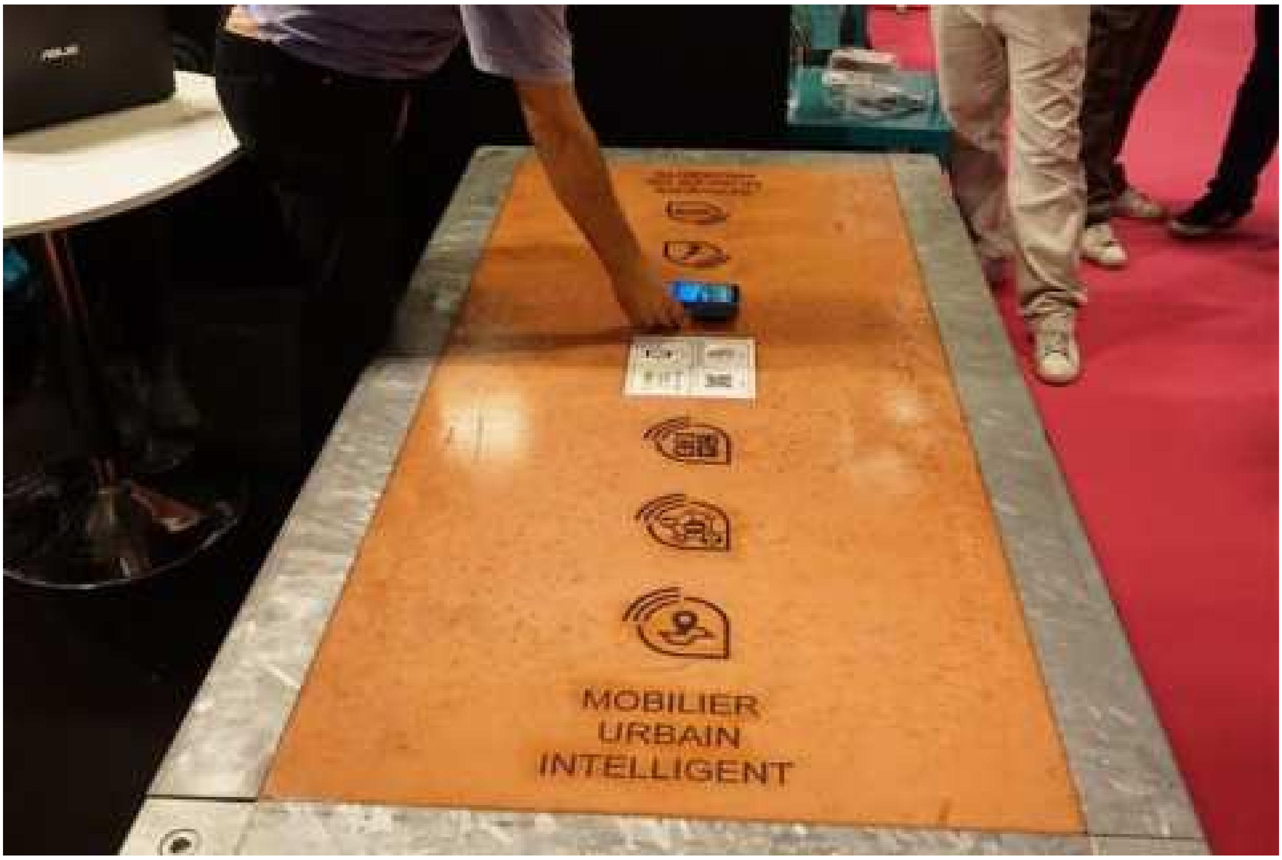

Fig. 2: BlocParc - intelligent urban furniture. (Source: http://www.blocparc.fr/tag/paris/)

Another interesting example connects urban public spaces on several levels via ICT. To promote its travel service, the railway company SNCF teamed up with the advertising agency TBWA Paris creating an ad-campaign called ‘Europe, It’s Just Next Door’. In an amusing and creative way, it sends pedestrians to other European cities—simply by opening brightly coloured doors with the names of cities. The interactive doors were positioned across various tourist locations in Europe and all around Paris. Each door hid full-bleed LED Screens which are connected live to other parts of Europe, transmitting specific cultural attractions. When opened, the doors displayed real-time events happening in those cities (Figure 3). Consequently, pedestrians in Paris were able to open a "door" containing a digital screen and take part in characteristic activities in

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Milan, Barcelona, Genève etc. Similar campaign was set up for promoting the train connecting Lyon and Brussels. This time, the digital portal was incorporated in a three-meter high big white cube, which was placed in a public space of both cities. The pedestrians were invited to stick their heads into a cube in order to be 'teleported' into a street scene in another city. Simultaneously, they were able to interact with the mayor and his official marching band or to chat to their counterparts in Lyon/Brussels.

Fig. 3: Interactive doors placed in open public spaces of Paris. (Source: http://designtaxi.com/news/361896/In-Paris-Interactive-Doors-Transport-Pedestrians-To-Other-European-Cities/?interstital_shown=1)

Fig. 4: Strawberry Tree - multipurpose urban furniture for facilitating the use of portable devices. (Source: http://www.innovationfund.rs/portfolio/the-strawberry-tree/)

Another approach in combining digital and material reality is focused on using a new kind of urban furniture as a support for ICT in open public space. The good example of this practice represents the so-called 'strawberry tree', which is the first public solar charger for mobile phones. It was designed in Serbia five years ago, the first one was installed in the centre of Obrenovac in 2010 (Figure 4), and since then it has become a part of many squares and parks in different cities. Two devices have also been set up in Bosnia and Herzegovina. The Strawberry Tree uses pure energy of the sun converting it into electrical energy. The derived electrical energy is stored in in-built accumulator batteries and then used for charging small portable devices on public places. During the night hours it uses cost-effective and energy efficient light system.

4 CYBER-PARKS (DIGITAL SPACE) VS. OPEN PUBLIC SPACE (PHYSICAL SPACE)

The space could be considered as more abstract term than the place. It describes broader three-dimensional realm in which we live (Harrison, Dourish, 1996). 3D Google maps, Bing maps, birds eye and streets view of cities enable us to simultaneously exist in several places or visit them without leaving the current position and 'real presence'. The advanced ICT supports and intensifies augmentation of spaces, broadening information about specific places and experiences (Aurigi, De Cindio, 2008; Brewer, Dourish, 2008; De Souza Silva, Frith, 2010). The digital augmentation provides users new ways of perceiving and understanding a certain environment, moving through, annotating and enacting (Graham at al., 2012). Furthermore, ICT mediates these experiences and practices, creating new and flexible spatiality (Liao, Humphreys, 2014). Therefore, research has shown that users sometimes apply augmented reality to demonstrate their own power on/in a public place by virtually changing it, posting comments and alerts. Following this trend, it is possible to modify current asymmetric approach in urban designing, opening and extending the possibilities for public participation and interactive changes.

Digital systems have also become important reinforcement of our climate/environmental awareness, due to their capability to detect environmental data (via sensors) and make them instantly visible and generally available (via networks). Using two basic types of interfaces - personal (smart phones, notebooks, tablets etc.) and public (wi-fi nodes, urban touch-screens, info-beamers) users receive information on urban resources, processes and activities which might modify their choices, behaviour and attitude in physical space. Numerous companies and/or non-profit groups (e.g. IBM, Cisco vs. MySociety, Open Knowledge Foundation etc.) create software, web-services and applications dealing with environmental conditions, transportation, urban services or resources, which have an impact on our relationship with environment. Therefore, some cities use their own meteorological networks to provide accurate information about weather, its influence to general condition of environment, as well as to increase the awareness about climate change and carbon footprint (e.g. 'Urban EcoMap', an interactive web service provided in San Francisco and Amsterdam, displaying environmental footprints for each zip-code area).

Obviously, the existing technology, with its various applications and manifestations, becomes a vital ingredient of urban culture. The specific urban situation has an important influence on the design of technologies and their performances, intensifying the interaction of city, society and technology, but also stimulating and promoting urban and technological innovations. The parallel world of technology has already established the substitutes for a number of mundane life-supporters and anchors. According to Paul Drewe (2000), these ‘pairs’ are:

bookstores - bitstores

stacks (in libraries) - servers

galleries - virtual museums

theatres - entertainment infrastructure

schoolhouses - virtual campuses

hospitals - telemedicine

prisons - electronic supervision

banking chambers - ATMs (automated teller machines)

trading floors (stock exchange) - electronic trading systems

department stores - electronic shopping malls

work (in offices) - telework

at home - @ home

The ambiguity of the contemporary reality has been further elaborated and reflected in public space. Therefore, each one of overlapping realms (digital and physical) provides certain advantages and limitations, which might complement, coexist or negate each other. Their characteristics, listed and compared in Table 1, clearly display almost unlimited possibilities which could be achieved in a hybrid public space. It would incorporate elements of both 'realities', but preserve their uniqueness given by their essential qualities. Consequently, open public spaces should remain nodes of urban cultural identity, while evolving and multiplying performances of cyberspace will reflect level of achieved cyber-culture, as an inseparable ingredient of contemporary, technologically advanced network society.

Digital space	**Physical public space**
Global identity	Local identity
Belonging to virtual groups	Belonging to local community/groups
Predicted encounters	Possibility of sudden and unexpected encounters
Group identity/cyberculture	Social identity/cultural identity
No possessing?	Sense of "possessing" of physical space
Unlimited - no physical limits despite the distance (limited within the group/ possibility for expansion)	Limited in physical context / no possibility for expansion
Contacts through smartphone, tablet devices	Direct contacts between users, touch
Augmented, virtual reality	Real place
Hybrid identity	Symbol of city/identity
Contacts within hidden groups/possibility for separation	Contacts within groups, but transparent
Only for users with ICT tools	For everyone
Possibility for hiding (identity)	Transparency
Talking/chat/social contacts between strangers, "being more visible"	Social contact are usually between acquaintances
Happn, app-based dating scene	Possibility of spontaneous meetings
Social contacts on everyday base despite the distance	Social contacts are usually not on everyday base and they are conditioned with distance between individuals
Virtual game	Experience game
Affordable information 7/24	Hidden information

Table 1: Digital space vs. physical public space

5 CONCLUSION

Although modern technology could cause confusing feelings and distort human perception, it is evident that its power directs our world towards the augmented and fast-changing future. Our lives are already over-exposed to technological wonders and the challenges initiated by their proclaimed omnipotence are multiplying every day. Nevertheless, the material features of physical world still represent anchors of our urban identification, providing tangible setting for our activities and dynamic urban processes. Therefore, it is evident that digital alternatives cannot completely replace physical nodes of gathering, interaction and intellectual exchange, but they have to be integrated into traditional and new urban functions and spaces (Drewe, 2000). Supporting the new economy of presence and creating systems of interlinked, interacting, silicon- and software- saturated, smart, attentive and responsive places (Mitchell, 2000) contemporary cities should achieve a high level of heuristic changeability on all levels. The open public spaces, traditionally considered as nodes of social contacts between people, as well as places where people come to see other people and to be seen, will certainly follow this course of development and upgrading. Consequently, the multiplying social networks will be just one of many elements of open spaces of the future, which will demand a complex architecture of existing and emerging networks - created by and for people.

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Visualization of Vibrant Cities and Regions – Identification, Design and Development of 3D-GIS Applications and Modules

Willi Wendt, Jana Mauthner

(Dipl.-Ing. Willi Wendt, Fraunhofer IAO, willi.wendt@iao.fraunhofer.de)
(M.A. Jana Mauthner, Fraunhofer IAO, jana.mauthner@iao.fraunhofer.de)

1 ABSTRACT

Facing a continuous state of transition and herewith connected financial, societal and ecological challenges such as the climate or demographic change (United Nations 2013), cities try to integrate innovative information and communication technologies in order to optimize administrative processes, legitimize decision making and to involve all relevant local actors into processes of public relevance. In this context 3D-GIS-models offer various not yet exploited potentials for all named levels of interest. This paper presents an overview over existing application fields for 3D-GIS-solutions, further proposing a categorization in order to be able to develop and implement target-oriented solutions.

Moreover, this paper presents the project activities of the Fraunhofer IAO, the city of Cologne and the provider of geo-information-services ESRI, designing and developing end-user oriented applications for the 3D-GIS-tool CityEngine. Therefore various city departments such as the agencies for city planning, traffic and environment were involved in an iterative process in order to identify potential application fields and their benefits within the administrative work as well as their andvantages regarding existing solutions and processes. Aditionally, the particpants decided upon a set of focus applications to be developed within the project.

Therefore, this document will concentrate on the potential benefits of the identified and cooperatively designed application fields, further outlining the first steps of the deleopment phase of the citizen particpiation application.

2 INTRODUCTION

Today, cities are in a continuous state of transition, adapting to financial, societal and ecological changes such as climate or demographic change. Understanding the resulting need for adaption as a chance for a city development towards more sustainability and resilience, most modern cities try to introduce innovative tools and methods to include and address as much relevant actors as possible into planning processes. In that context, 3D-City-models have been identified as a promising technology to build a common understanding between all kinds of actors regarding various thematic fields. Moreover, these models include fully operational GIS functionalities nowadays, opening up even more possible areas of application for public management, decision support as well as citizen participation. Unfortunately, besides pure visualization benefits and usages most of the imaginable application fields are merely ideas or at an experimental status.

Therefore, this paper analyses existing application fields of 3D-City-models and presents an research approach which aims to identify and develop user oriented application fields for this technology. Therefore, the paper is based on an ongoing project of the German research institute Fraunhofer IAO, ESRI Germany and the City of Cologne. Within the framework project City of the Future phase 2, which tries to implement innovative and sustainable projects for city development, this subproject aims to develop modules for the ESRI 3D-City-Engine by identifying use cases with various departments of the Cologne city administration as for example the agencies for city, traffic and environmental planning.

Methodically this paper first outlines the state of the art regarding the benefits of 3D-City-GIS models (chapter 3) as well as existing application fields and research projects addressing the use of 3D-City-models (chapter 4). On this basis, a categorisation of application fields will be proposed in order to be able to design solutions that fit to the end-users needs as good as possible (chapter 4). Subsequently, chapter five addresses the project activities performed by ESRI, the City of Cologne and the Fraunhofer IAO within the Morgenstadt: City insights project. Herein the procedure as well as the results of an iterative design process will be outlined which aims to develop user oriented application fields of 3D-City-GIS-models in close cooperation of end-users, developers and research. The paper concentrates onthe development of solutions adressing specific gaps within the administrative work and will therefore outline specific benefits and requirements regarding this application fields. Finally, chapter 6 summarizes the papers key insights and draws a first outlook on a possible participation tool for planning processes.

3 POTENTIAL BENEFITS OF 3D-CITY-GIS-MODELS

There are enormous challenges for sustaining city infrastructures, due to financial, societal and ecological changes, nowadays. In the recent scientific discussion 3D-City-modelsare reflected as an effective medium to sustain urban planning, especially, when multidisciplinary experts have to collaborate with the general public and municipal actors in infrastructure projects. Hence, a 3D-City-model should profitably be utilized in urban planning, cartography, architecture and environmental planning (Gröger, Plümer 2009).

3D-City-models can be defined as digital models that "represent spatial and geo-referenced urban data by means of 3D-geovirtual-environments that basically include terrain models, building models, vegetation models as well as models of roads and transportation systems. In general, these models serve to present, explore, analyse and manage urban data. As a characteristic element, virtual 3D-City-models allow for visually integrating heterogeneous geoinformation within a single framework and, therefore, create and manage complex urban information spaces (Döllner, Baumann, Buchholz 2006)."

There are different 3D-City-models and 3D-applications that already exist, reaching from prototypes to commercial solutions. In the last years growing efforts were put into the creation of 3D-City-GIS solutions. A 3D-City-GIS is an information management system that is suitable for geospatial and non-geospatial data. According to Fredericque and Lapierre, it is a collection of functionalities that allow for the effective management of data, users and processes related to the city infrastructure by enabling comprehensive and transparent visualisation and navigation. Based on a underlying 3D-City-model it is suitable for the management and geocoordination of information on infrastructure and provides an overview as well as detailed information on existing urban infrastructures. It therefore offers a framework for monitoring and analysing the whole information lifecycle. The main functionalities of a 3D-City-GIS can be characterized as follows (Fredericque, Lapierre 2010):

- "3D modeling and quality control,
- Persist, manage and serve,
- 3D analysis and design."

3D-representations in general and a 3D-City-GIS in particular can increase the value of data, support decision making processes, provide up-to-date information to various stakeholders and enhance an effective communication in complex situations. Providing a simple visualization of future projects and making a more in-depth analysis of existing infrastructures possible, these systems can help to generate a more realistic view of the urban area (Moser, Albrecht, Kosar 2010).

Recently, 3D-City-modelling is becoming more popular in urban planning analysis, noise propagation simulations and flood simulations. But still it is relatively new compared to the 2D-GIS-paradigm. The promising progress of 3D-technologies in the last years has shed light on the main contributions 3D-City-models can make to urban planning, including the validation and evaluation of competing proposals for urban planning projects and the visualization of planned buildings as well as urban areas (Bahu et al. 2014).

Accordingly, the following central benefits of 3D-models – compared to 2D-models – could be highlighted in urban planning processes:

- near-reality visualization on different levels of detail (LOD),
- experience driven and interactive visualization,
- simple navigation in urban areas,
- aggregation of different data sets,
- generation of a common understanding.

Despite these advantages, special challenges like different scales and the necessity to fuse data streams according to different GIS standards need to be faced too.

It can be assumed that visualization is the key factor for a comprehensible presentation of spatial projects. A 3D-visualization can enhance an experience-driven and interactive reflection of projects and accordingly generate a common understanding. In this context, collaborative 3D-City-GIS can support the involvement of citizens as well as the collaboration of urban planners and citizens in spatial decision making processes. Recently participation possibilities on the internet become more and more relevant. Web participation that can be for example supported through Web-GIS applications allows for intuitive and more accessible citizen participation. At the same time it supports the dynamic interaction of decision makers and the general public offering the opportunity to review planned projects and make comments directly (Bugs et al. 2010).

Overall, it seems that collaborative 3D-City-GIS and Web-GIS-visualization technologies that enhance synchronous and asynchronous communication between all stakeholders can foster a more effective citizen participation in urban planning and especially decision making processes (Klimke, Döllner 2010).Therefore, the project presented in this paper aimedat theidentification of application fields of the 3D-City-GIS-tool CityEngine, mainly trying to strenghten the potential benefits for the end-users (municipal employees) as well as the final target group of citizens (compare chapter 5).

4 ANALYSIS AND CATEGORISATION OF EXISTING APLLICATION FIELDS

These described benefits have partially found their way into first applications developed by private as well as public research projects. Since most of them are not widespread throughout the potential base of end-users it is necessary to provide an overview on these solutions, further offering a categorization approach for the identified solutions.

In the context of the research activities the following general areas of application were identified:

- Energy: Simulation and visualization in 3D-models can be used to evaluate buildings with regard to energy consumption. They enable planners and decision makers to forecast and assess the efficiency of measures.
- Environment: Different environmental media – noise emissions, pollutant emissions etc. – influence the urban climate. 3D-models can support a comprehensible visualisation and simulation of impacts of the above mentioned environmental media.
- Mobility: Traffic is producing noise and pollutant emissions. Therefore, integrated traffic and transport planning and management gain in importance. 3D-models allow for visualizing and simulating traffic, air and emission flows. Accordingly, they can contribute to reduce negative impacts of traffic on the environment and the urban climate.
- Crisis Management: Countries throughout Europe are more frequently subject to a wide range of emergencies, such as forest fires, accidents with hazardous substances or extreme weather events. 3D-visualizations and simulations can support crisis management actors in the preparation of special crisis plans as well as response or reconstruction activities.
- Other Applications: 3D-models gain in importance in various other fields, like facility management and building planning, also.

All identified applications fields were assigned to one of these areas, helping end-users in identifying relevant approaches for their area of expertise. The following table 1 provides an overview over the application fields of 3D-GIS-tools, structured on the basis of the respective application areas.

Application field	Description
Energy	
Energy demand estimation	Energy and heat demands can be presented in 3D-City solutions. Furthermore, they support the calculation of actual and future heat demands and needs for different housing units. In this context an examination of restructuring requirements and potential savings is possible.
Solar potential analysis	With the support of a 3D-model, taking into account complex building geometries and building orientation potentials of solar thermal energy can be assessed. This allows for the evaluation of potential savings on one hand side. On the other hand, requirements for restructuring could be forecasted. In addition to the analysis of solar thermal potentials, 3D-modelscan support the evaluation of the suitability of buildings for the installation of photovoltaic systems.
Geothermic potentials	3D-models support the identification of available geothermal heat sources. The results of their visualization and simulation can be used for the evaluation of requirements of

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	reconstruction projects and the estimation of the energy balance of buildings.
Grid implementation	3D-models promote an integrated planning and analysis of grids allowing for a detailed visualization of network and building plans as well as semantic relations on different floors and levels (infrastructure, buildings, administrative districts etc.).
Environment	
Urban climate analysis	Climatological factors play a major role in development planning and urban planning in general. 3D-models enable planners to evaluate the impact of construction projects on the urban climate. Hence, they can support decision makers with the planning of construction projects.
Emissions evaluation	3D-models allow for the simulation and presentation of CO2 emissions and noise pollution on different levels and floors. They support the visualisation of load values for specific areas and buildings in different colours also.
Mobility	
Terrain model	With the support of 3D-models it is possible to visualize and simulate traffic flows with reference to terrain models. This enables planners to create route suggestions with efficient consumption profiles. The data that is gathered in the 3D-model can be integrated in modern driver assistance systems and support the refinement of route suggestions as well as intelligent interconnections of traffic flows.
Crisis management	
Flooding protection potentials	3D-City-models allow for a forecast of impacts of floods on cities and districts. Furthermore, predicted water levels with reference to the terrain model as well as flooded areas and water flow rates can be visualized and simulated. Simulation and visualization of flooding in a 3D-City-model supports flood warnings given by authorities, citizens' information and disaster management training also.
Earthquake damage evaluation	The evaluation of damages caused by earthquakes requires not only seismic terrain models, but also detailed simulations of impacts of earthquakes on buildings and the closer surroundings. Based on regional risk classifications it is possible to identify potential risks and calculate damages within 3D-solutions. Furthermore, restructuring requirements become obvious.
Gas incidents risk assessment	Dynamic 3D-presentations can predict the impacts of gas incidents. The real-time simulations of the diffusion of gases can be further used to identify requirements for safety technologies, to develop special preparedness plans and to support emergency planning.
Other applications	
Parametric design	3D-solutions can support automated planning taking into account framework conditions, like floor spaces, and special algorithms. They enable planners and decision makers to compare alternative proposals as well as the impact of general planning parameters directly.
Open space identification	In 3D-solutions it is possible to visualize open space in different urban areas and quarters. Accordingly, open spaces for cycle paths or parking space can be identified. The simple visualization of open spaces can in turn support integrated mobility concepts.
Facility management	Building Information Modelling which is focussing on the optimisation of processes in the planning phase of the building, building construction and facility management can be supported by 3D-solutions that provide a common data base for all involved parties. On this basis information sharing and data preparation can be simplified and optimized both.

Table 1: Existing application fields of 3D-GIS

Based on this initial research on existing applications, which are already on the market or in use, a first categorization was developed, dividing two main perspectives on such applications with diverse subcategories. While category A is technical oriented, category B differs the application fields on the basis of objectives and respective target groups as well as user orientation. The following figure 1 provides a first overview of this categorization.

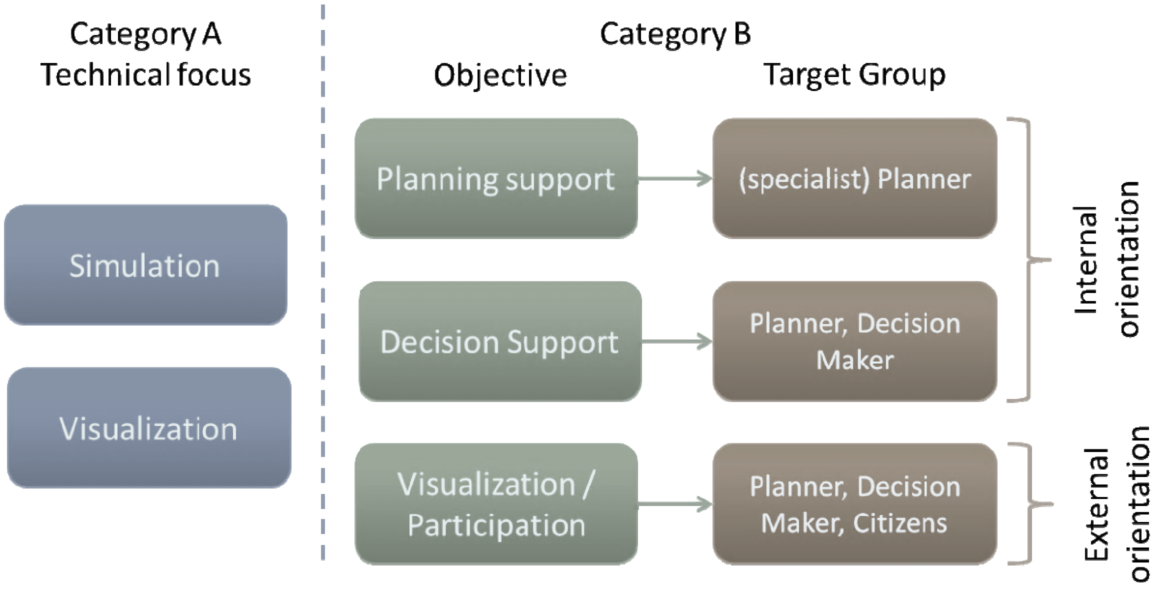

Figure 1: Categorization of application fields of 3D-GIS

The clear distinction and classification of category B is not applicable to the technical category A, since both simulation-tools as well as strict visualization-tools are usable for all target groups and objectives. For instance, a 3D-visualization of planning alternatives can contribute to the formation of opinions within the group of decision makers as well as within the population. On the other side simulations processes are able to support the decision process as well as the planning process.

The sub-categories within category B were defined due to the highly diverse orientation of the identified solutions presented in table 1. The existing specialised and mostly isolated applications of 3D-GIS-tools strongly differ withregard to their main objective, the targeted user group and their internal or external orientation. In particular the necessary level of detail declines from applications supporting planning processes over decision support processes to participation processes according to the background knowledge of the respective user groups. The basic orientation of the applications is also connected to the level of detail presented. While highly condensed information is reserved for internal use, end-users outside the administrative body get access to simplified information, aligned to the limited know-how to be expected.

Finally, in order to be able to design applications that match with the demands, requirements and aims of each target group as good as possible, the sub-categories were defined, helping to focus development and implementation processes on requirements for each sub group.

The following chapter 5 will describe the project activities of ESRI, the Cityof Cologne and the Fraunhofer IAO, developing applications for the 3D-GIS City-Engine referring to the outlined categorization approach and respective requirements and needs identified within the process.

5 THE MORGENSTADT: CITY INSIGHTS PROJECT ACTIVITIES - DEVELOPMENTS OF 3D-GIS APPLICATION FIELDS

The 3D-GIS application field project is part of an interdisciplinary long-term research project called “Morgenstadt: City Insights” (m:ci) initiated by the Fraunhofer Institute and conducted within an network of industry and city partners. In its first phase, the project analysed innovative and sustainable solutions and projects of the city sectors mobility, water infrastructure, production and logistics, governance, buildings, energy, security and ICT in six leading cities around the world in order to identify common characteristics, structures of success stories and key action fields for sustainable city development (Wendt et al. 2014). On the knowledge basis of phase I (2012-2013), the second phase (started in 2014) focusses on the development and implementation of innovative solutions in order to support cities in achieving a sustainable and resilient future. Within this context the City of Cologne, the provider of geo-information-services ESRI and the Fraunhofer IAO initiated a project in order develop application fields for the 3D-GIS-tool City-Engine.

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The project concentrated on the city district Köln Mühlheim-Süd which is currently in a state of transition. The transformation of the district was already initiated, proclaiming a planning competition and receiving a set of structural concepts. Based on the winning proposal the project partner ESRI implemented a 3D-model within the CityEngine as well as a model of the current situation. Therefore, all participants were able to discuss and develop ideas for possible applications of a 3D-GIS-tool on a common basis.

5.1 Project procedure& general application fields

From the very beginning of the project it was intended to develop applications in constant cooperation between all partners in order to be able to meet all demands and requirements of the aimed target groups. In respect to the categorization, outlined in figure 1, solutions can have different target groups, as for example participation applications mainly target citizens, collecting their opinions on planned projects. Nevertheless, is the planning department another central target group of such an application, offering a tool to interact with the population and all other concerned actors. Therefore a three step process was conducted leading to a defined set of first applications to be developed in a first development process phase:

I. Identification of relevant application fields for the Cityof Cologne,

II. Specification of a first set of possible applications,

III. Prioritization of application fields.

Within the first step workshops were organized in order to detect potential application fields of use for various departments of the Cityof Cologne such as the transport, environment or city planning department. As a result of this first set of workshops eight potential application fields were identified.

(1) Flooding Simulation, including visualization and simulation of high water levels and backwater for crisis management activities as well as population training.

(2) Energy demand estimation tool in order to simulate energy demands of planning alternatives on the basis of active and passive parameters such as solar radiation, construction arrangements or applied building materials.

(3) 3D-visualization and analysis of unused urban spaces in order identify spaces of potential use (e.g. for ecological projects, food or bike paths etc.)

(4) Visualization of noise emissions on the detail level of house floors as well as balancing of planning alternatives on the same level.

(5) City climate simulation to assess the potential impact of planned projects on the cities climate, including comparing functionalities for planning alternatives.

(6) Comparing visualization of the traffic situation (real situation as well as scenarios) for various uses, such as the optimization of energy consumption or the evaluation of different usage scenarios.

(7) Traffic emission simulation of different planning alternatives as well as integration of such information into traffic management systems.

(8) Planning of traffic infrastructure on the basis of a 3D-GIS-tool, helping to control relevant sight axis respecting all road users.

In the second step, these first ideas of the city employees were also categorized and iteratively refined, starting with the named overall themes and developing specific modules for respective target groups. The following table 2 presents the output of this step.

Objective & Target Group	Benefit of 3D-GIS
Flooding simulation	
Planning support for (specialist) planners	Simulations for water back-up or back-pressing during floods for crisis management experts.
Decision support for decision makers and planners	Visualization of water flows and levels in order to support decisions regarding: • The implementation of risk reduction infrastructure, • Planning proposal alternatives within threatened areas.
Visualization and participation	Visualization of water flows and levels during floods in order raise

Objective & Target Group	Benefit of 3D-GIS
functionalities for all involved local actors	awareness within the population.
Energydemandestimationtool	
Planning support for (specialist) planners	Definition of specifications in land-use or development plans based on simulations of expected energy demands (e.g. regarding building orientation or structure).
Decision support for decision makers and planners	Visualization of demands of alternative planning proposals
Visualization and participation functionalities for all involved local actors	Visualization of before-after comparison for participation processes.
3D-visualisation andanalysisofunused urban spaces	
Planning support for (specialist) planners	None - specialist planners can accomplish this task sufficiently with 2D-solutions (workshop result/statement).
Decision support for decision makers and planners	Visualization of alternative locations for different purposes in order to support location decisions.
Visualization and participation functionalities for all involved local actors	Visualization for participation processes in the context of location decisions.
Visualizationofnoiseemissions	
Planning support for (specialist) planners	Simulation and visualization of emmissions up to house floor levels. At the moment 2D-solutions are required by law and 3D-visualisations are elaborated afterwards with extra tools. A 3D-GIS-apllication could cover all needs.
Decision support for decision makers and planners	Visualizionof alternative planning proposals
Visualization and participation functionalities for all involved local actors	Visualization for participation processes in the context if alternative planning proposals and sensitization of the population.
City climatesimulation	
Planning support for (specialist) planners	Definition of specifications in land-use or development plans based on impact simulations of different building settings.
Decision support for decision makers and planners	Visualizion of alternative planning proposals.
Visualization and participation functionalities for all involved local actors	Visualization for participation processes in the context if alternative planning proposals.
Visualizationofthetrafficsituation	
Planning support for (specialist) planners	Simulations in order to support urban traffic planning.
Decision support for decision makers and planners	Visualizion of alternative planning proposals.
Visualization and participation functionalities for all involved local actors	Visualization for participation processes and utilization of simulation data for: • Traffic guidance systems, • Local traffic calendar (providing information on critical traffic situations as well as alternative routes).
Traffic emissionsimulation	
Planning support for (specialist) planners	Simulations in order to support street environment design
Decision support for decision makers and planners	Visualizion of alternative planning proposals.

Objective & Target Group	Benefit of 3D-GIS
Visualization and participation functionalities for all involved local actors	Visualization for participation processes in the context if alternative planning proposals and sensitization of the population.
Planningoftrafficinfrastructure	
Planning support for (specialist) planners	Visualization of sight axis for the planning of traffic infrastructures, street display and advertisement installations.
Decision support for decision makers and planners	None
Visualization and participation functionalities for all involved local actors	None

Table 2: Identifiedapplicationfieldsandtargetorientedbenefits

On this basis further workshops were organized in order to synchronize the identified first set of application fields and requirements with the thematic experts in each field.Within this process certain potential application fields have been identified as not necessarily urgent due to already existing sufficient 2D-solutions, while others were ruled out because of non-existent but required data sets. On the other side, various applications have been identified as realizable and therefore specified in more detail.

This phase provided two main outcomesthat are relevant for the next project phases:

I. Expert modules are not feasible at the moment due to a lack of available information and existing national regulations, demanding for certain output standards not anticipating 3D-solutions.

II. The first set of applications should focus on the assistance of processes of the planning department, including supporting information of the other involved departments, since the majority of the applications of the other departments is targeting participation and decision making processes to be prepared and organized by the city planning department.

The key outcomes referring to the benefits to be expected by a citzen participation apllication will be outlined in chapter 5.2.

The third and last step aimed at prioritizing the remaining applications and developing a strategy for the implementation process. Therefore, a further workshop with the planning department was organized, cooperatively developing solutions tackling the different levels of category B. As a main output of this workshop it was decided to perform the development process bottom-up, starting with the level of citizen participation, followed by decision support applications and concluding in solutions supporting the planning-design phase.

This specific order was a result of two main considerations:

- The quality of the required input data increases with each level. Sufficient data is only for the level of citizen participation already available. The determination of additional information for the other two levels will take more time and could require new survey/ data exchange methods or techniques. During the implementation phase of level 1, additional research on such methods can be executed.
- The solutions of the two upper levels of planning and decision support will strongly benefit from a well implemented participation level, profiting from the technical basic infrastructure, an already experienced group of actors and colleagues and a set of lessons learned.

In summary, by addressing the participation processes of level 1 the project first targets the low-hanging fruits, building the fundament for more detailed steps at the same time.

5.2 Participatory planning processes

Respecting these results, the analysis of needs within participatory planning processes was intensified within the project phase, specifically searching for open questions the planning department liked to address with the help of a 3D-GIS-Particpation tool. In that context, a further workshop revealed the following basic needs of the planning department on such a tool:

- Easy understandable visualization of planning proposals, also in comparison to the existing situation.

- Inclusion of environment information (e.g. traffic volume, noise emissions or lightning) in order to allow a realistic assessment of the situation by the key audience.
- Obtainment of geo-referenced suggestions and objections directly within the tool in order to optimize participation processes.
- Usability and maintenance of the 3D-GIS-model should not exceed efforts of usual 2D-GIS-applications. Further, the 3D-GIS-model should allow easy adaptions and changes between iterative participation workshops within a short period of time.
- Compatibility to existing visualization and analysis tools as well as to data interfaces should be well established (e.g. existing 3D-traffic-simulation for specific road sections). This would not only simplify specific implementation steps of phase 1, rather these data sets could support the development process of the participation and planning tools of the next phases as well.
- Further, the citizen perspective on requirements for such a tool was analysed, building on the experience of the involved experts and a comprehensive analysis of already performed participation processes:
- Adaptable level of abstraction is necessary, since the model to be used in the participation process needs to be understandable, but should not give the impression of an already finished planning result. Citizens are very sceptical regarding their influence on highly detailed models. Therefore the model needs to suggest a certain level of incompleteness.
- Freely scalable visualization (zooming functionality) is necessary due to the need of citizens to check the impact of planning proposals on the personal situation.
- The visualization needs to provide a pedestrians perspective, since citizens mostly see and understand urban spaces from this perspective. Therefore, a great number of specific questions often raised by citizens can be examined herewith, including topic areas such as barrier liberty or the design of public space or the street environment.

Based on this two sets of requirements, it is possible to develop a first version of a CityEngine participation-tool which benefits the city administration as well as the citizens. This tool is currently in development, providing a before/after comparison of the planning area with sliders and direct interaction functionalities for citizens (e.g. comments, zooming etc.). Since the project is still ongoing, further planned steps will be outlined in the following chapter, basing this foresight on a summary and lessons learned from already completed project steps.

6 CONCLUSION& OUTLOOK

Nowadays, the enormous challenges for sustaining city infrastructures have increased the need for new Information and Communication Technologies on the one and collaboration processes in urban planning and development on the other hand. In this context 3D-City-models have become more popular in the recent years. The transition from 2D- to 3D-models can help to increase the value of data, improve decision making processes and capabilities, simplify the access to relevant information and enhance a more effective communication between different stakeholders in complex situations.

Since decision making in urban planning is always a multi-stage process, collaboration among urban planners, decision makers and citizens is strongly required. In this paper it was outlined that high benefits can be expected of 3D-solutions especially with regard to citizens' participation. 3D-City-GIS provides a more intuitive and accessible medium for citizen participation allowing for near-reality as well as experience driven and interactive visualisation. This comprehensible visualisation is the key factor for collaborative and group-based decisionmaking processes.

Recently, 3D-GIS participation possibilities in the Internet have been identified as promising means to foster effective and efficient collaboration in urban planning in general and citizen participation in particular(Bugs et al. 2010). These technologies are meant to ease the understanding of complex urban planning projects for non-professional participants and offer a low participation barrier. A Web-based GIS can create a virtual meeting space, where citizens can explore different plans and comment on them. This allows for synchronous and asynchronous communication both. The realisation of such a collaborative 3D-City-GIS approach is able to support citizen participation in multi-stakeholder decision making processes.

Despite all benefits of 3D-City-models, the implementation of 3D-City-GIS-systems in organisations and especially public administrations cannot be seen as a simple process, because of the various organisational aspects that have to be considered. Furthermore, the integration of 3D-City-GIS-systems requires a broad acceptance of the involved organisations and public administrations. Accordingly, the implementation is always an evolutionary process, which has to be critically accompanied by the scientific community, developers and the end-user organisations.

On the basis of the outlined application fields as well as functional and non-functional requirements elaborated above ESRI, the Cityof Cologne and the Fraunhofer IAO are developing a 3D-CityEngine participation-tool within the Morgenstadt: City insights project. This tool enables for before/after comparison of the planning area with sliders as well as direct interaction (e.g. comments, zooming etc.) with citizens. To further explore the benefits of 3D-GIS-systems in citizen participation we plan to implement the ESRI CityEngine-participation tool after its finalisation in an actual participation process. The implementation of the tool in a participation process will allow for the evaluation of the usefulness of the tool and will give hints in view of potential (modification) needs for the tool adaption. After consolidating the effectiveness and efficiency of the citizen participation tool, we intend to transfer the 3D-City-GIS-model to the decision support and planning support level also.

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Web Based Land Valuation System in Infrastructure Planning in India: An Approach

Bikram Kumar Dutta

(Bikram Kumar Dutta, Regional Planner, Associate Manager, IL&FS Transportation Networks Limited, L-30, Delta II, Greater Noida, bikramdutta@hotmail.com)

1 ABSTRACT

Government organizations in developing counteries all over the world that are responsible for infrastructure development and government is responsible for land acquisition as well as prepare the detailed project report with the help of consultants where as the private sector responsibility is to develop the infrastructure through private public partnership. The infrastructure development may be to built roads, dams, airports ect. The examples of land holding are freehold, leasehold, common hold interests and government holdings. The property interms of land and structure can be compulsorily acquired by government for development activities. Although the matter differs from country to country, if a property owner is affected due to compulsory acquisition, compensation can be claimed for any land acquisition is injurious affection (severance) caused and for disturbance. The legal basis of the right to claim compensation in these respects may differ as the statutory regulations and circumstance prevailed in each country. Proper valuation of and compensation for lost assets are crucially important counteractions to mitigate impoverishment risks for affected persons.

The Government of India recognizes the need to compensation of loss where displacement is inevitable, the need to handle with utmost care and forethought issues relating to Resettlement and Rehabilitation (R&R) of Project Affected Families (PAF) and formulate R&R Policies as named as TheRight to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.

Now the question is how to valuate market price. Economic market principles determine what value any commodity will have at a particular point in time. If there is a plentiful supply of a commodity and little or no demand, the price of the commodity is likely to be low, whereas, if there is little supply and a great deal of demand, the price will be higher. In the real estate business it is common to assume that the value and potential of a property is fundamentally determined by its location, acces to existing infrastructure and its productivity. Different users of land might be prepared to offer different prices for a piece of land because it offers the potential to earn different amounts of revenue depending on the use to which it is put. So, futurastic usage is also determinants to valuate the market price. Land values and intensity of land use becomes lower when we move away from the center of the city. With lower land values, there is less pressure for high-rise development to maximize usage of the available sites. Establishing the economic area of land use within which a property is located is an essential factor in understanding the economic, social, political and geographical factors that exist and help determine the levels of supply and demand for a particular property type and thus influence its value.

The principle of comparison underpins all valuation methods but sales comparison is allways preferred method of valuation. The sales prices of the properties that are judged to be the most comparable ones tend to indicate the range in which the estimated value for the subject property will fall. The degree of similarity or difference between the subject property and the comparable sales is usually established on the following elements of comparison: property rights conveyed, financing terms, conditions of sale, expenditures made immediately after purchase, market conditions (time), location, physical characteristics, economic characteristics, use (zoning), and non-reality components of value etc. This all determinants can be summarised into well access sytem to individual when these information would be disseminate through land revenue department in well structured format. Web based land valuation system is information technology based interface developing system where all determinants of land valuation can be calculated with the each and every parcel of land maps in India. This paper has approached to formulate the interface mechanism for valuation of land for infrastructure planning over periods.

2 INTRODUCTION

Compensation in financial form or as replacement land or structures is at the heart of Resttlement and Rehabiliation in infrastructure planning. According to Keith (2007), in developing countries where there is the financial resource limitation, less emphasis should be put on monetary compensation where resettlement or reinstatement are often the best means of putting the claimant back in the same position as if his/her land had not been taken from him /her.The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 has also mentioned to account the market value for compensation mechanism. The fair market value is commonly defined as "the amount that the land might be expected to realize if sold in the open market by a willing seller to a willing buyer."(ADB, 2007). The underlying reason for adopting the fair market value standard is that the market is an objective gauge for assessing the value of the land. Market value has been the most popular suggestion for calculating compensation payable. The use of market value as measure of compensation that is "just, adequate, full, fair," etc raises questions because it seems to contradict the basic logic. When the government acquires the land compulsorily and pays compensation, the transacted price cannot be equal to the market value because of the coercive conditions attached to the sale. This equation defeats the very basic rule of a free market, i.e. "free operation" of the transitions. In a free market, market value can only be produced in a situation where willing buyers and sellers of commodities meet and transact freely under market conditions and the price arrived at is supposed to be fair assuming that negotiations were not interfered (Hardwick et.al 1990; cited in E.ndjovu, 2003). It is argued therefore, since there is no freedom of transaction, there is no market as such for the compulsorily acquired property and any attempts to equate "just compensation" to "market value" is incorrect (Eaton, 1995). Market values only provide a useful guide towards determination of the market value case. Now the question is how to determine the market value.

3 DETERMINANTS OF MARKET VALUE

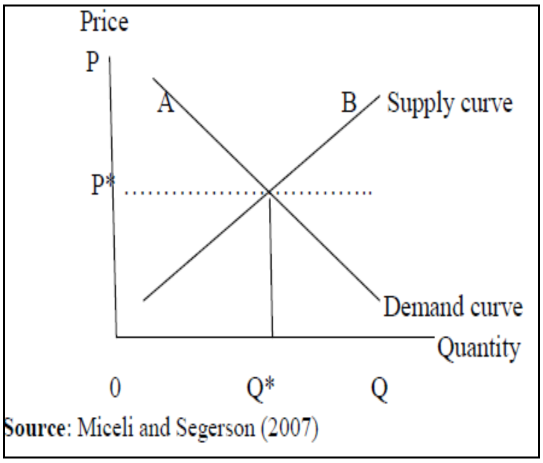
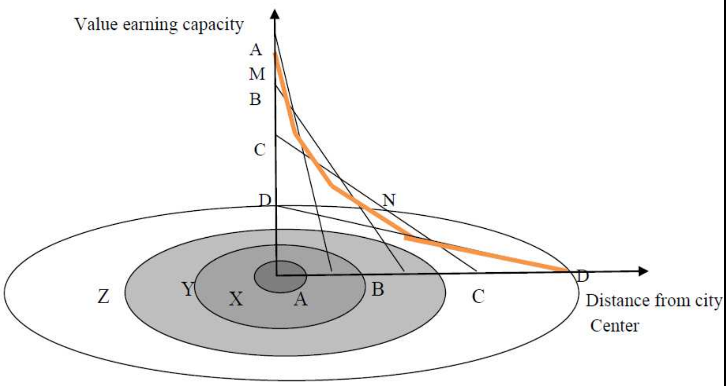


Fig 1: Demand Supply Equilibrium graph

The concept "market value"is not necessarily the equivalent of "just compensation" but rather a useful and generally sufficient tool for arriving at this value. In a compulsory land taking, the government is a willing buyer, but the affected landowners are often not willing sellers.In this sense, fair market value must necessarily undercompensated unwilling sellers (J.Miceli and Segerson, 2007). The idea is illustrated using a simple supply-demand diagram as shown in figure 1. The demand curve represents the marginal private benefit to potential buyers of putting additional land into an alternative land use. It thus gives potential buyers' marginal willingness to pay for land. The supply curve represents the marginal private cost to current owners of taking additional land out of its current use. It thus gives the owners' reservation prices; that is, their marginal willingness to accept in compensation in exchange for giving up their land. The equilibrium price in this market, P* can be interpreted as the market value for this class of property. It represents the price at which those parcels between 0 and Q*would sell in consensual transactions. In contrast, parcels to the right of Q* would not sell because the reservation prices of the owners exceed the equilibrium price.

-2: The Concentric circles of value



Source: Harvey and Jowsey (2004, cited in Wyatt, 2007)

Now the question is how to valuate market price. Assigning market value to property is always the attempt to anticipate the price which the market will determine. As such, its major tool is market analysis and its result is an estimate of an expected outcome of the interplay of a constellation of price-determining factors. It is – usually a well-founded – guess that whenever property valuers fail to acknowledge and account for the subjective and uncertain nature of their task – which simply stems from the subjective and fluctuating nature of the underlying concept they clearly face the risk of putting the credibility of the valuation profession into question (Lorenz, 2006a). Basically the value of a property is determined by supply and demand. Economic market principles determine what value any commodity will have at a particular point in time. If there is a plentiful supply of a commodity and little or no demand, the price of the commodity is likely to be low, whereas, if there is little supply and a great deal of demand, the price will be higher. In the real estate business it is common to assume that the value and potential of a property is fundamentally determined by its location (Lahoz, 2007). If we compare similar types of properties in different areas, we may discover significant variations in price.The existences of good communication and accessibility have always been important in influencing value.What urban land uses desire is accessibility, not just access to the market (where the customers are) but also access to factors of production and to other complementary land uses.In explaining the cause of different land values within an urban area, Hurd suggested that 'since value depends on economic rent, and rent on location and location on convenience, and convenience on nearness, we may eliminate the intermediate steps and say that value depends on nearness.' Theoretically, as Kivell (1993; cited in A.F.Millington, 2000) pointed out, in a monocentric urban area the centre is where transport facilities maximize labor availability, customer flow and proximate linkages, and therefore attracts the highest capital and rental values.Basically greater accessibility leads to higher demand, which, in turn, causes value to rise and land use intensity to increase. The prime location factor revolves around linkages to people and other uses measured in terms of accessibility to market(s) and factors of production (capital and labor).Different users of land might be prepared to offer different prices for a piece of land because it offers the potential to earn different amounts of revenue depending on the use to which it is put. The shaded areas in Fig 2: The Conentric Circle of value above represents value- earning capacity and the sizes of these are maintained for each land use. A value curve MND is derived showing the value for land at different distance from the center of the city. The central area of the city has the highest levels of accessibility and complementarity. It is relatively small sized and, coupled with intense demand from users due to the advantages of its location; it will enjoy peak land values. The scarcity of land together with these high values will produce the greatest intensity of use of land in the center urban area. Land values and intensity of land use becomes lower when we move away from the center of the city.The majority user is residential at moderate densities and associated complementary uses including open space and recreational areas. With lower land values, there is less pressure for high-rise development to maximize usage of the available sites. Establishing the economic area of land use within which a property is located is an essential factor in understanding the economic, social, political and geographical factors that exist and help determine the levels of supply and demand for a particular property type and thus influence its value.

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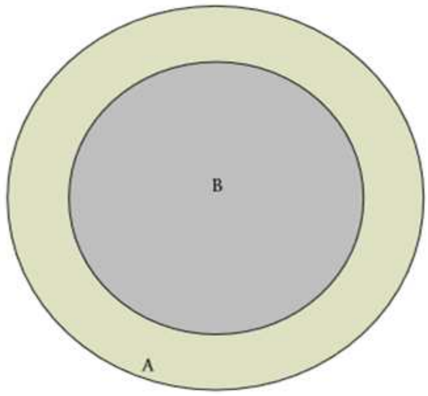


Fig 3:Bugess Model of Land Valuation

In India's Infrastructure Report, 2009 : Land—A Critical Resource for Infrastructure, ed al, one artcle has been refereed named as NON-AGRICULTURAL USE CLEARANCE by "Land Markets in India Distortions and Issues" by Sebastian Morris and Ajay Pande. The article has explained through one diagrame following burgess theorem. If B is entirely built up and A is entirely devoted to agricultural use, the value of a unit of land in A (V) is the rental yield of the land in agriculture (Ra) multiplied by the probability of land continuing to be used for agriculture (1-P) plus the rental value of the land in non- agricultural use (Rna) multiplied by the probability of the land being used in non-agriculture (P) use. This is the case when the value of land in agricultural use is less than that in non-agricultural use. Now, P is a function of the area's proximity to B and the growth rate of the urban area. P is typically large in an area in the urban periphery (say 0.5 at the time land is sought for an alternate use) and Rna is typically many times (usually 10–20 times) higher than Ra. Thus, for an annulus like A in the immediate periphery of the built up area, the value of A is determined almost in all cases by the expected rental value in non-agricultural use. Assuming Ra as X, and Rna as 12X, V is 0.5•12X+ 0.5•X = 6.5X. If there is a compulsory acquisition of a portion of the land A and its land use is changed, then its market price would jump close to 2 times (from 6.5X to 12X), the price that would be prevalent in case there were no restrictions on land use. Now consider the situation created by the need for NAC, as in India. Prior to acquisition, the probability P is close to zero, because there is a requirement of NAC, which is granted only after acquisition or after concrete proposals for non-agricultural use are shown to the au- thorities; the possibility of the latter is generally remote (see below). Therefore, the price that the land holders can realize is a little more than X. Now, post-acquisition, the price would be 12X, which would be realized by the requiring body.

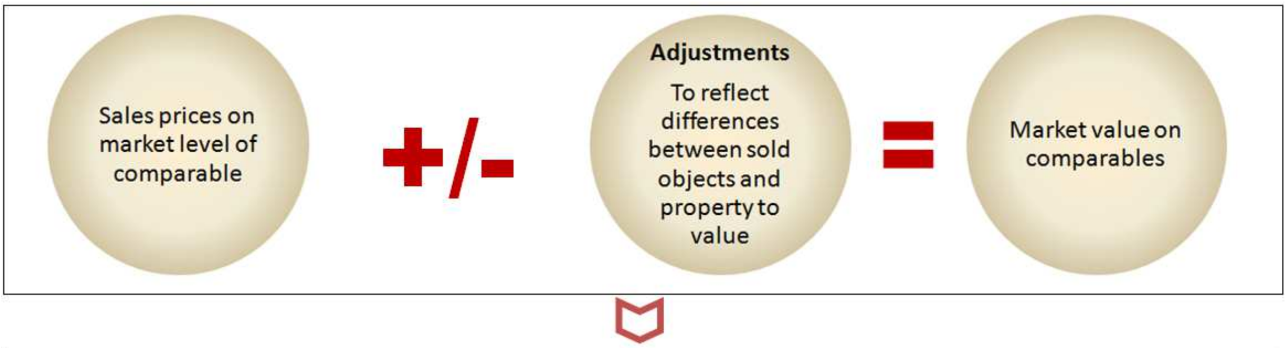
As per 1894 Land Acquisition Act under Section 23rdand 24thdate of publication of the declaration of acquisition of land under section 6 market rate shall be given to affected people as compensation. The transection value of similar type of land on that publication date of Land Acquisition Act in a particular district or region the rate has been considered as market value. Market rate of the land is to be decided basis of its utilsation potentiality i.e. fertility of land in terms of productivity (one time productivity or two time or three time productivity in a year). The usability of the land is another parameter to account its cost. The useage of land has been enlisted in state revenue list. On government record on dated 26.05.1981 Santhal Parganas in West Bengal on Section 794 the Court had declared that the land productivit has enhanced due to use of scientific method of practice in agriculture. As a result the productivity of that District has enhanced from 8 times more. Subsequently all land acquistion had been banned on that region.

Another criteria has been framed by Videh Upadhyay and Chandrima Sinha in their artcle 'Regulatory and Policy Regime of Land Acquisition: A State-level Perspective'. They stated that the relevant criteria (such as reference date and land usage) for determining the market value of the land for the purpose of compensation under section 23 across states is applicable. For example, in West Bengal, the market value is calculated with reference to the date of taking possession of the land, while in most cases it is calculated with reference to the much earlier date of publication of section 4(1) notification, in line with the Land Acquisition Act. The amendments for Manipur, Maharashtra (Nagpur City), and Maharashtra (Highways) take into account the date of publication of the declaration of acquisition of land under section 6. While the Land Acquisition Act does not specify the land use criteria, most states have added amendments specifying that the market value will be based on the land use as on the date on which market value is to be calculated. However, Bihar (Patna

City) Amendments specify that market value will be according to the use to which the land was put in the preceding five years.

V.K.Sharma and Tarun Choudhary in article "Land Acquisition Process for National Highways Issues and Recommendations"pg 82 stated that The land acquisition act provides for solatium amount (30% to 60% percent of the market value of land earlyer and now it is 100%) to those whose land is acquired in consideration for the compulsory nature of acquisition. Besides, landowners receive a payment of an interest (12% per annum on the market value of land) for the period commencing from the date of publication of notification till the award of the collector or the date of taking possession, whichever is earlier. However, no such provision exists in the National Highway Act, 1956.There are three internationally recognized methods of property valuation and they are all based on the principle of market comparison. They are (1) sales comparison; (2) income capitalization; and (3) replacement cost.

Sales Comparison method: The economic rationale of the sales comparison method is that a knowledgeable and prudent person would not pay more for a property than other persons have recently paid for comparable properties given that the general market conditions are the same. When the market is weak and few market transactions are available, the applicability of the sales comparison approach may be limited. For example, the sales comparison method is usually not applied to special – purpose properties because few similar properties may be sold in a given market, even one that is geographically broad in Indian market.



The adjustments derived in comparative analysis and applied to the sale prices of the comparables may be expressed as percentages, as dollar amounts, or in descriptive terms that clearly convey the magnitude of the difference between the comparable and the subjective property in terms of each element of comparison

It can be necessary to find out and give information on both real circumstances and circumstances adjusted to market conditions regarding rents, vacancies, operating and maintenance costs, and their estimated values must be openly showed in one's calculations.

Income Capitalisation

Income method is usually applied for property that is capable of generating rental income and for which and investor is the most likely purchaser.Income methods are based on basic investment analysis methods, which do not mean that the sales comparison and the cost approaches are no good for valuing income properties. The problem with the sales comparison approach lies on the fact that income properties are not frequently traded, so the available sample becomes so small that it is very difficult to apply that method. Due to the characteristics of income properties, the cost approach is also difficult to be applied. In this case, the income approach is the most appropriate method to assessing this type of properties (Lusht, 1997; cited in Hungria-Garcia, 2004). The economic rationale of the income approach for existing properties is that no investor will pay more for a property than he/she will retrieve by holding the property.

Replacement Cost Method

The cost method is used to value specialist properties that are seldom sold because there is no clear market demand. Consequently, there is little or no comparable evidence. A property might be specialist because its use requires it to be constructed in a particular way, including highly production-specific manufacturing plants such as chemical works and oil refineries; public administration facilities such as prisons, schools and colleges, hospitals, town halls, art galleries and court facilities; and transport infrastructure such as airports and railway buildings, etc. (Vos and Have, 1996; Wyatt, 2007). Its economic rationale is that no a rational

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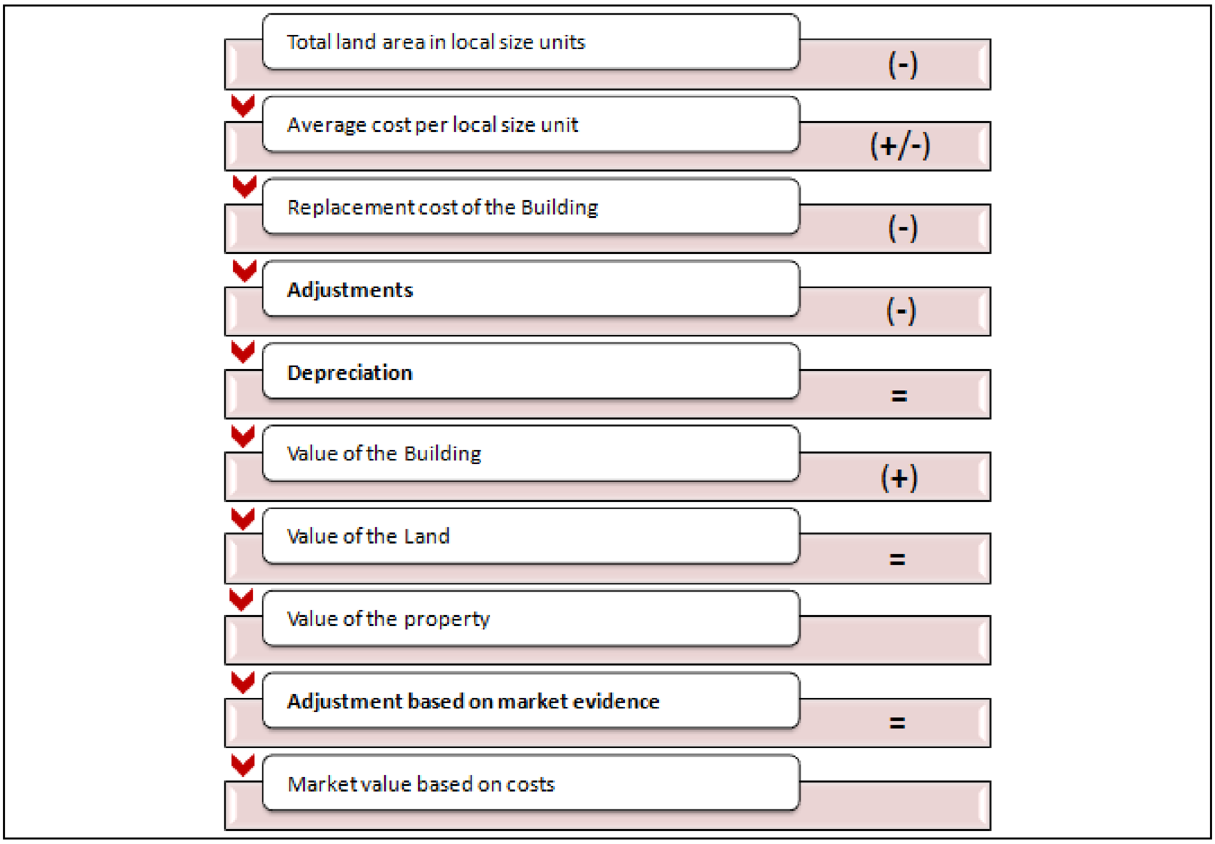
person will pay more for an existing property than it would cost to buy the land and to build a new building on it. However, given that construction of buildings needs time and that land for building purposes might not be immediately available, prices and costs will diverge in the short-run. The method is employed when the existing uses of these sorts of properties need to be valued for different purposes, for example, compulsory purchase and compensation. So, mathematical equation of this as:

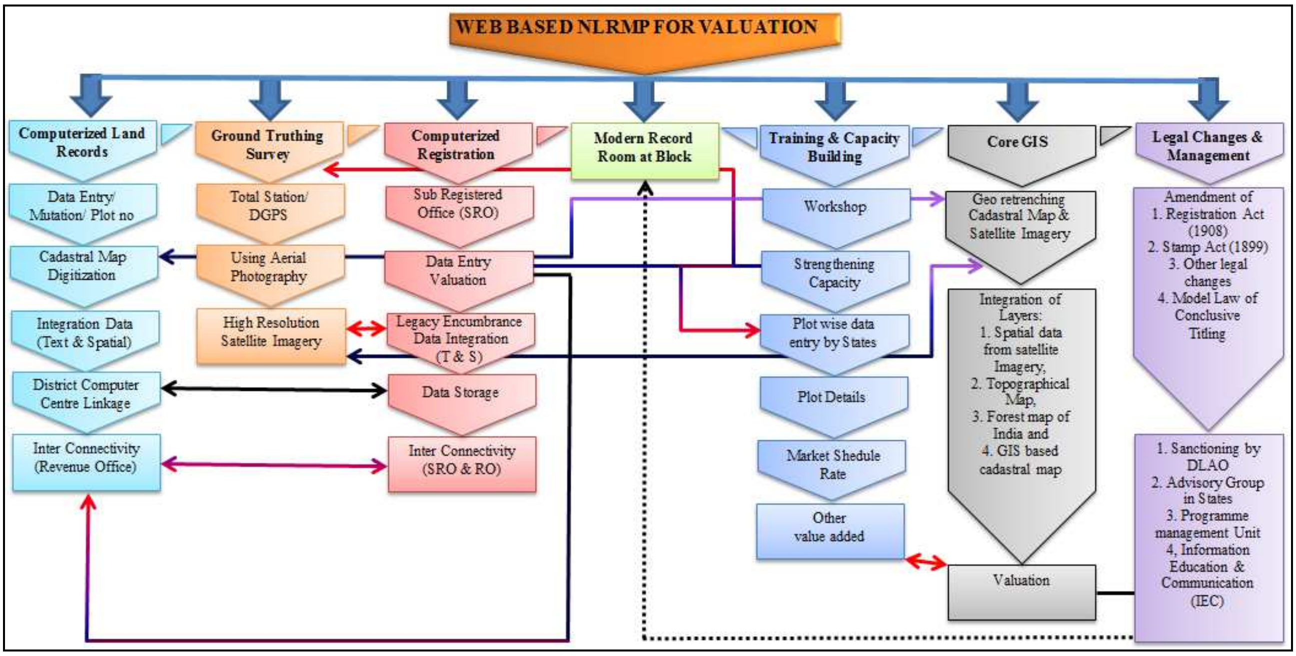


4 WEB BASED VALUATION SYSTEM

To conclude, property valuations are needed for many different purposes and different valuation methods involve valuers making different assumptions and the use of different information. The choice of one method instead of another can result in a different figure of value being produced. The diversity of property makes valuation a difficult task, no two properties are ever the same, yet valuation relies on the comparison of properties to give an indication of value. With the frequently changing economic and property scenarios of the recent years, the choice of the wrong valuation method or the careless application of a chosen method by the valuer could result in a widely wrong valuation figure being produced. It is therefore, stressed that a property valuer can determine the valuation method which is appropriate to value the property based upon the purpose and type of property to be valued. To do this, the valuer must be aware of, and be able to quantify, differences in type, location, legal interest, quality and the state of the market. For this web based management system of Land valuation is essential where buyers are paying less-amount to seller for ‘public purpose’ land acquisition process where market value of that land or assest is almost 10 times more.

The Government of India has decided to implement the Centrally-Sponsored scheme in the shape of the National Land Records Modernization Programme (NLRMP) by merging two existing Centrally-Sponsored Schemes of Computerization of Land Records (CLR) and Strengthening of Revenue Administration and Updating of Land Records (SRA&ULR) in the Department of Land Resources (DoLR), Ministry of Rural Development. The integrated programme would modernize management of land records, minimize scope of land/property disputes, enhance transparency in the land records maintenance system, and facilitate moving eventually towards guaranteed conclusive titles to immovable properties in the country. The major components of the programme are computerization of all land records including mutations, digitization of maps and integration of textual and spatial data, survey/re-survey and updation of all survey and settlement records including creation of original cadastral records wherever necessary, computerization of registration and its integration with the land records maintenance system, development of core Geospatial Information

System (GIS) and capacity building. The following is an outline of the components and activities to be taken up under the NLRMP as shown in following flow chart.



Summary of procedure adopted for land valuation and acquisition plan are followed:

(1) Project Initiation: The user agency shall issue letters to concerned district administration, acknowledging them about the project and the district administration shall appoint district land acquisition officer (DLAO). DLAO is notified post by the state government and under entire process of land acquisition has been done.

(2) Identification of alignment: This process is done by user agency by superimposition alignment plan on web base interfase for identification of project affected rural and urban areas.

(3) Collection of revenue maps, 3 year registery/deed rates and circle rate: After the identification of villages, the user agency shall approach respective revenue department website to download project affected rural and urban area and by using GIS software affected plots can be identified and registery or deed value of affected plots can be downloaded through sub registree website for last three years and there after download, there after prevailing circle rate can also be downloaded.

(4) Overlapping of Revenue Maps and calculation of average deed value: Once after getting all the revenue Maps, the proposed widening plan should be superimposed on the revenue maps with the help of GIS software. Highest 50% of the deed/registery value has been taken for last 3 years in each village to calculate the market price of the land.

(5) Identification of Affected Plots and collection of circle rates: The exercise of overlapping could bring out specifically the affected plots. Such affected plots have been marked out and also collect information regarding circle rate from sub registery office or from the deputy commitioner office.

(6) Demarcation: After identification of affected plots, the specific area of the affected plot could be demarcated on ground and land schedules have been prepared.

(7) Collection of Land Records: On demarcating the affected area, land records would be collected from Revenue Officer. This could fulfil the requirements of section 3A notification.

(8) Compilation: After collecting land records for all the plots and sub plotes are been jointly mesurement along with user agency and revenue department on ground and collected ditales for ownership and all the details are been crocess checked with revenue racords collected from record room and objection filed by the affected people from respective Revenue Officer, the same has been sorted out for affected plots under section 3D notification.

(9) Final Land Acquisition Plan: All the information collected from Revenue Officer has been worked out with respect to proposed widening plan there after the final land Acquisition Plan as well as valuation of land was prepared and estimates are prepared (in the estimates costing has been take for

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Land+Solatium+Structure+aminities (trees, wells, animan shed, tube well ect.)+intrest are been calculated and submitted to user agency and demand note) which is also known as section 3G notification.

(10) Valuation of affected plots: Each plot has been marked in web based system. User agency has authority to edit the data. Any one can view the plot/ location which are to be acquired through web based land system. Now the cost of each plot of last 3 years or circle rate which ever is highest shall be taken and have been marked and tabulated on the basis of schedule of rate of area and valuation khatian has been prepared and land owners has surved notices to collect money form revenue department under section 3H process.

(11) Handing over and Taking over land: After 80% pament to affected persons land is handed over to the user agency by revenue department. All data has to be tabulated in different Colums which will multiply the sales deed price of existing year and will give total market value of that plot.

5 CONCLUSION

Modern web based integrates various kinds of advanced, dynamic, multi-layered, time series data and graphical information which transform the tedious data analysis job to a faster, dynamic and realistic exercise. Regular updation of information makes the monitoring and management of land parcel in records more transparent and realistic approach towards any infrastructure development. This information system can be used as a tool disseminating information and valuation of land in open platform. As well as it can also be a useful support system for change of ownership, land value evaluation and ultimately land acquisition in fare compensation method.

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reviewed paper

Working Together, Planning Together! Evaluation of the Cross-Border Survey between Austria and Slovakia

Oliver Roider, Roman Klementschitz, Sebastian Riegler

(Dipl. Ing. Dr. Oliver Roider, Institute for Transport Studies, University of Natural Resources and Life Sciences (BOKU), oliver.roider@boku.ac.at)

(Dipl.-Ing. Dr. Roman Klementschitz, Institute for Transport Studies, University of Natural Resources and Life Sciences (BOKU), roman.klementschitz@boku.ac.at)

(Dipl.-Ing. Sebastian Riegler, Institute for Transport Studies, University of Natural Resources and Life Sciences (BOKU), sebastian.riegler@boku.ac.at)

1 ABSTRACT

The Eastern part of Austria and the regions Bratislava and Trnava in Slovakia form an economic growing region (called Twin-City region). A steadily increase of cross-border traffic between these two countries is expected. However, no compatible transport demand and mobility data are currently available. In particular, in Slovakia no comprehensive mobility survey has been organised since 30 years, despite a lots of efforts in the past. Up to now, only in Austria mobility data has been collected on a regular basis, but comparable cross border data are missing.

In 2013 the Austrian and Slovakian Ministries of Transport decided to organise a cross-border survey conjointly. The aim of this survey was to quantify the number of people crossing the border at each cross-border station between Austria and Slovakia and to collect information about the purpose of the trip, the modes used as well as the trip's origin and destination. In total, information about more than 12.000 trips was collected at ten cross-border stations between Austria and Slovakia. The survey consisted of two parts: (1) manual traffic counts and (2) face-to-face interviews on trains and busses as well as on the street. Respondents could choose between bi-lingual questionnaires (German or Slovak language), additionally the interviewer offered translation into English, if requested.

The collected data were stored in an electronic database accessible from Austria and Slovakia. In order to avoid spelling problems more than 600 municipalities were pre-coded to be selected by the staff entering the data. To achieve a high level of quality, plausibility checks were included in the database. Reference data were used for weighting and grossing up: data of manual traffic counts, data of road site automatic count stations as well as passenger counts provided by the public transport operators were used to calculate average traffic volumes on workdays and Sundays.

In total, more than 50.000 persons cross the border between Austria and Slovakia on an average workday. More than four out of five of these trips are made by car, around one in ten by train and three percent by bus. The proportion of trips made by bicycle or on foot paths is negligible. On Sundays the share of car trips is even higher than on workdays. People crossing the border are mainly Slovakian citizens (more than 2/3 of all trips). The majority of trips is undertaken in order to get to or to return from work (about 50% on an average workday). It is remarkable that even on Sundays the share of work-related trips from Slovakia to Austria is almost 50%, which seems to be caused by weekly commuters. As the capital cities Vienna and Bratislava are the main hotspots of the regions and are located close to each other, one might assume that most of the traffic is generated between these two cities. However, the survey's results show that the regional traffic from the metropolitan area of Bratislava towards Austrian municipalities located close to the border is of high importance as well (e.g. the municipality of Hainburg in Austria). On workdays more than 20.000 trips are made between Bratislava and other Austrian regions than the city of Vienna. In comparison, approximately 10.000 trips are made between the two capital cities on an average workday.

2 INTRODUCTION

The border region between the two capital cities Vienna (Austria, AT) and Bratislava (Slovakia, SK) form a growing economic area called Twin City Region. Since both countries became members of the European Union (AT in 1995 and SK in 2004) and the Schengen Agreement became effective in the year 2007, cross-border traffic has been steadily increasing and cross-border transport planning has become a more and more important issue. However, no compatible transport demand and mobility data are currently available, so that the Austrian and the Slovakian ministry of transport decided to launch a common mobility survey at the border stations to get reliable data as basis for transnational transport infrastructure planning.

Goal of the project Brawisimo (2011 – 2015) was to collect and process current compatible transport demand and mobility data and to make them available for a wide range of applications:

- the analysis and monitoring of transport and mobility development in the region, and its impact on the environment and safety;
- the evaluation of transport policies according to their effectiveness as well as sustainability;
- the improvement of the quality of cross-border transport demand models and
- mobility and social research.

Standardized surveys focusing on cross-border traffic guarantee the comparability of results and provide the basis for a coordinated transport policy and infrastructure planning on both sides of the border. The project was co-financed by the European Development Fund, Cross Border Cooperation, Slovakia - Austria 2007-2013 project ERDF.

3 CHARACTERISTIC OF THE REGION

The border region of Austria and Slovakia has been defined in the Brawisimo project as follows (Brawisimo region):

- Austria: The city of Vienna, the eastern parts of the Province of Lower Austria (6 districts) and the Northern parts of the Province of Burgenland (4 districts)
- Slovakia: City of Bratislava and its surroundings (3 districts) and the Province of Trnava (7 districts)

About 2.4 Mio people live in the Austria part and about 1.2 Mio people in the Slovakian part of the border region. Hotspots are the two capital cities Vienna (1.8 Mio inhabitants) and Bratislava (613,000 inhabitants). The distance between these two cities is not more than 80 km (from city centre to city centre), which is a unique situation in Europe (Figure 2 1).

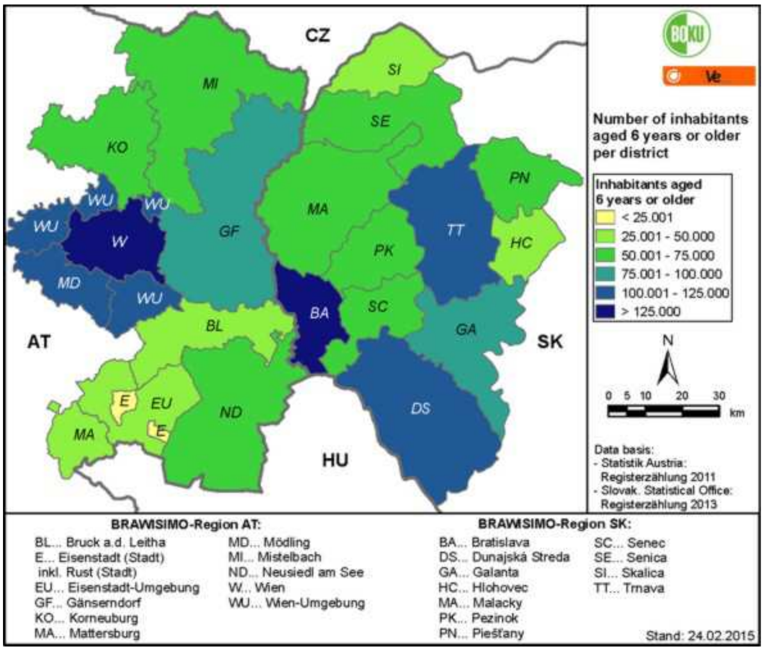

Figure 2 1: Distribution of the number of inhabitants living in the districts of the Brawisimo region

There are four road border crossings between Austria and Slovakia; three of them are located close to the City of Bratislava. The distance between these cross-border stations and the next road cross-border station in the north at Hohenau/Moravský Svätý Ján (B48/EV13) is about 60 km, without any road connection between the two countries, except a ferry at Angern an der March / Záhorská Ves operating daily between 5 am and 10 pm. Bus lines are operating between Austria and Slovakia via the cross-border stations at Berg / Petržalka (federal road B9/61) and Kittsee / Jarovce (motorway A6/D4). Two railway lines are connecting the two capital cities with each other; one via the cross-border station Marchegg / Devínska Nová Ves in the north of the river Danube, the other one via Kittsee / Bratislava - Petržalka south of the river Danube. Two cross-border stations are open for cyclists and pedestrians only (Figure 2 2).

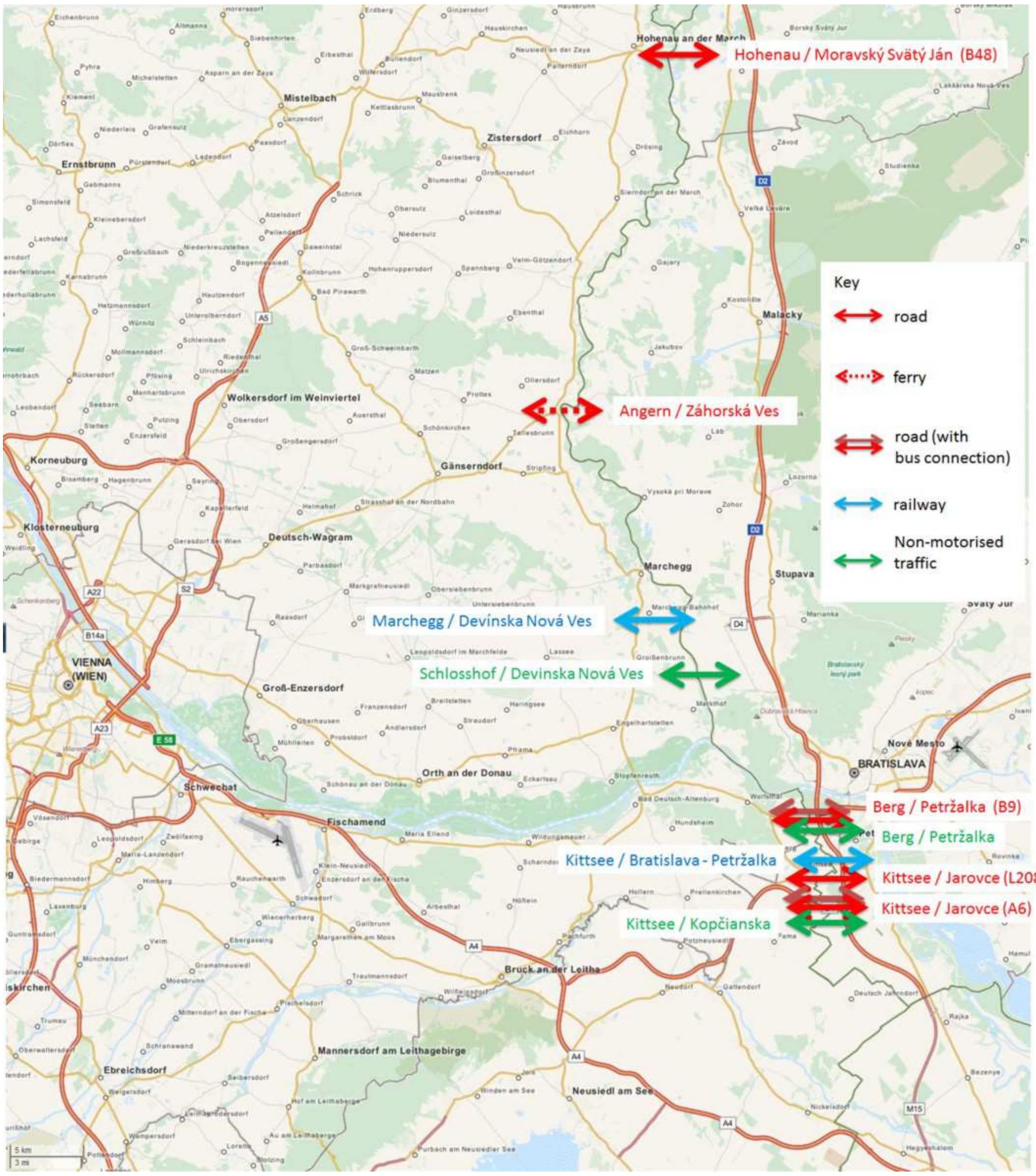

Figure 2 2: Cross-border station included in the cross-border survey between Austria and Slovakia covering different kind of modes (Source: own illustration based on http://www.openstreetmap.at)

4 CROSS-BORDER SURVEY DESGIN

Aim of the cross border survey was to quantify the following figures:

- number of people crossing the border between Austria and Slovakia on an average workday and on Sunday;
- share of modes used (car, public transport, walking and cycling);
- share of trip purposes and
- origins and destinations of cross-border traffic between Austria and Slovakia.

The cross-border survey consisted of two parts:

(1) Manual traffic counts at each cross-border station to get the numbers of vehicles and transport users passing and

(2) face-to-face surveys at each cross border station asking people about their origin and destination as well as trip purposes and other socio-demographic variables.

All people crossing the border by car, public transport, cycle or on foot were identified as target group. Trucks, delivery vans and coaches were counted, but not considered in the face-to-face survey. The survey was organised in October 2013 at the ten cross border station between Austria and Slovakia as described

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above (see Figure 2 2). At each cross border station people were asked on 4 half days at least; two on a workday (covering Tuesday to Thursday) and two on Sundays.

4.1 Manual traffic counts

Manual traffic counts were organised in order to quantify the traffic volume crossing the border between Austria and Slovakia. Staff were recruited and advised by the Technical University of Bratislava (Slovenská Technická Univerzita v Bratislave, STUBA). Traffic counts were organised in intervals of 15 minutes with the help of tally sheets. Apart from the number of vehicles passing a particular road cross-border station, the number of car passengers as well as pedestrians and cyclists was identified as well. At each road cross-border station direction-bound traffic counts were organised on four half days at least; two on a workday (covering Tuesday to Thursday) and two on Sundays. Counting periods were defined from 5 am to 1 pm and from 1 pm to 9 pm.

Counting sheets were used to collect the number of passengers using cross-border public transport. Survey stuff used the trains and counted all passengers when passing the border. Except early morning and late evening services all connections were recorded; i.e. 65 of 73 connections on workdays and 41 of 52 connections on Sundays. Counts of bus passengers were organised by counting the number passengers embarking and disembarking at particular bus stations. Out of 102 bus connections (three lines), the number of passengers was counted in 82 connections on a workday and 85 on Sunday (the supply doesn't not differ between workday and Sunday) (Figure 3 1). The survey period was the same as for the road border stations, i.e. four half days at least, as described above.

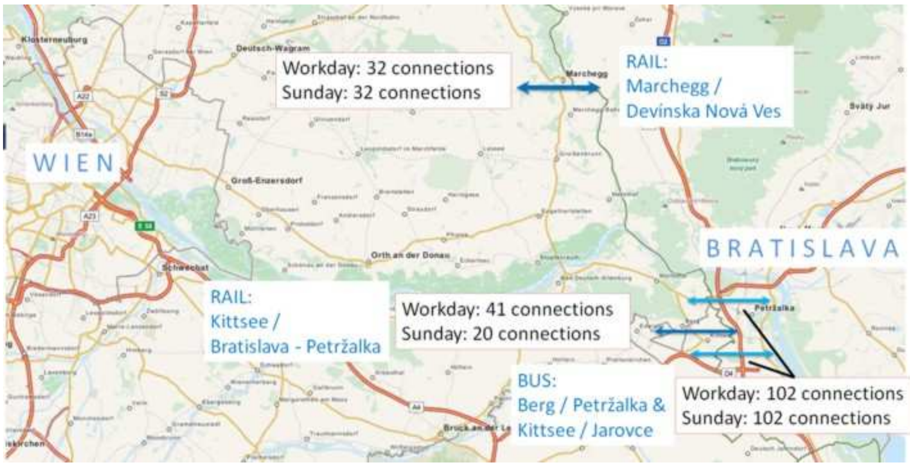


Figure 3 1: Public transport service between Austria and Slovakia

4.2 Face-to-face survey among border crossing people

At the same time as the traffic counts, face-to-face surveys were organised based on a random sample. Main goal of this survey was to collect information about origin and destination as well as trip purposes of border crossing trips. The survey collected this information by using a short questionnaire; not only for the trip currently undertaken, but also for the trip in the opposite direction, which could be the outbound or the return trip; i.e. information of two trips were collected at the same time. Respondents were selected randomly at each border station, independently of the origin or destination of the trip, the home town or the nationality of the persons. A trip was defined from the origin to the final destination without considering transfers between different modes / stages of different modes (see example in Figure 3 2).

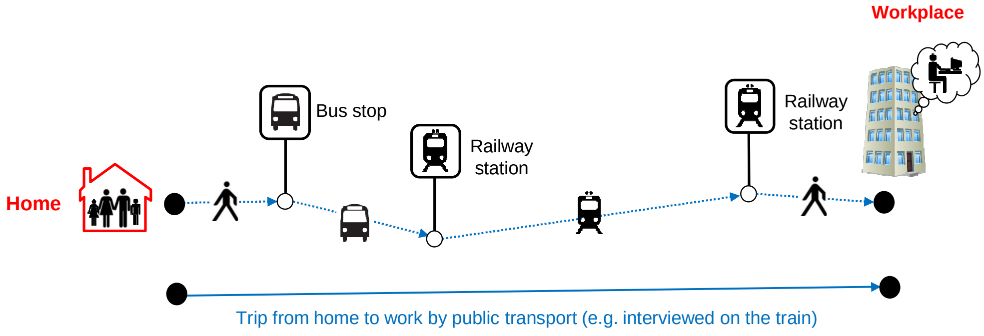


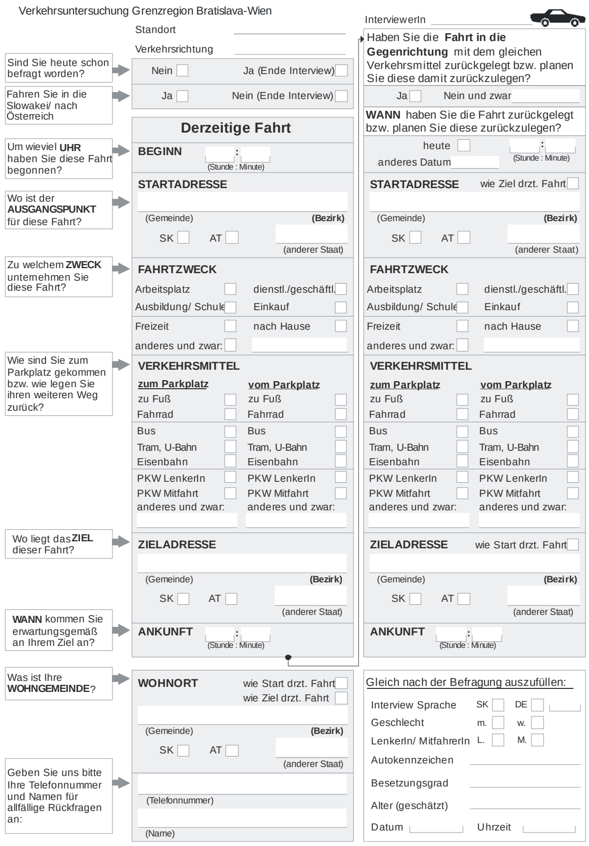
Figure 3 2: Public transport trip to work (including stages of the trip not considered in the survey)

The survey was conducted by using a standardised questionnaire collecting the following trip information:

- origin and destination (country, district, municipality);
- purpose of the trip;
- feeder transport to main mode;
- date, purpose and mode of the trip in the opposite direction.

Additionally, socio-demographic variables have been collected:

- place of residence of the respondents;
- age of the respondents (estimated by the interviewer);
- gender of the respondent (filled in by the interviewer);
- car driver or passenger;
- car occupancy;
- nationality and district in AT and SK of the license plate.


Verkehrsuntersuchung Grenzregion Bratislava-Wien
Standort
Verkehrsrichtung
InterviewerIn

Sind Sie heute schon befragt worden? — Nein / Ja (Ende Interview)
Fahren Sie in die Slowakei/ nach Österreich — Ja / Nein (Ende Interview)

Derzeitige Fahrt

Um wieviel UHR haben Sie diese Fahrt begonnen? — BEGINN (Stunde : Minute)
Wo ist der AUSGANGSPUNKT für diese Fahrt? — STARTADRESSE (Gemeinde) (Bezirk) SK AT (anderer Staat)
Zu welchem ZWECK unternehmen Sie diese Fahrt? — FAHRTZWECK: Arbeitsplatz, dienstl./geschäftl., Ausbildung/ Schule, Einkauf, Freizeit, nach Hause, anderes und zwar:
Wie sind Sie zum Parkplatz gekommen bzw. wie legen Sie ihren weiteren Weg zurück? — VERKEHRSMITTEL: zum Parkplatz / vom Parkplatz: zu Fuß, Fahrrad, Bus, Tram, U-Bahn, Eisenbahn, PKW LenkerIn, PKW Mitfahrt, anderes und zwar:
Wo liegt das ZIEL dieser Fahrt? — ZIELADRESSE (Gemeinde) (Bezirk) SK AT (anderer Staat)
WANN kommen Sie erwartungsgemäß an Ihrem Ziel an? — ANKUNFT (Stunde : Minute)

Haben Sie die Fahrt in die Gegenrichtung mit dem gleichen Verkehrsmittel zurückgelegt bzw. planen Sie diese damit zurückzulegen? — Ja / Nein und zwar
WANN haben Sie die Fahrt zurückgelegt bzw. planen Sie diese zurückzulegen? — heute / anderes Datum (Stunde : Minute)
STARTADRESSE wie Ziel drzt. Fahrt (Gemeinde) (Bezirk) SK AT (anderer Staat)
FAHRTZWECK: Arbeitsplatz, dienstl./geschäftl., Ausbildung/ Schule, Einkauf, Freizeit, nach Hause, anderes und zwar:
VERKEHRSMITTEL: zum Parkplatz / vom Parkplatz: zu Fuß, Fahrrad, Bus, Tram, U-Bahn, Eisenbahn, PKW LenkerIn, PKW Mitfahrt, anderes und zwar:
ZIELADRESSE wie Start drzt. Fahrt (Gemeinde) (Bezirk) SK AT (anderer Staat)
ANKUNFT (Stunde : Minute)

Was ist Ihre WOHNGEMEINDE? — WOHNORT wie Start drzt. Fahrt / wie Ziel drzt. Fahrt (Gemeinde) (Bezirk) SK AT (anderer Staat)
Geben Sie uns bitte Ihre Telefonnummer und Namen für allfällige Rückfragen an: — (Telefonnummer) (Name)

Gleich nach der Befragung auszufüllen:
Interview Sprache SK DE
Geschlecht m. w.
LenkerIn/ MitfahrerIn L. M.
Autokennzeichen
Besetzungsgrad
Alter (geschätzt)
Datum Uhrzeit

Figure 3 3: Questionnaire for car trips in German language

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The questionnaire was produced for each mode in German and Slovakian language. Additionally, the interviewer offered translation into English, if required (Figure 3 3).

Interviewers were recruited by the Technical University of Bratislava (STUBA). The instruction of the staff was organised by the Technical University in Bratislava and the Institute for Transport Studies of the University of Natural Resources and Life Science Vienna (BOKU) to ensure appropriate language skills. Additionally, comprehensive guidelines were produced, describing background information of the survey as well as the course of the interview distinguish between different modes in a very detail way.

At road border crossings cars, cyclists and pedestrians were stopped by the local (Slovakian) police. Transport users were interviewed by the interviewers subsequently at the road site. At border crossings which are open for cyclists and pedestrians only, people were contacted by the interviewers directly. At the border crossing at Angern an der March / Záhorská Ves the interviewer asked people who were waiting for the ferry boat without any help of the police as well. Passengers of the train connections between Vienna and Bratislava where interviewed on the trains, as the staff had the permission to ride on the train for free. Particular attention was paid for a random selection procedure to ensure that all passengers of a coach (from door to door) had the same chance to be interviewed. According to the law, for safety reasons it is not allowed to change places in bus while the vehicle is in motion. Therefore, it was decided to interview people waiting for the bus at selected bus stops. If embarking persons agreed, they were interviewed as well.

5 DATA ENTRY

The completed questionnaires were transferred into a digital secure data base. Access were provided via an encrypted server at the Institute for transport Studies in Vienna. Staff in Bratislava as well as from BOKU had access to the database on different secure levels. The input screen was designed in the same way as the paper version of the questionnaire and included mainly tick boxes to ensure an easy data entry procedure. In order to avoid phonetic and spelling problems with names of municipalities, more than 600 municipalities of the border region were pre-coded to enter origins and destinations by a drop down button. In case a municipality was not pre-coded, staffs were allowed to add names in a free box (Figure 4 1). In total 12,103 trips of 6,193 persons were coded in the data base.

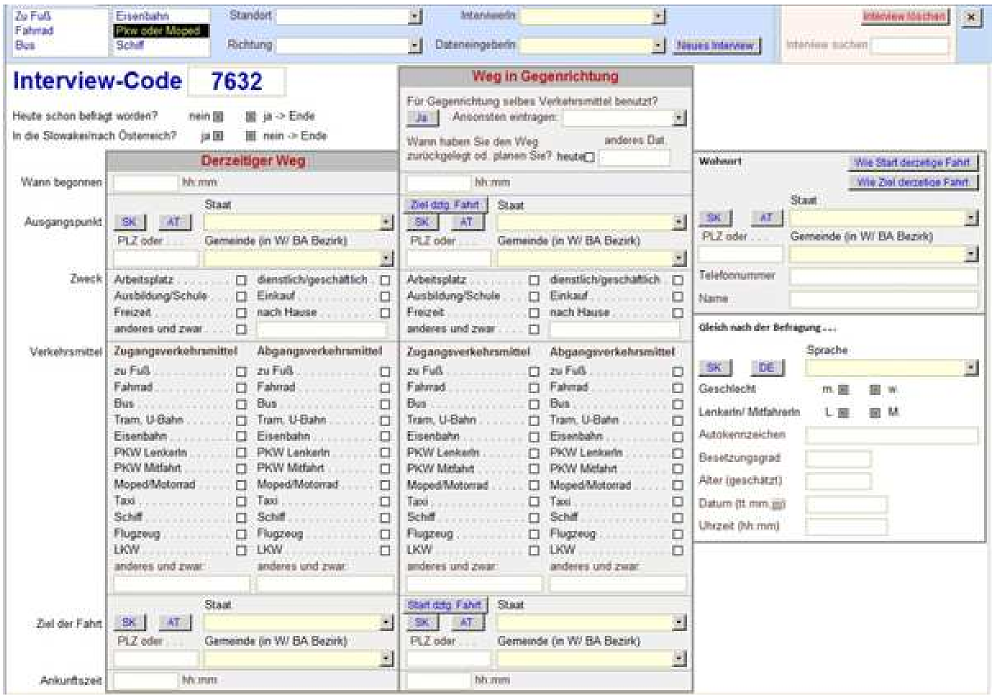

Figure 4 1: Data entry mask of the face-to-face survey

6 CROSSING UP PROCEDURE

The manual traffic counts provided data of the hourly road transport volume from 5 am to 9 pm. References data of automatic traffic counts were available for all four road border crossings. Based on the distribution as percentage the remaining traffic volumes during the night hours (from 9 pm to 5 am) were calculated to provide data for an average daily traffic volume (ADTw, ADTso), an example is shown in Figure 5 1. Finally, all distributions calculated were checked for plausibility.

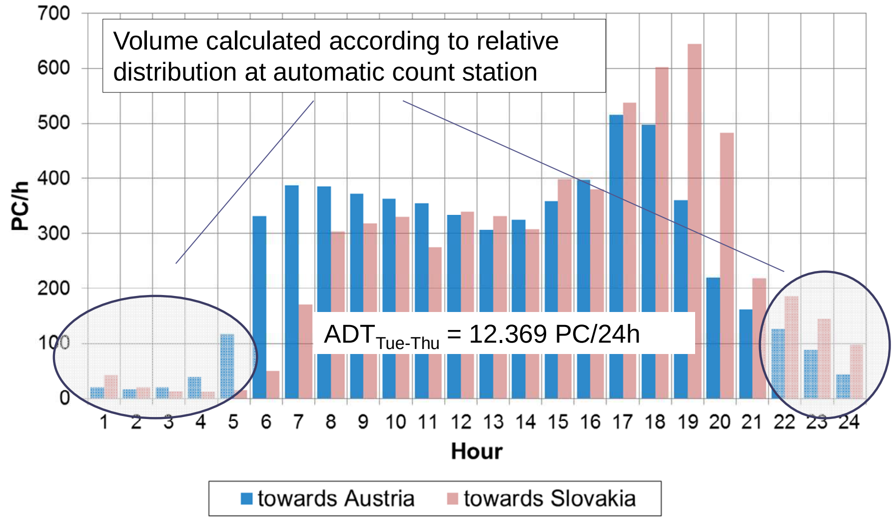

Figure 5 1: Hourly number of passenger cars at the border crossing in Berg/Petržalka (workday, October 2013)

Passenger counting on trains and busses covered almost all connections between Vienna and Bratislava. In order to be able to calculate the remaining train connections, reference data of manual counts of the Austrian railway operator were provided. The share of these connections was calculated in order to estimate the number of passengers using these connections based on the manual counts organised within the Brawisimo project. Thus, the number of passengers for an average workday and Sunday could be provided for both train lines, north and south of the River Danube. In the same way, the number of bus passengers was estimated. However, references data were available for the bus connections operated by the ÖBB-Postbus GmbH und Slovak Lines only.

7 MOBILITY FIGURES

7.1 Modal Split

About 50,000 people are crossing the border on an average workday in both directions. More than four of five trips are made by car; every tenth trip is made by train and 3 % by bus. The share of cyclists and pedestrians are negligible. The traffic volume on Sunday is slightly less than on workdays (49,000 persons) and the share of car trips on Sundays is even higher. The share of bus users stays at the same level (Figure 6 1).

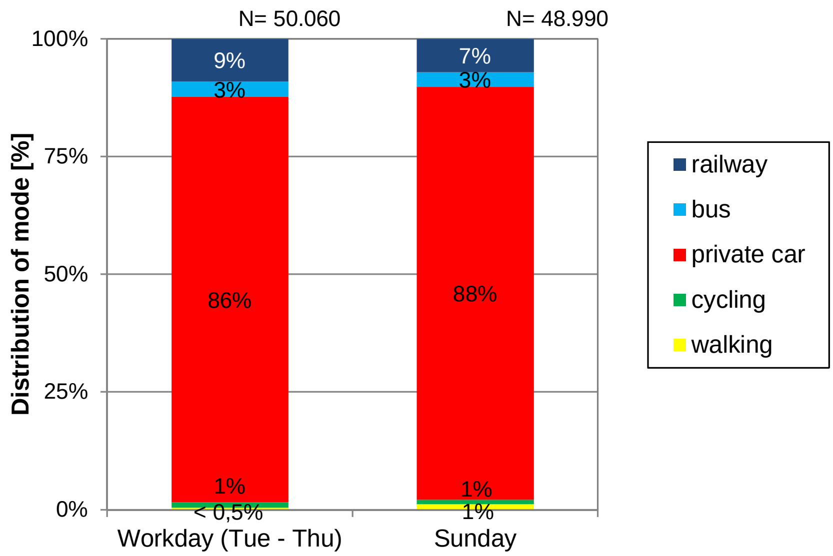

Figure 6 1: Modal Split of cross border traffic (workday, Sunday)

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7.2 Trip purposes

The following figure shows the share of the purpose (activity) at the destination; i.e. return trips back home are not included. On an average workday differences are mainly related to the purpose shopping and leisure. Towards Austria more shopping trips are made than in the opposite direction. On Sunday the difference in the share of trips to work are noticeable. The high share of trips to work towards Austria is presumable caused by weekly commuters. Main purpose of crossing the border towards Slovakia is for leisure and shopping, which might be caused by open shops on Sunday in Bratislava.

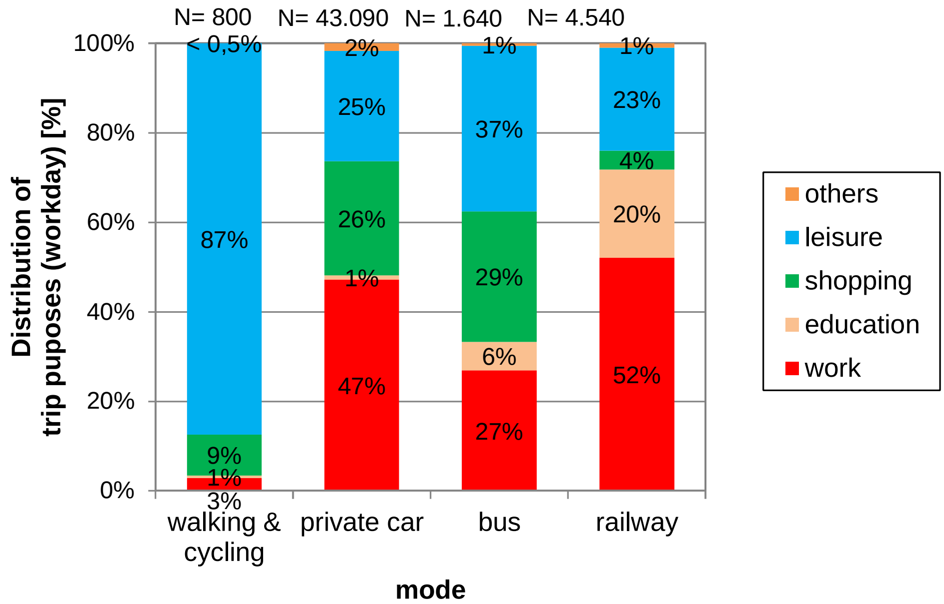

Figure 6 2: Share of purposes (activities) at destination according to mode, trips back home are not included (workday, n= 7.289 trips)

7.3 Traffic volume at the border stations

Most of the trips are made within the border region defined in the Brawisimo project (see Figure 2 1). On an average workday 41,100 trips have the origins or destinations within this region (82 % of the total number of trips) and on Sunday about 32,200 trips (66 % of the total number of trips).

7.3.1 Road traffic

In total, almost 40,000 people are crossing the border in both directions near the City of Bratislava at three road cross-border stations (federal road, state road, and motorway). It is remarkable that more people are using the federal road at Berg / Petržalka than the motorway, which shows the regional context of the Austrian municipality Hainburg at the border and Bratislava. Considering the total number of people crossing the border by car, the cross-border station at Hohenau / Maravský Svätý Ján and the ferry crossing at Angern / Záhorska Ves plays a minor role (Figure 6 3). Traffic volume on Sunday shows a different picture at the cross-border stations near Bratislava, as the traffic volume on the motorway is about 20 % higher than on a workday (21,580 persons / 24 h), whereas the traffic volume at the federal round decreases slightly (17.920 persons / 24 h). This proves again the regional importance of e.g. the municipality of Hainburg, in particular for shopping trips and trips to work on a workday. On the motorway national and regional weekly commuter traffic towards Austria seems to be overlapped.

7.3.2 Public Transport

Despite the fact that the supply of the north connection is less than on the south the connection, more people are using the train connection via Marchegg / Devínska Nová Ves (Figure 6 4). One reason might be that this train line connects both city centres directly (main station to main station), whereas the terminal station of the connection via Kittsee / Petržalka is in the peripheral district Petržalka south of the city centre of Bratislava. On Sunday the north line is mainly use as the supply is almost the same as on workdays (2.600 persons / 24 h). The supply on Sunday on the south line is by far less and the demand is decreasing remarkable (850 persons / 24 h). The bus connections between Vienna and Bratislava (via Berg / Petržalka und Kittsee / Jarovce) show almost the same demand on a workday as on Sunday (Figure 6 4).

Figure 6 3: Number of people crossing the border by car (persons / 24 h, workday)

Figure 6 4: Number of people crossing the border by public transport (persons / 24 h, workday)

7.3.3 Non-motorized traffic

Cyclists are mainly using the border crossing at Berg / Petržalka, which is part of the cycle path along the River Danube (250 persons / 24 h). Due to the higher traffic volume on workdays than on Sunday one might assume that the bicycle is used not only for leisure trips but also for trips to work or shopping. Pedestrians prefer to use the bridge at Schlosshof / Devinska Nová Ves (see also Figure 2 2), which is open for cyclists and pedestrians only. As the number of users is significant higher on Sunday, this area is mainly used for cross border recreational activities (130 persons / 24 h on workday, 530 persons / 24 h on Sunday).

8 ORIGIN-DESTINATIONS

The analysis of the origins-destinations of trips shows the regional importance of the border station at Berg / Petržalka (B9). Only 15 % of all trips made by car towards Austria have their destination in the City of Vienna. All other trips are within districts of the border region, in particular, the municipality of Hainburg (Figure 7 1). On the contrary, the motorway has a national function as more than 50 % of all trips towards Austria have their destination in Vienna, one fifth is going outside the Brawisimo region (other districts in Austria or abroad) (Figure 7 2).

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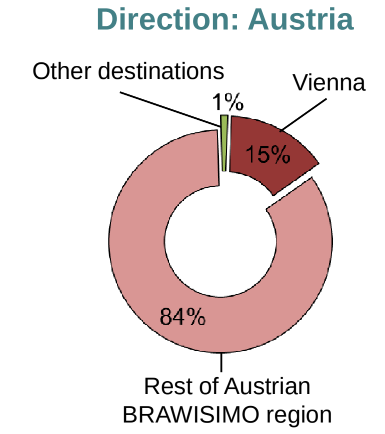

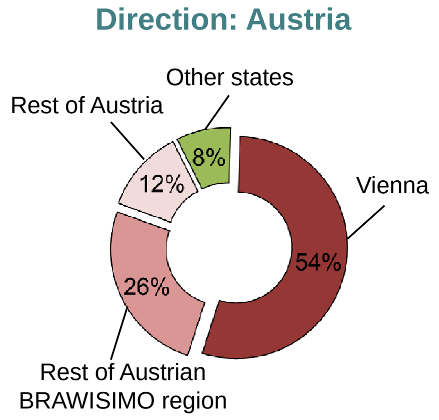

Figure 7 1 (left): Distribution of destinations of trips towards Austria at the border stations Berg / Petržalka, federal road (workday).
Figure 7 2 (right): Distribution of destinations of trips towards Austria at the border stations Kittsee / Jarovce, motoway (workday)

The railway connects mainly the two capital cities. 88 % of all trips towards Austria via Strecke Marchegg / Devínska Nová have their destination in Vienna. Due to minor shopping or working facilities along the line only 5 % of the trips have their destination in a district of the Brawisimo region. As the train terminates at the main station in Vienna 7 % of the people are using this transfer hub to reach other Austrian districts outside the Brawisimo region or other countries. Similar figures are shown for trips towards Slovakia. About one third are using Bratislava main station as transfer station (Figure 7 3). Due to the isolated location of the terminal station of the south connection 91 % of the trips towards Slovakia have their destinations in Bratislava.

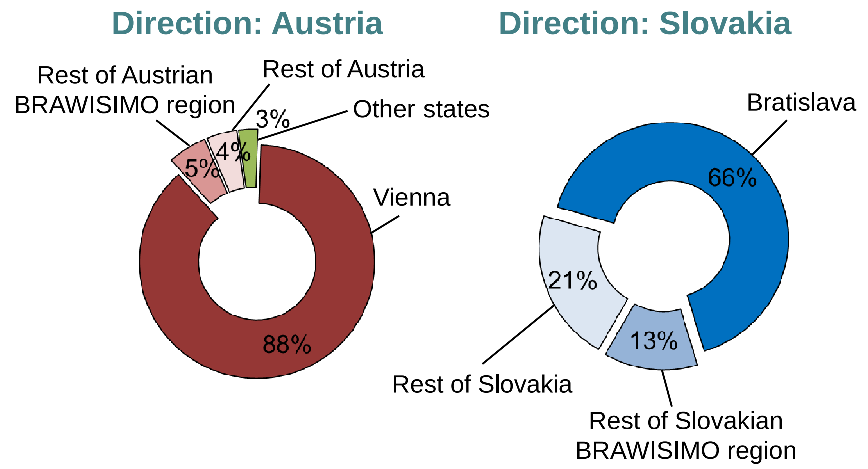

Figure 7 3: Distribution of destinations of trips using the connection via Marchegg / Devínska Nová Ves (workday, both directions)

9 CONCLUSIONS

As a result of the cross-border survey, data of cross border traffic between Austria and Slovakia are available in a unique and comparable form for the first time. These data provide a solid basis for transnational transport planning and infrastructure investments, but also for improving a transnational transport demand model, which is currently established by the Technical University Vienna (Emberger G. et al. 2012).

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About Drugs in the Cities: Is there Something New?

Olivier Lefebvre

(Dr Olivier Lefebvre, Olivier Lefebvre Consultant 4 rue Rollin 75005 Paris France, o.lefebvreparis05@orange.fr)

1 ABSTRACT

The history of drugs allows to focus on three interesting points: (1) The city has always been the place where artificial pleasures (like drugs) are invented then diffused (2) The involved actors (doctors, the Church, intellectuals …) have displayed fluctuating doctrines in the field (3) There have been successive “waves of moralizing”. One can build two scenarios: a majority in the Opinion appears which is in favor of drugs use and it will be decriminalized or legalized, either a new “wave of moralizing” triggers the choice of repression.

2 INTRODUCTION

We could depict the history of drugs as “a tale told by an idiot, full of sound and fury” (Hamlet, Shakespeare). It provides picturesque stories.[1] But from our point of view it is more a story of actors whose behaviors fluctuate and with confuse doctrine.

We start from the works of Dr Olivienstein, who distinguished three approaches:

- The approach by repression supposes that use of drugs is an evil to eradicate thanks to hard laws efficiently enforced.
- The approach by the product is the one of the doctors, relying on physiology. The drug addict is a patient to cure. In particular this approach leads to use substitutes like methadone (a heroin substitute). It is not a panacea: it does not create addiction but it can be used … as a drug, if a high dose is taken or if it is mixed with other products (in this case it becomes dangerous).
- The social approach. Use of drugs is a social link. This is exemplified today by the “botellons” in Spain. People use Internet to choose a place where they meet, escaping police. They have bought cheap alcohol in supermarkets and drink it. It is a problem of urban governance: we have already an example of fluctuating doctrine, since local authorities can be hard or tolerant. In his famous book “John Barleycorn” the American novelist Jack London has shown how anomic people are linked together by drinking alcohol in a saloon. The American sociologist HS Becker in his book “Outsiders” has shown how a community of marijuana users allows social life: they speak of their experience, they can learn one from the other how to use the drugs etc. Of course it happens that addiction triggers serious problems, which are psychological and physiological. More, use of drugs in dramatic circumstances can be a “solution” to cope with personal difficulties (Barsony, 2010). But all this casts doubt on the utility of repression.

Indeed, to combine the approach by repression and the approach by the product could be a “solution” or a “way” for society. It should be to build a Foucaldian “analytical space” to track users and traffickers. The users should be considered as patients, and the traffickers as swindlers. But there are many criticisms to make. Repression involves to fill jails with prisoners, and in jails drugs are diffused (a dose of drug is small, and easy to hide). Repression of traffic triggers higher price of drug: while demand does not decrease, poor users are indebted, become traffickers etc. Or they buy cheap, altered product which is dangerous.[2] Traffickers make illicit profit where not taken. Even, in Mexico, they use Internet to recruit youngsters and they use technology to carry the drug (submarines, planes, drones to cross the border between Mexico and the United States). In some countries, drug traffic triggers corruption.

In this paper we shall insist on the social approach.

We shall focus on three interesting points:

[1] For instance the French adventurer Henry de Monfreid has described his adventures as a Hashish trafficker in the region of the Red Sea, in three books.

[2] An example is the «crack», the «drug of the poor». It is a mix of cocaine and another product, which is smoked. It is dangerous. There is also the Ecstasy, which is taken during the “rave parties”.

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- The city has always been the place where artificial pleasures are invented and diffused. It is the case with drugs. Indeed, the economic aspects exist and matter. That is to say, the City could benefit from liberalization of drugs, from an economic point of view.
- The involved actors have had fluctuating stances, and have displayed changing doctrine. Are concerned the Church, the doctors, the intellectuals … For instance, the United Nations (after the League of Nations) have been the spearhead of struggle against traffic and use of drugs. But currently they are changing their mind.
- There have been successive "waves of moralizing".
- Having examined these points we have enough material to build two scenarios:
- Decriminalization or legalization could be decided, after the appearance of a majority in the Opinion in favor of them. Use of drug is in accordance with the Second Modernity (in the terms of Lipovetsky): happiness, individualism, hedonism. It corresponds to democratization of luxury and "emotional luxury" (Lipovetsky, 2003). For instance drugs could be added to edibles, should the fashion appear.
- Repression could be chosen, if a new wave of moralizing occurs.

3 THE CITY AND THE INVENTION OF PLEASURES

The City has always been the place where new pleasures are invented and diffused. It is also the place of artificiality. The Italian writer Malaparte quotes the noblemen of Versailles: "the countryside is where the birds are raw". It is commonplace to tell that cities have benefitted from production, trade and sale of luxuries (which have become ordinary goods), like alcohol, tobacco, sugar, coffee, tea … In the 18th century, the Physiocrats, a school of French economists, were aware that luxury generates large cities like Paris or London (Sombart, 1967). According to Sombart the noblemen at the Court were obliged to spend very much money to have a sumptuous appearance: it was necessary to attract the favor of the King to get honor … and money. The financiers were on watch, lending money to the noblemen. Often they were bankrupt. The recourse was some marriage between members of a noble family and a family of financiers. The nobles won money and the financiers won a glorious name. The rich people were the courtiers, the noblemen living in the city, the financiers and … the creditors of the State. And what about the drugs? In his book "Luxury and capitalism" the German sociologist Sombart quotes the cordials, which are often aphrodisiacs. It is not surprising, since Sombart puts the stress on the role of women and eroticism. He quotes also the import of laudanum (syrup with opium inside) from India. Indeed, it is an omission. Since the time of Renaissance, the doctors sold laudanum to rich customers: Richelieu, Colbert, Louis XIV and prelates, for instance (Escohotado, 1995). These syrups were made expensive by the doctors by adding power of gems, of silver, or gold… This kind of powder was supposed to make the women nicer (hence the name of "belladonna", a plant which is a painkiller and triggers a nice dilation of the women's pupils when used as a cream). The drugs were part of luxury. Later, luxury is democratized and an "emotional luxury" appears (Lipotevsky, 2003). The use of drugs is diffused in almost all the groups of the society. This shows that economic factors matter, even if they are not the only which matter. Let us describe an historical example which shows this: the return of opium in Occident.

The ancient Greeks and Romans used opium. In Rome there was a large organized market of opium, the authorities maintaining a low price (Escohotado, 2003). Then the Christian religion eradicated drugs for centuries.[3] They were considered as pagan entheogens, triggering the contact with the Devil. According to Saint Augustine, the contact was imaginary (a dream), but according to Saint Thomas Aquinas, the contact was real (Escohotado, 1995). A psychoanalytical explanation is the "comeback of the repressed", since the Christian religion originates from pagan rites which have been changed (for instance repressed Bacchus is considered as the Devil). The Church prohibited use of drugs and even the remembrance and knowledge, destroying the documents mentioning them. It culminated in the witch-hunt (the witches were accused to be in touch with the Devil thanks to drinks and creams). The Hippocratic medicine and the pharmacopoeia were forgotten. They survived in Byzantium then in Arabic countries, and finally came back to Occident at the

[3] Alcohol is an exception. Even, wine is used during the mass, since it is the symbol of the blood of Christ (but only the priests drink it).

time of Renaissance. Given the individualism, the search for happiness and the prestige of the study of Nature at this time, drugs were examined and sold by doctors.[4] But drug users who were not rich and powerful were risky, they could have been given up to the Inquisition. Venice and Genoa began importing opium. At some time the commercial routes allowing trade between Orient and Occident changed (the Silk Roads being abandoned, the new route was the one of the Cape of Good Hope). Portuguese, Dutch and English tradesmen wanting to sell goods in Orient, to be able to import, sold the opium of the Mediterranean region (Iran, Turkey)[5], which was of an excellent quality, to customers in Orient. The consequence was that Portuguese, Dutch and English doctors examined the qualities of opium (it is also a med) in detail, and that paved the way for the diffusion of this drug (and later, of other ones).

4 THE INVOLVED ACTORS AND THEIR FLUCTUATING STANCES

The involved actors are the Church, the doctors, and the intellectuals.

4.1 The Church

The church has always been (is still) a fierce opponent to drug use. But in History there are exceptions, in Latin America at the time of the Spanish Empire. In Colombia and Peru the Indians were accustomed to use cocaine. The clergy accepted the trade which was heavily taxed. It was the main source of the clergy's revenues. There was the same in Paraguay where the Jesuits accepted and taxed the trade of mate.

4.2 The doctors

They have been proponents of drugs, during a long time. Today they are opponents, even if there are exceptions.[6] At the time of Renaissance they struggled against the Church, to exist as doctors, taking into account Nature and the results of study of Nature. They were interested in studying drugs. Often, the doctors studying the effects of drugs experienced them. For instance, the French doctor Moreau de Tours was the first psychiatrist having the idea of a psychological study of the "insane" (his predecessors Pinel and Esquirol only examined external, clinical signs of the illness). He thought there were similarities between insanity, effects of hashish and sleep and dream. He experienced hashish. In his book "Du haschish" ("On hashish") he describes his personal trips and the ones of other people. According to him there are eight features of the effects of the drug on the user, one of them being "compelling impulses". It is the only danger for hashish users: the beginners have to be surrounded by experienced friends, or should have received advices from doctors. Otherwise they are risky, if they take a too high dose. At this time drug use was authorized and rich amateurs were accustomed to use hashish or opium. Often they were doctors. Freud himself became notorious thanks to research on cocaine and experienced it. Later Albert Hofmann discovered the LSD, used it and became a proponent of its consumption. Timothy Leary is another example. In the 20th century doctors invented drugs (meds like barbiturates and amphetamines), experienced and used them. Also, it was lucrative trade. When repression began, in the USA, doctors and pharmacists protested it. They were angry because they lose a role. They ceased to be those prescribing the drugs their customers wanted to use.

4.3 The intellectuals

Innumerable intellectuals have experienced drugs, described them and praised them. Let us quote Baudelaire, De Quincey, Benjamin. Antonin Artaud described the religious rites in the tribe of Tarahumaras in Mexico, who used peyotl (with mescaline inside). Even, there are movies. The French writer Henri Michaux wrote a book on mescaline, he experienced, but without praising it (the title of the book is "Miserable miracle"). He made a movie showing the effects of mescaline "Images du monde visionnaire" ("Images from the visionary world") which is available on Wikipedia. Intellectuals and artists have not created the fashion of drugs use. It existed already in the 18th century (the cordials). But they have strengthened it. At some time the students took amphetamines before exams. Sportsmen took drugs to upgrade performance. Then there were the hippies taking LSD. The show business took cocaine like the "golden boys" (the traders). Those having to bear sufferings, jobless youngsters or victims of racism, or discrimination had recourse to drugs

[4] At this time (in the 16th century) the Swiss doctor and alchemist Paracelse invented the laudanum.

[5] Sombart quotes the production of opium in some islands of the Mediterranean Sea.

[6] Dr Olivienstein became a proponent of decriminalization of hashish when AIDS appeared, due to intravenous injections of heroin in bad conditions.

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(Olivienstein, 2000). Someday the price of cocaine lowered and the consumption extended. Finally almost all the middle class has tried or used (on a regular basis) drugs (see the title of the book of Dr Barsony). Many factors are involved: drug use is a distinctive sign (among rich people), or it is imitation of rich people by those having less money, or it the pleasure of challenging prohibition, or it is really a need of anomic people etc. It is also "emotional luxury" in the terms of Lipovetsky. Drugs are painkillers and provide comfort. But they also provide euphoria and pleasure. They are part of the urban way of life at the time of the consumers society. They upgrade one's performance, allow bearing the frantic pace of urban life (to work five days, then to take heroin or ecstasy during the week end), they are useful to build one's experience (sensations, emotions) and one's image etc.

5 THE SUCCESSIVE WAVES OF MORALIZING

There were three successive waves of moralizing

- The first dates from the beginning of the 20th century. In our opinion it was due to the proletarian misery at this time. Alcohol drinking in this context of misery is well documented in famous novels: "L'assomoir" by the French Emile Zola, "The jungle" by the American Upton Sinclair, or the Jack London's report "The people of the abyss". Also, in the "underworld" heroin was often taken. Leagues and personalities militated in favor of the prohibition of alcohol. The goal was moralizing the proletariat. It was also the goal of urban planners concerning their projects of "company towns". The Volstead Act triggered the Prohibition from 1920 to 1934. It failed for many reasons: the consumption did not decrease, the price increased, Americans drunk an alcohol of bad quality, triggering illness, the traffickers were rich etc. The Harrison act concerned opium and the Marijuana Tax Act concerned marijuana. The jails in the USA were full of people sentenced for drug use or traffic. The other countries imitated the USA, but laws were more or less enforced.
- The second wave dates from the Cold War. There was a rumor that Soviet Union would flood the USA with drugs, to undermine the country. The goal of the Boggs Act was hard repression: all was in the hands of police, the judges were no more concerned. Doctors, pharmacists, advocates and intellectuals (HS Becker) protested this law. Not only the doctors and the pharmacists lose their role (before it was possible to buy drugs by asking them for it) but they were trapped by policemen simulating to be customers. It is the time of the "junkie", a poor youngster living for drug, selling it to be able to buy it etc.
- The third wave dates from the 1960s and 1970s. In the USA a struggle between proponents of and opponents to drug use begins. According to Escohotado, the opponents won from a material point of view while the proponents won from a moral point of view. Millions of Americans took LSD and marijuana. At this time the "therapeutism" (according to Escohotado) appears. It is the Olivienstein's "approach by repression" and "approach by the product": the drug trafficker is a criminal and the drug user is a patient. Strangely the other countries followed the USA. Almost all ratified some Conventions in Vienna (1971, 1988) allowing the United Nations struggling against production, traffic and use of drugs. In France, only in the beginning of the 1970s the size of the department of police struggling against drug traffic and use became important. Even, at this time, it was prohibited by Law to praise drug use (in books or speeches in public).

To sum up, shocks on the society trigger a reaction of Order. But the Rebel creates the Order and the Order creates the Rebel (Escohotado, 1995). At some time, the choice of repression is challenged. Of course, Law can be changed. The condition is a majority in the Opinion which appears, wanting this change.

6 CONCLUSION

Now we propose two scenarios, one on decriminalization / legalization of drugs, and the other on repression again. We shall take into account what has been shown in the paper:

- There is a trend in the cities toward invention and diffusion of new pleasures. Drug use corresponds to the Second Modernity according to Lipovetsky: hedonism, individualism and search for happiness. Repression should correspond more to the First Modernity: self-control. Also, with the democratization of luxury has appeared an "emotional luxury" (Lipovetsky, 2003), which affords emotions and sensations. Of course, it is provided by drugs.

- The involved actors have often changed their mind, in the past. It could happen again: it would be enough if a majority appears, in favor of drug use. Doctors would have a role: they should give advices to drug users in lawful conditions and they would be in charge of the very serious cases (dependency) which would exist. Even, they could treat the most serious cases in better conditions: the recourse to them would be lawful. Today, it is more or less mandatory and drug users hesitate to consult a doctor and accept a treatment (under control) or to go in jail. The States would win more taxes and make economies (the struggle against drug use and traffic is costly).
- Economic factors matter. Recently in the European Union one has decided to count drug use (and prostitution) in the National Product of every country. In case of legalization of drugs, a sector would appear: cultivation of plants, transport, transformation and sale of drug.

6.1 A scenario on decriminalization / legalization of drugs

Decriminalization is to allow drug use. Production and traffic remain unlawful. In principle, the price decreases: a user can change his (her) provider, since he (she) no more fears to be denounced to police. Also the product should be of better quality (again, since a user can change his provider).When the price is high poor users are incited to buy a product of bad quality. Illicit profit from traffic decreases. In the Nederland, where marijuana use is tolerated, one can cultivate the plant (cannabis) at a small scale, not selling it. The legalization is to allow production, sale and use. In the State of Colorado (in the USA) where legalization has been decided one year ago, the growing of cannabis and the sale are under the control of the State. It allows the control of the quality of the product. Also, there are …taxes. The results seem good: there have been just a few accidents, due to the Moreau de Tours's "compelling impulses". The beginners should receive advices from doctors (it is lawful) or experienced friends. In Portugal, where drugs are decriminalized for years, the consumption did not increase, crime related to drug traffic has decreased, and more users have recourse to doctors. In Uruguay, an experiment of legalization of marijuana has started. In Colombia all the drugs are legalized and in Mexico they are decriminalized but the serious problems come from unlawful production and transport of cocaine which is sold in the USA, where it is forbidden. There are more and more experiments of this kind in the world. The results should incite Opinion to accept decriminalization or legalization of drugs in many countries.

6.2 A scenario on repression again

A new wave of moralizing is possible. For instance, if jihadism becomes a more and more terrible threat for Occidental countries, a scapegoat could be the drug user, to justify a moral crusade and Order. However it seems improbable. First, the link between the jihadist and drug is loose: often jihadists make money thanks to drug traffic. Also, the Second Modernity involves (1) individualism, therefore acceptance of any means allowing happiness, like drugs[7] (2) human rights, therefore refusal of restriction of individual freedom and privacy which is the consequence of moral crusade and Order. More a product is diffused, more it is uneasy to prohibit its consumption. An example is the failure of the Volstead Act (the Prohibition). Also, the repression of tobacco use in Russia, Iran, Turkey, China … has failed. As many drugs are popular (the use being for entertainment and occasional) it could trigger the failure of repression. And the existence of repression makes usage more attractive (therefore it remains popular).

There is no society without drugs (Olivienstein, 2000). But the community decides how drugs are used. In the cities, facts and how the stake is considered by actors (the users themselves, doctors, Opinion…) should be observed and examined. The paramount goal should be to understand the evolution of Opinion: today Opinion is all powerful, and when a majority will appear, concerning the use of drugs, a definitive choice between repression and tolerance will be made. In any case, discussion will last a long time. Today the controversial topic is the supervised injection sites (places where drug users find a help when they want to make an injection). Interestingly, there are diverse reactions (acceptance or refusal) of people living in the surroundings of the sites. Depending on the city, the drug users are accepted in the urban space or excluded from it. This happened to tobacco smokers. Today, they are allowed to smoke tobacco as they want, but not in some places (public spaces). But they are not stigmatized. In other words it is not the question of their pleasure, but only the question of fear of transmission of diseases and the "presentation of the self". Returning to the topic of drugs, we see how things could progress. In Spain and the Nederland, the

[7] It is the argument of the hippies in the 1960s: "my body belongs to me, I treat it as I want".

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supervised injection sites have been more accepted than in other European countries. Of course, it is because in these countries drug (marijuana, cannabis) is decriminalized or tolerated: the users do not infringe laws. The law facilitates an evolution of the society, and then this triggers laws again etc.

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Analysis of 2D/3D Urban Density Indices in Context of Land Surface Temperature

Caroline Baumgart, Christian Berger

(Caroline Baumgart, Research Institute for Regional and Urban Development gGmbH, Brüderweg 22-24, 44135 Dortmund, caroline.baumgart@ils-forschung.de)

(Christian Berger, Friedrich-Schiller-University Jena, Fürstengraben 1, 07743 Jena, christian.berger@uni-jena.de)

1 ABSTRACT

Cities worldwide cover only 2 % of earth`s surface but spend almost 75 % of the world`s energy resources (Gago et al. 2013). The emission of heat and the structure of built-up areas can increase the phenomenon of urban heat islands (UHI), which highly infects the well-being of all inhabitants. Future work will focus on monitoring capabilities to manage the development of urban settlements. The study investigates the relationship between urban density indices and land surface temperature (LST) using multi-sensor remote sensing data. All processing steps are performed for the City of Cologne, Germany. The input data are consisting of high resolution multi-spectral Ikonos imagery, as well as an object height model, derived from Light Detection And Ranging (LiDAR) data and thermal information, provided by the Landsat 7 satellite mission. The first working step, the derivation of six land cover (LC) classes, is based on a geographic object based image analysis (GEOBIA) approach. Therefore, LiDAR and pan-sharped Ikonos data with a spatial resolution of one meter are used. In a second step, and based on the extracted LC and object height information, existing and new measures of urban density are computed, that take into account the horizontal and/or vertical characteristics of a city. All measures are separated into single object related and area related indices, depending on the basis of calculation. The significance of different Areas of Interests (AOI) are analyzed and compared for area related indices. Finally, the correlation between multi-temporal LST data, derived from Landsat Enhanced Thematic Mapper (ETM+), and each indicator is calculated with regard to their dependency on the predominant type of urban land use (LU) and the acquisition date (season) of the Landsat ETM+ data.

2 INTRODUCTION

Urban structure and land cover affect the city climate and thus the well-being of their inhabitants (Jusuf et al. 2007:232). Furthermore, certain land cover and building types reduce or intensify temperature (Franck et al. 2013:170, Jusuf et al. 2007:232). Especially buildings with closed forms e.g. block development, high number of floors and narrow roads, interfere the exchange of warm and polluted air with fresh air (Franck et al. 2013:175, Gago et al. 2013:755). Planted areas and tree populations have an opposite effect and cool down their environment because of plant transpiration (Gago et al. 2013:751).

In terms of increasing urban populations, social and ecological factors become more and more relevant for future urban development. The technique of remote sensing can be an efficient tool to characterize and quantitatively describe parameters, concerning urban structure and environmental factors. Several studies deal with the derivation of urban density indices and land use classifications, particularly with regard to high resolution optical datasets (Yu et al. (2010), Tompalski & Wezyk (2012), González-Aguilera et al. (2013) and Berger et al. (2013)). Parallel to high resolution imagery, data methods of object based image analysis (OBIA) are more and more popular (Weng 2012:43), especially at small-scale applications e.g. infrastructure and settlement development (Wurm et al. (2009), Yu et al. (2010), Dinis et al. (2010), Salehi et al. (2012), Zhou (2013) and Li et al. (2014)).

This study focuses on urban density indices derived from an object based land cover classification. In the following, a selection of indices is analyzed regarding their correlation with LST in an urban environment. The input data as well as a short discribtion of the study area is presented in the next paragraph. Afterwards, the methodology is divided into three parts concerning (i) object based land cover classification, (ii) urban density indices and (iii) correlation analysis. Finally, we try to figure out wether two- or three-dimensional indices improve the correlation results with LST and if specific land use classes affect this relationship.

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3 MATERIALS

3.1 Data source & preparation

The data basis of this study consists of Ikonos, LiDAR and Landsat ETM+ data as well as additional datasets (Fig. 1). The high resolution optical dataset is available for one time step (2005-09-20) and as a GEO-product. Due to missing position accuracy a co-registration had to be done. Afterwards, the High Pass Filter, a pan-sharpening technique was conducted with Erdas Imagine in order to improve the spatial resolution up to 1 m.

A normalized Digital Surface Model (nDSM) was produced by subtracting a digital elevation model (DEM) from a DSM, derived from LiDAR data. The LiDAR dataset is characterized by a point density of 1-4 points/m² and can be used with a resolution of 1 m. A mosaic of orthophotos, resampled with a bilinear method up to a resolution of 1 m, was used for validation. Additional vector data consisting of a land use classification and land cover change time series were provided by the city of Cologne and German Aerospace Center (DLR). The land use dataset, available on block level, provided the basic unit for the correlation analyses and to differentiate between major land use classes.

LST data were derived from Landsat ETM+ for six scenes, covering acquisitions of all seasons, with recordings during day-time between 1999 and 2001 and one night-time image of 2008.

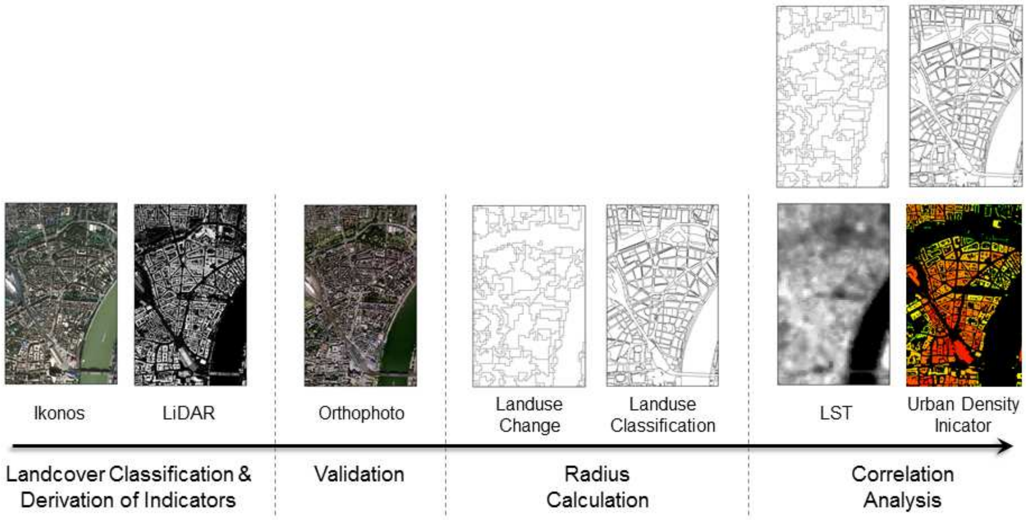

Fig. 1: Data input and methodical approach

3.2 Study area

The city of Cologne is located at the river Rhine in the North-western part of Germany and belongs to the federal state of North Rhine-Westphalia (50°56'29''N, 6°57'28''E). The development of the settlement structure started already in 38 B.C. and was influenced by several circular expansions during the High Middle Ages (Curdes & Ulrich 1997). The historical structures, especially the circular formation of streets around the city centre, are still distinctive elements of Cologne. Today, the city has more than 1 million inhabitants and covers an area of 405.2 km² (IT.NRW 2013).

4 METHODS

In the following chapter, the methodical approach of the main working packages is presented. The derivation of the landcover classification and the adaption of the existing ruleset is described as well as the validiation of the result using orthophotos. Based on a previous landcover product, urban indicies were implemented from a preceding study by Berger et al. (2012) and from further literature studies. Different analyses, concerning the correlation between indicators and LST are discribed in the final part.

4.1 Object-based Classification

The ruleset of Berger et al. (2012), developed for test sites in Erfurt and Rostock, provided the basis for the land cover classification of Cologne and was simultaneously tested in terms of transferability. All working steps of the classification and the calculation of all indices were performed with Definiens eCognition software.

The segmentation is maintained due to better comparability and consists of three processes: Quadtree Segmentation, Multiresolution Segmentation and Multiple Object Difference Conditions-based Fusion. The two segmentations subdivide the Ikonos scene using spectral information and slope as well as height derived from nDSM. The last step aggregates objects, if they meet defined threshold values regarding specific spectral and spatial similarities. Afterwards, the input scene is classified into elevated and non-elevated areas using the height as a parameter and a threshold of 2 m to exclude vehicles and small artefacts from elevated land cover. Basing on this classification, six different land cover classes were identified: Tree, Building for elevated objects as well as Grassland, Water, Bare Soil and Impervious for non-elevated objects. Every single class is defined by single or multiple attributes of nDSM, multispectral information or geometrical properties (Fig. 2). For classes with similar characteristics e.g. Bare Soil and Impervious, the separability was analysed with Box-Whisker-Plots, in order to find specific ranges of attribute values to avoid overlaps and an inaccurate object classification. The classification ruleset of Berger et al. (2013) therefore was adapted and in some cases renewed.

The software Erdas Imaging 2011 was chosen to perform a validation of the classification result by distributing 50 random points per class. As reference data a mosaic of orthophotos from Cologne with a spatial resolution of 1 m was used.

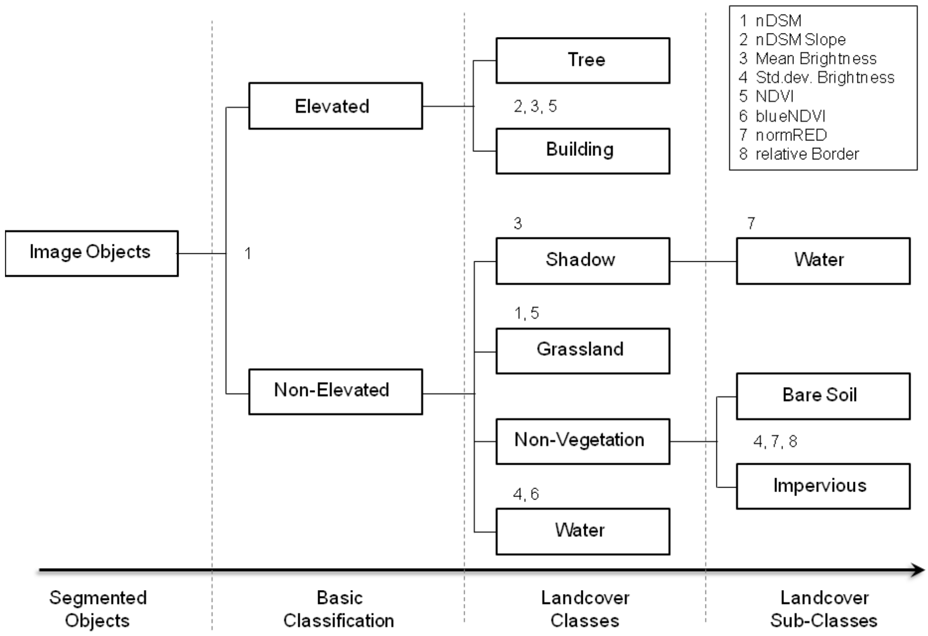

Fig. 2: Derivation of land cover classes and input parameters

4.2 Urban Density

The ruleset of Berger et al. (2013) was provided and extended for derivation of urban indices. The most appropriate indices were considered in the following. For each indicator the result is a map of building objects, where every object contains one indicator value. All of them differ concerning their area of interest (AOI), which can be object or area oriented. In the former case the calculation is only based on the object information e.g. building height and gross floor area. For area related indices the AOI was defined as a specific radius around the centroid of the active building. The radius was set to 100 m for further analyses.

The inverted Floor Area Ratio (iFAR) was modified by Berger et al. (2013) and is an object related indicator, which reflects the ratio of active building area to the sum of all floors. The iFAR takes into account each separate floor by proofing and recalculating each floor individually using the nDSM.

In the following all named indices are related to the AOI. The two normalized indices Impervious Surface Area (ISA) and Vegtetation Fraction (VF) present the relationship between impervious surface or vegetation and the AOI (Lazzarini et al. (2013), Berger et al. (2013)). The Building Aggregation Index (BA) focuses on the arrangement and compactness of buildings within the AOI and contains information about the number of

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buildings within the AOI, median iFAR, median distance between active building and closest one as well as a ratio of building area and AOI (Berger et al. 2013). Both indices, Urban Vegetation Index (UVI) and Vegetation Volume to Built-Up Volume (VV2BV), by Tompalski & Wezyk (2012) are presented in a normalized form in this article. The second one, similar to VF and ISA, takes the third dimension into account and is a ratio of high vegetation volume and building volume. The UVI consist of VV2BV, a ratio of vegetation and building area and a weighted factor of all green and impervious areas. The indicator Urban Density (UD) was published by Berger et al. (2012) and describes the relation of urban development to vertical and horizontal settlement structure with a scale range from -2 to +2 with high values indicating high urban development. Urban Density consists of four independent indices: BA, ISA, iFAR and VF.

4.3 Correlation Analysis & LST metrics

The correlation analysis was performed between all indices and LST data for all block level objects and for specific land use classes. Besides single LST time steps, three different metrics were calculated to improve the regression results. The input data for the metrics: Mean Annual Surface Temperature (MAST), Yearly Amplitude Surface Temperature (YAST) (Bechtel 2012) and Principle Component Analysis (PCA) are listed in the table below (Tab. 1) and were computed within ArcGIS.

	Apr. 2008 (Night)	Aug. 2001	Oct. 2000	Apr. 2000	Jan. 2000	Aug. 1999
MAST	x	x	x	x	x	x
YAST/PCA		x	x	x	x	x

Tab. 1: Input data for LST metrics

5 RESULTS AND DISCUSSION

The classification of Cologne into six different land cover classes is illustrated in figure 3. Buidling objects differ within the study area from compact block development with sparse vegetation in the CBD area (Central Business District) to open block and row development with higher amount on vegetation in suburban settlements and detached houses in periphery zones. The validation of the object based land cover classification achieved an overall accuracy of 91.33 % with user and producer accuracies ranging between 78 to 100 %, where the classes Building, Water and Bare Soil stand out with high accuracy values whereas areas classified as Impervious were characterezied with lower accucary results. Similar validation results of land cover classifications with object based methods also published Wurm et al. (2009) for Cologne and Dinis et al. (2010) for a study site in Lisbon with overall accuracies of 90.12 % and 87 %. Misclassifications occurred between Bare Soil and Impervious classes especially in industrial areas or between Impervious areas and Water in shaded areas on bridges and harbour areas. In the latter case, the Quadtree segmentation caused rough quadratic objects in shaded water areas, which could not be correctly classified because Brightness values do not match the defined classification parameters. The same situtation arose along shore areas, where overlaps of Bare Soil occurred. An improvement of the classification result can be associated with high site specific adjustment of the ruleset.

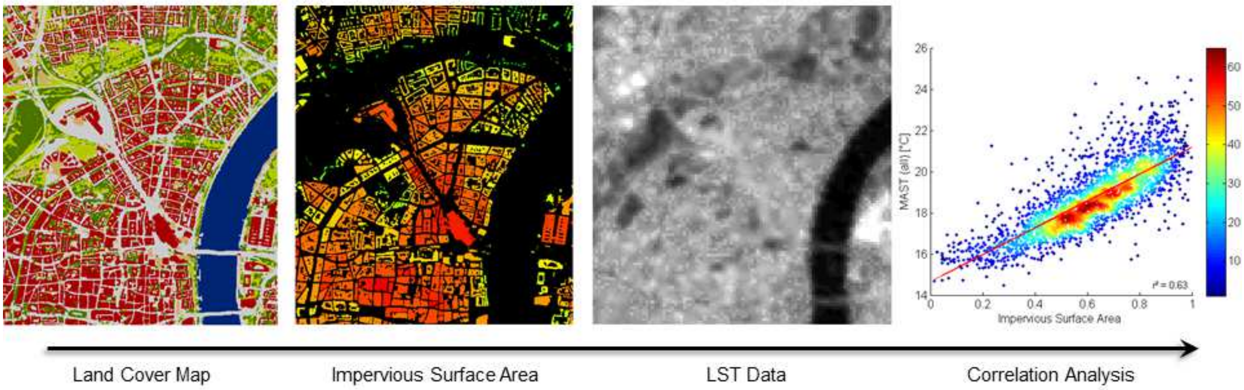

Fig. 3: schematic representation of interim results and final correlation diagram

The results of the urban indices were analysed in terms of spatial distribution and concerning their relationship to LST. In contrast to UD, ISA, UVI and VV2BV do not only indicate a radial behaviour, they also highlight industrial areas and settlements in peripheral regions with high values, indicating urban density. Whereas, using UD and BA only the CBD area is presented with high values with increasing distance UD decreases. The following table 2 summarizes all correlation results of urban density indices and LST metrics. Besides an examination of significance was applied, which confirm the significance of the correlation. The highest correlation results were achieved using the mean value of all LST datasets, MAST or single LST data, recorded between spring and autumn and the two-dimensional indices ISA and VF.

	UD	ISA	VF	BA	VV2BV	UVI	iFAR
MAST	0.69	0.79	-0.82	0.40	-0.77	-0.78	-0.30
YAST	0.50	0.63	-0.67	0.23	-0.62	-0.62	-0.15
PCA	0.62	0.75	-0.78	0.32	-0.73	-0.73	-0.22

Tab. 2: Correlation Matrix of urban density indices and LST

Considering the different land use classes, nearly no correlation was shown for the city area. Only 31 block objects and a very narrow range of indicator values might be the reasons for those results. Whereas, the settlement regions like block and row development, single houses and allotments achieved satisfying correlation results.

6 CONCLUSION

The analysis of different urban indices demonstrate, that three-dimensional indicators could not improve the relationship to LST. Moreover, simple ratios of urban green or impervious areas to the AOI are most suitable to achieve the best correlation results. The UVI and VV2BV indices work like ISA and VF and also consider volume information. Thus, their correlation results are similar to the two-dimensional ones. A mean value of a LST time series could also lead to improvments in this context. Future work will focus on multiple regression models, which might be a better approach to describe the characteristics of LST in urban environments than linear anlyses.

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Art Can (Not) Save The World, You Can – Towards a Better Understanding of Art as Collaborative Action within the Process of Urban and Regional Planning

Claudia Gerhäusser, Markus Jeschaunig, Wolfgang Oeggl

(Dipl. Ing. MA Design Univ. Ass. Claudia Gerhäusser, architect, University of Technology Graz/Think tank oiXplorer, Mariahilferstrasse 30, 8020 Graz, Austria, c.haeusser@googlemail.com)

(Mag. arch. Markus Jeschaunig, artist and founder of Agency in Biosphere/Think tank oiXplorer Graz, Mariahilferstrasse 30, 8020 Graz, Austria, studio@agencyinbiosphere.com)

(Mag. phil. Wolfgang Oeggl, philosopher, based in Graz/Think tank oiXplorer Graz, Mariahilferstrasse 30, 8020 Graz, Austria, dukepages@hotmail.com)

1 ABSTRACT

The region of Eisenerz in the heart of Austria is currently in a state of post-industrial structural change. Migration, abandoned structures, vacancies and shrinking are displacing the centuries-long iron industry boom.

During the Rostfest 2012, an annual art and culture festival that focuses on regional development impacts, the art installation “re-light Eisenerz” was staged in the form of a do-it-yourself water power plant. The energy it generated was used to light an abandoned 18th-century building using LED technology. This joyful project started a dynamic public participation process on the topics of renewable energy production and future cityscapes. It created new perspectives on the city’s resources and a resilient image for the broader region.

The team of oiXplorer[1] is moderating this ongoing art-driven process. Together with local initiatives and citizens the group is currently working on the realization of a prototype, using innovative waterpower technology (gravitation water vortex power plant). The micro-implementation will power the local grid of streetlights and revitalize the vanished industrial water infrastructure of Eisenerz. In this sense, water makes light and light makes community.

In this paper we will, based on our own experiences, discuss the role of art practice related to planning culture. We pose the question of whether art does not replace urban development, but stimulates and pushes it to the next level. The artist might dig it out, but we all make it happen.

2 INTRODUCTION

Since the beginning of humankind, art has played a significant role in life and is undeniably connected with the way we communicate with each other and our environment. Each culture developed various kinds of artistic practice as part of its spirituality, for example in order to appease their ancestors and nature. Art is seldom used for economic purpose and goes beyond the mere expectations of function. It seems to be the last “open field”, not responsible to anyone, independent and not profit-oriented. Does this mean to say that art is the opposite of a capitalist economy? Can artists point out the ways into a more sustainable future? Does art convince decision-makers to follow those ways?

“Kunst thematisiert, kommentiert und verändert Räume. In den besten Fällen definiert und schafft sie neue Orte.” ["Art deals with, comments on and changes spaces. Sometimes it even defines and creates new places.“] (Claudia Büttner, 2013. p.139.).

Following this notion of art, we find the question as to how arts-based experimental work and engagement reshape cities or regions in the long term? The case of an art project in Eisenerz gives an insight into the process of the reinterpretation and redesign of public space. It shows the advantages and disadvantages of this approach to reinventing spaces by a non-planning process. This reveals findings about the critical role of artists within cities and society

[1] About oiXplorer: The name is a word creation from English "explore" research and Greek "oikos", the house, from which later "ecology" and "economy" arised. oiXplorer stands for an independent and open art collective, trying to decipher ecological and economic systems to comment and act. The think-tank & Do-tank was found by Markus Jeschaunig (artist), Claudia Gerhäusser (architect) and Wolfgang Oeggl (philosopher) in 2012, based in Graz. Since than oiXplorer realized already several projects in public space. The Arc de Triomphe has been awarded with the environmental award of the city of Graz. www.oixplorer.blogspot.co.at

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3 ECONOMY, POLITICS AND SOCIETY: ABOUT THE QUESTION OF DEMOCRATICRESPONSIBILITY

Currently we are at a crucial point regarding the interaction between citizens, state and economy. What was thought to be an equalizing system of mutual control is today structuredas a strong vertical hierarchy. Politics are increasingly influenced (and executed) by economy and legal decrees that serve to benefitcompaniesrather than society. Because of the fiscal relief of global enterprises, the financial burden of preserving public institutions and the "state" institution are shifting to the population. The state is increasingly shying away from the responsibility of legally regulating the economic system, leaving the duty of economic survival to the global players – with partly devastating and so far unforeseen consequences for the ecological system and humanity."A primary concern of the original eighteenth-century formulations of free-market economic doctrines by Adam Smith and others was to disentangle the political world and private entrepreneurs from each other, combating in particular the granting monopolies and contracts to court favourites." (Colin Crouch: Post-Democracy. Cambridge, 2004. p. 51.)

After more than 200 years of fighting for equality and democratic rights of participation, we are heading again towards a class society. While the citizens have to carry the main part of the fiscal burden, a small elite in important economic positions has gained access to political power. "Its return is one of the most serious symptoms of the move to post-democracy, as the rise of the corporate elite parallels the decline in the vigor of creative democracy." (p. 52.) Though the populace has to bear the financial responsibility for maintaining the public institutions, it is escaping from the responsibility of participating – like the state, which is following the imperative of the proceeding economization of life by privatizing public services and outsourcing the administration of commons such as public space and common property.

3.1 Invisibility as a weapon: about structures and superstructures

Beyond this, the privatization of public services and common properties implicate the concealment of persons in charge and responsibilities. This becomes apparent when it comes to cloudy and stolid decision-making such as interventions in public space. A certain structure of unconsciousness reveals itself in pushing responsibility onto an individual as well as at a governmental-institutional level from which economical decision-makers profit. Democratic structures preserve at the best a superficial (pseudo-) character and politics assume the form of a blatant spectacle by focusing on short-term goals and headlines instead of contentual information and democratic decision-findings about economical processes such as free trade agreements. The economic system creates an unclear or even invisible superstructure with free trade agreements such as the GATT, the WTO or recently the TTIP, which is long-term intervention in the ecological system. Thus, the free market system – once planned to guarantee the diversity of enterprises and unfolding of individuals – becomes the demiurge of consumers unable to criticize, who are largely unaware of their individual needs. Consumption without information means irresponsibility. The globalization of the market also implies a concealment of relations, origins and ways (including ways of transportation) of production.

Alternative movements criticizing globalization and with a focus on content-based questions about transparency, inclusion or regionality are not heard by politics and considered to be anti-democratic or anti-global. But, as Donatella Della Porta puts it, they are more “new global” than “anti-global” – trying to find alternatives to the neo-liberalistic globalization that concentrate on the future of democracy and sustainable forms of the ecological bases of human life – and deserve to gain critical attention. „Wenn die Demokratie wirklich funktionieren soll, muß zwischen diesen Anforderungen ein Gleichgewicht hergestellt werden. […] Heute gilt es, den globalen Finanzkapitalismus einzudämmen. Doch wer dies auf der globalen Ebene fordert, verlangt Unmögliches. Der Rahmen internationaler Steuerung, der durch die WTO, die OECD, den Internationalen Währungsfonds (IMF) und – für uns Europäer – durch die Europäische Union vorgegeben wird, bewegt sich genau in die entgegengesetzte Richtung.“ (Colin Crouch, 2008, p..134f.) [If democracy really should happen there has to be a balance between these needs...Currently it is necessary to embank financial capitalism. But demanding on this level means claiming the impossible. The frame for international governance that is set by the WTO, OECD, IMF and – for us as Europeans – by the European Union is moving in the opposite direction.]

4 CREATIVITY AND CRITICAL FACULTY AS ACTION-ORIENTED ANSWER AN ACTION-ORIENTED ANSWER

The French philosopher Bernard Stiegler approaches the problem of the commercial cannibalization of all spheres of life in the course of globalization from the aspect of responsibility. In his disillusioning finding of the current social state of mind, he criticizes the attitude towards responsibility of adults who – in the absence of their own beliefs – foist their children's education off on an educational system that is infiltrated by consumption-oriented mass technologies. Proponents of the capitalist system argue that access to the educational system is – apart from economic growth – one of the great achievements of neo-liberalism. But education does not guarantee a critical faculty – that becomes apparent in the social desolidarization and the uncritical preservation of a system that endangers the future of the natural resources for the following generations.

The unrestrained consumption of the fun society is the enemy of creativity. This does not mean artistic creativity, but creative thinking in general. To obtain a critical faculty, a personal point of view is required that is based on the creation of a self-image. The autonomous ability to act (and with this alsoresponsibility) assumes creative thinking that is spatialized through the action and as a consequence becomes responsibility. Marketing machineries and mass technologies aim exactly at this point: before one comes to the creation of a self-image (self-determination, autonomy), heteronomy starts to guide the desire. Desire (as the French psychoanalyst Jacques Lacan says) is unconscious of its object – it first has to create it. But if the advertising industries work on controlling our desires (and not the wishes resulting from it), we never come into the situation to intervene creatively in our environment – and as a consequence we are losing our responsibility and the achievements of the Enlightenment. The lifeworld we live in is an expression of our ability to symbolize and of technical-technological achievements. This isprecisely why we have the possibility to co-create the world and why we achieve improvements – and why we are not biologically and/or culturally determined living beings.

4.1 Art as remedy?

Art cares increasingly about the education of the mind, since educational institutions (including universities) have made it their business to ensure a frictional cycle and supply on every educational level for preserving the system(even educational institutions – especially universities and colleges – increasingly depend on private research funds). The artist has the option to act with a particular independence and impartiality, because artistic work – with a few exceptions – still is an uneconomised field. In this sense, art is a field of experimentation under laboratory conditions, where it is possible to try out new sceneries and to reveal invisible, unconscious processes. Under these conditions, art must ignore social conventions and legal acts to create a new mental world made of ingredients that build our realities to serve (the) unquestioned for public interest. Dialecticallyopposing the current system (and dialectical knowledge always needs a counterpart) can initiate negotiations about the reality as a common, public good – that is exactly what is meant by responsibility and democracy.

5 FROM THEORY TO PRACTICE – THE EXAMPLE

"In immerwährender Bewegung wandeln die Wasser aus den tiefsten Tiefen der Meere zu den höchsten Gipfeln der Berge, wobei sie die Natur des Schweren missachten; … Wenn das Wasser aus einer geplatzten Ader der Erde heraustritt, folgt es der Natur der anderen Dinge, die schwerer sind als Luft, und strebt deswegen immer nach den tiefer gelegenen Orten." [With endless movement the waters shift from the deepest depths of the oceans to the highest heights of the mountains, whilst not respecting the nature of gravity; … if water bulges form the burst veins of earth, it follows other guidance, heavier than air, and longs therefore always towards the lower sites.] Leonardo da Vinci, Leicester Codex (Marianne Schneider, 1996. p.7.)

"Re-Light Eisenerz" is an artproject that demonstrates a critical approach towards our environmental reality. It is not dominated by the common regulations of public life and properties. This temporary artproject was realizedwithout the need to compromise. It became an enriching experience in terms of directdemocracy, by integrating specific location characteristics, the direct environment and by cooperating with local citizens. The visualization of the sources of water and electric energy – everyday energy resources – created points of identification for locals and visitors

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5.1 Town of Eisenerz – post-industrial change

In the near future, Eisenerz will change into a post-industrial and almost post-democratic region. Migration, abandoned structures, vacancies and shrinking are displacing the centuries-long iron industry boom.

5.2 Demographic change in the region

Formerly the heart of Austrian industry, Eisenerz changed with globalization and the technical optimization of economy. Although the average amount of mined iron stayed nearly the same, less man-power is needed nowadays. Since the middle of the 20th century, Eisenerz has therefore shrunk dramatically – from a peek of 13000 in 1950 to around 4800 today. At 52 years, Eisenerz has – beside its neighboring town Vordernberg – the highest average age in Austria. Those facts are a result of more than 40 years of the process of decline in Eisenerz. (cf. W. Nussmüller, R. Pichler, R. Rosegger, 2006. p.4.)

5.3 Situation in Eisenerz today

Eisenerz is located on a high plateau within the lower parts of the Alps, in the middle of the Styrian mountain region, with mountains of 2200 m height. It lies at the foot of the impressive iron-mountain – the source of some of the best iron ore in Europe. Tourist attractions in the region are the Leopoldsteinersee and the GesäuseNational Park, both very impressive natural landscapes. Besides sports and fossil resources, Eisenerz offers very little other structural potential except for tourist attractions. These branches of the economy are not capable ofcompensating for the lack of jobs and financial hedges caused by the optimized iron ore mining. Without a doubt the topographic situation, the high age of the local population and therefore the low visitor frequency in the town leads to empty shops and streets, the departure of young locals and a very low birthrate. Visible signs are decorated fake shop windows, which convey a non-existing virility on the surface. All other empty windows seem to be blackholes into an unknown future. Eisenerz is a Potemkin place of our times.

5.4 Local challenges

The iron ore reservoirs might last a few decades more, until all economically viablesiderite deposits are depleted. Perspectives like this have turned Eisenerz into the most studied city in Austria. Investors, universities, students, experts in tourism or in sociology, environmental planners and even scientists of future have come to study Eisenerz and suggest ways out of the growing crisis. „Der Großteil der Studien befasst sich mit dem zentralen Paradigma des Wirtschaftswachstum, als Garant für soziale Kohärenz: der Wirtschaftsstandort als möglicher Motor der Bevölkerungsentwicklung.“[Most of the studies deal with the central paradigm of economical growth as a guarantee for social coherency: business location as a potential engine of population development] (W. Nussmüller, R. Pichler, R. Rosegger, 2006. p.5.) Meanwhile it is generallyacknowledged that conventional approaches of planning, data interpretations and prognoses of growing will not work with the structures of such destabilized cities.

5.5 Global challenges

Statistics about climate change, about the increased and excessive shortage of resources and the worldwide lack of commitment to reducing national and global energy consumption are no secret at all. Companies with a focus on economic growth and fossil-based industries seem to be expanding even further. The lifestyle of western society is still seen as ideal and serves as inspiration for fast-growing regions in the world. Technical innovations support the development of new-regenerative energy sources or they optimize the efficiency of existing ones. In the context of a growing worldpopulation, it is surprisingly hard to convey the need to reduce energy consumption, to offer solid living conditions to more of us and to following generations. Within a comparably short period of time, changes in our living conditions and environments will force us to turn around and to change direction.

At the beginning of the Anthropocene, we face changes in global structures such as the demand for power, our working conditions and production processes. In the eyes of Harald Welzer, we are challenged to “...ein historisch ungeheuer erfolgeiches gesellschaftliches Modell so umzubauen, dass wir die zentralen Errungenschaften bewahren und zugleich den Ressourcenverbrauch radikal absenken, [darum]kommen wir um die Erkenntnis nicht herum, dass die Transformation der Gesellschaft unweigerlich die Transformation unseres eigenen Lebens ist: ...die Veränderung der konkreten Praxis, also die Veränderung der Mobilität, der

Ernährung, des Arbeitens, der Freizeit, des Wohnens…”[…transform a historic and very successful model of society in such a way that we will not lose its central achievements yet still radically reduce energyconsumption. Thus we are confronted with the finding that the transformation of society will inevitable transform our lives: …the change of practice, thus the change of mobility, of diet, of labor, leisure time, of housing…] (Harald Welzer, 2013. p.131.)

Because of the world’s growing population, shrinking processes seem very abstract and paradoxical. Individual and place-specific solutions on a micro-level have emerged as effective methods for dealing with the situation. That implies for Eisenerz – being representative of places of demographic change – reduction and loss instead of growth and development should be the focus.

5.6 Overcoming Rost – What comes after shrinking?

What kinds of options are suitable for those places? Can the spiral of shrinking find an end? Could re-branding of the region be an answer? Could one see shrinking as a concept, and force the de-building towards lower infrastructural costs and to densify social networks? Could art-based strategies help to find suitable ways for dealing with the situation?

5.7 Initiatives and Agencies in Eisenerz

Beside investments in established branches such as mining, tourism and sports – for example new investments in the Nordic ski-jumping hill and training center – plans for some extraordinary and internationally substantial tunneling research facilities are on their way.

In Vordernberg – a neighboring town – a center for immigration detainees pending deportation was built, whose location has been discussed and shifted for years all over Austria.

Smaller private protagonists reflect the regions identity. The Erzbergbräu, the first private brewery and bar-on-demand, was the idea of an Eisenerz-born IT-developer who lives part-time in Vienna. It is an important place for the city’s social life.

Cultural input comes with the eventseries „eisenerZ*ART“, which offers a regional cultural program and works with the city’s rich historic past and the impressive geographical environment. Projects like a montaneperformance with Caterpillars and Dancers in the iron ore mine are part of the program and there are screenings of historic documentations about traditional iron mining.

In 2012 the “Rostfest” took place in Eisenerz for the first time. It aims to combine a festival with urban and regional development

5.7.1 “Rostfest" – between festival and urban development

Like a musicfestival or similar to the raveparties of the 1990s, which occupied abandoned locations temporarily, the Rostfest aims to revitalize the “rusted” city. The aim is to generate sustainable impulses in an understandable and approachable way. “Das Rostfest will die Stadt am Fuße des Erzberges nicht als Kulisse nützen. Vielmehr wird das Rostfest mit den Eisenerzerinnen und Eisenerzern gefeiert”, [The Rostfest doesn’t want to use the city at the bottom of the Erzberg as a kind of movie-set. Primarily it is celebrated together with the locals], according to the Rostfest organisers. Urban camping in empty apartments, concerts in an abandoned dance location, Heavy-Metalmorning-beer together with the local Metal-Label or cake and coffee with the regional hunter-ladies are some of the events around the Rostfest. International and regional artists have been invited to work with the public space in the city and to exhibit in the empty but historically valuable Fisikatenhaus. The local bars and restaurants are integrated into the program with a nightline and extra events. As a mixture of block party and city-experiment, it is an extraordinary event of celebration. With the potential of the local economy and companies and the temporary use of open or empty spaces within the city, visitors from Vienna, Graz and all of Austria come to Eisenerz – at least once a year, for a few days.

6 ART PROJECT "RE-LIGHT EISENERZ" – PHASE ONE

For the first time, oiXplorer became active players in Eisenerz with their art-project “Re-light Eisenerz” within the context of the Rostfest 2012.

6.1 oiXplorer

The oiXplorer team works with the following background: It seeks to bring the two divergent systems of economy and ecologycloser together. Infinite growth is unrealistic in a world of limited resources. The import of fossil energy is not an option, because of those limitations. Regional and regenerative energy production is therefore necessary to cover the world's energy demands. Each of us is responsible for becoming part of this transition. Decentralized energy production systems should be structure-focused and aesthetically integrated into our urban and rural environments.

6.2 Initial situation of "re-light Eisenerz"

oiXplorer raised the question of how to visualize - by artistic strategies - new potentials of the structurally altered town of Eisenerz. They started with the abandoned building of the Fisikatenhaus, which was lacking electricity, but offered a vibrant stream with waterfalls in its backyard: the Trofengbach. Besides the mining of iron ore, the power of the city's streams were identified by this, as sustainable but long forgotten. oiXplorer's answer came as a temporary light installation made from recycled materials. It used the Trofengbach to generate the missing power (electric energy). Local craftsmen, stakeholders and neighbors were mobilized at the Rostfest to help to illuminate the 18th-century building for three days.

Applied resources: water – Trofengbach; wood, truck & drill – local spatial decorating firm; waterwheel & generator; food – farm shop; welding work – mechanic on site; V-Belts – vacancy; bicycles – Loan of municipal lost property office; Know How & timber formwork – carpenter from neighborhood;

In this setting, a construction carpenter met with festival people to build the structure together. Mutual help, enthusiasm for the idea of producing electricity and improvisation skills were substantial for the project. Neighbors watching the event told stories about the history of the place. They also discussed their ideas about renewable energy and its implementation in their town. A rush of knowledge, actions and experiences of collaboration among citizens were developed – the principal of shared work thematized and intensified the topic of identification with the place for all projectparticipants. Awareness of the formerly abandoned spatial resource was created as well, as citizens showed their commitment in supporting ideas and developments that bring visible change. Intuitively (with only basic knowledge about the local situation) people took advantage together of something that has been present in Eisenerz for a long time –hydropower. Old types of blast furnaces, mills, tanneries and farms used only water power and dominated the visual and audible cityscape. Although these wheels and buildings have disappeared, the old infrastructure of waterfalls, barrages and flooders still exist in the streams.

The relatively small, unbiased project evolved into a dynamic process of natural and direct participation on the topic of renewable energies and future urbanity. Surprisingly quickly, neighbors and residents accessed the idea of installing an "inner-city water power plant" in Eisenerz. In this sense, oiXplorer had used an art project to create a future vision, and inspired further ideas

7 FROM THE ART INSTALLATION TO A COMMUNAL LIGHT PROJECT – PHASE TWO

During the festival of Rostfest the question was raised as to whether the Trofengbach could regain its old function and in the long run serve as an economic hydropower site, as well the question as to whether and how such a plant could be financed as a common project and build "citizen power plant Trofengbach"? How can one implement decentralized energy production in areas of inhabited urban space? A further task had been raised: How can a short-term temporary art installation be transformed into a project with a long-term horizon?

At the Rostfest, the idea was proposed of using the Trofengbach in its old function as sustainable waterpower and an economicallyviable site. How could one do that today? How would such a civic power plant be funded, how would it be built? In general, it is a question of how to implement sites of energy production in residential housing areas and historic city centers. With these questions, the next step in the project process became tangible: How could one turn a temporary artproject into a communal project with long-term perspectives?

7.1 Short-term and long-term perspectives

Austria is the country with the third largest hydropower potential in Europe. From a long-term perspective the implementation and reactivation of waterpower in the historic town of Eisenerz is conceivable. Since the project is not meant to be transferred to third parties (external planners), oiXplorer started working on an alternative process. This is time-consuming, but the strength of it lies in the interaction of all participants. It seemed to be easier to initiate the renegotiation of commons (public property) and their management in this way, rather than going the established way of planning and top-down implementations.

7.2 Technical innovation: Gravitation water vortex power plant (GWVPP)

The company Zotlöterer has developed a small but innovative hydropower technology. The "Gravitation water vortex power plant" is a vertical turbine type in an open and circular basin, propelled by the water's current. Small altitude differences, simple implementation and ecological fish permeability are key advantages for a wide range of applications. The first completed projects have shown that small organisms and fish even like to settle at the pool's edges because the water swirl increases the concentration of oxygen and provides appropriate microclimates. In this way already regulated streams can be upgraded to a higher ecological category by supplementing several swirls. Thus the basins along the riverbanks bring back the positive ecological effects of the - largely vanished - former meandered rivers

7.3 Advantages of an energy sculpture

Public lighting is a medium that is available to all residents on a daily basis. The principle idea of an energy sculpture is to sensitize the public by experiencing waterpower and visualizing energy quantities. Compared with conventional systems, gravitation water vortex technology does not cover the moving mechanical parts. Showing the motion and transformation from water to power through an engaging light-installation in the middle of the city center changes energy into something that we are able to perceive with our senses.

Most important in communicating the concept of this energy sculpture is the visibility of the turbine. The visibility of energy production is substantial to a coherent promotion of decentralized and self-sufficient energy supply systems. A small hydropower plant can be integrated into the urban fabric and "revitalize" old streams. The historic town merges with an innovation of the ecological future.

7.4 Aesthetic Innovation: Designing a communal light-project

New power for Eisenerz: The greenelectricityprovided directly powers the public streetlights. It becomes visible in the form of a characteristic light mood. During the day, the power generated will be fed into the public electricity network. In the evening "re-Lights" (specially designed street lamps) illuminate public spaces in the town center in a soft light color. The stronger the force of the water actually is, the more re-Lights light up and increase the light radius in the city (idea: Light as amplifier in public space). Some design component indicate whether the respective lamp takes power straight from waterpower or from the public grid.

7.5 Prosumer – Citizens become producers

The projectdesign involves citizens - financially, with their own labor, with material or knowledge. The do-it-yourselfenergy leads from passive consumers to active producers. The operation of the hydropower plant could be administered in the form of an energy cooperative. Seeing and experiencing day-by-day one's own achievement creates awareness of energy amounts and power consumption

8 PROCESS EXPERIENCES

After the clear artistic impulse, the conventionalapproach to planning was considered in order to implement the vision. A lack of knowledge about alternatives became the driving force for further steps in the process. In a team, two by two, experts and administrative institutions were visited in order to integrate them into the process. Always focused on a holistic understanding of the project and on the aim of including ecological, technological and design aspects, subsequent decisions about contacts and what to do (e.g. on an authorization level), were developed gradually. This kept the process open for the unexpected and flexible for feedback, on one hand. On the other hand, this way of working kept stalling because some steps proved to be not helpful or a failure. After an investigative phase it turned out that none of the residents were involved any more. Does thiscall the approach into question? Basically, the moderation is still in the hands of oiXplorer. Meanwhile, a constant back and forth between lively network and sporadic work arose.

General insecurity arises from the financing/funding situation. Market value and investor interests had been tested during the application procedure for an economic start-up grant. It became apparent that for a promotion at this level a different project orientation and status are necessary. It also became clear that by building trust within a business development, the countable benefits are substantial.In the work on site, no such profit calculations were necessary. Basically this dilemma confronts oiXplorer with the need to promote themselves and to create a visible market value. This is in contradiction to their social demands.

Those process experiences increased the discussion about values. Why is it difficult to explain that light, visible/available to anybody, can work as an economic alternative currency and why is it complicated to convey that there is no wish for a prime investor?

9 SOCIETY, ART AND PLANNING

“The artist shows the unknown with the known” (Friedrich Kiesler). The role of artpractice related to planning culture needs to be discussed based on our own experiences. We pose the question as to whether art, instead of replacing urban development, stimulates it and pushes it to the next level. The artist might dig it out and act as an explorer.

9.1 Artists as independent players - how does that work?

Mainly by spending time on site and by approaching locals in the “Re-Light Eisenerz” project, water as a formerly common source of energy was rediscovered. The way oiXplorer approached the situation and the Eisenerz residents, we would now say, was the key to all following developments. OiXplorer started to implement a clear concept of a small do-it-yourself water-plant without any further concerns: visible facts were safely established. Because it was art creation, some major difficulties in planning and some of the bureaucratic regulations could be temporarily taken out of consideration. A faster workflow and a more open realization procedure only by “doing” were established. This led to rapid mode of operation in which decisions could be taken directly during the realization (implementation) - without complicated planning in advance. In that sense, oiXplorer made visible a different idea of commons, ownership and common ground. People in the town suddenly had points of connection with which to approach us, to help out with materials, their own expertise and infrastructure, such as tools or transportation. Collaboration was supported (not forced) and grew into an open but multi-layered network, which turned out to be more viable and stable than the art installation itself. Muf, a London-based studio, uses similar strategies to redevelop and redefine destabilized areas of British Labor settlements: “The Relationship: Paradoxically, in order to make the thing, the collaboration has to be about the making of the relationship rather about the object.” (muf, 2000)

The power of artists lies in their independence and their time and creative hands-on mentality. They need to receive economic forces like money, materials, labor or technical expertise from others. In Eisenerz oiXplorer has been able to engage others to contribute with those resources. They work like agencies instead of being artists working more or less isolated on their own oeuvre.

Artist’s force: time without money

Investor’s force: money without time

Communal force: management, negotiation experiences and conflict management

10 REFLECTION & CONCLUSION

“Das Konzept der Commons:Die Commons können gemeinschaftliche und generationenübergreifende Güter sein, wie Artenvielfalt, Wasser, Atmosphäre, genetische Ressourcen, Boden, Saatgut, Wissen, Ideen, kulturelle Vielfalt usw. […] Sie sind das Netz, das die produktiven, reproduktiven und kreativen Prozesse auf unserem Planeten stützt. Sie sind oder sie beschaffen uns die Mittel, uns zu ernähren, zu kommunizieren, uns zu bilden und uns fort zu bewegen, sie nehmen sogar die Rückstände unseres Konsums auf. Die Vielfältigkeit und Vitalität der Commons stellen den Schlüssel dar, den wir benötigen, um zu Beginn des 21. Jahrhunderts den Veränderungen unserer Zeit entgegentreten zu können.” (Ingrid Spiller, 2009.)

Currently, managing these public properties is more a matter of individual interests than of representing the spirit of commons. Water is a common, nevertheless it is administered by small, elite units. The word "rival"

(Latin: rivus: brook, stream) for example, arose only because mills wanted to use the power of water on the same shore. Because of a lack of distance they mutually held back the waterflow. That situation created the need for legal and independent guidance through the arising conflicts. Administration meant the responsibility to manage conflicts in a fair way. Over time this actual core competence of communal administration got lost in a prevention-oriented bureaucracy of regulations, standards and regulatory requirements.

It would be necessary again to step back and call for a fair handling of diverse interests at administrative levels. New negotiations on the management of commons, whetherthey are water, public space or the urban fabric, would be necessary for this. In particular, it is time to focus on the following questions:

- What participation in existing, ongoing and planning structures looks like?
- What is actually the situation of the relation between planning and democracy?
- Could an artist (or an independently operating individual) overcome to a certain degree the requirements of an administration environment?
- Could one question, recollect or change the legal framework by rejecting it or by "do-not-ask-what-is-legal"?
- Could one raise awareness for legal frameworks, question them and shift them with the action of overcoming them and with the attitude of "non-demands-if-something-is-allowed"?

Fig. 1: View of Eisenerz with Erzberg, 2012 (photo: Alex Koch)

Fig. 2: Re-Light Eisenerz, light-installation with DIY water power plant, Rostfest 2012 (photo: Alex Koch)

Artists can indeed act in this way, because they reveal that criticisable rules are limiting social action. They create interaction, which is simultaneously connective, a dialogue and associative. This may have an effect where legal action would not be authorized anymore. If collaboration and successive tasks have been generated, a process starts, which is supported and controlled by the participation of more than a small ruling elite. The project in Eisenerz is a collaboration that caused changesin the relation between locals and the site. oiXplorer has created reference points where interested people can build on their own skills and ideas. This work happens without general tasks, but specific ones are developed for each of the participants during work. Certainly, the size of the evolving network plays a role. What constitutes a "maximum size" still needs to be identified. Currently, a critical mass has not been reached. It shows as well that one does not want to "save the world", but seeks to change manageable parts of it.

The primarily contribution of an artist in planning processes can be seen in the elaboration of taskfields within a thematic framework. Inspiration (e.g. by the way, how work happens) seems essential for any realization.

Supposing that the artist shows "the unknown with the known", e.g. regarding global challenges, possible solutions for a sustainable future - does that say that the world can be saved? The artist cannot compensate for what society neglects to do. He/she cannot take the role of a "superhero" who saves the life environment before irreparable damage increases. Rather he/she is part of changes. Those cannot happen in isolation, they require the active engagement of anybody - policy-makers, entrepreneurs, politicians and citizens. Together – WE can save the world.

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CentropeMAP – Cross-Border Geoportal with Interactive Cross-Border Statistics Database

Manfred Schrenk, Clemens Beyer

(Dipl.-Ing. Manfred Schrenk, Multimediaplan.at, 2320 Schwechat, Austria, schrenk@multimediaplan.at)
(Dipl.-Ing. Clemens Beyer, Multimediaplan.at, beyer@corp.at)

1 ABSTRACT

Centrope combines several adjacent regions from the neighbouring countries Austria, Czech Republic, Hungary, and Slovakia. CentropeMAP is a cross-border geoportal which brings together geodatasets from all four contries in a single map viewing application. The layer themes are selected in a way that they are of interest for regional planners and similar professions. CentropeSTATISTICS is a cross-border statistics database directly connected to CentropeMAP. It allows interactive creation of user-defined maps, which are visualised in the CentropeMAP geoportal, and charts wich are delivered as graphic files for further use in any other application. To ensure that CentropeMAP and CentropeSTATISTICS are a well-known tool among planning and statistics experts, multi-language newsletters are released twice a year. In the second half of 2015, there will be a complete relaunch of CentropeMAP and CentropeSTATISTICS including a new geoportal software, a visual refreshment of CentropeSTATISTICS, a new user manual and online tool tips for easier use.

2 OVERVIEW

The Centrope region consists of a number of adjacent counties and states along the borders between Austria. the Czech Republic, Hungary, and the Slovak Republic, comprising regions Vysocina, Jihomoravsky, Bratislavsky, Trnavsky, Győr-Moson-Sopron, Burgenland, Lower Austria, and Vienna. It was founded 2003 by a political declaration and aims to strengthen partnership and economy in a region which suffered from the Iron Curtain during the second half of the 20th century.

CentropeMAP is a geoportal connecting the region by collecting web map services from the partner countries. The services are brought together in a single map viewer and allow the user to experience a cross-border working area with dozens of data layers dealing with all topics which could be of interest for regional planners and similar professions. Layers are coming from the fields of biota, boundaries, elevation, imagery/base maps, inland waters, planning/cadastre, structure, and transportation.

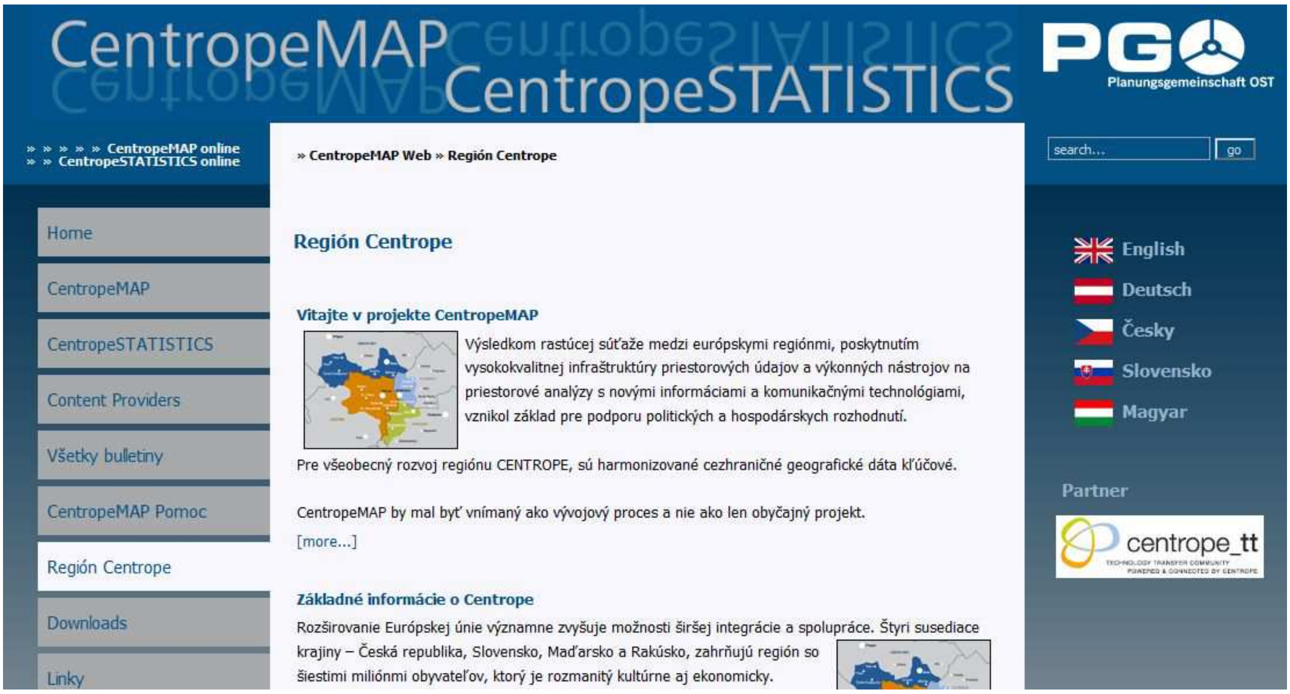

Fig. 1: Multi-language CentropeMAP website (Slovak version).

Initially, the CentropeMAP project started 2004 with postal exchange of CD-ROMs containing shapefiles for use with standard desktop GIS applications. Only two years later, there were already web map servers in all partner countries so that we could start to set up an internet geoportal. In addition, a website in five

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languages was created (Czech, English, German, Hungarian, Slovak) to make sure that the main contents are accessible for anyone in the four countries without a language barrier. However, the standard language of the geoportal itself remains English because here changes happen more often than on the website and there is no budget for continuous and simultaneous translation between all five languages.

Soon after CentropeMAP had been established, the idea came up to integrate statistics layers into the geoportal. First, only static layers were integrated, but soon the idea came up to allow the user to influence the statistic data display mode. Furthermore, the statisticians welcomed the possibility to put together data from four countries in single tables and gave permission to publish not only the map output, but also the numbers behind these graphics. The CentropeSTATISTICS cross-border database was born in the year 2009 and is steadily growing since then. Annual workshops bring together delegations from the statistical offices of Burgenland, Lower Austria, Vienna, the Czech Republic, Hungary, and the Slovak Republic to discuss the further extension of the cross-border statistics database.

3 WHAT MAKES CENTROPESTATISTICS A UNIQUE SERVICE

3.1 General

CentropeSTATISTICS is not the only cross-border statistics database in the world wide web; but at least as far as the involved partner countries are concerned, it is the only available free web tool to visualise cross-border statistical data in its own connected geoportal allowing the user to influence the way of visualisation in multiple ways. CentropeSTATISTICS can not only create maps, it also serves charts which are interactively created from the data in the cross-border database.

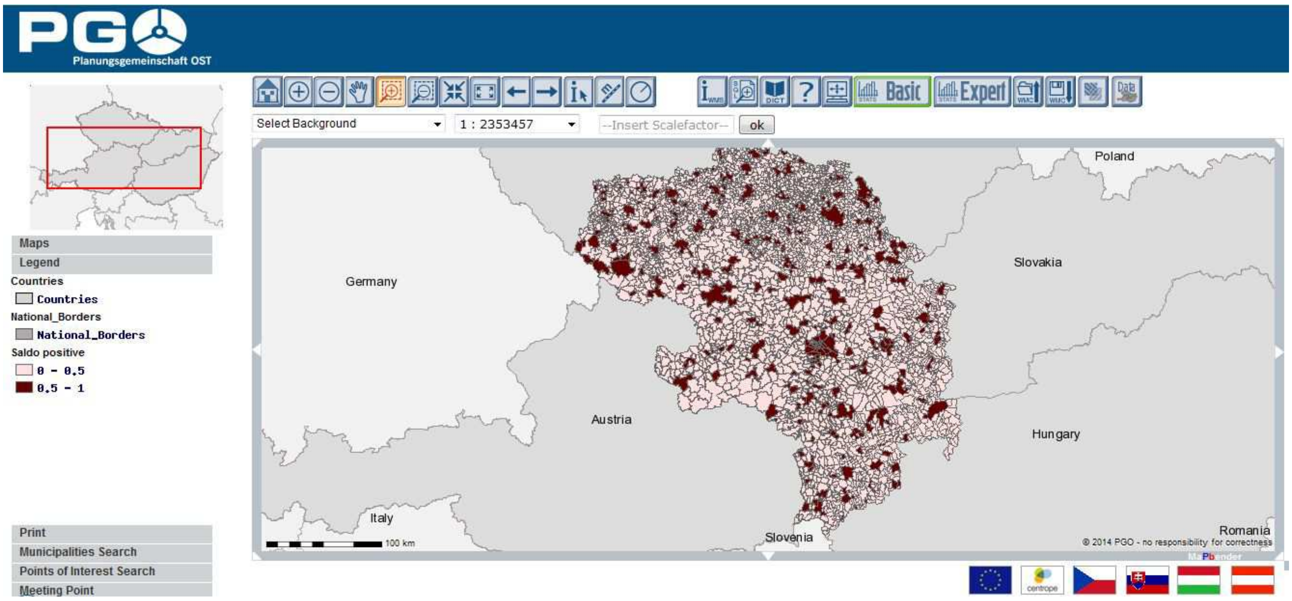

Fig. 2: Example of an interactively created chloroplethic map from census 2011 data showing the commuter saldo per municipality. Municipalities shown in dark red colour have more commuters in than out.

There are two main emphases of data collection: population data and census data. Almost all population datasets in the cross-border statistical database are collected in a time series so that the development of the region can be explored in yearly steps since 2001; the data range comprises various fields like population statistics, population development and projection as well as land use, educational statistics or migration. The census datasets concentrate on the recent 2011 census and go back to previous census dates until 1970/71, calculated according to today’s municipality boundaries so that all data can be compared with each other.

CentropeSTATISTICS provides almost all data on municipality level. An automatic aggregation to NUTS 3 level is also available. CentropeSTATISTICS features two working modes:

(1) The Basic Mode provides pre-defined maps and charts. It serves mainly to gain a quick overview about the most important data about the region and helps people who do not have sufficient experience in working with statistical data. There are no options which can be user-defined (except selection of municipalities for chart creation).

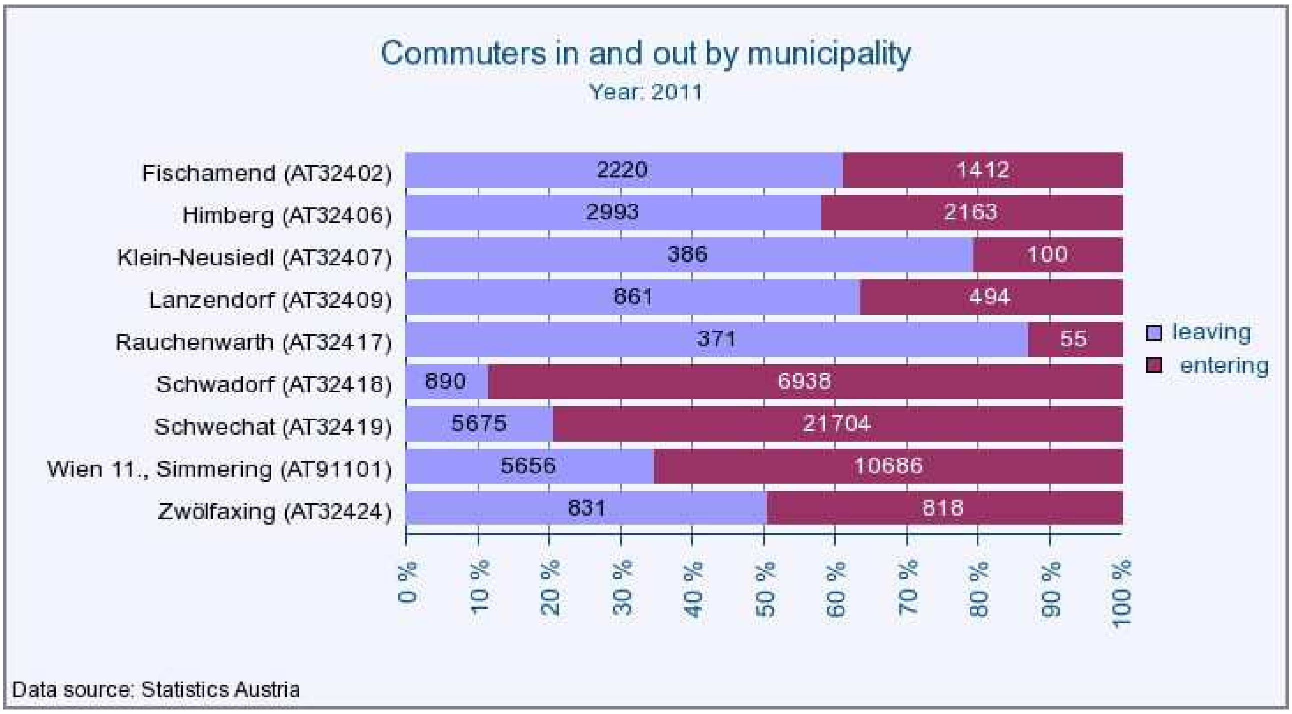

Fig. 3: Example of an interactively created horizontal bar chart from census 2011 data showing the number of commuters leaving and entering municipalities around Schwechat (hometown of Vienna international airport).

(2) The Expert Mode gives direct access to the cross-border statistics database and opens the full range of interactive map and chart creation. It requires some knowledge in statistics, mapping and/or cartography because an unexperienced user could run into danger to create nonsense maps. The expert mode allow creation of standard chloroplethic maps, symbol maps and various types of charts like bar charts, point and/or line charts and pie charts. There is the possibility to create own tables from one or more tables from the cross-border database and/or personal data uploads. With this function, personal data can be used with the CentropeSTATISTICS map and chart interface. When the CentropeMAP and CentropeSTATISTICS relaunch is released in the second half of 2015, a new menu structure will be implemented to the expert mode to clearly distinguish between annual (time series) data and census data.

3.2 Technical details

The main technique behind CentropeSTATISTICS is Styled Layer Desriptor (SLD): The user-defined maps are created through SLD only. The layer containing the geodata for the statistical map has a pre-defined transparent layout so that it is invisible without any attached SLD document (which is the default value when starting CentropeSTATISTICS). As soon as the user creates their own map layer from statistic data, their selections are converted into a SLD document on the CentropeMAP server. The mapview is refreshed then, containing the SLD URL as part of the GetMap request of the statistics layer. Also a timestamp is added to this request. These timestamp characters are ignored by the mapserver, but Mapbender only reloads a layer when the request string has changed, so the timestamp ensures that every GetMap request is different from the one before, causing the client to load the new map on refresh.

4 THE CENTROPEMAP NEWSLETTER

The CentropeMAP newsletter is published twice a year and aims to inform members of state administration and statistical offices about the capabilities of CentropeMAP and CentropeSTATISTICS as well as news from the statistical offices of the partner countries. It also distributes information regarding geodata in the CentropeMAP geoportal. The contents of the newsletter are delivered by all partner countries: Each partner hands in their articles which are then brought together in a commonly layouted PDF document. The PDF is then put online at the CentropeMAP website and the information is spread via internal mailing lists of each partner involved.

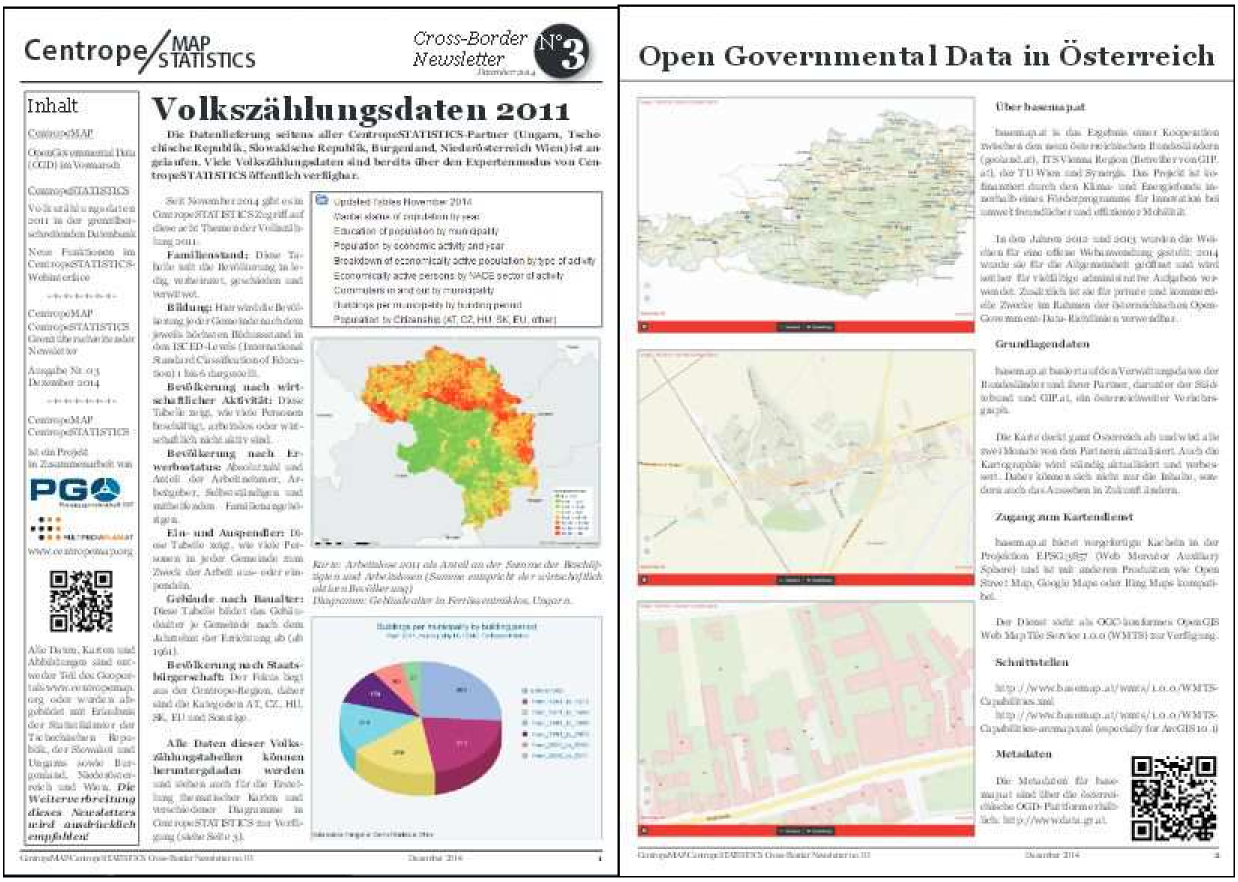
Centrope MAP STATISTICS
Cross-Border Newsletter N°3
Volkszählungsdaten 2011
Open Governmental Data in Österreich

Fig. 4 : CentropeMAP and CentropeSTATISTICS newsletter (German edition, December 2014). Original is available for download at http://www.centropemap.org

The CentropeMAP and CentropeSTATISTICS newsletter is currently available in three languages (Czech, English, German). A Hungarian version is in the state of preparation.

5 PERSPECTIVES

The CentropeMAP geoportal is powered by Mapbender software, a content management system for mapping applications and geodata services. Currently, Mapbender is developing a totally new software bundle called Mapbender 3 which is faster and more powerful than its parent Mapbender 2, which we have currently in use. Progress in technology makes it necessary to have a major software update done this year, so there will be a migration from Mapbender 2 to Mapbender 3 including a graphical relaunch of both CentropeMAP and CentropeSTATISTICS. Also, we will clean up the content: Some changes in the past were added with little coordination so that now there are a few confusing areas in the interactive statistics client. These will be fixed together with the release of an all new manual for CentropeSTATISTICS. Tool tips will be added to allow for context based online help.

6 WEB LINK

CentropeMAP Website http://www.centropemap.org
CentropeMAP and CentropeSTATISTICS Geoportal: http://map.centropemap.org

Crowdmapping – kollaborative Erfassung und Visualisierung räumlicher Daten anhand der Plattform OpenCrowdMaps

Rüdiger Noll, Peter Zeile

(M. Sc. Rüdiger Noll, TU Kaiserslautern – Computergestützte Planungs- und Entwurfsmethoden, Pfaffenbergstraße 95 67663 Kaiserslautern, noll@3d-werkstadt.de)

(Dr.-Ing. Peter Zeile, TU Kaiserslautern – Computergestützte Planungs- und Entwurfsmethoden, Pfaffenbergstraße 95 67663 Kaiserslautern, zeile@rhrk.uni-kl.de)

1 ABSTRACT

„Crowdmapping“ bezeichnet ganz nach dem Slogan „PLAN TOGETHER – RIGHT NOW – OVERALL“ der diesjährigen CORP eine Form des Echtzeit-Crowdsourcings räumlicher Daten anhand von Webmaps und den damit verbundenen Erhebungs-,Visualisierungs- und Auswertungsmöglichkeiten. Es handelt sich um eine subversive Methode, die das vernetzte, kollaborative Arbeiten einer großen, nicht weiter definierten Menschenmenge - der Crowd -, an einer gemeinsamen Thematik ermöglicht.

Es existieren bereits Webanwendungen, die sich den „Wisdom of the Crowds“ zunutze machen, um eine im Optimalfall stets aktuelle und lückenlose Datenerhebung zu gewährleisten. Es zeigt sich jedoch bei genauerer Betrachtung, dass die Crowd oftmals durch unzureichende Methodiken in ihrer Kompetenz beschnitten wird. Die Gründe dafür erweisen sich als vielschichtig. Jeder Anwender sollte bei einer solchen Plattform die gleichen Rechte besitzen und keine Hierarchie innerhalb des Nutzerkreises bestehen, sodass ein jeder im selben Umfang Kontrolle über die Inhalte ausüben kann. Obwohl einige Crowdmapping-Plattformen einem hohen technischen Standard gerecht werden, fehlen stets grundlegende Funktionalitäten, um der Crowd die vollständige Kompetenz über die Inhalte zu gewähren. So erfolgt bei keiner relevanten Anwendung eine Versionierung der Einträge, um mögliche Datenmanipulationen widerrufen zu können. Eine Berücksichtigung des Wiki-Prinzips mit den entsprechenden Funktionalitäten würde demnach einen erheblichen Mehrwert für Crowdmaps bedeuten.

Die Limitationen der bestehenden Anwendungen waren der Anlass für die eigenständige Realisierung der Plattform OpenCrowdMaps. Diese erfährt keine Begrenzung durch ein vorgegebenes Thema mit starrer Kategorisierung. Vielmehr steht es dem Nutzer frei eigene Themenkarten zu generieren und mit der Crowd zu teilen oder an bestehenden Karten mitzuwirken. Die Vision dahinter ist eine sich selbst regulierende Kartendatenbank mit einer Vielzahl umfangreicher Informationen. Erscheint ein Thema für die Crowd unbedeutend, so findet keine umfassende Datenerhebung statt. Die allgemeine Relevanz der Daten regelt sich demnach selbstständig. Die Plattform liefert im aktuellen Entwicklungsstand, neben der Integration des Wiki-Prinzips mit all seinen Ausprägungen, diverse Visualisierungsmöglichkeiten. So können unter anderem die zeitliche Datenentwicklung abgelesen, Heatmaps erzeugt oder die Kartengrundlage gewechselt werden. Es bieten sich demnach im Planungskontext eine Vielzahl von Anwendungsmöglichkeiten.

2 THEMENEINFÜHRUNG

Über das Internet vernetzte Computer bilden in der heutigen Gesellschaft den Mittelpunkt der globalen Kommunikation. Das Medium, mit all seinen Folgetechnologien ermöglichte in nahezu allen Bereichen völlig neue, vorher undenkbare Methodenansätze. Diese, mit dem Computer verbundene, Entwicklungsdynamik darf jedoch zu keinem Zeitpunkt als abgeschlossen angesehen werden. Vielmehr zeigt die zunehmende Verbreitung smarter Technonlogien in sämtlichen Gesellschafts- und Wissensbereichen und die damit einhergehende Fortentwicklung des “Internet der Dinge”, dass es stets neuer, subversiver Denkweisen benötigt um einen Stillstand zu vermeiden (Streich 2014). So haben sich beispielsweise CAD- und GIS-Anwendungen mit ihren Erhebungs-, Darstellungs- und Analysemöglichkeiten in der Planungungspraxis als unverzichtbare Werkzeuge etabliert. Darüber hinaus ist spätetens durch das “Web 2.0” das Internet für den internen Datenaustausch, als Informationskanal zwischen Administration und Bürger sowie als Voraussetzung für sämtliche Formen der E-Partizipation unverzichtbar geworden. Unterstützt wird dies durch die inzwischen massenhafte Verbreitung mobiler Endgeräte, die eine umfassende, nahezu barrierefreie sowie ortsungebundene Verfügbarkeit sämtlicher Informationen des Internets ermöglichen (Exner 2013, S.35). Laien können so bei entsprechender Motivation im Austausch mit Anderen in kürzester Zeit bei spezifischen Thematiken nahezu Expertenwissen erlangen. Es stellt sich für den Planer die Frage, wie dieser „Wisdom of the Crowds“ zugänglich und nutzbar gemacht werden kann, um

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so zukünftige Planugsprozesse zu optimieren. Das hier vorgestellte Paper ist eine Kurzfassung der Arbeit „Crowdmapping - Realisierung einer Plattform für die kollaborative Erfassung und Visualisierung räumlicher Daten“ (Noll 2014), die am Fachgebiet CPE im Rahmen des DFG-Projektes „Urban Emotions“ entstanden ist (Zeile et al. 2014). OpenCrowdMaps stellt einen möglichen Baustein zur Protokollierung von Phänomen der urbanen Wahrnehmung unter dem Stichwort „tagging“ dar (vgl. hierzu Dörrzapf et al. 2015).

3 CROWDMAPPING

Beim “Crowdmapping” handelt es sich um einen Neologismus, welcher das generieren räumlicher Daten durch einen Crowdsourcingprozess beschreibt. Das Wissen der Crowd, einer nicht genauer zu differenzierenden Personengruppe, soll dabei in einer Karte zusammengetragen werden. Bei der Crowd handelt es sich demnach um eine offene und untereinander vernetzte Personengruppe, die sich einer freiwilligen Aufgabe widmet, an der es prinzipell jedem freisteht mitzuwirken (Streich 2014, S.104). Das grundlegende Prinzip des Crowdmappings ist also denkbar einfach und leicht verständlich. Eine, über das Internet, vernetzte Gruppe an Menschen erarbeitet gemeinsam Inhalte einer spezifischen Themenkarte. Diese sind im Web frei verfügbar und können von Interessierten eingesehen, ergänzt und im besten Fall editiert werden.

Abb. 1: Funktionsweise des Crowdmappings (Crowdmap.com)

Beim Crowdmapping handelt es sich um eine vom Mainstream der Planung abweichende, subversive Datenerhebungsmethode. Die Daten der Crowd können mit ihrer Dynamik in kürzester Zeit eine Quantität und Qualität in Verbindung mit stetiger Aktualität aufweisen, die von einzelnen Städten, Behörden oder Institutionen im vergleichbaren Umfang nicht zu leisten ist. Eine umfangreiche, öffentliche Beteiligung auf freiwilliger Basis ist hierbei jedoch Grundvorraussetzung. Crowdmapping ist überall dort denkbar, wo bereits eine Community, die sich einem bestimmten Thema widmet, existiert oder eine solche entstehen könnte (siehe Abb. 1). Es erfolgt demnach durch eine Gruppe von Interessierten und Experten ein räumliches Monitoring zu bestimmten, selbstdefinierten Thematiken. Diese Informationen können unter Umständen schon heute für Planungen von großer Relevanz sein oder es aber zukünftig werden. Eine solche Bedeutung wurde jedoch vom Planer möglicherweise noch nicht festgestellt. Diese kann letztendlich durch eine breite, öffentliche Beteiligung an der Erhebung sowie eine entsprechende Analyse und Interpretation der Daten aufgezeigt werden.

Es existieren diverse Webanwendungen die diesem Grundprinzip folgen. Diese weisen jedoch durchweg methodische oder funktionale Defizite auf, die den kollaborativen und offenen Charakter, den eine Crowdmappingplattform besitzen sollte, teils stark einschränken. Die größte Limitation erfolgt in der Regel durch die Administration der Inhalte. Diese stellt zwar die Datenqualität sicher, führt aber unter Umständen zu einer ungerechtfertigten Zensur. Einträge sind in diesem Fall entweder erst nach vorangestellter Überprüfung durch Administratoren sichtbar oder der Funktionsumfang wird bis zur Freigabe durch ebendiese begrenzt. Eine Ausnahme bildet die Plattform Wheelmap, die der Bewertung der Barrierefreiheit von öffentlichen Orten dient. Jedem Besucher der Seite ist es, auch ohne Regestierung, möglich sämtlich

Inhalte des Datenbestandes zu manipulieren. An dieser Stelle wäre ein "Logbuch" von Nöten, um die prinzipielle Möglichkeit zu bieten Einträge auf einen alten Stand zurückzusetzen.

Wird dieser Gedanke weitergeführt bedeutet die Integration des Wiki-Prinzips, wie bei anderen kollaborativen Plattformen üblich, einen erheblichen Mehrwert für das Crowdmapping. Die Administration der Inhalte könnte so nahezu vollständig durch die Crowd gewährleistet werden. Diesem Ansatz folgend müssen zum einen funktionale, aber auch psychosoziale Prinzipien beachtet werden (Moskaliuk 2008, S.17ff). Die funktionalen Aspekte umfassen dabei unter anderem die Visionierung von Einträgen, also ein, wie im vorangegangenen Absatz beschriebenes, "Logbuch". Des Weiteren muss ein einfaches und schnelles editieren für jeden Nutzer möglich sein. Der Fokus liegt demnach auf dem kooperativen Produkt der Crowd und nicht auf dem Werk des Einzelnen. Zudem werden spezielle Anforderungen an die Skalierbarkeit des Systems gestellt. Dies bezieht sich sowohl auf die Anzahl der verfügbaren Funktionen als auch auf den Umfang der Einträge und die Nutzerzahlen. Die psychosozialen Anforderungen umfassen die bereits angesprochene Offenheit, die Selbstorganisation und die Autonomie einer solchen Plattform. Dies bedeutet das keine formellen Rollen bestehen und somit alle Nutzer die gleichen Rechte, Pflichten und Möglichkeiten besitzen und die Crowd gemeinsam für die Qualität und Quantität der Daten verantwortlich ist. Dabei erfolgt die Mitarbeit an den Inhalten und der Umfang ebendieser stets auf freiwilliger Basis (Moskaliuk, Kinnerle 2008, S. 3f).

Weiterer Kritikpunkt an bestehenden Anwendungen ist die Geschlossenheit der Systeme. So sind die Daten bei der Betrachtung und Analyse auf die Funktionalitäten der entsprechenden Plattform beschränkt. Das Produkt der Crowd sollte ebendieser durch die Intergration einer Möglichkeit des Datenexportes zur Verfügung gestellt werden. Voraussetzung dafür ist, dass keine kommerziellen Interessen des Plattformbetreibers an den Daten bestehen, was dem Gedanken der Offenheit des Crowdmappings ohnehin wiederspricht. Ein Datenexport würde eine Schnittstelle zu anderen Anwendungen bedeuten und das Spektrum von Analyse und Visualisierungsmöglichkeiten erheblich erweitern.

4 OPENCROWDMAPS

In den Limitationen bestehender Anwendungen ist der Anlass für die Entwicklung einer eigenen Crowdmapping-Plattform mit integriertem Wiki-Prinzip begründet. Bei dieser subversiven Plattform ist das Ziel die Macht über die Inhalte einer Karte in vollem Umfang bei der Crowd zu belassen. Der „Wisdom of the Crowds" soll die Inhalte regulieren und die Datenqualität sicherstellen. Eine thematische Begrenzung erfolgt bei dieser Plattform - OpenCrowdMaps - nicht. Die Vision der Webseite ist eine sich selbstregulierende Datebank für geografische Informationen jeglicher Art, die eine Brücke zwischen Geo- und Socialweb schlägt.

4.1 Technische Konzeption

Das Erheben von räumlichen Daten ist für Nutzer vor allem direkt an Ort und Stelle interessant. Aus diesem Grund wurde die Plattform so konzeptioniert und designt, dass sie für alle Geräte und Displaygrößen im vollen Funktionsumfang nutzbar ist. Dies geschieht nicht über eine separate App, welche womöglich eine Hemmschwelle für die mobile Nutzung darstellen würde, sondern durch eine responsive Programmierung der Webseite.

Darunter ist nicht das Skalieren der Inhalte entsprechend der Displaygröße zu verstehen, sondern vielmehr eine Neuanordnung der Inhalte in Abhängikeit der gegebenen Displaygröße, Auflösung und der Ausrichtung bei mobilen Geräten (siehe Abb.2). Um daüber hinaus die Seite für mobile Geräte performat zu halten wurde der programmiertechnische Ansatz "Mobile First - Content First" verfolgt. Bei der herkömmlichen Programmierung von Webseiten wird zunächst die Desktopversion für standartisierte Displaygrößen einer Webseite erstellt. Anschließend wird, wenn vorgesehen, eine Überbarbeitung für mobile Geräte mit kleineren Displaygrößen durchgeführt. Dabei erfolgt eine Filterung der Inhalte und Funktionen und nicht benötigtes wird in der mobilen Version ausgeblendet (Graceful Degration). Für den Nutzer nicht sichtbar werden dennoch alle Inhalte der Webseite, womöglich große, ausgeblendete Grafiken geladen, anschließend aber nicht visualisiert. Es entsteht so ein unnötiger Datenstrom, der im mobilen Netzt nicht selten erhebliche Performanceverluste zur Folge hat und den Webserver beansprucht. Eine "Mobil First" aufgebaute Webseite, wie OpenCrowdMaps, verfolgt den programmiertechnisch umgekehrten Ansatz und wird von der mobilen Version zur Desktopversion hin aufgebaut. Dadurch wird sichergestellt, dass nur die Inhalte laden, die für die entsprechende Displaygröße benötigt werden und beabsichtigt sind (Progressive Enhancement). So rücken automatisch die Inhalte der Webseite, ihr Content, in den Mittelpunkt und das Nutzererlebnis wird aufgewertet.

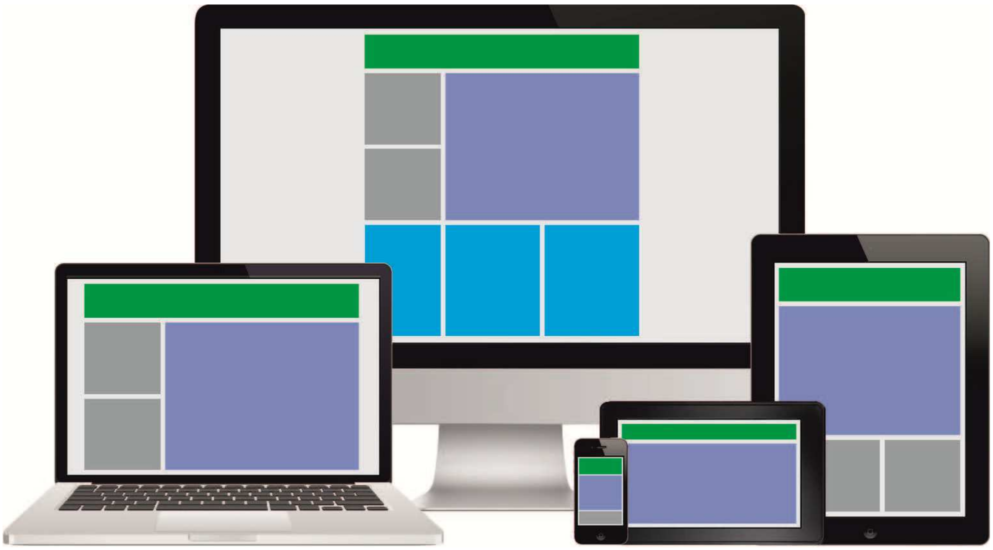

Abb. 2: Prinzip des responsiven Webdesigns (Eigene Darstellung)

Der Kern der Plattform ist ein Webgis-System, das Nutzeranfragen nach dem in Abbildung 3 dargestellten Funktionsschema bearbeitet. Anfragen werden vom Browser des Nutzers aufgenommen und an den Webserver übermittelt. Dieser verarbeitet die eintreffenden Informationen und ruft der generierten Anfrage entsprechende Einträge aus der Datenbank ab. Parallel erfolgt eine Abfrage entsprechender Geodaten vom genutzten Web Map Service (WMS). Die Ergebnisse dieser beiden Abfragen werden anschließend dem Browser des Nutzers zur Präsentation übermittelt.

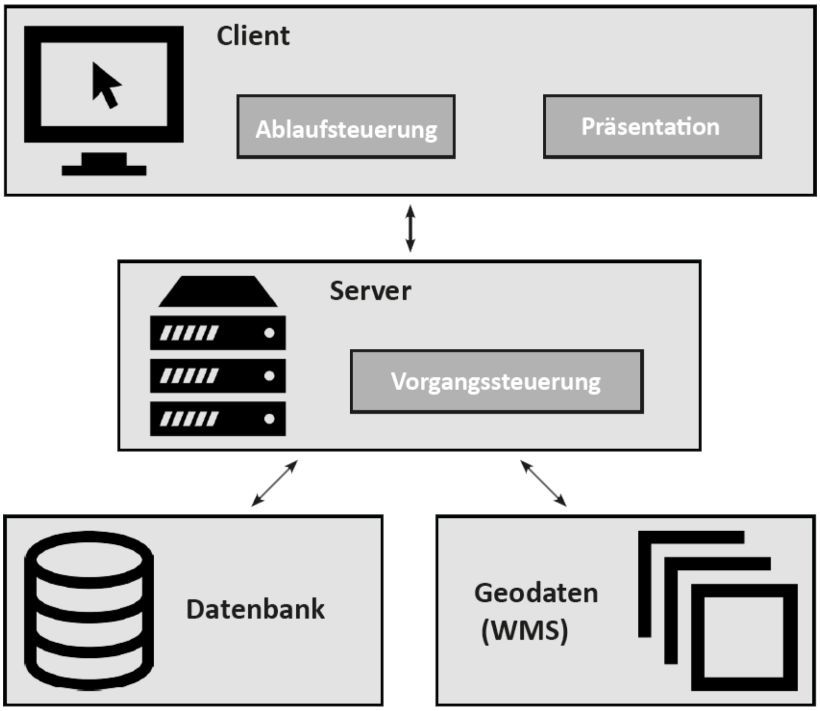

Abb. 3: schematische Funktionsweise der Plattform OpenCrowdMaps (Eigene Darstellung)

4.2 Funktionsweise

Das Interface der Anwendung ist sehr schicht gehalten, wie in Abbildung 4 zu erkennen ist. Dies gewährleistet eine möglichst einfache Bedienung. In der Kopfzeile der Anwendung befindet sich direkt oberhalb der Webmap ein bei Bedarf ausblendbares Hauptmenü. Dieses ermöglicht den Schnellzugriff auf eine Vielzahl von Funktionalitäten für die Bearbeitung, Visualisierung und Analyse der Daten sowie eine integrierte Suchfunktion sowie eine Liste der letzten, getätigten Änderungen.

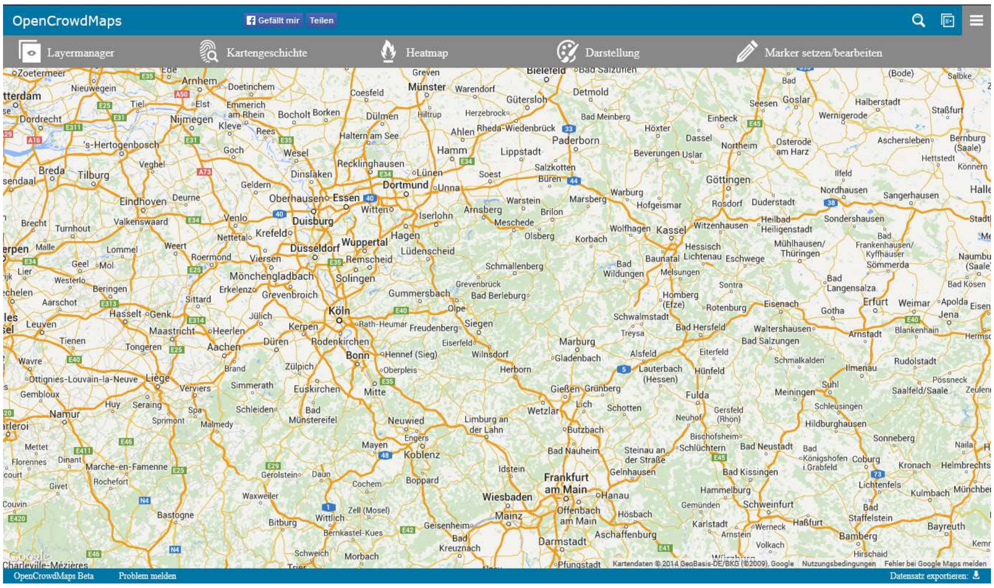

Abb. 4: Desktopversion des Interfaces von OpenCrowdMaps (Eigene Darstellung)

Die wohl grundlegendste Funktionalität, neben dem Anzeigen von vorhandenen Einträgen, ist die Möglichkeit für jedermann Inhalte zu generieren. Dies erfolgt über die Schaltfläche "Marker setzen/ bearbeiten" und der Aktivierung des Bearbeitungsmodus. Der Nutzer kann anschließend durch Auswahl der Option "Neuen Marker setzen" eine Postion in der Webmap bestimmen, wo daraufhin ein Pin sowie ein dazugehöriges Formularfeld erscheint.

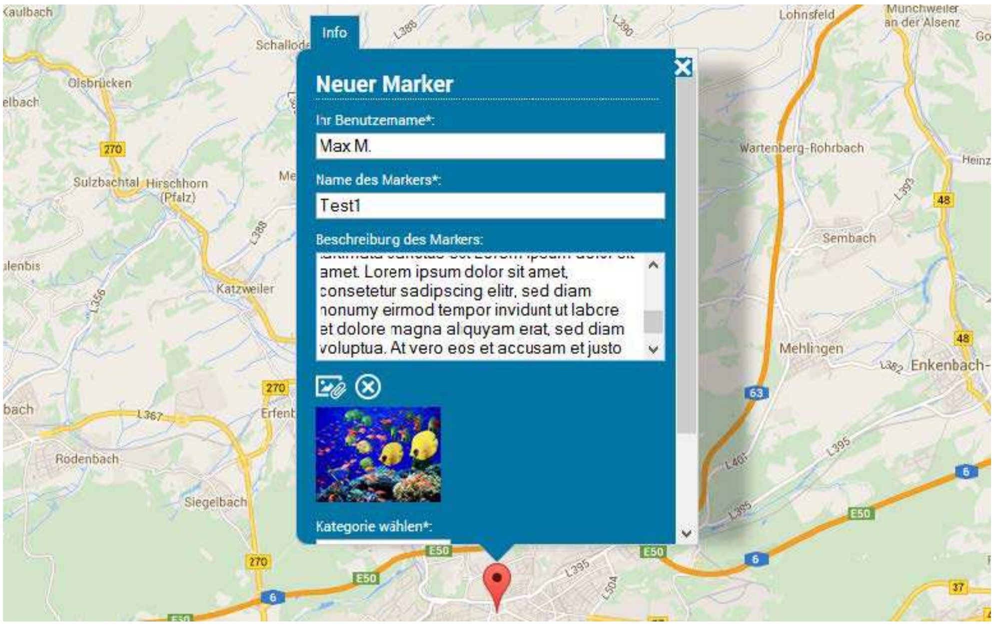

Abb. 5: Formular für die Marker-Erstellung (Eigene Darstellung)

In jedem Fall notwendig ist die Bearbeitung der mit einem Stern (*) markierten Pflichtfelder. Dabei handelt es sich um den Benutzernamen, den Markernamen sowie die Auswahl einer Kategorie. Optional ist hingegen eine weitergehende Beschreibung und das Hinterlegen einer Bilddatei. Der Benutzername ist stets frei wählbar und Bedarf keiner Anmeldung auf der Plattform. Er dient lediglich zum Setzen einer höheren Hemmschwelle für mögliche Datenmanipulationen. Der Upload einer Bilddatei erfolgt über das Symbol unterhalb des Beschreibungsfeldes. Bei Aufruf öffnet sich ein Dateibrowser, der das Auswählen eines Bildes direkt von der Festplatte des Gerätes ermöglicht. Dabei steht für mobile Endgeräte die Option zur Auswahl das Bild direkt über die Kamera aufzunehmen. Durch Bestätigung der Auswahl entsteht eine Vorschau des Bildes innerhalb des Formulars, um fehlerhafte Uploads zu vermeiden. Durch den Speichern-Button (in

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Abbildung 5 außerhalb des Scrollbereichs) erfolgt die Eintragung der hinterlegten Informationen in die Datenbank sowie die damit verbundene Generierung des Markers. Vorher wird jedoch eine Fehlerabfrage der im Formular getätigten Eintragungen durchgeführt. Wurden nicht alle Pflichtfelder ausgefüllt oder ein ungültiges Dateiformat für den Bild-Upload gewählt erscheinen entsprechende Hinweise. Das Löschen-Symbol führt zum Abbrechen der Markererstellung. Dabei wird der temporäre Marker für die Erstellung von der Webmap entfernt.

Zu jedem erstellten Marker wird ein “Diskussionstab” generiert, in dem Nutzer Kommentare zu den Inhalten des Markers beitragen können. Darüber hinaus werden dort Datenmanipulationen protokolliert. Diese werden chronologisch geordnet und ermöglichen so die Nachvollziehbarkeit der Entwicklung eines Markers und der dazugehörigen Diskussion. Über das Sprechblasensymbol ist ein Formular aufrufbar, welches das Verfassen eigener Beiträge und die damit verbundende, aktive Teilhabe an der Diskussion ermöglicht.

Mit aktiviertem Bearbeitungsmodus ist beim Aufrufen bestehender Einträge ein zusätzlicher Tab “Bearbeitung” verfügbar. Dieser ermöglicht jedem Anwender die Manipulation des Markers und seiner Inhalte.

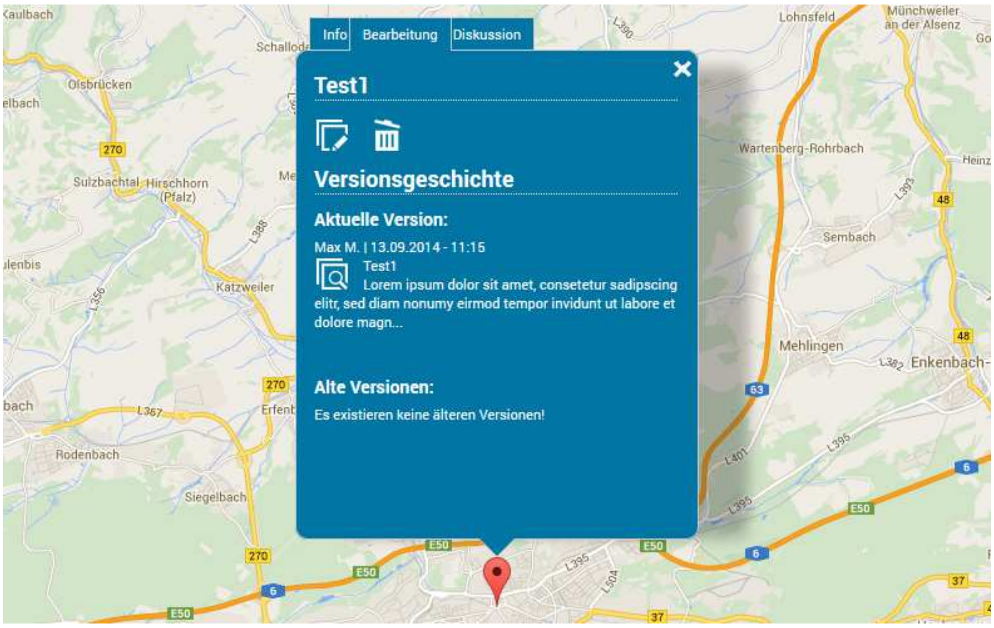

Abb. 6: Bearbeitungsstab eines Markers (Eigene Darstellung)

Über diesen Tab ist das Löschen, die Bearbeitung der Inhalte und das Einsehen und Aktivieren alter Versionen des Markers möglich. Ist ein Marker bereits als gelöscht markiert, wird die Löschaktion durch eine Wiederherstellungsaktion ersetzt.

Um auch bei Änderungen die Kontrolle der Crowd sicherzustellen und die technische Seite des Wiki-Prinzips vollkommen umzusetzen, wurde eine Versionierung der Einträge realisiert. Bei Änderung eines Eintrages wird dabei nicht der alte Datenbankeintrag überschrieben, sondern es wird eine Kopie inklusive Änderungen erzeugt. Die alte Version wird bei der Markererzeugung anschließend nicht mehr berücksichtigt und es erfolgt keine Darstellung der Inhalte. Generiert wird hingegen die neue Version. Im Bearbeitungstab werden jedoch stets sämtliche alte Versionen chronologisch gelistet. Diese sind jederzeit einsehbar und können gegebenfalls von jedem Nutzer wiederhergestellt werden.

Ein Löschen des Markers führt keinesfalls, wie bei anderen Anwendungen zum Entfernen des Datenbankeintrags. Ein als ausgetragen markierter Marker wird zunächst mit 60% Transparenz visualisiert. Pro Tag Differenz zwischen Austragedatum und aktuellem Datum nimmt die Transparenz um weitere 10% zu, bis der Marker nach fünf Tagen schließlich nicht mehr generiert wird. In dieser Zeitspanne steht es jedoch jedem Nutzer frei den Marker wiederherzustellen. Dadurch wird das Austragedatum in der Datenbank entfernt und der Marker wird wieder mit voller Deckkraft generiert. Wird der Marker im Folgenden wieder als gelöscht markiert, muss derselbe sechs Tage Zyklus erneut durchlaufen werden. Diese Methodik stellt sicher, dass keine relevanten Einträge von einem Nutzer gelöscht werden können. Die Kontrolle der Inhalte bleibt bei der Crowd.

Die Schaltfläche „Darstellung“ ermöglicht zum einen die Deaktivierung der Clusterfunktion der Marker, aber auch das Wechseln der Kartengrundlage. Das Clustern dient der besseren Darstellung von vielen Markern mit ähnlicher Geoposition. Diese werden maßstabsabhängig aggregiert und die Anzahl durch eine entsprechende Zahl repräsentiert. Bei der Kartengrundlage erfolgt keine Begrenzung auf die standardmäßige Google Maps Ansicht, sondern es wurden auch eigens erstellte Kartenstile sowie externe Dienste, wie OpenStreetMap oder Stamen Map, integriert.

Die Schaltfläche „Heatmap“ steuert die Generierung und Konfigurierung von Heatmaps. Dies sind Dichtekarten zur Visualisierung von „Brennpunkten“. Der Farbverlauf der Heatmap reicht von rot über gelb bis grün. Areale mit einer großen Markeragglomeration werden dabei rot dargestellt und Gebiete mit wenigen Markern grün (s. Abb. 7).

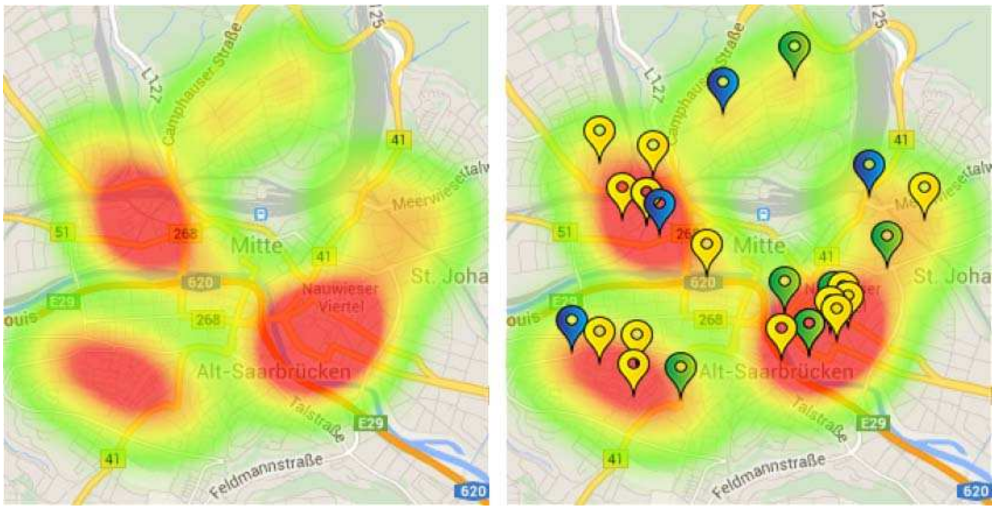

Abb. 7: Auswählbare Kartenstile (Eigene Darstellung)

Der Radius (in Pixel) der Heatmap kann dabei vom Anwender frei definiert werden, um eine dem Maßstab entsprechende Darstellung zu generieren. Zudem ist das Zublenden der absoluten Marker-Positionen möglich, um so den Bezug zwischen Marker-Position und Dichtekarte besser nachvollziehen zu können. Bei der Generierung der Heatmap werden keine als gelöscht markierten Marker mit einbezogen.

Hinter dem Menüpunkt „Kartengeschichte“ verbirgt sich eine Zeitachse, die bis zum Erstellungszeitpunkt der Karte zurückreicht. Marker, die bereits an einem spezifischen Datum existierten, können dadurch visualisiert werden. Dabei werden auch jene dargestellt, die anschließend gelöscht wurden und im aktuellen Datensatz nicht mehr enthalten sind (s. Abb. 8).

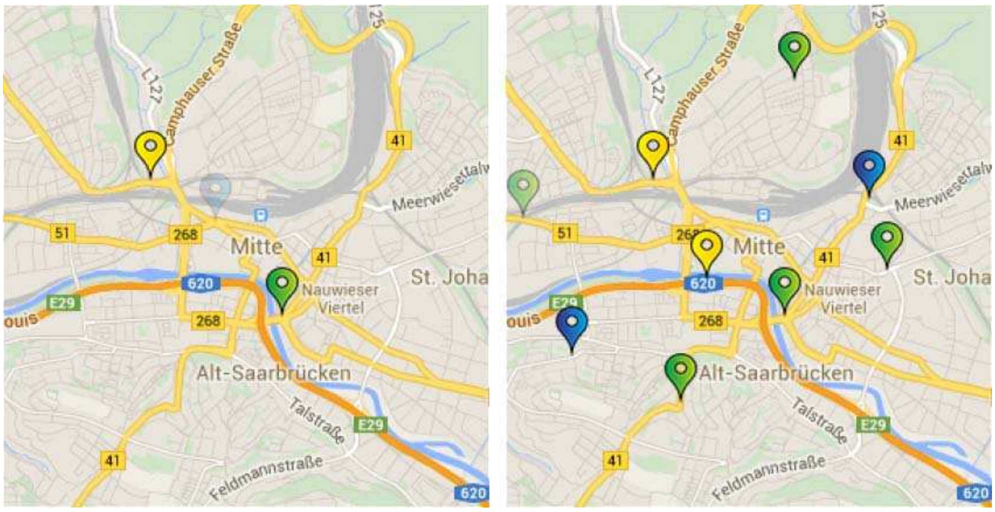

Abb. 8: Zeitpunkte der Marker-Entwicklung (Eigene Darstellung)

Der Layermanager, welcher ebenfalls über die Kopfleiste aufrufbar ist, ermöglicht das Filtern der visualisierten Kategorien in der Webmap. Wird eine Kategorie über ihre Checkbox deaktiviert, werden die entsprechenden Daten nicht mehr in der Webmap visualisiert. Dies ermöglicht eine benutzerdefinierte

Selektion und Reduktion der Inhalte. Für den jeweiligen Zweck irrelevante Inhalte können so vom Nutzer bei Belieben ausgeblendet werden.

Um der Crowd Darstellungs-, Auswertungs- und Analysefunktionen über die Möglichkeiten der Plattform hinaus zu gewährleisten, wurde ein Datenexport in der Fußleiste der Anwendungen integriert. Dieser erlaubt den Download des aktuellen Datensatzes der Marker-Tabelle mit allen Inhalten. Ausgegeben wird dabei eine CSV-Datei, die mit allen gängigen Tabellenkalkulationsprogrammen geöffnet und bearbeitet werden kann. Der Crowd wird somit die Option geboten, die Daten in externen Anwendungen weiter zu bearbeiten. Durch den Export wird eine völlige Datentransparenz und Offenheit gewährleistet.

Die Startseite von OpenCrowdMaps untergliedert sich in insgesamt drei inhaltliche Tabs. Neben einem Formular für die Erstellung eigener Karten existiert eine Kartenübersicht sowie der Administrationsbereich für bereits bestehende Karten. Die „Kartenübersicht“ listet alle bestehenden, öffentlichen Karten. Dies verschafft dem Besucher einen ersten Überblick behandelter Thematiken. Bei Interesse können einzelne Karten über die integrierte Verlinkung aufgerufen werden. Die Übersicht kann nach verschiedenen Kriterien (Erstellungsdatum, Anzahl der Aufrufe, Marker-Anzahl und Aktionenanzahl) geordnet werden. In Kombination mit einer Eingrenzung, durch die integrierte Suche, kann der Nutzer auch bei einer umfangreichen Kartenbasis schnell, nach für ihn relevanten Karten, filtern. Durch Aufrufen der Schaltfläche „Neue Karte erstellen“ wird ein entsprechendes Formular sichtbar. Dieses ermöglicht in wenigen Schritten die Erstellung einer eigenen Themenkarte. Die Anzahl der Kategorien und die dazugehörigen Einstellungen sind frei vom Nutzer wählbar. Der „Kartenadmin“ dient zur Editierung dieser Einstellungen.

5 FAZIT

Die realisierte Plattform OpenCrowdMaps liefert erstmals ein Instrument für das Crowdsourcing räumlicher Daten mit Integration des Wiki-Prinzips bei gleichzeitig völliger thematischer Offenheit. Bei der Plattform handelt es sich, ohne Zutun seitens des Planers, bereits um eine subversive Methode zur Datenerhebung planungsrelevanter Informationen. Aus der Crowd entspringen die Ideen für die Sammlung von Daten und diese reguliert deren Relevanz in Eigenregie.

Abseits dieser Vision können Crowdmaps gezielt von Behörden eingesetzt werden um planungsrelevante Informationen in Zusammenarbeit mit der Bevölkerung zu generieren. Dadurch würde eine aktive Bürgerbeteiligung gefördert und die Distanz zwischen Behörden und Bürgern verringert. Ein Einsatz für (verwaltungs)interne, kollaboratitve Datenerhebungen wäre genau so denkbar wie die Nutzung als digitales Echtzeit-Protokoll für Ideen in Bürgerworkshops.

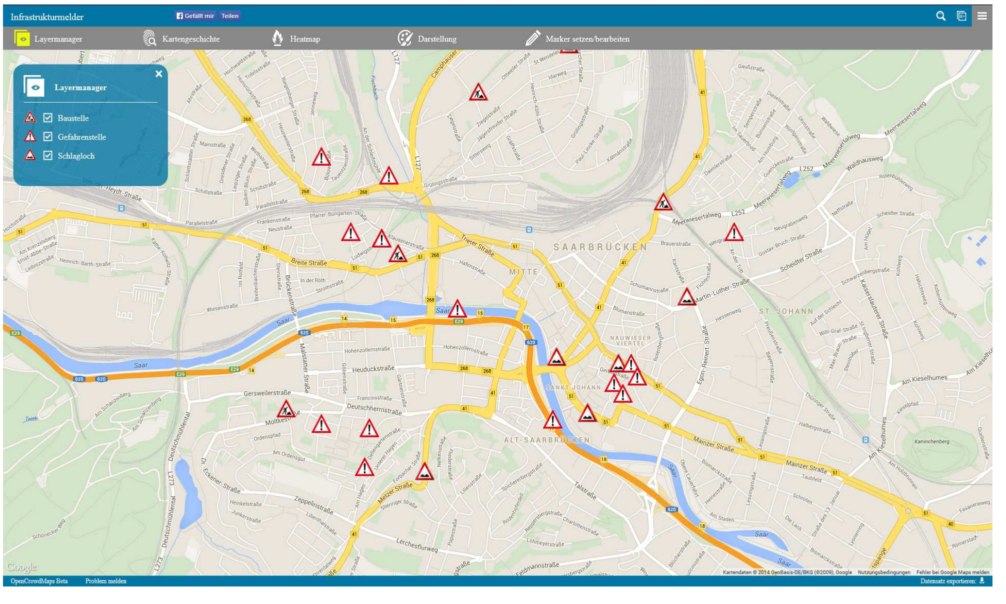

Abb. 9: Beispielhafte Themenkarte der Plattform OpenCrowdMaps (Eigene Darstellung)

Die Thematische Offenheit bietet Einsatzmöglichkeiten für nahezu jede planugsrelevante Thematik. Dies birgt die Gefahr einer für den Planer nicht auswertbaren Datenflut. Der Umgang mit “Big Data” und „Datenfriedhöfen“ ist jedoch zum einen eine Frage der technischen Entwicklung und zum anderen kann sich eine Klassifizierung als „Datenfriedhof“ zukünftig als falsch erweisen.

Für das erfolgreiche Crowdmappen bedarf es einer gewissen Bekanntheit der entsprechenden Karte sowie einer aktiven Crowd, die stetig neue Inhalte generiert. Es ist daher von großer Bedeutsamkeit die Karte über verschiedene Kanäle in den öffentlichen Fokus zu rücken und damit eine beständige und im Betsfall kontinuierlich wachsende Community zu erschaffen. Darüber hinaus sollten über eine Crowdmapping-Plattform niemals Notfälle oder sonstige Sachverhalte gemeldet werden, deren Inhalte keinesfalls dem Zufall überlassen werden dürfen. Das Crowdmappen eignet sich ausschließlich bei unsensiblen Daten mit einem Nutzen für große Teile der Gesellschaft.

6 DANKSAGUNG

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7 QUELLEN

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Dilemma of Vibrant City and Endless Urban Growth, Lessons from Alexandria, Egypt

Lotfy Azaz

(Lotfy Azaz, Associate Professor of Urban Planning and GIS, Geography Department, Faculty of Arts, Menofya University, Shebin-Elkom, Menofya Governorate, Egypt, Lotfy_Azaz@yahoo.co.uk, Director of Social Observatory Strategic Research Program, The Research Council, Sultante of Oman)

1 ABSTRACT

Urban planners and visionary leaders always have dreams of designing and establishing new vibrant cities or making new history by regenerating old cities. When the city (new or revived) starts to be "vibrant", it begun to attract more residents to work and live in it. The city will grow and expand as a natural result of that. This continuous urban growth may lead to dangerous environmental impacts. Some cities during growth may consume valuable cultivated lands to provide spaces for accelerated demands of urban development projects. This leads to "Urban desertification". Moreover, future scenarios of these cities tell us that urban growth will continue and the city will expand consuming valuable resources. In this case, some important questions will arise; do we need this endless urban growth? Can we bear the consequences of this endless urban growth? Do we need to control this growth to keep the city vibrant? Or we just leave the city grow endlessly? This paper will try to address these questions on Alexandria of Egypt. Alexandria was a dream of Alexander III the Great. Alexander ordered that a city be designed and founded in his name at the mouth of river Nile, as trading and military Macedonian outpost, the first of many to come. He never lived to see it built, but Alexandria will become a major economic and cultural center in the Mediterranean world not only during the Macedonian rule in Egypt but centuries after. Alexandria witnessed a continuous urban growth from the beginning of the Mohammed Ali era (1805) up to the present time. In 1905, Alexandria's 370 thousand inhabitants lived in an area of about 4 km2 between the two harbors. Since that time the city has expanded rapidly, eastwards and westwards, beyond its medieval walls. It presently occupies a built-up area of about 300 km2 and has a ten-fold increase in population at 4 millions in 1996, and become 4.7 millions in 2014, with a density of 2,760 per km². The urban physical expansion and change were detected using Landsat satellite images of 1984 and 1993. The images were classified using a tailored classification scheme with accuracy of 93.82% and 95.27% for 1984 and 1993 images respectively. This high accuracy enabled detecting land use/cover changes with high confidence using a post-classification comparison method. One of the most important findings here is the loss of cultivated land in favour of urban expansion. If the current loss rates continued, 75% of green lands would be lost by year 2191. These hazardous rates call for an urban growth management policy that can preserve such valuable resources to achieve sustainable urban development. The starting point of any management programme will be based on the modelling of the future growth. Modelling techniques can help in defining the scenarios of urban growth in the future. In this study, the SLEUTH urban growth model was applied to predict future urban expansion in Alexandria until the year 2055. The application of this model in Alexandria of Egypt with its different environmental characteristics is the first application outside USA and Europe. The results revealed that future urban growth would continue in the edges of the current urban extent, which means the cultivated lands in the east and the southeast of the city will continue to lose more day by day from their area.To deal with such crisis, there is a serious need for a comprehensive urban growth management programme that can be based on the best practices in similar situations.

2 STUDY AREA

Alexandria is the chief port of Egypt and is located in the northern part of the country. Alexandria occupies a T-shaped peninsula and strip of land separating the Mediterranean from Lake Maryout. (Figure.1). Alexandria was founded in 331 BC by Alexander the Great and was the capital of Egypt for over 1000 years. Alexandria witnessed a continuous urban growth from the beginning of Mohammed Ali era (1805) up to the present time. In 1905, Alexandria's 370 thousand inhabitants lived in an area of about 4 km2 between the two harbours. Since that time the city has expanded rapidly, eastwards and westwards, beyond its medieval walls, Figure 2 shows the urban expansion of Alexandria . It presently occupies an area of about 300 km2 and has a ten-fold increase in population at 4 million, with a density exceeding 1,200 per km2. (Halim & Shouk, 2000) Population is projected to become 5.4 millions by 2015, figure 3 (United Nations, 1997). Because of this, Alexandria is the second largest urban governorate in Egypt. At an international level, the

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city was ranked 62 in 1996 and it is predicted to become rank 54 by 2015, (United Nations, 1997). This enormous urban growth requires precise detection with good management, prediction and planning.

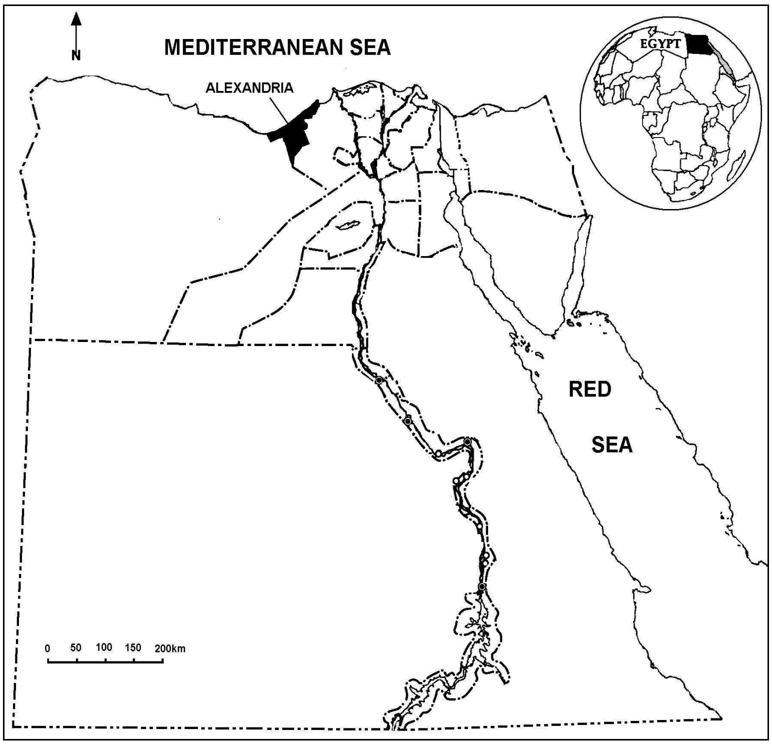

Fig. 1 Location map of the study area

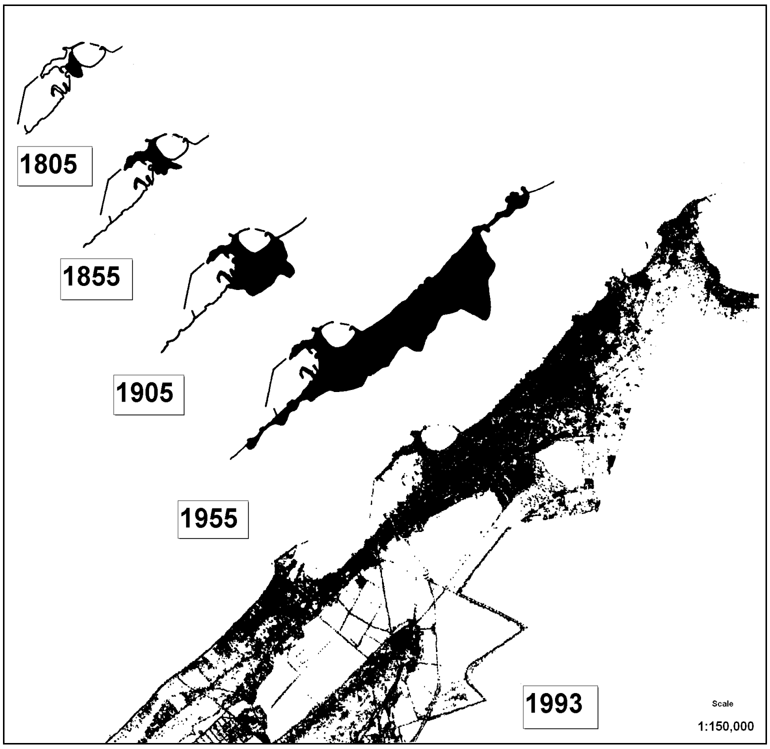

Fig.2 Physical Expansion of Alexandria during the 19th and 20th centuries

3 OBJECTIVES

The main objectives of this study are to detect changes and model urban growth in Alexandria through constructing an automated raster-based GIS to achieve the following sub objectives:

(1) Following the physical expansion of Alexandria from its establishment up to the contemporary stage and modelling growth stages.

(2) Production of contemporary satellite-based land use/land cover maps for the city.

(3) Mapping urban growth in Alexandria city, using multi-temporal change detection techniques

(4) Locating (defining the trends) and quantifying (size and rate) the changes of urban land use in the city at the specific period using classified satellite images.

(5) Defining the consequences of urban growth in Alexandria.

(6) Modelling urban growth in the city using the power of integrated spatial data (raster data / vector data / ancillary data) using the SLEUTH Model to simulate the future urban growth of the city.

(7) Managing future urban growth in Alexandria.

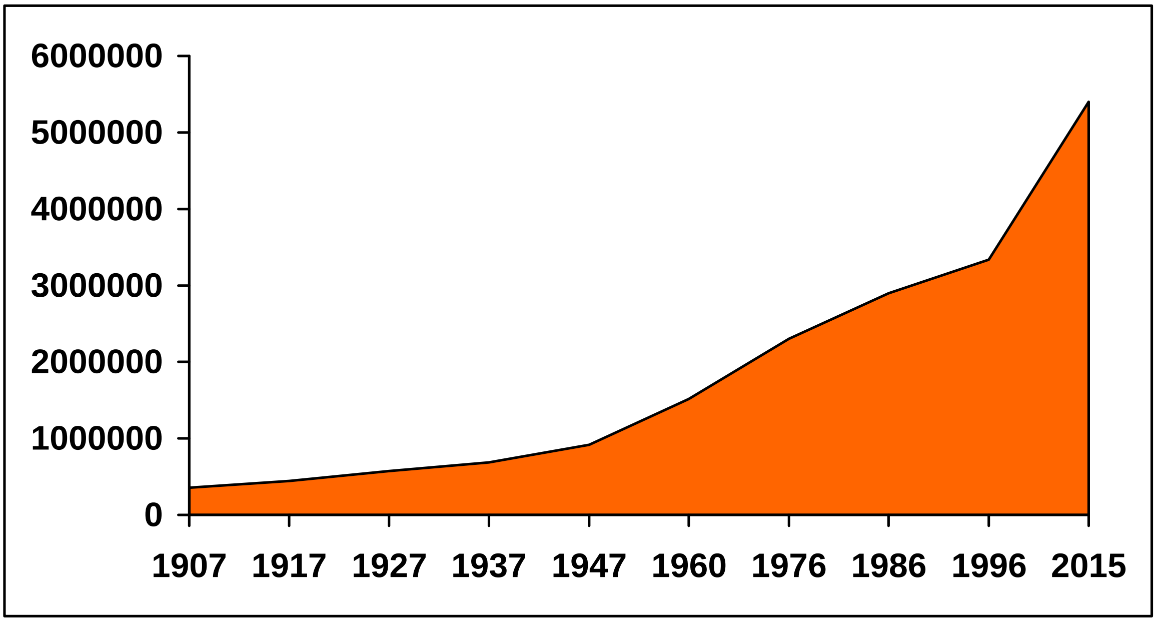

Fig.3 Alexandria population development

4 METHODOLOGY

4.1 Georeferencing

The satellite images used in this study were georeferenced with high accuracy providing a strong basis for further image analysis processes. The 1984 and 1993 images were rectified applying the first order transformation polynomial using between 39 and 43 GCPs from the reference maps of Alexandria of scale 1: 50,000. The transformation matrix was computed and tested many times achieving an acceptable total RMSE of 0.2566 pixel for the 1984 image and 0.2498 pixel for the 1993 image. Both images were resampled using the nearest neighbour method. Reference data source type has a great impact in decreasing RMSE of the rectified images and achieving high accuracy of land use/cover classification as the reference maps used in this study were produced from aerial photographs, which have their own high accuracy in presenting land features. This helped in achieving a very small RMSE and high accuracy classification as well.

4.2 Images Classification

Land use/land cover classification maps were produced with overall accuracy of 93.82% and 95.27% for 1984 and 1993 images correspondingly. Unsupervised classification using ISODATA clustering method was applied to perform classification. This study emphasizes the importance of special customisation of land use/ land cover schemes especially for developing countries studies as this research underlines the fact of non-existence of a universally applied classification scheme. In this context, a user-defined classification scheme has been customised to adapt with both data resolution and study area spatial and environmental characteristics. Figures (4 and 5) indicate the land use categories (classes) in Alexandria (1984, 1993).

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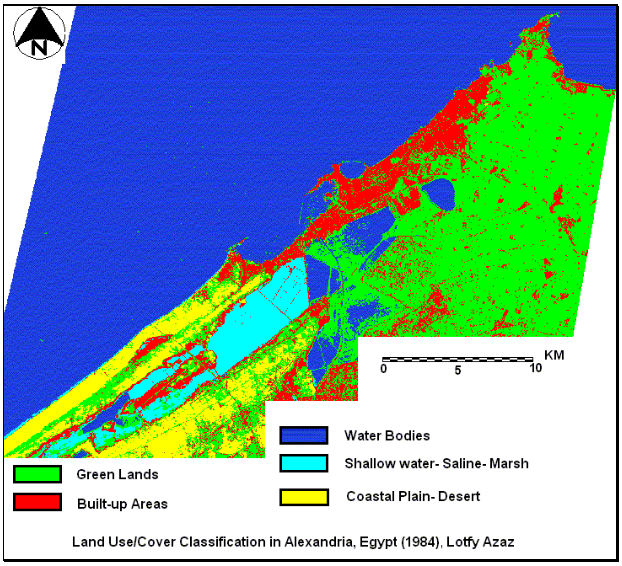

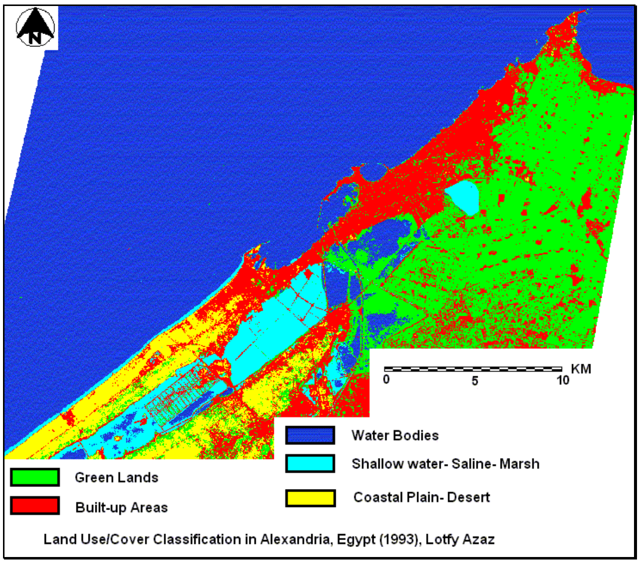

Fig. 4 Land use categories in Alexandria (1984), Fig. 5 Land use categories in Alexandria (1993)

4.3 Change Detection

In this study, two remotely sensed images (1984, 1993) were rectified, registered and classified into five classes. Land use/land cover change detection study reveals several changes in the period of study (1984-1993). These changes can be grouped into two divisions: spatial changes and quantitative changes. Spatial changes represent either emerging of new features or changing in the existing features. New features such as new Dekhila Port, Sidi Krir power station, fish farms, recreation villages, and lands reform projects appeared in the west. Maryout Lake was subject to some changes as some areas of the lake were dried to meet the accelerated demand for land; other parts of the lake have been used as Salina to produce salt. Indeed, all the above-mentioned features are results of urban development, but can be considered as indirect results. The direct results of urban development can be detected easily as new features in the eastern parts of the city consuming a significant part of the valuable agricultural lands. Moreover, the city centre area witnessed a little change of its existing features due to replacement and renewal factors. Quantitatively, green lands lost 23.79 % of its area for the built-up area with annual lose rate of 0.67%, which means the risk of losing about

75% of green land in the period between years 2096 and 2191. These are very optimistic projections if compared by other studies which estimated that ALL coastal agricultural lands in the northern of Egypt will be lost to urbanization and other activities by year 2061 (Salem et al., 1995). From a methodological point of view, Land use/land cover change analysis in Alexandria using post-classification comparison change detection method yielded high accuracy results especially if high-accuracy classified satellite images were used as inputs. The subtraction was done using Model Maker in Imagine 8.3 and the output (change map) was tested and proved using a Change Detection option in Imagine 8.4 and the result was the same. Figure (6) shows the change map for the area of study, summarized in Table (1).

Code	**Was**	**Become**	**Code**	**was**	**Become**
A	**Desert**	New Dekhila Port	**E**	**Lake**	Changes in Lake Maryout
B	**Desert**	Sidi Krir Power Station	**F**	**Desert**	Lands Reform Projects
C	**Lake**	Fish Farms	**G**	**Cultivated lands**	Urban expansion in the Eastern Areas
D	**Desert**	Western Coast	**H**	**Central Business District (C.B.D.)**	Central Business District (C.B.D.)

Table 1: Major Changes in Alexandria between 1984 and 1993

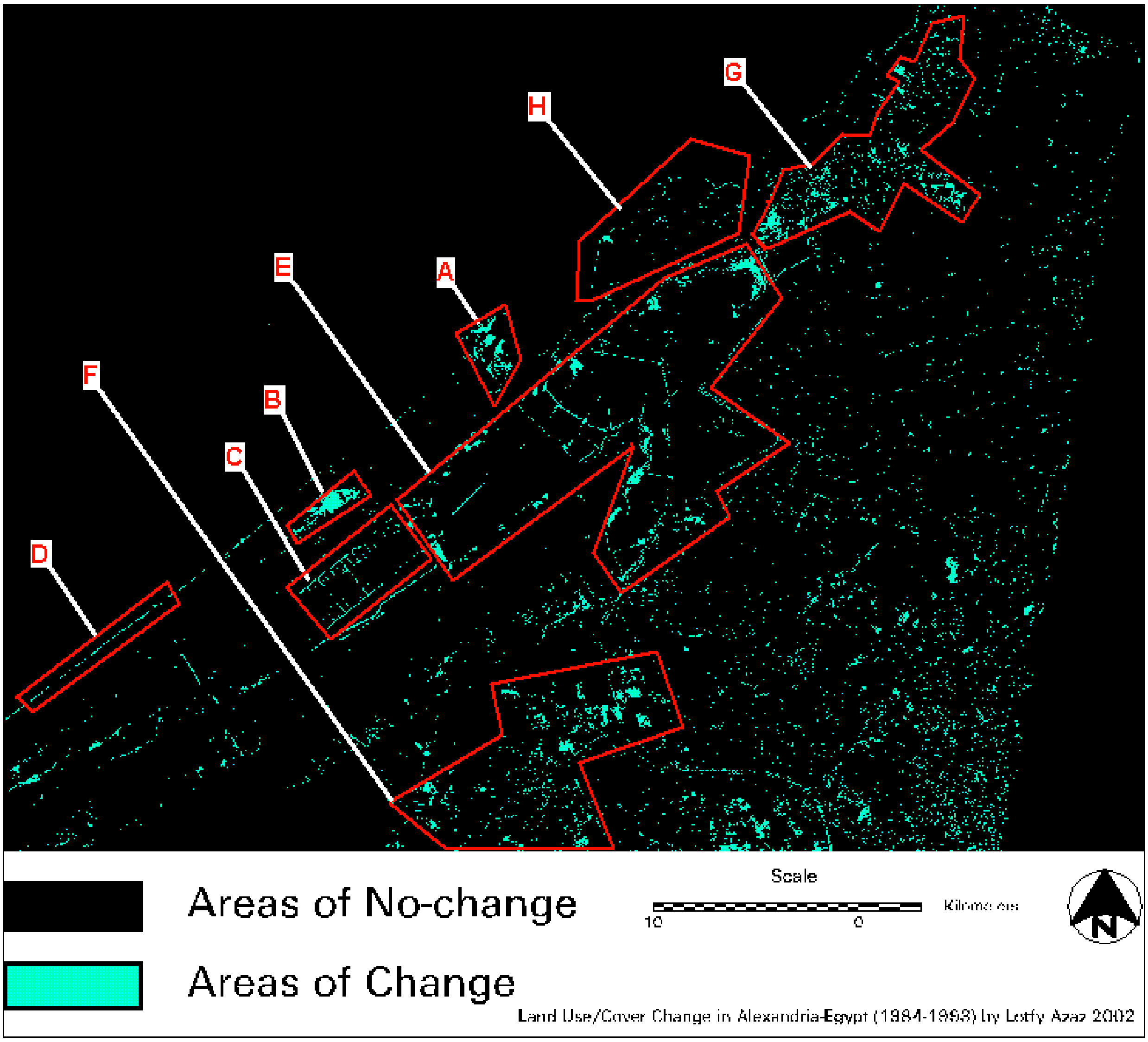

Fig. 6 Land use/land cover change in Alexandria (1984-1993)

4.4 Modelling Urban Growth

Modelling urban growth in Alexandria was done using SLEUTH model. The model was developed by Dr Keith C. Clarke of the Department of Geography, University of California, Santa Barbara. The name of the model (SLEUTH) was derived from the simple image input requirements of the model: Slope, Land cover, Exclusion, Urbanization, Transportation, and Hillshade (USGS 2000). The model is intended to simulate urban growth in order to aid in understanding how expanding urban areas consume their surrounding land, and the environmental impact this has on the local environment. This model simulates the transition from non-urban to urban land-use using a grid of cells (cellular automaton) each of whose land-use state is dependent upon local factors (e.g., roads, existing urban areas, topography), and temporal factors. Model inputs have been prepared for the area of study and the model was tested in its application phases.

The results of modelling urban growth using SLEUTH model emphasises that if the current physical urban expansion rates continued, it is expected that urban growth will persist in the edges of the current urban extent, Figure (7). This can be detected easily in the western, the southern, and the southeastern directions. Much development is expected to occur also around Al-Amrya area in the southwestern parts. The direction of urban growth to the southeastern parts means a serious threat to the cultivated lands, which already experience continuous loss.

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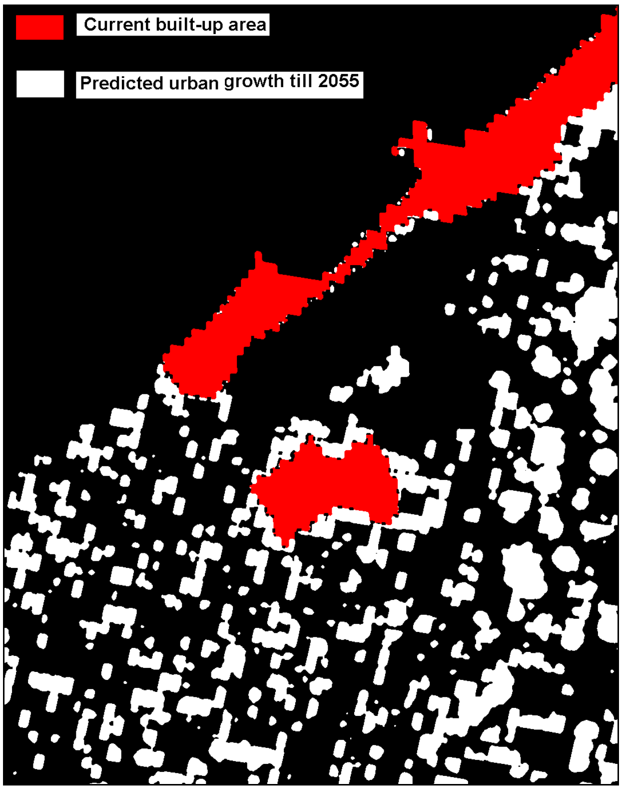

Fig. 7 Urban Growth in 2055 in all the area of study

5 RESULTS AND DISCUSSION

Table (2) shows the size and percentage of land use change in Alexandria area. Generally, the changes can be divided into two categories; (1) Increased change (positive) which includes built-up areas and Shallow water / saline and (2) Decreased change (negative) which includes green lands, desert and water bodies. The detailed change can be noticed in Table (3).

Class Name	**Size of Change (Hectare) (1984-1993)**	**Size of Change (Km²) (1984-1993)**	**Percentage of change (1984-1993)**	**Annual Change (Km²)**	**Annual Change (Percentage)**
Water Bodies	-2683.801	-26.838	-1.54	-2.982	-0.17
Shallow Water/S/M	2683.801	26.838	38.10	2.982	4.23
Green Lands	-6072.048	-60.72	-6.04	-6.747	-0.67
Built-up Areas	29240.729	292.407	56.74	32.489	6.30
Coastal Plain/ Desert	-23168.681	-231.687	-7.26	-25.74	-0.81

Table 2: The size of land use classes and the change in Alexandria area (1984-1993)

Water Bodies	**Shallow water**	**Green Lands**	**Built-up areas**	**Coastal Plain /Desert**	**Total**
Water Bodies	-2,683.801	0	0	0	-2,683.801
Shallow Water	2,683.801	0	0	0	2,683.801
Green Lands	0	0	-23,914.905	17,842.857	-6,072.048
Built-up Areas	0	0	23,914.905	5,325.824	29,240.729
Coastal Plain /Desert	0	0	-17,842.857	-5,325.824	-23,168.681
Total	2,683.801	-2,683.801	6,072.048	-29,240.729	23,168.681

Table 3: The gain and loss of Land Use/Land Cover categories in Alexandria Area (Hectare) between 1984 and 1993

The area of study witnessed a remarkable urban growth between 1984 and 1993. Two trajectories of urban expansion can be identified. The first is towards the eastern and southeastern parts of the area of study. This extension consumed the most valuable cultivated lands, which act as the hinterlands of Alexandria (the food basket of the city). If the current loss rates continue (0.67% annually) taking the year of 1984 as a base year, the green lands will face the risk of losing about 75% of its area through this artificial desertification by year 2191.

Nevertheless, if we use a more straightforward linear equation considering the annual loss (674.672 hectare), this means the green land will lose 75% of its area by year 2096. These projections of retaining some green lands are very optimistic. Another study estimated that all the coastal agricultural lands in northern Egypt will be lost to urbanization and other activities by the year 2061 (Salem et al., 1995). This indicates the need for strong policies to protect the valuable green lands from this serious continuous risk. These policies must direct urban growth trajectories to the lands that suit urban development. At the meantime, most of the urban expansion in the eastern parts is unplanned (Abdou-Azaz 1997) so there is a need also for planning solutions to this problem. Meanwhile, land reform projects should be continued to: a) compensate land lost to urban development, b) absorb part of the population increase, and c) provide employment and decrease unemployment rates as well especially for new graduates. The second trajectory is towards the western parts. This direction of expansion consumed only parts of the coastal dune series. Most of the expansion of built-up areas here is housing, but there are also other forms of built-up area such as storehouses and plants especially for petrochemicals and petroleum industries. Maryout Lake experienced different forms of changes. There is an urgent need to make appropriate decisions about the lake's future. There is some change in the old city areas in the central and eastern parts of the study area; this change occurred as replacement and renewal processes.

6 CONCLUSION

This continuous urban growth led to dangerous environmental impacts in Alexandria. This growth consumes valuable cultivated lands to provide spaces for accelerated demands of urban development projects. This can be called "Urban desertification". The future scenario Alexandria tells us that urban growth will continue and the city will expand consuming valuable resources. In this case, some important questions will arise; do we need this endless urban growth? Can we bear the consequences of this endless urban growth? Do we need to control this growth to keep the city vibrant? Or we just leave the city grow endlessly?

To deal with such critical questions, two approaches shall be adopted; the first approach requires legalization frame as a part of tough policies to direct urban growth of Alexandria towards suitable land for urban development, especially in the west and southwest of the city to protect the valuable agricultural lands. Moreover, to preserve the environmental resources of the city, especially the agricultural lands, this study suggests a greenbelt to be planned in the south of the city. This suggested greenbelt should be located before the agricultural lands leaving a reasonable buffer zone. GIS can help in placing this greenbelt and locating the buffer zone considering all geographical and environmental factors. Meanwhile, as most urban development in the eastern parts is unplanned, there is a need also for planning solutions for this problem as well. In addition, it is important not to allow vertical and horizontal expansion of the main built-up area as a response to continuous urban growth as this is considered as a short-sighted response as it will lead to easy access to the existing overextended services and utilities. The second approach suggests that future urban development process should create independent communities or even new cities. This approach would distinguish these communities from the core built-up area of the central city and reduce their dependence on its utilities and service systems (El-Shakhs 1997).

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Do Blurred Institutional Organisation and Inconsistent Policy Agendas Hinder Urban Development of Post-Socialist Neighbourhoods in Serbia? MAS-ANT Method of Analysis

Marija Cvetinovic

(PhD student Marija Cvetinovic, Ecole Polytechnique Fédérale de Lausanne, EPFL CODEV CM 2, 1015 Lausanne, Switzerland, marija.cvetinovic@epfl.ch)

1 ABSTRACT

In transitional countries, the course of merging socialist and neoliberal socio-economic condition, regulatory practices and organizational solutions led to inefficiently operationalized and inconsistently formalized institutional reforms rather known as “growth without development”. Included in this range of spatially and economically turbulent surroundings, post-socialist cities in transitional countries have undergone highly dramatic change in political, economic and social terms. This paper interprets blurred regulatory framework of post-socialist cities in Serbia through an assemblage methodological approach which combines Multi-agent system (MAS) procedure from computer science and Bruno Latour’s Actor-Network Theory (ANT) on social networks.

Generally speaking, any built environment always reflects political and economic processes, especially in turbulent social times such as the disintegration of Yugoslavia’s political system and the introduction of new context of market economy, decentralized administrative powers and a lack of investment and resources. Dramatic shifts in social organization and spatial transformations result in the incapacity of the post-socialist planning to define contextually appropriate and coherent urban management for tracing its chaotic urban development pattern. Conversely, with the huge socio-cultural base inherited from the socialist period, cities in transitional countries have continued to be centres of economic growth with a variety of services, expansion, technological innovation and cultural diversity. Therefore, the post-socialist period in these cities contains prevailing characteristics of the disintegration of the preceding system rather than a coherent vision of what should follow. The post-socialist urban governance fails substantially through the lack of consensus on priority goals, action-oriented implementation and horizontal and vertical coordination.

Tracing institutional articulation of post-socialist context through MAS-ANT methodology involves structural analysis of administrative procedures and content analysis of policy agendas to systematically deconstruct local urban governance in terms of political, economic and cultural aspects of transition with a multitude of actors, variety of interests, conflicted strategies and fragmented implementation. Multi-agent System serves as a generative bottom-up topography of the complex urban reality while Actor-Network Theory flattens the social into a panoptic internalized ontology. The schema thereafter involves taking into account all active agents regardless of their sort and form of social manifestation (ANT) and notwithstanding theoretical bias of their interdependencies and interconnections (MAS).

Finally, this dynamics of relations and influences between different layers of decision making and urban key agents indicates opportunities for altering post-socialist urban planning by analysing in which manner regulatory framework relates to urban actors and address spatial issues, and what urban patterns and social impact result from these actions and induce building a spatial and social vision. In the long run, the identification of relations and influences on post-socialist urban governance examines how urban actors, space and regulatory framework rely on planning and decision support systems as means to forecast and orchestrate any movement or change of the system.

2 INTRODUCTION

The development of cities is a contextual category, global and local. Nowadays, it is also political, economic and spatial category. This specifies the multilateral nature of urban development in contemporary world – it is not only strongly based on local socio-spatial capacities, but also responsive to global movements of capital, markets, goods and trends. Such complex and perpetual process could only be partially tamed and projected by regulatory practices and organizational solutions in the concrete urban environment. As institutional framework is the overarching historical and social invention that deals with the body of norms, projections and structures in the public domain, the institutionalization of planning restraints and administers how urban development unfolds.

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Unfortunately, dramatic shifts in social organization, state apparatus, political structures and economic model result in the incapacity of the post-socialist urban planning to define contextually appropriate and coherent urban management for tracing its chaotic urban development pattern. A long, declining way from the rigid, centralized planning model that served to build Serbian capital as a modern European metropolis to the arbitrary, market-oriented, politically biased planning started with Balkan wars in the 1990s, was followed by transition from socialist to capitalist economy. In the recent years, this process is also exacerbated by failed social reforms, shallow democratization and unfinished decentralization.

However, it must be admitted that considerable effort has been made to solve this continually enlarging list of conflicts and problems in urban planning, but it has been done rather partially and arbitrarily and almost without any substantial synchronisation between policy agendas and regulatory practices in question. In this respect, Djordjevic and Dabovic (2009) also emphasize that political and economic problems are the principle obstacles for updating post-socialist institutional design, either particular policy agendas or institutions. Therefore, MAS-ANT assemblage methodology[1] is applied to set the interpretation of structure-agency relations within the institutional framework on different levels, with the complex architecture of post-socialist urban planning flattened to internalized and equalized network of agents, regardless of their sort and manifestation (for example, material and / or non-material).

This paper aims at tracing institutional articulation of post-socialist urban planning through MAS-ANT methodological approach. It is divided in three logical, consecutive segments addressing background, method of analysis and discussion concerning the specificities of transition in Serbia, at stake during the last 30 years, and its influence on institutional framework of post-socialist urban development. First of all, we explain general theoretical background in terms of transition, institutional design and MAS-ANT methodology. Then, we analyse the reinterpreted specificities of post-socialist urban planning institutions system according to the MAS-ANT methodological approach. Finally, the third delves into the risks and opportunities to address inefficiency and inconsistency of post-socialist institutional framework.

3 METHODS & APPROACHES

3.1 Context analysis

3.1.1 Socio-spatial patterns of transition

Even though contemporary urban development is embodied in globalized urbanization as a worldwide, broad, general and mutable process, it still contains a necessary connection to place - making an actual urban setting a very vital factor with regard to dealing with power relations and the uncertainty that are generated when global aspects are transformed to meet local specifications. The urban transformation of Serbian cities falls into the cliché of the new post-socialist urban reality, which emerged during the “transition to markets and democracy” (Tsenkova, 2006). Included in this range of spatially and economically different environments, post-socialist countries in Central and Eastern Europe (CEE), and transitional countries in general[2], have undergone dramatic change concerning social organization in general and political system, economic model and cultural distribution in particular.

The mayor consequences of such post-socialist transition introduce, on one hand, the disastrous effects of increasing social polarization (inequity), deinstitutionalization of socio-spatial practices (informality) and unfair wealth redistribution (poverty), and, on the other, the huge socio-cultural base inherited from the socialist period where cities have continued to be unique centres of growth with a variety of services, infrastructural expansion, technological innovation and cultural diversity. This has had a profound influence on the spatial adaptation and social repositioning of post-socialist cities.

[1] MAS-ant methodology is a combination from Multi-agent system (MAS) procedure borrowed from computer scicences and Actor-Network Theory (ANT) on social networks designed by, French philosopher Bruno Latour, among others.

[2] In terms of transition theory, transitional countries experience the period characterized by the discontinuity and opposition of 2 different states of affairs before and after. It has the overall common path of continuity (proceedings). Even though, those societies usually show considerable level of path dependency, the mayor "transitions" happen in terms of: state apparatus, economic order, political entity, and civil society.

While Yugoslav socialist period was less grave than in the other CEE socialist countries and often referred to as "self-managing market socialism"(Estrin 1991), the initial transitional period in 1990s was characterized by civil wars in the Balkans, isolation and blocked socio-economic transformations. Finally, the real transition[3] started, but was rather qualified as slow socio-economic transformation with low rate of foreign investments, dominated by the flurry of wild capitalist and stumbling post-socialist proto democracy. Corruption, manipulation and clientelism have governed most of institutional relations and practices in the public domain, where political actors have become powerful economic actors within an un-transparent and semi-legal system (Vujović and Petrović 2007). In these circumstances, any substantial societal change has been degraded and misinterpreted with superficial economic liberalization and hyper production of ungrounded formalizations (emergence of new institutions and numerous policy agendas).

The belated post-social transition of 2000s can be best circumscribed as "growth without development" (Vujošević and Maricic 2012). This actually means that recently established Republic of Serbia[4], as well as its predecessor Serbia and Montenegro (2003-2006) and Federal Republic of Yugoslavia (1992-2003), has not hitherto managed to solidify the main pillars of coherent socio-economic progress pipeline and adequate legal, institutional and educational framework in order to ensure stability and sustainability of the whole system. Even though, since 2000, the standard of living has increased, the socio-political system shows the traces of surface decentralization and democratization and national economy seems partly revived, the Serbian society stays heavily dependent on international relations, worldwide economic circumstances and regional political movements, being even only a passive recipient of what is happening on the global scale.

This condition of total dependence and local incapacity to pave its own way of feasible and resilient flow of development draws attention that it is only the revival of research, strategic thinking and governance in any field of the public domain which can, slowly but surely, guarantee the continuity and validity of reforms, durability of the system and development based growth (Vujošević and Maricic 2012). Knowing that urban planning is an essential part of public domain of contemporary cities and that it is deeply embedded in its concrete societal context, all the negative effects and anomalies of post-socialist transition must be also taken in consideration within regulatory framework of urban planning.

3.1.2 Post-socialist Planning Context

Having said that spatial planning system reflects political culture and entity of its immediate surroundings (Stojkov and Dobricic 2012), detailed analysis of post-socialist regulatory framework requires reinterpretation of transitory path difficulties in its institutional scope. The state of political instability, convergent socio-economic forces and inconsistent planning practice overcast already loose institutional organization and documentation in terms of: misleading map of actors, provisory rules and inconsistent procedures, and manipulative field of influences (Djordjević and Dabović 2009).

In this jumble of old routines and new market-based demands, the current planning system kept "the worst of both worlds" (Vujošević and Maricic 2012):

1. Cumbersome institutional structure inherited from socialism and managed bureaucratically, which complexifies and blurs the distribution of substantive, qualitative and procedural tasks, leaving space for manipulations[5];

2. New management agencies and organizations formed to address recent market-oriented context, which prove to be incapable to cope with post-socialist development challenges, but prompt to minister political voluntarism and wild capitalism business models present in place.

On the one hand, although the post-social transition keeps changing the social climate in Serbia, the prevailing planning practice is still dominated by rigid traditional system with the planner in centre, even only nominally, and the fixed land use regulations in focus, though often arbitrarily implemented (Djordjević and Dabović 2009). When applied to the particular institutional and organizational arrangements, such planning habit is predominantly technical activity orientated towards end-state functionality of urban systems and the fixed image of the city. However, these practices initiate that policy agendas and projects are made

[3] We evaluate transition in reference to transition theory.

[4] The Republic of Serbia was officially established in 2006, after Montenegro gained independence on the referendum held on May 21 2006 and is a legal successor to the former state union.

[5] "old institutional zombies" as Maricic and Vujosevic call it (Vujošević and Maricic 2012).

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by a cluster of planners[6], who are deprived of officially binding authority and professional dignity (Vujović and Petrović 2007), and become a mere executive body for the decisions made elsewhere. Furthermore, urban regulative stays limited to the land use disposition, which is also non-obligatory, but rather biased by local power relations.

On the other hand, actual building and spatial planning carry on notwithstanding factual regulatory and planning authorities, but rather according to new rules of neoliberal market and the corresponding power relations. Therefore, emergence of multitude of new actors and actor groups from foreign investment organizations and councils to new local managerial structures (functions of city mayor, manager and architect, for example) serve only to ramify this new urban planning battlefield, but without any significant influence or clarified roles in the setting. With new institutional and private actors and strong pressure towards decentralization, urban planning system lose its authoritarian, vertical structure dominant in socialism, but at the same time offer hardly any solutions for (1) binding horizontal and vertical coordination, (2) insertion of efficient meso (regional) level to connect national and local decision making, priorities and interests, and (3) facilitating procedures and relations up and down the institutional structure. Public sector lacks engagement on the regional level; private actors engage individually to find their way through institutional procedures and corrupt public institutions; urban planners are marginalized by the partial and unclear legal framework; and political actors hesitate to introduce a new legal framework (Vujović and Petrović 2007). Consequently, urban planning tend to “happen” spontaneously as a mixture of different models, most often focused on crisis management or investor-based planning to support privatization and marketization, but the least preoccupied with adjusting the institutional framework to accommodate the needed social, economic, cultural and environmental transformation of the society (Vujošević and Maricic 2012).

In short, loose and blurred hierarchy of institutions, vertical clientelism as a way through complex institutional organization, and no trace of effective communication and exchange between national and local level are just few obvious conflicting issues that take place on the surface of instutionalized urban planning practice during the post-socialist transition in Serbia. In this manner, we outline the murky period of overlapping remnants of socialist system and its strong cultural and behavioural heritage with new practices and means of capitalist socio-economic order. Yet it is also clear that post-socialist regulatory framework has a particular set of material and non-material agents that govern its goings-on, which are not yet identified, demystified, traced and evaluated in order to have a functional map of post-socialist institutional design of urban planning.

3.2 Content analysis

3.2.1 MAS-ANT methodological approach

According to the complexity of post-socialist urban system broken down herein in terms of transitional context, path dependency of socialist and post-socialist urban planning and complex, blurred and changing institutional design of urban planning regulatory framework; its dynamics may be reinterpreted as a network constituted of active, operationally independent urban key agents that are being methodically orchestrated by the hierarchy of decision making. This methodology comprises structural analysis of administrative procedures and content analysis of policy agendas to systematically deconstruct local urban governance in terms of political, economic and cultural aspects of transition and investigate the influence of blurred institutional organization and inconsistent policy agendas on post-socialist urban development.

Within such an urban system, all agents and independent external factors influence the agent's functioning, but on the other hand, at the same time, the agent while being influenced by the others also influences them simultaneously (Ferber 1999). This interpretation corresponds to the Multi-agent system (MAS) approach for complex computing systems based on the concept of agents, communication, cooperation and coordination of actions. This approach has already been applied in urbanism as a simplified problem solving strategy primarily used for the decision making process of all urban actors converted into agents and to the social organisations in which these agents are embedded (Bousquet et al. 2004). However, we combine MAS it with Latour’s Actor-network theory (ANT), where all human and non-human agents, social and technical

[6] With the term “planners”, we refer to any professionals from all disciplines present in the planning process (spatial planners, architects and landscape architects, economists, sociologists, geographers, lawyers etc.)

elements are symmetrically treated within a system and together contribute to a dynamic never-ending network where understanding of all phenomena, including the social ones, lies in the associations among them (Latour 2005). Even though, if taken internally, cities are constituted as dual systems incorporating physical and social component; this MAS-ANT methodological approach thereafter involves taking into account all active agents regardless of their sort (ANT), their interdependencies and interconnections (MAS) and how they rely on the planning support system and decision support system to contribute to the overall urban functionality and produces a new complex reality of urban development.

Multi Agent System						***Actor-network theory***	***Urban theory***		
process	**technique**					**concept**	**content**		
	procedures			apparatuses					
Environment (E)	Types of agents					Agent based	Post-socialist urban planning		
Sensory input									
Assembly of agents (A)	Agent profile			Agent type		Human	Urban actors		
						Non-human	Spatial forms		
							Regulatory framework		
							Social aspects		
							political		
							economic		
							cultural		
	existence			Agent state	Agent behaviour				
	figuration	Agent preferences							
		content		Field	perception				
		priorities		Receptiveness	Pro-activity				
		position							
	challenges			sensibility	1-1 interaction				
Assembly of operations (Op)	Interactions			data exchange		Urban assemblages	Levels of decision making		
	Cooperation, coordination & negotiation			strategic					
				tactical					
				operational					
application (U)	Ethnography of causality	linking	Independent actions			Chain of networks	Technical	Functional	Social
						Networks			
Action output									

Table 1: Cross-pollination process of urban development (MAS-ANT methodological approach)

This methodological approach aims at developing the looped concept of building an urban development model through the continuous intermingling of network chains (technical, functional and social). Bearing in mind that actor-network explanations give real results only in strongly defined situations (Farias et al., 2009), the elaborated distribution of causality and linking (MAS) among the elements of the multifarious composition (ANT) activates the core of urban theory about modern cities if constrained to the specific, but non-deterministic urban environment. In this sense, simulating urban development is envisioned with:

- MAS methodology of process generation through basic agents and the pertaining technique of categorizing the pertaining infrastructure with apparatuses (set of fields of influences and major forces) and procedures (set of operational agencies)
- ANT concept of labelling all active elements of an urban ecosystem (urban environment)
- Urban theory layer of content that provides complete and accurate data on the circumstances in urban context of modern cities

The modelling spiral of urban development is in endless motion while the set of sensory apparatuses provide the input about the environment, while the procedures and action apparatuses give back the output that

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influence the immediate surroundings and constitutes the new environment reality to be further re-entered in the urban development loop (Table 1).

3.2.2 Institutionalization of post-socialist urban planning through MAS-ANT method of analysis

MAS-ANT methodological approach aims at balancing constrained theoretical influence, wide conceptual field (ANT) and the dynamic potential of MAS for the simulation of complex urban systems. Doing so practically involves exploring the pattern of apparatuses and procedures that determine the particularity of an urban context in spite of the multiplicity of general urban trends and its local influences, so that the direction of urban development can be traced and simulated. Consequently, this methodological approach deals with an urban environment as an indivisible entity with all mayor, actors, structures, practices, processes and procedures represented within a model (Fig. 1)

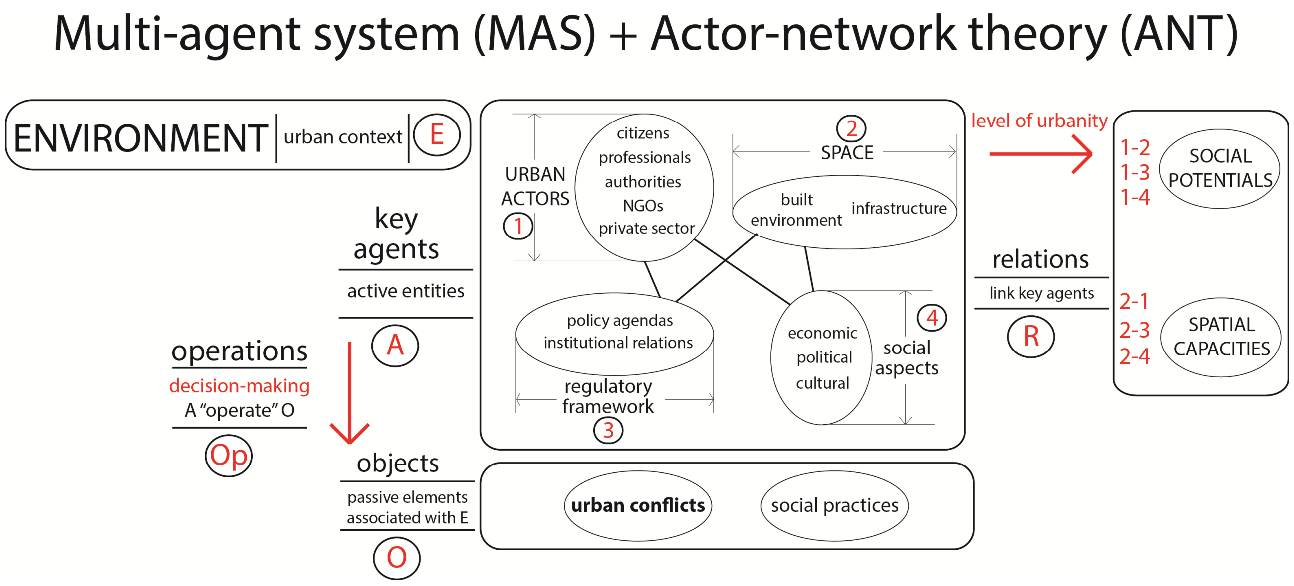

Fig. 1: MAS-ANT concept

Translating MAS-ANT terminology onto the institutional design of post-socialist urban planning works so that we consider the totality of this regulatory framework as an agent of the system and analyse it as a specific agent type in relations to all other set of agents present in the urban context.[7] In this manner, regulatory framework is being extensively defined through agent profile, with its state, preferences and behaviour, i.e. structure, functions and practices of the system.

Knowing that all active agents are identified using the same ontology, the co- and multi- actions among them could be traced in the form of field of influence or perception potential. In practice, it signifies that all urban conflicts and social practices could be identified as directed relations. In other words, the role of any agent of the system could be denoted as pro-activity, sensibility or 1-1 interaction according to (1) the changes recognized in its agent state (structure), fields of influence according to the agent preferences (envisioned function of its norms, rules and regulatory bodies), and mayor forces determining its agent behaviour. These broad domains of the agent profile answer the question of who, what and how acts in the network of complicate relations among istitutions and documents comprised within the institutional design.

If interpreted with MAS-ANT methodological approach, post-socialist institutional framework in Serbia represents linear organization and hierarchical relations of its structures and policy agendas (Fig.2). In reference to the agent state structure, it is organized hierarchically and we distinguish 3 consecutive levels: national, citywide (regional), and local (municipality, community). In this way, we structuralize all public authorities, services, agencies, organizations and enterprises and track the instigating factors, lines of amenability, as well as circulation of substantional, regulatory and executive tasks. Conversely, the distribution of functions differentiates strategic, tactical and operational sources of legal documents and it is identified as a core position, content and priorities of the agent type. Finally, the logistics of agent behaviour

[7] The specific terms of MAS-ANT are explained in the Table 1.

conducts through future-oriented actions and practice (strategies, programs, plans, projects, recommendations etc.)

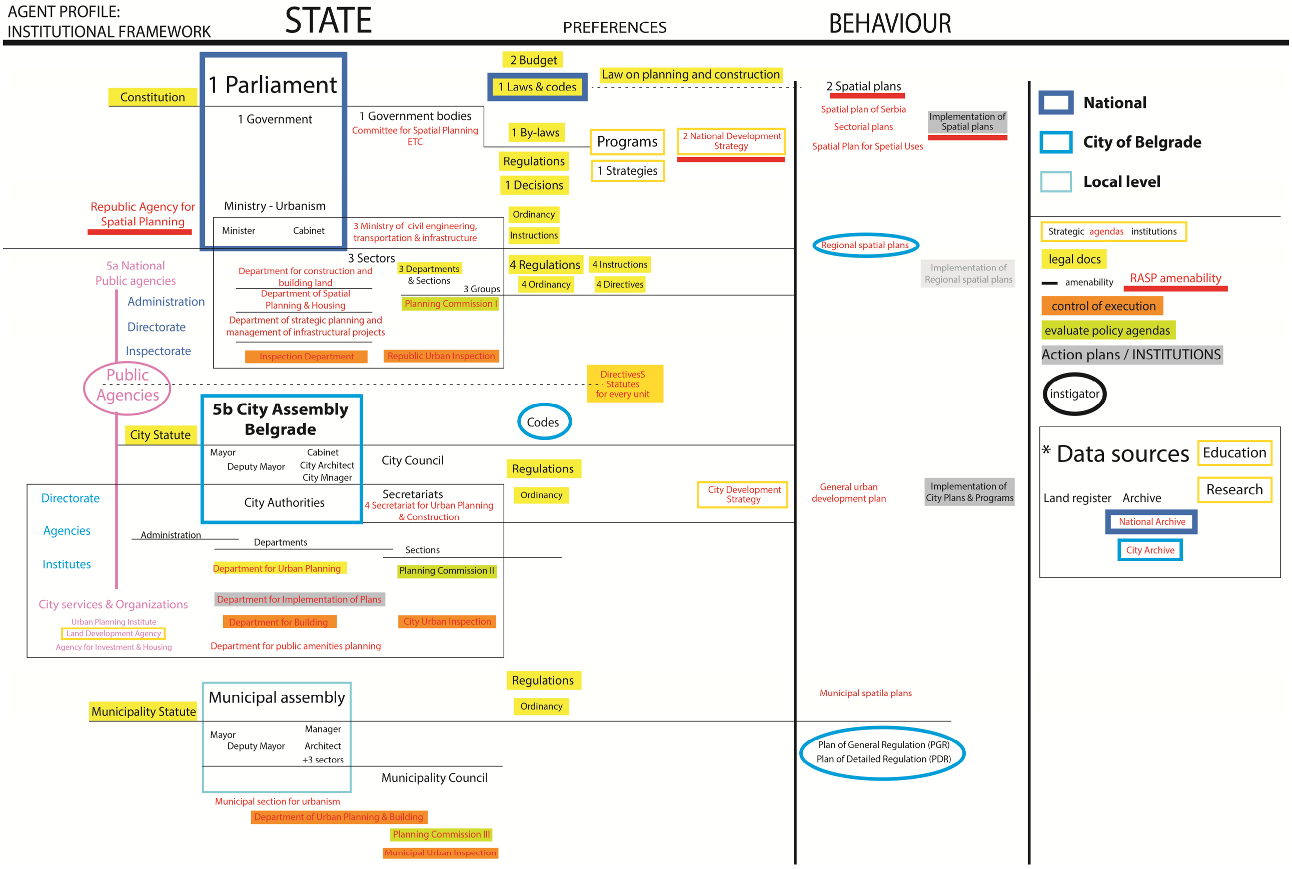

Fig. 2: MAS-ANT interpretation of the post-socialist institutional framework.

4 RISKS AND LIMIT OF POST-SOCIALIST INSTITUTIONAL FRAMEWORK

Institutional design is an overarching theoretical category which comprises rules, procedures and organization structure for enabling or constraining behaviour and actions to accord with values, achieve objectives, and execute tasks.[8] It includes legislative, strategic, procedural and executive tasks that address contextualization, policy making, planning and implementation. In other words, professional and practical spheres of planning respond in its particular manners to the societal circumstances (Djordjević and Dabović 2009), and all their different aspects should be enclosed within the institutional design. Only when we have an exhaustive definition for categorizing everything what happen "under the hood of regulatory framework of urban planning", could we be confident to track and trace any of its agents, analyse it properly and set the conditions for systematic improvements.

Institutional organization of urban planning regulatory framework in Serbia corresponds to the administrative organization of the Republic with 29 districts and 189 communes (including 16 municipalities of Belgrade and city municipalities of Novi Sad, Nis & Kragujevac). The districts act as political bodies, but they are not authorized to make their own decisions regarding spatial development. Therefore, in practice, spatial plan of the Republic, regional spatial plans and spatial plans of special uses are under the jurisdiction of the National authorities. On one hand, the Ministry in charge of spatial and urban planning[9] prepares those plans, while National Government and the Parliament initiate their preparation and adopt the finalized versions. Moreover, implementation plans and programs dealing with spatial development are also the

[8] This extensive definition is provided by Alexander (Alexander 2005) as a revision of a set of previous definitions from various authors, which were partial and incomplete.

[9] The name, organization and distribution of tasks vary from one Government mandate to another and depend on the political party in power. Currently the Ministry operates under the name ", the Ministry of Civil Engeneering, Transport and Infrastructure"

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responsibility of the Parliament and republic government[10]. In this respect, the Ministry of Civil Engineering, Transport and Infrastructure is the key public actor at national level in the domain which (1) conduct administration tasks, (2) govern strategic construction, site-development and infrastructure equipment works, (3) carry out survey jobs, and (4) perform inspection and supervision actions in the field (Maksic 2012)[11]. On the other hand, cities and municipalities have legal means and rights to make their own strategies, plans, and programs, as well as local regulations and rules in terms of urban development. In this respect, local authorities initiate and adopt all planning documents that control urban development and comprise guidelines for administration of their respective municipalities/cities/communities[12]. Urban plans, therefore, consist of General Urban Development Plans, Plans of General Regulations and Plans of Detailed Regulations[13]. They cover respectively smaller territory, incorporate all sorts of innovative, strategic and up-to-date methods, and in general offer the detailed solutions for issues already conceptually covered with spatial plans, such as land use and building zones, .transportation, infrastructure, natural and cultural heritage, green, recreation, protected areas etc. For example, General Urban Development plans control development on a local level, so that they are prepared and adopted locally; but, being regarded as strategic documents with a certain influence on national and/or regional level, the final consent upon their adaptation rest with the Ministry in competence.

According to Alexander (2005), core concepts of 3 institutional bonds that provide the functionality of the system on different levels are: governance, coordination and agency. His approach elaborates how institutional design emerged from institutionalization theory and how these categories of governance, coordination and agency and their independent development in the institutional context and on the different scale, in the long run, contribute to positive institutional transformations and eventually to significant urban development in our case. From a broader perspective, the issues of governance, coordination and agency refers to the ways conflictive hierarchy, activities and relations could be reinterpreted on macro-micro levels (governance), through network organizations and distribution of roles (coordination), and within task implementation procedures (agency). In post-socialist institutional framework, as it has been shortly presented herein, we can identify “cracks” in all 3 mayor institutional bonds:

(1) Centralized, top-down decision-making structure with the respective Ministry as an executive and regulatory entity and national authorities as a supreme legislative body.

(2) Loose horizontal and vertical communication among the institutions, with the authoritarian attitude on the national level, no adequate regional level, and no clear task separation among the institutions on the same level.

(3) Top-down political voluntarism as well as bottom-up vertical clientelism bringing about the institutionalization of various doubtful interests within the official institutional framework.

Finally, we may realize that all the particular conflicts of governance, coordination and agency could be traced within legislative regulatory, executive, external and internal controlling substantive, technical, managerial and financial procedures, identified by MAS-ANT methodology.

5 CONCLUSION

Knowing that the way cities function shapes the expectations and actions of all the urban actors involved, who also influence the constitution of the city itself; MAS-ANT concept is based on the notion of an open-ended future, which implies that uncertainty must be accepted and managed. MAS-ANT methodology enables us to make a crucial change in approaching urban development in post-socialist cities that can then be circumscribed by the rise of the global concept from static to itinerant and dynamic and susceptible to

[10] The exception is the capital (Belgrade) and the autonomous province of Vojvodina. They adopt implementation plans and strategies for their respective territories.

[11] Another important role on the national level was assigned to the Republic Agency for Spatial Planning, in charge of strategic and tactical documents, programs and tasks on the national level such as: (1) preparation, coordination and monitoring of spatial plans, (2) technical assistance for plan preparations, and (3) spatial planning training programs. However, the Agency has been recently discontinued according to the new Law on blablba

[12] For the city of Belgrade, which consists of 16 minicipalities, this is contucted on the citywide scale by the city administration.

[13] Any Urban Development Projects, Schemes or Land Subdivision Projects are subordinate documents to these 3 hierarchical types of urban plans.

change through continual iterations. This dynamics of relations and influences between different layers of decision making and urban key agents indicates opportunities for altering post-socialist urban planning by analysing:

(1) how all the processes and procedures are interrelated within an urgan agent profile (such as institutional design of urban planning framework),

(2) in which manner regulatory framework relates to urban actors and address spatial issues,

(3) what urban patterns and social impact result from these actions and induce spatial, social or institutional changes.

Therefore projecting the urban development on a post-socialist urban environment or a city could be only the final product of an overarching decision making procedure that comprises and reconciles all its different levels and the way how each of them address urbanity as its constitutive reality and urban development as its ultimate positive goal.

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Exploring the Alpine SUMP with the PUMAS ASC: An Online Community of Practice for Combining Planning and Learning in Urban Mobility Planning

Till Schümmer, Martin Mühlpfordt, Giuseppe Mella, Pier Paolo Pentucci

(Dr. Till Schümmer, FernUniversität in Hagen, Universitätsstraße 1, 58084 Hagen, Gemany, till.schuemmer@fernuni-hagen.de)
(Dr. Martin Mühlpfordt, FernUniversität in Hagen, Universitätsstraße 1, 58084 Hagen, Gemany, martin.muehlpfordt@fernuni-hagen.de)
(Giuseppe Mella, City of Venice, European Policies Department, San Marco 4299, 30124 Venice, Italy, giuseppe.mella@comune.venezia.it)
(Pier Paolo Pentucci, City of Venice, European Policies Department, San Marco 4299, 30124 Venice, Italy, pierpaolo.pentucci@comune.venezia.it)

1 INTRODUCTION

Sustainable urban mobility planning (SUMP) is an approach for empowering all stakeholders in mobility planning (WEFERING et al., 2014). By involving a large group of stakeholders and structuring the interaction between stakeholders and planners in a way that the citizens' needs are met, new responsibilities for the shared environment, i.e., the planned city are built up and good practice develops. Many cities have by now established sustainable urban mobility plans (SUMPs). In some countries, e. g. in France, the creation of such a plan is mandatory (in France, the SUMP is called PDU). However, the people in charge of creating and establishing a local SUMP often lack experience in SUMP. Good practice repositories approach this problem by collecting experiences and explaining how a SUMP has been established in a specific city (cf. Section 2). Interaction is, however, still limited in these communities. On the other hand, shared workspaces for planning often lack a connection to existing planning knowledge. Planners do not have knowledge awareness and thus redesign SUMPs from scratch.

In this paper, we will first summarize a small part of theory relevant for knowledge-aware workspaces for SUMP and relate this to good practice repositories for planning knowledge. Our analysis shows that existing knowledge sharing environments are very well addressing the needs of planners who actively seek information and inspiration. However, in current working settings, planners and to-be-involved stakeholders often do not know what they could learn from other cities. They do not even look for this information. To overcome this problem, we present the PUMAS ASC platform and elaborate on the platform's mechanisms towards knowledge awareness. The platform is complemented with a set of tools that help planners and other stakeholders to engage in a conversation on planning issues. We will describe how we design planning workspaces and processes that support mobility planners and stakeholders in SUMP-related planning activities.

2 PARTICIPATIVE PLANNING AND GOOD PRACTICE REPOSITORIES FOR SUMP

Participation can be considered as one core pillar of the SUMP approach. The SUMP guidelines request the participation of citizens and stakeholders in all phases of the decision making process but also in the planning and the implementation of concrete measures (WEFERING et al., 2014). Regarding urban planning, this approach is not new. The Oregon Experiment (ALEXANDER et al., 1975) was a pioneering work towards a participative planning process. Participation was defined there as a "process by which the users of an environment help to shape it. The most modest kind of participation is the kind where the user helps to shape a building by acting as a client for an architect. The fullest kind of participation is the kind where users actually build their buildings for themselves." (ibid., p. 39) In later works, especially in his latest writing, Alexander became clearer about the underlying principles (ALEXANDER, 2012): The ultimate goal for his participative approach was to enable inhabitants and citizens to shape their environment towards a high level of wholeness. Wholeness speaks of the oneness of all things." (ibid., p. 87). Instead of separating the ownership of processes and measures from the people affected by the process and the measures, construction should be done in a way that it reconnects the inhabitants with the space. Instead of separating roads and buildings from the environment, it should be adapted to the environment so that it creates an organic whole. We can even extend this notion to the level of meta-physics: Instead of separating inhabitants' utopia (the non-being, the non-physical, the sense for infinity) from what most people call reality

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(the being, the physical, the objective truth, the world of engineering), inhabitants should recover a mode of communication where the potential to be has its space again.[1]

Looking at the SUMP guidelines with such a perspective in mind, we can discover multiple commonalities between SUMP participation and Alexander's vision for participation. SUMP, e.g., calls for the development of a common vision. The public is to be involved in this process through a Vision Board (WEFERING, 2014, p. 49). The board, however, already increases the distance between citizens and planners. Direct participation is reduced. When it comes to the selection of measures, planners "should build on discussion with key stakeholders, consider experience from other places with similar policies, ensure value for money and exploit as much as possible synergies between measures." (ibid., p. 58). Notably, the selection and evaluation of measures becomes a task for the planners again. They should take into consideration the results of the stakeholder meetings but do a first selection of suitable measures and only when these are evaluated move back to the stakeholder group to check the suitability of the measures. Again, we can observe a reduction of direct influence or wholeness in this process.

We thus argue that, although SUMP is much closer to a planning in wholeness, decision strategies in SUMP still have the danger of a separation between planners and citizens. Citizens should get the chance to involve more intensively in order to take responsibility for their environment.

This requires that two prerequisites for participation are met: (1) There needs to be an efficient communication and interaction space where a discourse on visions can take place and (2) citizens and other stakeholders who are not trained in planning should be empowered to act like experts (but still keep their connection with the environment).

For the focus of this paper, we will investigate how these two dimensions can be supported with electronic media. EFFING et al. (2011) make the following mapping between technology and the level of involvement supported by the technology:

- e-Enabling mainly focuses on informing stakeholders and citizens. This is the weakest form of participation. Electronic support includes Web pages or newsletters.
- e-Engaging has the goal of involving stakeholders in a dialogue. They do no longer only consume information about the planning process but also contribute their opinions. They comment plans and provide background information from their specific perspective. In some cases, decisions are made through online polls. The term Web 2.0 stands for such interaction, where ideas are shared, commented and connected in an online information space.
- e-Empowering describes the highest level of participation. Stakeholders are empowered to co-design their own solutions. The main focus is on the collaboration towards a plan that is supported by all stakeholders. Effing et al. connect this participation level with the concept of social media. To a large extent, this connotation makes sense: In social media, stakeholders can organize themselves, form interest groups, initiate discussions and share ideas. However, besides social media, one should also consider tools for online collaboration. Empowered stakeholders should be able to develop their own plans and play a leading role in the coordination towards a consensus.

Current good practices in SUMP participation often focus on e-Engaging. Web technologies are used for enabling online communication and providing consumer access to a shared information space (i.e. on a web site). In fewer cases, social network technology is used for raising awareness on the current planning activities. We argue that future IT solutions for participation in SUMP should focus on e-Empowering. The proposed solution in Chapter 3 of this paper will show how participation in the sense of e-Empowering can be reached through the mechanisms of the PUMAS ASC.

But before we go into details of our solution, we will briefly summarize some examples for communication and interaction spaces in planning and for good practice repositories, i.e., tools helping practitioners to gain planning knowledge and derive requirements for a participative planning environment for SUMP.

[1] This last statement shows that the underlying problem is much larger than the pragmatic dimension of planning. The point is that participatory planning should not limit itself to the dimension of pragmatics. However, this requires a fundamental change in planning attitudes. The same challenge is currently discussed in other fields as well (e.g., in computer science, cf. SCHÜMMER et al., 2014).

2.1 Interaction Spaces in Planning – Theory and Practice

Participatory planning requires that stakeholders have access to a shared information space in which the plans are stored and manipulated. In times before the computer, such a space would be a common planning office. The office should be open to the public and inhabitants of the environment should be welcome to contribute to plans, e.g., by creating their own sketches, collaborating on health maps, or co-designing mock objects. The Oregon Experiment that was mentioned above provided such an interaction space as part of the process. A more recent example is the Bergamo 2.035 exhibition lab (a part of the project Bergamo 2.035, http://www.bergamo2035.it).

When it comes to online interaction, many planning initiatives build on the use of existing social networks. As the physical planning offices move into the centres of the city and open up for the public to be involved (that is the case with the Bergamo lab), projects use existing social networks such as Facebook to inform the public about current planning activities. The PUMAS pilot activity of the City of Venice, e.g., created a Facebook page to inform the public about current activities for a safe school travel.[2] The interaction in such networks typically ranges from e-enabling to e-engaging.

When it comes to the development of the concrete measures, tools for closer collaboration are needed. Examples include a SHARED FILE REPOSITORY to exchange planning documents, a communication space such as a FORUM or a synchronous multi-user editor to support SHARED EDITING (an overview of current approaches to remote collaboration is provided by SCHÜMMER and LUKOSCH (2007)). In theory, online interaction spaces can become a rich space for exchanging future visions and developing shared ideas and measures together with the stakeholders.

However, most current practice does not involve such interaction. A survey among the project partners of the PUMAS project, although not representative, showed that most interaction takes place in face-to-face settings or by the exchange of office documents via e-mail. This means that interaction structures need to be planned beforehand and that they require a high level of commitment. Collaborating with stakeholders is often considered as demanding and time consuming.

At the same time, stakeholders are still not used to enter virtual collaboration spaces. They can be convinced to join stakeholder meetings but to our experience will not be able to invest much time between the meetings, especially when they do not see a direct outcome of their engagement.

Both aspects indicate that there is a barrier towards a close interaction in stakeholder-driven planning. At the same time, we observed in selected pilot settings (especially in the PUMAS Voyage project, SCHÜMMER et al., 2015) that even children can stay motivated to share their visions in a participatory planning project, once the project manages to speak in their language (i.e., visual sketches of their utopian shape of the environment). We thus recommend that a shared space for participation in SUMP should be open to visions and allow participants to talk about these visions. It should also constantly provide new inspirations on how the city could be.

2.2 Knowledge Repositories and Sharing of Practical Knowledge

Good practice repositories, such as the Eltis (http://eltis.eu) platform, the CiViTaS Wiki (http://civitas.eu), or the EPOMM network (http://www.epomm.eu) aim at making good practice in urban planning accessible. The platforms collect case studies where cities document their experience with new mobility concepts or other aspects of planning.

Although the case studies differ in structure from platform to platform, they can be considered as modern variants of pattern collections in the sense of ALEXANDER et al. (1979). This collection includes 253 so-called patterns, guidelines for good design of towns, buildings and construction. Frequent critiques have considered this book as a collection of authoritarian and deterministic imperatives. This reception is due to the structure of the patterns: Each pattern starts with a description of a situation that ends with a problem statement. Then it describes a solution ending with a summary that always starts with the word „Therefore“ and then adds an imperative description of the solution. ALEXANDER et al. claim to have at least some patterns „stating a true invariant: in short, that the solution we have stated summarizes a property common to

[2] https://www.facebook.com/lamiascuolavainclassea; More information about the pilot activities of the City of Venice can be found in (SCHÜMMER et al., 2015).

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all possible ways of solving the stated problem.“ (ibid., p. xiv). The same critique has been made to other good practice collections: they would limit creativity and lead to a uniform style of planning and design.

A closer look at A Pattern Language, however, shows that this interpretation was not intended by the authors: „The fact is, that written this book as a first step in the society-wide process by which people will gradually become conscious of their own pattern languages, and work to improve them.“ (ibid., p. xvi).

We think that this point is of great importance for good practice collections in general. Good practices, considered as externalized representations of individual tacit knowledge (POLANYI, 1966) initially only reflect personal knowledge, values and feelings. Through a communication process, they may become part of the organizational knowledge (NONAKA & TAKEUCHI, 1995). Individual practice is combined and in some cases also repurposed to a specific context. The communication process leading to the combination of knowledge is often as important as the knowledge artefact itself. From this perspective, it is clear that the creation of a pattern language is the first step towards a participatory design. This is why ALEXANDER et al. (1975) placed the process of creating an own pattern language for the specific design project at the beginning of the process.

SUMP follows the same spirit but with slightly modified orders of steps: In phase 4 of the SUMP, stakeholders are asked to create a shared vision (WEFERING et al., p. 48). This vision is from then on used as a basis for future planning. In phase 6.2 „Learn from others experience“ (ibid., p. 63), current good practice shall be investigated and collected as inputs for the own planning process. We argue for a more iterative approach where vision building and the reference to existing good practice are intertwined in a way that existing practice can inspire the vision building process and modified visions change the relevance of good practice guidelines so that other good practice may move into the focus of the participants.

In addition, participants should be encouraged to contribute their good practice knowledge. The fact that this knowledge is in most cases tacit knowledge, in other words knowledge that people show in their performance but cannot easily express, calls for a carefully crafted support process in which indications of knowledge are taken up and refined together with the knowledge owner.

One example for such a process is called shepherding (HARRISON, 2006). It is a structured review process often used among design pattern authors. The basic idea is that an experienced author, a so-called shepherd, collaborates with an author, the so-called sheep, and helps the author to improve his or her text. At the beginning of the shepherding process, the future sheep is assigned to a shepherd or selects a shepherd on his own. Once the shepherd accepted the invitation, he reads the text and starts to ask questions or makes recommendations for improvement. Typically, the shepherd starts with his first impression of the text. Then he looks at the core elements of the text and checks if both are well aligned. The shepherd adds comments to the document and sends the document back to the sheep.

Instead of starting a discussion with the shepherd, the sheep reads the annotations and tries to reformulate the text. The sheep then adds another comment to the shepherd’s comment explaining how the text was changed so that the shepherd’s comment is resolved. Once all comments are worked through, the sheep sends the document back to the shepherd and awaits new comments. Through this dialogue, the sheep learns how to express experiences in a way that they can be combined in the project’s pattern language.

From other contexts (MATSCHKE et al., 2014), we know that knowledge intensive group interaction often faces the problem of knowledge sharing barriers. One important factor is the lack of knowledge awareness. Knowledge awareness means that potential receivers of knowledge become aware of the existence of the knowledge. „When users [are] aware of various aspects of knowledge existence, this awareness provides rich cues for possible interactions.“ (YAMAKAMI, 1993) Knowledge awareness may help to solve the knowledge sharing paradox, because: Without knowing what others know, practitioners will not know what knowledge they can expect from others. And without knowing what others need to know, practitioners will not provide this knowledge. For the implementation of a SUMP knowledge repository, it means that the awareness of existing approaches is as important as the awareness of required approaches as well as the awareness of own tacit knowledge.

One final issue extends the notion of tacit knowledge: Polanyi’s definition of tacit knowledge focuses on the individual. In the context of a SUMP, we should in addition consider tacit knowledge from people who are not yet participating in the process. These are stakeholders that do not yet know that they have a stake in the project. They are not aware of the need of their participation.

2.3 Requirements for a participative planning environment for SUMP

From the above observations, we can summarize a set of requirements for a participative planning environment for SUMP:

- R1: Shared Space. Planners and stakeholders need a shared space for exchanging ideas and visions on the future of the city.
- R2: Communication. Ideas and planning material should be discussed by the members. Facilitation should encourage the discussion with a focus on the joint project. The communication should avoid language barriers. This means that participants should talk in their local language and that they should also try to prevent language barriers caused by planning specific language.
- R3: Knowledge awareness. This is probably one of the most important requirements. An environment for participative SUMP has to establish awareness on existing knowledge within the project and from other projects. It has to make people aware of knowledge needs and it should raise the awareness of tacit knowledge.
- R4: Knowledge mining. Participants should be engaged in a communication process where they express their experience with similar planning situations. They should get support in structuring their knowledge.
- R5: Knowledge evolution. Shepherds should support practitioners in the evolution of early knowledge.

3 THE PUMAS ASC APPROACH

The Alpine Space Community (ASC) developed in the INTERREG “Alpine space 2007-2013” project PUMAS focuses on the interplay between concrete planning activities and learning as a pre-requisite for efficient actions. The basic idea is to provide protected workspaces for stakeholders in a planning project, capture tacit planning knowledge and augment this knowledge with knowledge obtained from other work groups or knowledge repositories. The platform is currently opening up for participants outside the PUMAS project consortium. More information on how to access the PUMAS ASC and use it can be found at the project homepage (http://www.pumasproject.eu). The system is also available for commercial use, distributed by a spin-off company of the FernUniversität in Hagen (cf. http://www.patongo.de for details).

If a city, e.g., aims at improving bicycle traffic, they will typically set up a workgroup at the PUMAS ASC. They start working by sharing a first draft of the SUMP goals as a wiki page. By a semantic analysis of the wiki document, the PUMAS ASC system identifies experiences from other projects that also addressed bicycle traffic. It reminds the planners and other stakeholders of the new project on these experiences and thereby establishes knowledge awareness.

In the following sections, we will show in detail how this approach helps to satisfy the requirements presented in the previous chapter.

3.1 A shared workspace at the PUMAS ASC

For the development of SUMP measures, the PUMAS ASC provides protected group spaces. Alternatively, groups can be open to the public. When initiating a project, the facilitator invites members he or she is already aware of. These members can be granted facilitation rights as well so that they can invite additional members. In addition, the address for the group can be shared in the physical space by means of flyers with QR codes so that inhabitants can easily find the group. Facilitators can decide whether or not these inhabitants are asked to only contribute visions and ideas or become full members.

As contributors, they will find a form in which they can submit content even without a prior registration but they will not be able to see or discuss the content unless it is publically released by the facilitator. As full members, they get access to discussion boards as well as document spaces of the group.

The PUMAS ASC distinguishes four main document types to be worked on in the group at an early stage:

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(1) A SWOT document can be used to carry out an online SWOT analysis. Stakeholders could be invited to the online SWOT and contribute their experience with SUMP-related planning aspects. Unlike in traditional workshops for analysis, a much higher number of participants can be part of an online SWOT. They do not have to contribute at the same time and can take some time for reflecting on their experience and the experience of others. In addition, the online SWOT place can become a SWOT discussion space in which stakeholders not only share their understandings of strengths, weaknesses, opportunities and threats but also discuss underlying reasons.

(2) Ideas can be used to describe visions of the future mobility in the city. They do not have a detailed structure. Basically, they consist of a name, a summary and a detailed description as well as an illustrating picture and user-defined tags.

(3) Challenges document mobility aspects that are considered as problems by the contributing stakeholder. They have the same structure as ideas.

(4) Generic Wiki pages are meant to be structured by the participants. They can be used to document the plan and create detailed descriptions of the measures to be implemented.

Each document can have attachments and thus collect additional planning specific material (such as topographic maps, spread sheets, etc.). However, the participants should avoid using document types that create new barriers (by requiring planning specific software).

Documents are language specific and can be translated to other languages. This was especially relevant in cross-border teams working on cross-border SUMPs. The translation can be done by all group members. Members of the group can be notified on new activities by e-mail or by periodic reports. All documents have a discussion space. Contributions to the discussion can either be received by mail or in a periodic report. This ensures that group members stay aware of relevant discussions without being flooded by too many e-mails.

Except the explicit distinction of ideas, challenges, and generic pages, and the document-centric forums the group space has no major differences to other shared workspace systems (such as BSCW, http://bscw.de, or Microsoft SharePoint). The main innovations will thus be presented in the next sections.

3.2 Establishing Knowledge Awareness at the PUMAS ASC

The core idea of the knowledge awareness in the Pumas ASC is to analyse contributions and propose related content in the workspace. When participants contribute a document (i.e., a SWOT analysis, a challenge, an idea, or a wiki page), the system analyses the content of the document and finds other documents that address a comparable content. The analysis uses an adapted version of Apache Lucene’s “MoreLikeThis” search filter (cf. http://wiki.apache.org/solr/MoreLikeThis). Relevant terms of the submitted document are extracted and other documents are searched that use the same terms.

Retrieved related documents are shown together with the document. This has the positive effect that a contributing user will immediately see related documents when saving the own document the first time. The intended workflow for getting aware of relevant existing knowledge thus does not start with a an explicit search for content but with a description of the first set of ideas and challenges. Note that the existing knowledge is taken from other groups’ documents that are shared with the PUMAS ASC community.

In a next phase, participants or facilitators will explore the related content and add relevant content to the group’s set of favourites. This way, the group incrementally builds a group specific repository of background material, similar to the project specific pattern language proposed by Alexander. Additional related documents will still be shown together with the group document, but they move out of focus as soon as explicit links and favourites are selected.

One special challenge in the Alpine Space is the combination of different languages (Italian, Slovenian, French, and German in the case of the PUMAS project). Language-oriented recommendation mechanisms would lead to language-specific sub-communities. Each document can thus be translated to any of the project languages (a similar approach is followed by the Eltis platform). However, it became clear as well that the effort for translating all documents exceeded the project’s capabilities. Thus, it was decided to put special attention on the translation of keywords. The semantic network of keywords and documents was then used to recommend content from other languages. Whenever interesting content was found this way, the group could decide to translate the content for internal use or share this translation again.

3.3 Unveiling tacit knowledge with PUMAS Storm

The recommendation mechanisms are one way to establish knowledge awareness. For setting up a planning community, it still has the cold start problem. Unless there is a base set of good practice knowledge, participants fear the investment of contributing.

In other projects, e.g. when setting up a participation process among planners in churches or planners in sports organizations, we were able to reach very positive effects with a methodology called PATONGO Storm (SCHÜMMER & MÜHLPFORDT, 2012). The idea of this method is that participation requires communication in face-to-face interaction as a starting point. During a stakeholder meeting, participants are placed randomly on group tables. The workshop begins with simple story telling: In groups of three, one participant starts to report on his or her most successful action during the last 12 months. The other two group members listen and ask if they want to know more details. After 2-3 minutes of conversation, the group summarizes the report in one paragraph and identifies main topics addressed in this experience as tags.

After all group members have acted as storyteller, the group starts the next phase, where challenges are reported. Again, these are captured in short summaries and afterwards they are tagged. Since all groups talk in parallel, this phase will generate a large number of knowledge stubs in a very short time.

At the end of this phase, the PATONGO Storm system analyses the content and matches problems with experiences. As a result, it initiates conversations across groups where people with experiences in a specific area are connected with others who have ideas or visions for this area. These new pairings begin to formulate a possible future scenario that can be commented by others again. Finally, there will be a collection of contributions as well as an initial network among the participants. These connections can continue after the workshop and jointly work on the concrete parts of the SUMP (or concrete measures).

The main benefit of this approach is that initial knowledge awareness is achieved in a face-to-face setting. Knowledge is connected with people. And people motivate one another to start talking about their ideas. In the conversation, participants start reflecting on their practice and explicating tacit knowledge. Even though only small chunks of knowledge are explicated, the value of these chunks becomes clear instantaneously.

3.4 Evolution of knowledge

Once knowledge was identified and connected in the PATONGO Storm or in the first working phase of the group space, quality assurance can begin. The PUMAS ASC supports shared annotations on documents and models a workflow for shepherding.

Authors can invite a shepherd who will then find the document under review in his personal dashboard. The dashboard contains all documents for which action is required. The PUMAS ASC supports the shepherding process by keeping track of comments, roles and tasks.

Documents can be annotated and passed back to the author. Whenever a document changes its status, the author and the shepherd are informed about required actions. Annotations can be tagged as to-dos that the author has to take care of. This process is repeated until the author and the shepherd are satisfied with the document’s quality.

Shepherding is especially relevant for reflective writing. As in PATONGO Storm, where the small group helped the reporting group member to enter a mode of conversation, the shepherd can ask relevant questions and thereby help the author to better understand what the core of the experience was or what parts of the experience could be of general interest for other contexts.

The PUMAS ASC offers two additional document types for capturing reflection knowledge. Experience reports are thought as knowledge structures to report on a project or measure. They have a pattern-like structure, i.e. a context description, the description of the problem and the challenges, and a description of the performed activity together with some sections focussing on the effect of the action. Unlike patterns, they should keep the link to the concrete experience. Consequently the author who made the experience is the only person who can modify the page (with the help of the shepherd). When an experience is more abstract and thus applicable in wider contexts, it can be described as a method. Methods have a comparable structure but combine experiences from different projects. Typically this is the knowledge structure that is hardest to write but on the other hand has the widest applicability. Again, shepherds can support the team of authors in writing the methods.

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Experience reports and methods are intended to be shared across group boundaries. They will be considered as recommendations when a new planning process starts.

4 SUMMARY

SUMP aims at participatory planning of urban mobility so that cities improve their wholeness. Transport should become healthier, environment-friendlier, and more oriented on people. To reach this goal, participation is a key issue. Giving inhabitants of the city a new responsibility and empowering them to steer mobility measures can transform cities to a place where citizens can live more connected to the city.

Successful participation however requires a shift in processes and knowledge sharing. In this paper, we proposed the PUMAS ASC approach as a means for generating new visions and turning these visions into reality. The PUMAS ASC approach heavily builds on the idea of a living pattern language, i.e. a collection of good practice knowledge that is selected and adapted to the concrete planning project. This pattern language interacts with visions and challenges contributed by the stakeholders and is stepwise refined to the concrete project's needs. Semantic computer technology is used to relate knowledge and thereby inspire the project members with alternative solutions to their habitual way of approaching the challenges in the city. A workshop model, the PATONGO Storm approach, can further be used to initiate conversations.

Once a project is on track, constant reflection of practices shall help to capture knowledge. Special document types (experience reports and methods) support the reflection. Shepherding is intended as additional means for improving captured knowledge.

Within the PUMAS project, we have gained first experiences with the process and the tools. Both were discussed and tested in site workshops at the project partners' locations. Especially the semantic recommendation approach was considered as helpful for the project work. Few project partners have also gained experiences with shepherding. They appreciated the interaction with the shepherd and were positively evaluating the improvements of the content.

The PATONGO Storm format has been evaluated in one concrete planning setting of the City of Vienna. Although external factors limited the time of the workshop, first connections could be established in the workshop and an exchange of visions took place. As expected, all participants had the chance to contribute in a way that their vision was heard. In another workshop on institutional cooperation, we varied the process in a way that good practice scouts monitored small group discussions (that were run without computers) and contributed their observations as experience reports directly to the PUMAS ASC. Again, we could observe that valuable practical knowledge was captured and communicated in the community.

However, we are also facing challenges. In daily practice, some partners see the difficulty of integrating the reflection phases demanded by the PUMAS ASC in their job schedule. When working under time pressure to reach project deadlines, reflection phases that do not directly contribute to the next deadline are hard to justify. Future work should place special attention on the integration of reflective work modes and project-related activities. However, such a change typically requires changes in the organizations and thereby months or years before it can show effects.

Another challenge is the cold start problem. Although a first collection of contributions has been collected at the PUMAS ASC, it is still relatively small compared to other good practice collections that are developed top down with an editorial board (e.g., the Eltis repository or the CiViTaS Wiki). Future work should continue to forge links between the PUMAS ASC and these repositories.

Last but not least, we were approached with the question, whether such a system could be used on a smaller scale inside an organization. Building on experiences made by a commercial partner of the FernUniversität (www.patongo.de) who transferred the PATONGO technology, the core of the ASC, to other domains, it is very likely that an in-house ASC installation can reach the required momentum. It is, however, a challenge for future work to investigate means for exchanging practical knowledge across different ASC communities taking privacy and intellectual property rights into account.

Finally, we invite you to become a member of the PUMAS ASC, use it for your project work and share your knowledge with the community. Finally, it will not be the technology that defines knowledge exchange but it will be the community members with their visions and experiences that make the difference towards a sustainable human-centred planning culture.

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Gestaltung einer Energie-Kultur-Landschaft in Stadt und Land

Dagmar Everding

(Prof. Dr. Dagmar Everding, Hochschule Nordhausen, Weinberghof 4, 99734 Nordhausen, everding@hs-nordhausen.de)

1 ABSTRACT

In einer nachhaltigen Kulturlandschaft werden natürliche Ressourcen gebraucht und nicht verbraucht. Dieser Gebrauch soll in Einklang mit einem kulturellen Stadt- und Landschaftsbild erfolgen, das sich mit den technologischen Veränderungen weiterentwickelt. Aus Hauskaminen auf Dächern werden thermische Solaranlagen, aus Wassermühlen mit Werkstatt- und Lagergebäuden Wasserkraftwerke, die sich mit Museen, Gastronomie oder Wohnnutzungen verbinden. Im Rahmen der Internationalen Bauausstellung Thüringen sollen in der Stadt Nordhausen wie auch in der Region Nordthüringen in historisch geeigneten Stadtraum- und Landschaftstypen erneuerbare Energieprojekte vernetzt und initiiert werden. Sie gestalten, auf der Folie einer gewachsenen Kulturlandschaft, neue nachhaltige Stadt- und Landschaftsräume. Energiepfade bilden die raumstrukturelle Idee für die Entwicklung einer Energie-Kultur-Landschaft, die historische – mit der Energienutzung verbundene – Linien in der Landschaft aufgreifen, beispielsweise Gewässer oder Handelswege. Die Pfade ermöglichen eine konzentrierte Wahrnehmung dezentraler Projekte und eine Weiterführung zu künftigen Projektorten. Aufbauend auf bestehenden Konzepten des energetischen Stadt- und Landschaftsumbaus werden innovative Wege zur Umsetzung der Energiewende im Einklang mit bestehenden kulturhistorischen Werten aufgezeigt.

2 DIE ENERGIE-KULTUR-LANDSCHAFT ALS EINES DER ZIELE DER INTERNATIONALEN BAUAUSSTELLUNG THÜRINGEN

Das Bundesland Thüringen bereitet zum Jahr 2023 eine landesweite Internationale Bauausstellung (IBA) vor. Präsentiert werden sollen nach einem dann achtjährigen Vorbereitungsprozess Projekte, die vorbildlich sind, Freiräume nutzen und neue Wege gehen. Die IBA Thüringen stellt sich nach ihrem Selbstverständnis der großen Herausforderungen der Energiewende und des demografischen Wandels und sucht nach Wegen ihrer baulichen und landschaftlichen Umsetzung. Bei der Energiewende, die auch von dem Bundesland Thüringen zu leisten ist, betont die IBA Thüringen insbesondere die kulturelle Dimension. Sie fordert eine gestalterische Behandlung der Energiewende in Stadt und Land und einen kultivierten Umgang mit der erwarteten erhöhten regionalen Wertschöpfung (www.iba-thueringen.de/konzept-und-idee-der-iba-thueringen). Bei der IBA Thüringen handelt es sich um einen experimentellen Prozess in einem Land mit einer kleinteiligen und polyzentrischen Siedlungsstruktur und einem lebendigen Kulturleben. Ein Beispiel stellt die Theaterlandschaft in Thüringen dar, die – bedingt durch die lange Kleinstaaterei – noch heute besonders vielfältig ist. Fast jede kleine Stadt in Thüringen verfügt auch heute noch über ein eigenes Theater mit einem eigenen Ensemble.

Die Ergebnisse der IBA Thüringen sollen Impulse für andere europäische Regionen geben, die vor vergleichbaren Aufgaben stehen. Die IBA Thüringen arbeitet mit Projektaufrufen. Beim ersten Projektaufruf im Jahr 2014 reichte die Hochschule Nordhausen den Vorschlag „Pfade in der Energie-Kultur-Landschaft / Offenes Stadtumbau-Labor an der Hochschule Nordhausen“ ein und erreichte mit diesem Vorschlag den Status „IBA-Kandidat“. Um IBA-Projekt zu werden, ist eine weitere Qualifizierung von den Kandidaten gefordert. Die Idee der „Pfade in der Energie-Kultur-Landschaft“ wird im Folgenden näher erläutert.

3 KULTURLANDSCHAFT UND DER UMGANG MIT NATÜRLICHEN RESSOURCEN

Die Städte bilden die großen Energie- und Ressourcenverbraucher. Ihr ökologischer Fußabdruck zeigt eine gravierende Ressourcenübernutzung, den Verlust an Biodiversität und den Anstieg an Kohlendioxid-Emissionen weit über die Stadtgrenzen hinaus.

Für diesen Verbrauch greifen sie auf Potentiale in anderen Teilen der Erde und auch im ländlichen Raum ihres näheren und weiteren Umlands zurück:

- auf eine industrialisierte Landwirtschaft für eine kostengünstige Lebensmittelversorgung
- auf eine großflächige Rohstoffgewinnung wie den Abbau von Braunkohle oder Kies
- auf in die Fläche ausgreifende Infrastrukturtrassen und Infrastrukturanlagen,

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- auf Monostrukturen in der Erzeugung von Biomasse für die Energieversorgung.

Die Leitbilder der Raumordnung der Bundesrepublik Deutschland (Beschluss der Ministerkonferenz für Raumordnung „Leitbilder und Handlungsstrategien“ am 30.6.2006) enthalten das Ziel, Kulturlandschaften zu gestalten. Damit stemmt sich die Raumordnung – in Abwägung mit anderen Belangen - gegen die Vereinnahmung des ländlichen Raums und des Verbrauchs natürlicher Ressourcen, indem es die Bewahrung historischer Raumbilder propagiert.

Härtere Grenzen als das weiche Kriterium der Kulturlandschaftsgestaltung setzen in den Planungsverfahren für die o. g. Raumnutzungen die vorgeschriebenen Umweltverträglichkeitsprüfungen, weil sie Belastungen definieren, die zu vermeiden sind. Generell lässt sich sagen, dass nach erfolgter Umweltverträglichkeitsprüfung zwar ein Teil der Vorhaben, die in ein erhaltenswertes Landschaftsbild eingreifen, ausgeschlossen ist, aber nicht die Gesamtmenge. In Einzelfällen kann es auch geschehen, dass aus Umweltverträglichkeitsgründen Infrastrukturprojekte in kulturlandschaftlich weniger sensiblen Bereichen nicht realisiert werden können, weil hier eine bestimmte Tierspezies gefährdet ist und deshalb die Projekte in sensiblere Bereiche ausweichen.

Um Raumbilder für Erhalt und Gestaltung der Kulturlandschaft zu nutzen, müssen sie konkretisiert werden. Dies wird im Bundesland Nordrhein-Westfalen mit den Kulturlandschaftlichen Fachbeiträgen zum Landesentwicklungsplan sowie zu den Regionalplänen geleistet (z. B. Landschaftsverbände Rheinland und Westfalen (Hrsg.): Kulturlandschaftlicher Fachbeitrag zur Landesplanung in Nordrhein-Westfalen, Köln und Münster 2007). Die Fachbeiträge der Landschaftsverbände Rheinland und Westfalen orientieren sich in ihrer Bewertung von Landschaftsräumen an

- geologisch – landschaftlichen Besonderheiten,
- geschichtlichen Bedeutungen sowie
- denkmalgeschützten Gebäuden und ihrem Umfeld.

Bewertungsergebnis sind Landschaftsräume, welche die Kulturlandschaft, der sie zugehörig sind, prägen und deshalb in ihrem Charakter zu erhalten sind. Würden diese Landschaftsräume in ihren Wesenszügen beeinträchtigt, ginge ein Teil der regionalen Identität verloren. Die Bewertung stellt zwar auf die Individualität einzelner Landschaftsräume ab, dennoch lassen sich aus den erhaltenswerten Landschaftsräumen typische Raumbilder herauskristallisieren, z. B.:

- Raumbild besonderer geologischer Landschaftsformationen mit ihrem historischen Bewuchs und ihrer historischen Bewirtschaftung,
- Raumbild von Burgen, Schlössern und Villen mit ihrer historisch landschaftlichen Umgebung,
- Raumbild historischer Siedlungen mit ihrer stadträumlichen bzw. landschaftlichen Einbindung,
- Raumbild historischer Infrastrukturanlagen mit ihrem Umfeld und das
- Raumbild historischer Industrieanlagen sowie industrielandschaftlicher Relikte mit ihrem Umfeld.

Die kulturlandschaftlichen Fachbeiträge nehmen auch landschaftliche Relikte des Industriezeitalters auf und bewerten charakteristische Bestandteile der Industrielandschaft im Rheinland und in Westfalen als erhaltenswert: Waschkauen und Lohnhallen ehemaliger Zechen als „Kathedralen“ der Industriekultur, technische Infrastrukturen wie Kanäle, Schleusen und Werksbahnen sowie die Halden als weithin sichtbare landschaftsräumliche Hinterlassenschaft.

Die raumordnerische Inwertsetzung der Kulturlandschaft – wie sie im nordrhein-westfälischen Planungssystem geleistet wird - reicht alleine jedoch nicht für eine nachhaltige Kulturlandschaftsentwicklung aus. Ergänzend müssen auch ressourcensparende Wirtschaftsweisen entwickelt werden, welche generell den Bedarf nach Ressourcenverbrauch im ländlichen Raum verringern.

Mit der kontinuierlichen Umstellung der Energieversorgung auf die Verwendung erneuerbarer Energien kommen zunehmend ressourcensparende Technologien zum Einsatz. Aufgrund der regenerativen Energietechnologien kann entweder auf die Gewinnung von Brennstoffen vollständig verzichtet werden oder es werden nachwachsende Rohstoffe wie Holz (Restholz, Holzabfälle), landwirtschaftliche Produkte und Abfälle genutzt. Es entfällt zunehmend die Notwendigkeit von Tagebau und Bergbau mit ihren landschaftlichen Eingriffen und Folgewirkungen ebenso wie die Notwendigkeit von Großkraftwerken.

Allerdings führt die dezentrale Anlagen- und Verteilungsstruktur der regenerativen Energiegewinnung zu einer großräumigeren Verbreitung, d. h. die Anlagen und die Anbauflächen dringen in Bereiche vor, in denen sich die gewohnten Raumbilder der Kulturlandschaft bis heute erhalten haben. Hier entwickeln sich nun neue Konflikte.

Die Vehemenz der öffentlich ausgetragenen Konflikte zwischen erneuerbaren Energien und Kulturlandschaftserhalt dürften als einen Grund die rasant zunehmende Geschwindigkeit der Veränderung der Raumbilder haben. Während die alten Raumbilder sich in langen Zeitabschnitten wandelten, z. B. beim Ausbau des Straßennetzes oder des oberirdisch geführten Stromnetzes, geschieht der Ausbau der erneuerbaren Energien seit der Verabschiedung des Erneuerbare-Energien-Gesetzes im Jahr 2000 in schnellem Tempo.

Asphaltierte Straßen und Stromleitungen wurden von den Bewohnern des ländlichen Raumes sehnsüchtig erwartet. Der Ausbau dieser Infrastrukturen versprach ihnen Teilhabe an der allgemeinen Wohlstandsentwicklung. Infolgedessen war man bereit, Veränderungen der Landschaft hinzunehmen. Auch heute finden Erneuerbare-Energien-Projekte eine höhere Akzeptanz, wenn sie Bedürfnisse der Bewohner ländlicher Gemeinden erfüllen, z. B. durch die Eröffnung zusätzlicher Einkommen.

4 AUSBAU ERNEURBARER ENERGIEVERSORGUNG IM EINKLANG MIT DER BAUKULTUR UND DER GESTALTUNG EINER ENERGIE-KULTUR-LANDSCHAFT

Der Zusammenhang von Kulturlandschaft und Baukultur ist kein einfacher, er spielt allerdings für die Überlegungen zur Konzeption von Energie-Kultur-Landschaften eine wesentliche Rolle.

Die Baukultur bezieht sich eindeutig auf Gebäude. Zur Baukultur in einer Stadt oder in einer Region gehören die Gebäude, die unter Denkmalschutz stehen, weil sie Zeugnisse der baulichen Entwicklung in diesem Gebiet darstellen. Zur Baukultur gehören auch neu errichtete Gebäude, die besondere Qualitätsansprüche erfüllen. Solche Ansprüche formulieren beispielsweise die Architektenkammern, wenn sie Auszeichnungen verschiedener Art vornehmen.

Die Kulturlandschaft kennt bisher die qualitative Zukunftsgewandtheit der Baukultur nicht. Den Menschen vertraute historische Raumbilder prägen die Vorstellung der Kulturlandschaft: kleinteilige Dörfer mit roten Dachziegeln und einem aus ihnen herausragenden Kirchturm kuscheln sich in einer hügeligen Landschaft mit den farbenfrohen Flickerlfeldern der Realteilung und Wäldern in den höheren Lagen. Diesem romantischen Bild setzen die kulturlandschaftlichen Fachbeiträge der Landschaftsverbände Rheinland und Westfalen eine wissenschaftlich differenzierte Aufbereitung entgegen. Diese bleiben allerdings der historischen Betrachtung verhaftet, auch wenn nicht nur die vorindustrielle Landschaft sondern auch die industriell geprägte Landschaft als Kulturlandschaft bewertet wird.

Die Energie-Kultur-Landschaft des Projektvorschlages der Hochschule Nordhausen für die IBA Thüringen überträgt den Ansatz der baukulturellen Gestaltung von Stadträumen auf die Gestaltung von Landschaftsräumen, wenn sie nach Wegen der Integration erneuerbarer Energien in Stadt- und Landschafträume sucht.

4.1 Erneuerbare Energien, Energieeffizienz und Baukultur

Im städtischen Raum wurde die Energieversorgung von Gebäuden lange nicht als Widerspruch zur Baukultur gesehen. Dachlandschaften historischer Altstädte waren von Schornsteinen übersät, ebenso die Quartiere der Gründerzeit und Siedlungen der 30er und 50er Jahre. Da die Gebäude nur mit Öfen und Kaminen benutzbar waren, gehörten sie zum Gebäude selbstverständlich hinzu.

Der Abbau zahlreicher Kaminzüge durch die Installation von Zentralheizungen bzw. Fernwärmeversorgungen hat das Stadtbild verändert, ohne dass ein Verlust von Baukultur beklagt wurde. Der Grund hierfür dürfte die Wahrnehmung eines harmonischen Raumbildes sein, das weniger „Technik" zeigt. Insbesondere in den historischen Altstädten und auch Gründerzeitvierteln fanden in den letzten Jahrzehnten kontinuierlich Verschönerungsprozesse statt, nicht nur an den Häusern sondern auch im öffentlichen Verkehrsraum und in den Innenhöfen. Dies gilt – wenn auch in einem geringerem Maß – für andere Stadtquartiere. Die Restaurierung der Altstädte und Gründerzeitquartier geht einher mit einem Nutzungs- und Strukturwandel. Heute überwiegen Wohn- und Dienstleistungsnutzungen, die von dem urbanen Charakter und dem gepflegten Umfeld profitieren.

Fig. 1: Alte und neue Dächer in der Solarsiedlung Gelsenkirchen Lindenhof (Foto: Prof. Dirk Slawski, Essen).

Der Beitrag, den Eigentümer und Nutzer von Immobilien in diesen beiden Stadtraumtypen durch Energiesparen und Nutzen erneuerbarer Energien leisten können, ist durchaus relevant, jedoch kleiner als die Beiträge von Wohnsiedlungen und Gewerbegebieten der Nachkriegszeit bis einschließlich der 80er Jahre des vergangenen Jahrhunderts.

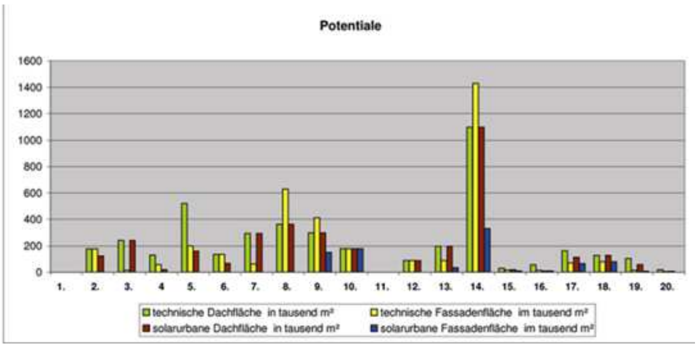

Fig. 2: Solarurbanes Flächenpotential in den verschiedenen Stadtraumtypen (Quelle: Everding u.a., Solarer Städtebau, Stuttgart 2007).

Die Diskussion über Konflikte zwischen energetischer Sanierung und Baukultur konzentriert besonders auf die Gebäudebestände in Altstädten und Gründerzeitvierteln. Folgt man den Energienutzungs- bzw. Energieleitplänen, welche viele Städte in den letzten Jahren flächendeckend für ihr Gemeindegebiet erarbeiteten, dann eignen sich Altstädte und Gründerzeitquartiere ideal für Nah- und Fernwärmeversorgungen. Bauliche Maßnahmen zur Reduktion des Wärmebedarfs lassen sich in Kombination mit der Umstellung der Wärmeversorgung auf die Erneuerung der Fenster, eine behutsame Dämmung, Beseitigung von Wärmebrücken und die Installation von Flächenheizungen beschränken, ohne die baukulturelle Qualität zu beeinträchtigen. Aufgrund ihrer kleinteiligen Eigentümerstruktur stößt allerdings die Realisierung der zentralen Wärmeversorgung in diesen Quartieren auf große Umsetzungsprobleme. Jeder Eigentümer plant für sich, Gemeinsinn ist leider noch zu wenig gefragt. Um gemeinsames Handeln anzuregen, sollten die Städte so früh als möglich eine zentrale Wärmeversorgung für diese Quartiere festlegen, auch wenn der Anschluss einzelner Gebäude nur auf einer langen Zeitschiene gefordert werden kann. Nur so lassen sich Fehlinvestitionen und nicht notwendige Konflikte mit dem Erhalt der baukulturellen Qualität vermeiden. Der Ausbau der zentralen Wärmeversorgung beinhaltet mehr als die Verlegung von Wärmeleitungen und den Anschluss der Gebäude an diese. Benötigt werden Wärmequellen, welche die Wärmenetze versorgen sowie Wärmespeicher, die Überschüsse abfedern und für Versorgungslücken aufbewahren. Wärmequellen können Blockheizkraftwerke sein, großflächige Solarthermieanlagen und Abwärmenutzungen, sei es direkt oder über Wärmetauscher.

Die Solarenergienutzung kann auch in historischen Altstädten und Gründerzeitvierteln zur Energieversorgung beitragen. Geht man von der in diesen Quartieren sinnvollen zentralen Wärmeversorgung aus, bietet sich insbesondere die solare Stromgewinnung an. Da Solaranlagen auf Dächern und an Fassaden nach den Landesbauordnungen in der Regel genehmigungsfrei sind, ist die Gestaltung der Solaranlage und ihrer Integration in die Gebäudehülle den privaten Bauherren überlassen. Unter anderem in Reaktion auf diese Baufreiheit werden Solaranlagen an Denkmälern und in historischen Altstädten oft generell ausgeschlossen.

Eine andere Strategie, die dem Gestaltungsanspruch einer Energie – Kultur – Landschaft entspräche, stellt die Einforderung einer baukulturellen Qualität von Solaranlagen dar (anstelle ihres generellen Ausschlusses). Als Steuerungsinstrument stehen Gestaltungssatzungen zur Verfügung, wie sie für viele historische Altstädte bestehen und in denen häufig die Installation von Solaranlagen untersagt ist. Eine Pro-Solar-Gestaltungssatzung könnte z. B. die zulässigen Standorte von Solaranlagen regeln und auch die optische Erscheinung sowie die Installationstechnik. Gestaltungssatzungen sind auch in anderen Stadträumen einsetzbar, in denen die bauliche Integration von Solaranlagen geregelt werden soll. Empfehlungen zum Umgang mit der Solartechnik in verschiedenen Stadträumen gibt das Forschungsprojekt „Leitbilder und Potentiale eines solaren Städtebaus“ aus dem Jahr 2007.

Große Energieeinspar-Potentiale können durch die energetische Sanierung von Gebäudebeständen der 50er, 60er, 70er und 80er Jahre erschlossen werden. Um das deutsche Klimaschutzziel von 80 bis 95 Prozent CO-2-Reduktion bis zum Jahr 2050 gegenüber dem Basisjahr 1990 zu erreichen, ist es notwendig, anstehende Sanierungen so durchzuführen, dass optimale Reduktionen des Kohlendioxid-Ausstoßes erfolgen. Der hiermit verbundene Investitionsaufwand lässt sich nur rechtfertigen, wenn gleichzeitig die Nutzqualität der zu sanierenden Bestände entscheidend verbessert wird, damit die Gebäude auf dem Immobilienmarkt langfristig nachgefragt werden. Solche umfassenden Modernisierungen führen zu einer Veränderung des Erscheinungsbildes, die bisher nur selten in ihren baukulturellen Auswirkungen bewertet wird. Ob die modernisierte Fassadengestaltung stimmig oder deplatziert wirkt, hängt nicht von der Höhe der Energieeinsparung oder vom Nutzen der Solarenergie ab, sondern ob ein integriertes Architekturkonzept verfolgt oder hierauf verzichtet wurde.

Die baukulturelle Gestaltungsaufgabe der energetischen Sanierung von Nachkriegsgebäuden wird trotz des Engagements von Architektenkammern, Architektenverbänden und mancher Wohnungsbaugesellschaften und öffentlicher Bauherren leider noch immer zu stiefmütterlich behandelt.

Im Unterschied zur energetischen Sanierung finden sich unter den neu errichteten Energiespar- und Solargebäuden viele interessante Architekturbeispiele. In Planungswettbewerben wird nach den gelungensten Verbindungen von baulicher und ökologischer Qualität gesucht. Für eine sachgerechte Bewertung unter Einbeziehung vieler relevanter Gesichtspunkte steht in Deutschland mit dem Bewertungssystem Nachhaltiges Bauen für Bundesgebäude (BNB) des Bundesbauministeriums ein gut durchgearbeitetes Instrumentarium zur Verfügung.

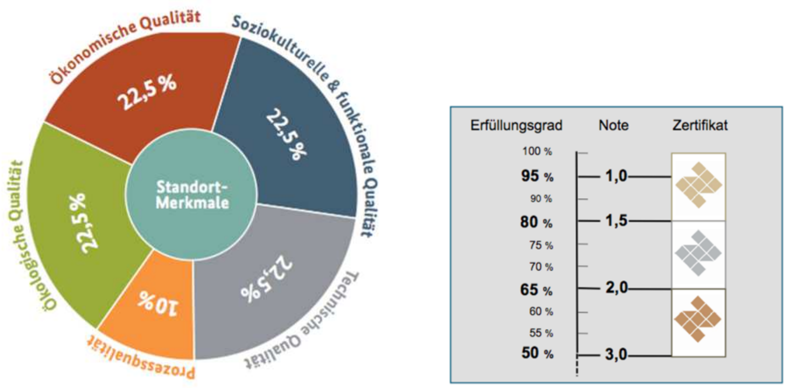

Fig. 3: BNB Bewertungssystem, aus: Leitfaden Nachhaltiges Bauen, hrsg. vom Bundesministerium für Verkehr, Bau und Stadtentwicklung, Berlin 2013.

Zwar stellt die baukulturelle Qualität in der Gesamtbewertung nur einen kleinen Baustein dar, jedoch bewirkt die Forderung von Planungswettbewerben für größere Vorhaben eine Stärkung von Planungs- und Baukultur.

Würde die Nachhaltigkeitsbewertung in Verbindung mit der Durchführung von Wettbewerben allen Neubauvorhaben und Komplettsanierung zu Grunde gelegt und würden die bewerteten Planungen alle einen Erfüllungsgrad von mindestens 80 Prozent erreichen, wäre ein großer Schritt zur Verbindung von Wohn- und Nutzqualität, Innenentwicklung, Baukultur und Klimaschutz im Gebäudebereich getan.

Bei Planungen, die gravierende Auswirkungen auf die Entwicklung der baukulturellen Qualität im bebauten Raum oder auf die Entwicklung der Kulturlandschaft erwarten lassen, sollte die Nachhaltigkeitsbewertung um eine bau- bzw. landschaftskulturelle Begutachtung, z. B. durch Gestaltungsbeiräte, ergänzt werden.

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4.2 Erneuerbare Energie und Gestaltung einer Energie-Kultur-Landschaft

Die Anpassungen, die die erneuerbaren Energien erfordern, erweisen sich in der Landschaft als vielfältiger als in den Städten, weil der ländliche Raum Potentiale für eine größere Palette regenerativer Energietechnologien bietet. Genannt seien die Windkraftanlagen, die sich mit Türmen auf mittelhohen Bergrücken ausbreiten, die Wasserkraftanlagen an den Flüssen, die teilweise mit neu zu schaffenden Stauseen verbunden sind sowie Biogasanlagen als technische Nebengebäude von landwirtschaftlichen Betrieben. Hinzu kommt die land- und forstwirtschaftliche Gewinnung von Energiepflanzen, die sich ebenfalls auf das Landschaftsbild auswirkt.

Dieses Vordringen der erneuerbaren Energien im ländlichen Raum wird nicht nur von besonders heimatverbundenen Menschen als Beeinträchtigung der Kulturlandschaft gesehen und als Identitätsverlust empfunden. Wahrnehmung ist aus sich heraus vor allem durch subjektive Faktoren bestimmt. Für eine Versachlichung durchaus unterschiedlicher Wahrnehmungen erneuerbarer Energien eignen sich die Termini der Kulturlandschaft bzw. der Baukultur.

Die Verbreitung von Windkraftanlagen wird häufig von ihren Gegnern als „Verspargelung der Landschaft" kritisiert. Historisch sind Windmühlen in der Landschaft nicht fremd. Sie hatten allerdings eine lokale bzw. regionale Funktion, das heißt z. B., sie sorgten für die Produktion von Mehl oder Öl oder auch für die Entwässerung von Sumpfgebieten.

Windkraftanlagen können auch heute und in der Zukunft Bestandteil der lokalen bzw. regionalen Identität sein wie das Beispiel der Allgäuer Gemeinde Wildpoldsried zeigt. Auf einer Kuppenlage am Rande des Dorfes entstehen nach und nach Windräder, die von der Gemeinde und ihren Bürgern finanziert werden. Auch mit anderen Investitionen in Energieeinsparung und erneuerbare Energien erwirtschaftet sich Wildpoldsried Geld, mit dem z. B. ein Kulturhaus im Ortszentrum geschaffen wurde. Während das Dorf geschützt im Tal liegt, sind die Windkraftanlagen von Wildpoldsried weithin sichtbar. Sie haben sich zum Markenzeichen dieser vielfach ausgezeichneten Klimaschutzgemeinde entwickelt.

4.3 Elemente einer Energie-Kultur-Landschaft am Beispiel der Stadt Nordhausen und ihres Umlandes

Die Stadt Nordhausen in Nordthüringen hat sich an den Flüssen Zorge und Salza entwickelt. Sie stellten für die Stadt entscheidende Energieadern dar, die sich in einer historisch gewachsenen räumlichen Konzentration von Gewerbegebiete und Gewerbebrachen in der Flusslandschaft niederschlagen. Bis heute hat sich Nordhausen eine kompakte Stadtstruktur bewahrt. Gelegen an den Südhängen des Harzvorlandes verfügt Nordhausen über bevorzugte klimatische Verhältnisse. Sichtbare Indikatoren sind zum einen wunderbare bewachsene Parkanlagen und Berggärten am Stadtrand, zum anderen große Photovoltaik-Anlagen auf den südorientierten Dächern der modernisierten innerstädtischen Mietwohnungsbestände. Vom Petersberg in der Oberstadt öffnet sich der Blick über das Tal hin zu den Windkraftanlagen auf der ehemaligen Deponie Nentzelsrode Das Wohnungsangebot stellt sich heute als gut differenziert dar und wird zu einem großen Anteil umweltfreundlich mit Nah- und Fernwärme versorgt. Ab 2015 wird eine Biomethananlage Biogas in das Erdgasnetz einspeisen.

Der Nordhäuser Landschaftsraum setzt sich aus drei Haupträumen zusammen:

- dem topografisch gegliederten Südhang des Harzes, an dem die Hauptsiedlungsbereiche der Stadt liegen,
- der breiten Talebene mit den Flüssen Zorge und Salza, den Bahnlinien und der Autobahn (BAB 38), alten und neuen Industrieflächen, gründerzeitlicher Besiedlung und Plattenbauten der DDR-Zeit,
- den Kuppen der Hainleite und Windleite, die ein hohes Windkraftpotential aufweisen und bereits mit einem Windpark bestanden sind.

Am Südhang des Harzes befindet sich die sanierte Altstadt von Nordhausen, oberhalb der Altstadt schließt sich ein gründerzeitliches Villengebiet mit ausgedehnten Garten- oder Parkanlagen an. Östlich der Hochschule liegt die Plattenbausiedlung Nordhausen-Ost aus der DDR-Zeit. Zwischen der Hochschule und der Altstadt entstanden nach dem 2. Weltkrieg, in dem große Teile der Stadt zerstört wurden, Geschosswohnungsbauten in Zeilenbauweise. Durch die Hanglage sind die Zeilen in Nord-Süd-Ausrichtung gebaut. Nach der Wende modernisierten die Nordhäuser Wohnungsbau-gesellschaften diese Bestände, die überwiegend heute umweltfreundlich mit Fernwärme versorgt sind. Hier könnte eine baukulturell verträgliche Nordhäuser Solardach-Landschaft entstehen, die als Gesamtprojekt mit Beteiligung von Bürgern finanziert werden könnte.

Fig. 4: Solardächer auf Geschosswohnbauten am Südhang von Nordhausen.

In den Gärten und Parks der vielen dekorativen Villen, die nach der Wende mit Liebe zum Detail modernisiert wurden und überwiegend mit Gas beheizt werden, fällt viel Grünabfall sowie Baum- und Strauchschnitt an. Würden diese „Abfälle“ als Rohstoffe in der neuen Biomethananlage verwendet, könnte auch in diesem Stadtquartier bilanziell ein Kreislauf begonnen werden.

Die Flusslandschaft in der weitläufigen Talebene stellt ein verstecktes Potential dar. Teilweise bestehen noch alte Wasserrechte, die für die Stromgewinnung aus Wasserkraft in Verbindung mit multifunktionalen Projekten genutzt werden können, wie das in Bau befindliche Wohnprojekt an der Ellermühle, gelegen an der Zorge, zeigt. An anderen Flussabschnitten haben sich naturbelassene Uferbereiche mit hoher Biodiversität erhalten. In dem Wechsel der Flusslandschaft tauchen auch Relikte der Industriegeschichte Nordhausens auf oder man findet interessante Unternehmen, die sich über Jahrzehnte in Nischenbereichen gehalten haben. Letztere für Energiemaßnahmen auf dem Weg in die Zukunft zu gewinnen und über Energiepfade bekannt zu machen, würde zur Belebung der Flusslandschaft beitragen.

5 ENERGIEPFADE UND MESSLABOR ALS MOTIVIERENDE UND STEUERNDE IDEEN FÜR DIE ENTWICKLUNG EINER ENERGIE-KULTUR-LANDSCHAFT

Energieprojekte mit relevanten Energieeinsparungen und bzw. oder mit der Nutzung erneuerbarer Energien sind bisher sowohl in den Städten als auch im ländlichen Raum nur punktuell zu finden. Das Stromnetz verbindet die Anlagen regenerativer Stromgewinnung miteinander, ohne dass man die unterirdisch verlegten Leitungen sieht. Auch ohne Smart Grid können Stromgewinnung und Stromnachfrage räumlich und nachfragemäßig aufeinander bezogen werden. Ähnliche Bezüge sind bei zentralen Wärmequellen, dem Wärmenetz und der Wärmenachfrage darstellbar.

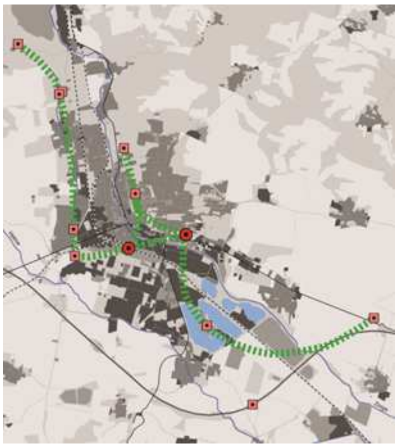

Fig. 5: Energiepfade als Raumstruktur für die Entwicklung der Energie-Kultur-Landschaft (Projektvorschlag der Hochschule Nordhausen für die IBA Thüringen, 2014).

In Nordhausen kann durch die in Bau befindliche Biomethananlage auch der Bezug zwischen Gasgewinnung und Gasnachfrage bilanziert werden. Eine Aufgabenstellung des zukünftigen Energiesystems stellt die Entwicklung bilanzieller Kreisläufe von Energiegewinnung und (reduzierter) Energienachfrage dar. Je enger

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die projektbezogenen Knotenpunkte in den Verteil- und Einspeisenetzen durch immer neue Projekte zusammenwachsen, desto ausgeglichener wird das Energiesystem.

Die Idee der Energiepfade verfolgt mehrere sich überlagernde Zielsetzungen:

- Das Zusammenwachsen von dezentralen Energiegewinnungs- und verbrauchsanlagen sollen die Energiepfade erlebbar machen. Das bedeutet für ihre Planung, dass die Wegeführung das Zusammenspiel von Energie-Gewinnung und Nachfrage aufgreifen muss.
- Entfernungen können durch Bewegung, aber auch – mit viel weniger Zeit- und Energieaufwand – durch Sehen, d. h. Sichtbeziehungen, überwunden werden. Aussichtspunkte stellen deshalb ein wesentliches Element von Energiepfaden dar. Von den Aussichtspunkten soll sich der Blick auf die Raumbilder einer neuen Energie-Kultur-Landschaft öffnen.
- Energiepfade sollten Ziele und Anlaufpunkte enthalten, die durch ihre Attraktivität dazu motivieren, sich in Bewegung zu setzen, zu Fuß, mit dem Rollstuhl oder mit dem Fahrrad. Sie sollten das vorhandene Fuß- und Radwegenetz bereichern oder vorhandene Strecken und geeignete Wege und Straßen nutzen.
- Der Bewegung auf den Energiepfaden vor- oder nachgelagert sollte sich der Besuch einer Informationsstelle anbieten, in der eine laufend fortgeschriebene Übersicht über die Planung und Realisierung von Projekten zur Umsetzung von lokalen sowie regionalen Energie- und Klimaschutzzielen gegeben wird. Die Informationen sollte man sowohl in der Informationsstelle als auch über abrufbare QR-Codes auf Infotafeln an den Pfaden erhalten.
- Die Energiepfade sollten mit unterschiedlichen thematischen Schwerpunkten wie Industriegeschichte, Stadtnatur etc. zur Stärkung der regionalen Identität beitragen. Auch eignen sie sich, um Orte und Projekte im Umland in die Gestaltung der Energie-Kultur-Landschaft einzubinden.
- Durch das Wahrnehmbar-Machen von konkreten Fortschritten bei der Umstellung des Energiesystems übernehmen die Energiepfade die wichtige Aufgabe der Motivation, damit sich Bürger und Unternehmen durch eigene, in die lokale Gesamtstrategie passende, Aktivitäten beteiligen. Die Planung und Gestaltung von Energiepfaden in einer Kommune bzw. Region kann allerdings nur dann einen Sinn ergeben, wenn in diesem Gebiet tatsächlich ernsthaft und mit erkennbaren Erfolgen an der Umsetzung von Energie- und Klimaschutzzielen und an der Entwicklung einer Energie-Kultur-Landschaft gearbeitet wird.

Die Kommunen verpflichten sich in Energie- und Klimaschutzkonzepten zu längerfristigen Zielen, z. B. die Stadt Nordhausen zu den Zielen

- bis zum Jahr 2030 den Anteil der erneuerbaren Energien auf 100 % am gesamten Stromverbrauch sowie auf 30 % an der Wärmebereitstellung zu erhöhen und
- bis zum Jahr 2020 die Treibhausgasemissionen (direkte Emissionen, d. h. ohne Vorketten) um 30 % gegenüber 1990 zu reduzieren.

Als Voraussetzung für die Umsetzung der genannten Ziele nennt das Nordhäuser Konzept die Lösung der Probleme im Bereich der Speicherung der erneuerbaren Energien sowie im Bereich des Netzausbaus. Als Grundlage des Konzepts wurde eine fortschreibbare CO-2-Bilanz erstellt.

Die Maßnahmen der kommunalen Energie- und Klimaschutzkonzepte setzen auf sich ergänzende Aktivitäten der öffentlichen Hand, von Bürgern, Unternehmen und zivilgesellschaftlichen Gruppen. Ein solches aufeinander bezogenes Handeln bedarf einer kontinuierlichen Information und Motivation. Damit Akteure in ihrer Stadt aktiv werden, benötigen sie – nicht nur einmalig -möglichst konkrete Informationen, wie weit und in welcher Weise z. B. die Umstellung des Energiesystems auf erneuerbare Energien in ihrem näheren und weiteren räumlichen Umfeld geschieht und welche künftigen Aktivitäten anstehen. Auch sollten die Akteure informiert werden, wenn sie sich an einem Energieprojekt in ihrer Nachbarschaft beteiligen können. Viele Energieeffizienz-Verbesserungen lassen sich durch nachbarschaftliches Zusammenwirken in ihrer Wirkung steigern.

Ein laufendes örtliches Monitoring des energetischen Wandels sowie ein Messlabor, das seine Erkenntnisse der Öffentlichkeit zugänglich macht, ermöglichen Bürgern und Unternehmen eine gezielte und erfolgversprechende Mitwirkung. Über offene Informationssysteme sollte es gelingen, Energiewende-Akteure zur freiwilligen Datenbereitstellung über von ihnen geplante oder durchgeführte energetische Maßnahmen zu gewinnen. Um es konkret zu machen: Beispielsweise könnte ein Unternehmen sein Abwärmepotential offerieren, um Abnehmer in seiner Nachbarschaft zu finden. Auch dezentrale Speicherkapazitäten könnten auf diese Weise gefunden und eingebunden werden.

Ergänzend zum Datenmanagement und zur wissenschaftlichen Datenauswertung zwecks Optimierung des neuen regenerativen Energiesystems soll über die Mechanismen der Veranschaulichung und räumlichen Wahrnehmbarkeit zur Mitwirkung am energetischen Wandel motiviert werden. Die Monitoring-Daten und Auswertungen des Messlabors erreichen eine viel größere Zahl von Menschen, wenn sie an zentraler Stelle visualisiert dargeboten und mit den Besuchern diskutiert werden.

Der räumlichen Wahrnehmung dienen u. a. die o. g. Energiepfade, nicht nur zum Sehen der Veränderungen sondern auch zu ihrem Verstehen. Wer als Akteur mit seinem Projekt an einem Energiepfad liegt, z. B. ein Bauherr eines energieautarken Bürogebäudes, kann sich mit seinem Klimaschutzbeitrag der Öffentlichkeit präsentieren. Dazu muss er die Öffentlichkeit nicht zu sich hinein lassen, es reicht eine Informationstafel am Energiepfad, die - auch über einen QR-Code – die besondere energetische Bauweise des Bürogebäudes erläutert.

Das oben beschriebene Zusammenspiel von privaten und öffentlichen Investitionen in energetische Projekte, von wissenschaftlicher Fundierung und Begleitung sowie der räumliche Veranschaulichung der Entwicklung der Energie-Kultur-Landschaft bedarf in seiner Umsetzung einer permanenten engen Zusammenarbeit der kommunalen Planungs- und Umweltverwaltung mit einer wissenschaftlichen Einrichtung, die sowohl über Kompetenzen in der regenerativen Energietechnik, in der baulichen Energieeffizienz, in Energiesystemen, Umweltbilanzierung, in der Informatik und Visualisierungsmethoden als auch über die Integration von Energie- und Stadtplanung verfügt. Für die Hochschule Nordhausen stellt die Mitwirkung an der Internationalen Bauausstellung Thüringen eine große Chance dar, in der Region Nordthüringen und in der Stadt Nordhausen ihr Können unter Beweis zu stellen.

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“Ghent 3D, in 4th Dimension”, Startup for a Holistic Multi-D City Model, using Augmented Virtuality

Mario Matthys

(Mario Matthys, 3D-Coordinator, Architect and Urban Planner, City of Ghent, Keizer Karelstraat 1 9000 Ghent Belgium, mario.matthys@gent.be)

1 ABSTRACT

“Ghent 3D, in 4th dimension” was funded (2009-2014) by the EFRD (European Fund for Regional Development). The project had a holistic scope. 3D-data gathering was not the only focus of the project. Different applications for using a digital 3D-city model, as a digital art-engine for designing, discussing, developing and managing a city, were developed. Attention for all kinds of spatial creativity was the goal. “Ghent in 3D“ is now the start up for a holistic Multi-Dynamic city model.

2 THE HISTORY OF “GHENT IN 3D”

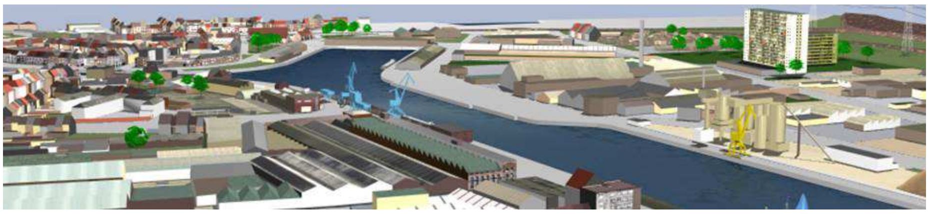



Fig. 1: 3D-vector model of part of the in city in 1999, Fig 2: 3D-scan of part of the city in 2013

At the end of the eighties the City of Ghent started with CAD and GIS. Since the 90s 3D-CAD and VR (Virtual Reality) were used in city planning and communication, followed by the first 3D-GIS exercises in 2003. Some parts of the city were built digital in 3D, depending on which urban planner was the leader of an urban project. Some planners had digital inspiration, but most of the planners and designers didn’t use 3D-technology… But communicators and citizens asked more and more 3D-models. The preparation of using BIM (Building Information Management) as a kind of 3D-GIS for buildings started in 2013. Since 2009 (start of the EFRD-project) the first municipal 3D-coordinator and 3D-team in Belgium take care of a holistic and structured 3D-environment.

3 3D

3.1 From 3D-scanning to vectorised city model

During the EFRD-project the whole city was airborne lidar-scanned. Also mobile scanning was used to get more details. Ghent was the first city using a terrestrial 3D-scanner in a fulltime job since 2010.

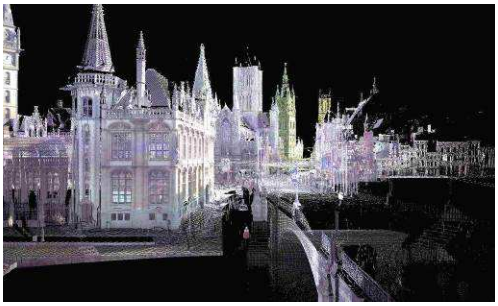
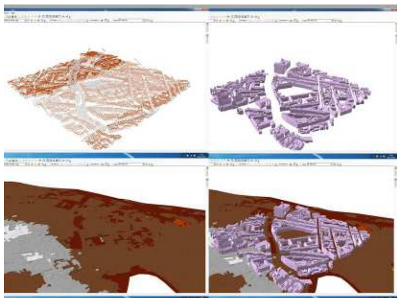
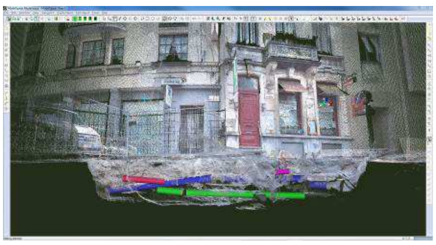




Fig. 3: terrestrial scan of the city center, Fig. 4: process of vectorisation, Fig. 5: Level Of Detail 3 model (LOD3)

Even parts of the underground (infrastructure and archeological sites) were scanned in 3D.



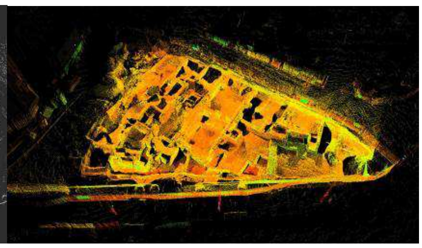


Fig. 6: Infrastructure in the underground, Fig. 7 en 8: Archeological site in 3D

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4 4D

4.1 Crowd Sourcing and co-creation with citizens

One of the co-creating projects of the 3D-cityteam was the initiative to involve citizens to draw together. We started with a free initiation “Sketch up” course for citizens. After one hour instructions they reconstructed beautiful old demolished buildings in a 4D-timescale, in collaboration with the city museum and city archive. This crowd sourcing project with happy people, reconstructs different disappeared townscapes in 4D.

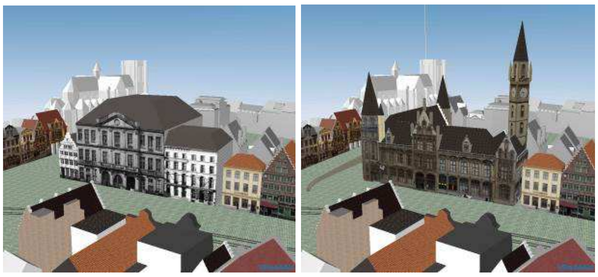



Fig. 9: Time scale of the city center in 4D, Fig. 10: citizens drawing in 4D the history of the city

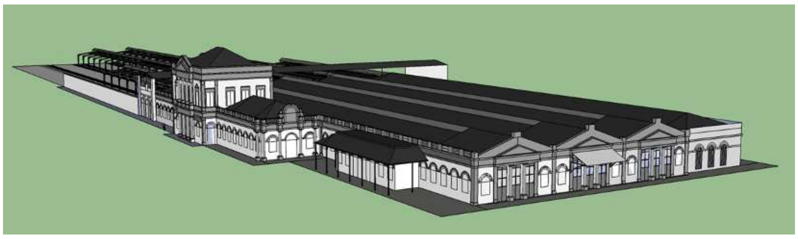
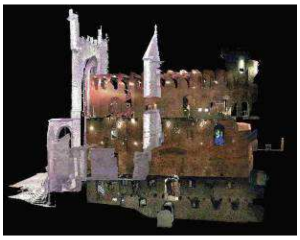



Fig. 11: Reconstruction of the old main station Ghent South, by citizens, Fig. 12: Reconstruction of an old station in a district

4.2 New facades for buildings using light-technology

The results of a competition for citizens to re-design the facades of the old “Castle of the Graves” in the city centre, were shown during the light-festival of the city January 2012. The combination of the 3D-scans of the entire old interiors, with the existing big castle wall, and future dreams for new facades for this castle, was a real-time 4D time-scale evocation.



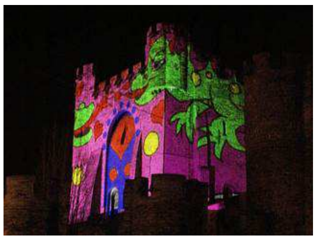
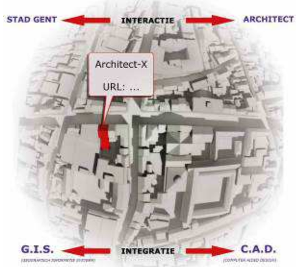


Fig. 13: Castle of the Graves: 3D-scanning of the interior, Fig 14 and 15: competition for citizens, designing new castle facades

This is city-art-entertainment, using games and 3D-technology, in collaboration with citizens to augment data-actualisation, not only as it was, as it is built, but also as it is dreamed.

4.3 Guideline for architects

In december 2011, a guideline for exchanging architectural 3D-CAD data and 3D-GIS data of the city, was born, as a pioneer in Belgium. The next version of the guideline will be related to BIM and City-GML. In the 4D-scale, the integration of new drawings of buildings and designs for urban public space in 3D, shows the future of the city. Architects can also use the 3D-C.A.V.E. (see 7.1) to discuss their design research.



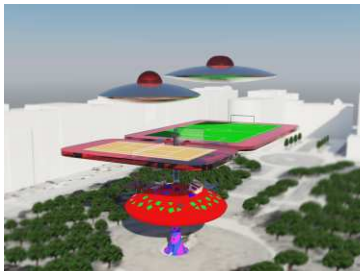
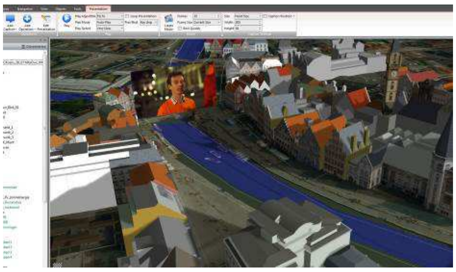


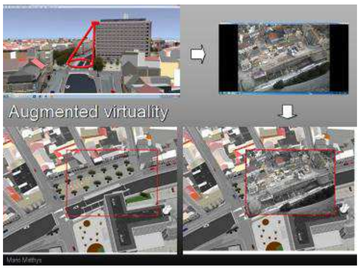
Fig. 16: Guideline for architects Fig. 17: Integration of 3D-drawingsl Fig. 18: competition for children, “My house, my dream”

5 MULTI-D

5.1 Augmented Virtuality

“Augmented Virtuality” is the opposite of Augmented Reality. When you upload parts of the reality in the digital city model, you can talk about Augmented Virtuality. We connect videos of the real world IN the city model, even in real-time. For example the traffic situation on the roads can be managed or studied in the 3D-model combined with visual real-time information.





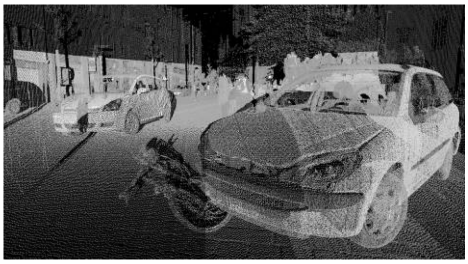


Fig. 19: Integration of video’s from citizens, Fig.20: time lapse video, Fig.21: 3D-scanning of an accident

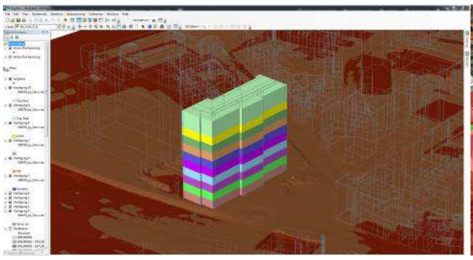
5.2 Noise, accidents, crime, actions, environmental conditions, the weather…

In collaboration with the Crime Unit of the federal police, we integrate 3D-scanning of crime scenes. With the local police we discussed the use of our terrestrial 3D-scanner to register car-accidents. The results of scanning can be combined with the environment of the 3D-model, even the results of accidents are printed in 3D. It is also possible to optimize the city model with real-time noise if we connect sources to the model. In the 3D-C.A.V.E. (see 7.1) we use stereo sounds of cars, talking people … for a multi-D experience.

6 ANALYSES

6.1 Spatial analysis preparing structure and destination maps

The 3D-GIS model uses attributes in spatial databases to analyse the environment in 3D. Dynamic and interactive real-time visibility research is done. When Multi-Data of the whole city is connected it’s evident you will design also all your urban structure and destination plans in 3D.



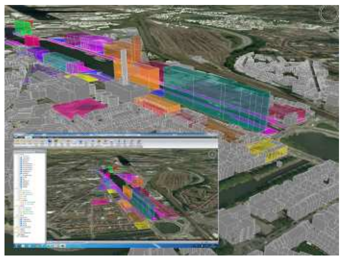


Fig. 22: 3D-GIS attributes with information of volumes, Fig. 23: visibility research, Fig. 24: Spatial structure and destination maps

6.2 Eye tracking on 3D-models to augment spatial quality

In collaboration with Ugent we started Eye-tracking research, using Eye-tracking instruments in combination with 3D-data. The analysis of eye-movements and the focus on city objects will tell us more about spatial attraction and design quality.

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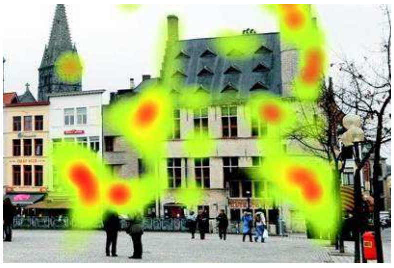
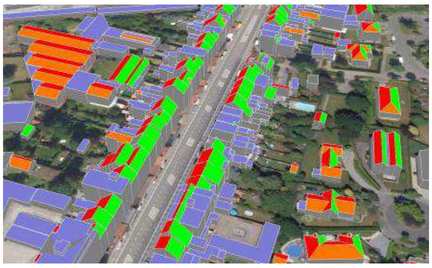


Fig. 25: 3D-EYE-tracking research, Fig. 26: Sun potential of roofs in 3D-model, Fig. 27: Population Density in 3D

6.3 Solar potential in 3D

Ghent is the first Belgian city that is showing solar potention of roofs in a 3D-portal on the internet. This was done in partnership with the European MUSIC project in 2014.

7 INTERACTIVE OUTPUT: EVALUATION AND COMMUNICATION

7.1 3D-C.A.V.E.

Since more than 10 years, the City of Ghent uses a 3D-C.A.V.E. It's a virtual room where you can navigate with a joy-stick or hands-free tracking motion, while flying and walking through the whole city. Architects and other city designers use this interface for urban analysis and spatial designing. Decision makers and citizens use the 3D-C.A.V.E. for evaluation and communication. It's also a promotional instrument of the city.


Fig. 28 and 29: 3D-C.A.V.E. (Computer Aided Virtual Environment)

7.2 Dynamic city model using Game-engines

A game engine is a fantastic instrument to analyse the movements of objects in the city. The high-quality visualisations and the hyper-realistic flying birds or splashing water are the most beautiful environments in evaluation and communication. Game engines can also be used in all kinds of visual analysis.


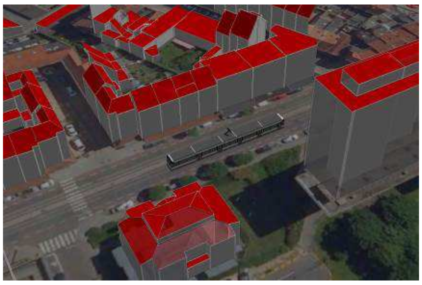

Fig. 30: Dynamic 3D-city model in a Game Engine, Fig. 31: the movements of a tram in the 3D-city-model

7.3 3D-printing

Gent in 3D uses two little 3D-printers for demonstrations and to print physical models. The results of 3D-printing are in the city-museum, even used in architectural competitions and in communication actions.


Fig. 32: 3D-printing, Fig. 33: 3D-portal with url-links to website of owners

7.4 3D-portal

In 2014 the first 3D-portal of an entire Belgian City was online www.gent.be In future this will be an online big-data environment including big parts of open 3D-data. It's an interactive design and communication tool.

7.5 3D Mobile and QR-codes

An other output interface is the transformation of an old bus into a 3D-mobile. With the Multi-mobile we drive to the inhabitants to show them IN their street how the street will be redesigned. They can even use laptops in the bus to draw there own ideas of the environmental design. There is a little 3D-CAVE on board. So decision makers can discuss with people (using interactive 3D-infrastructure) even if those people are not able to use 3D-interfaces on a homecomputer. The 3D- mobile can also be used for those citizens who are less mobile.

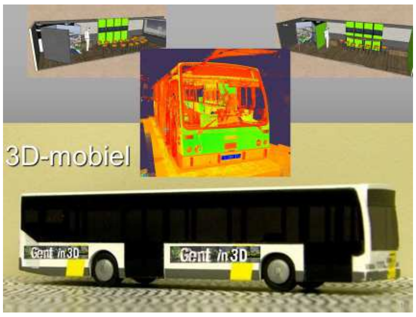

Fig. 34: 3D-mobile, Fig. 35: 3D-models in combination with QR-codes

The integration of QR-codes in the city model offers an interactive link to extra information of city objects.

All those output instruments are used to optimize the use of the Multi-D model.

8 FUTURE

A city is a little universe. This work is only the start of a growing Multi-D city model. There is no way back.

Multi-Dimensional + Multi-Disciplinar + Multi-Dynamic = Multi-D³.

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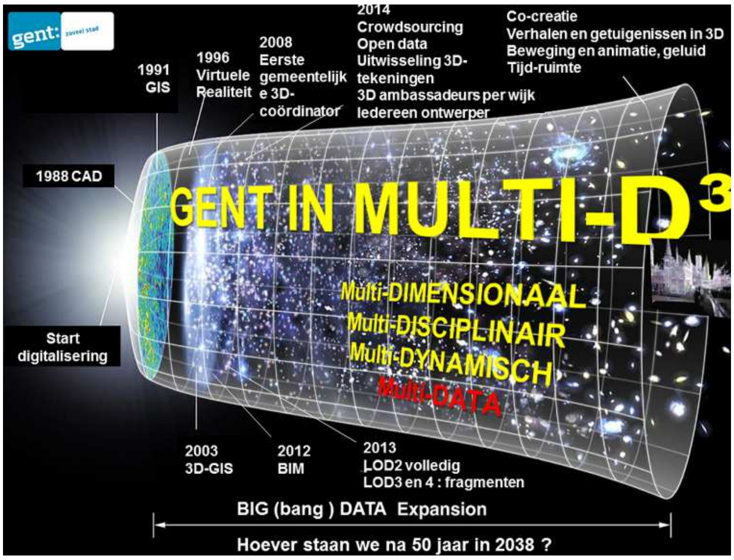

Fig. 36: BIG-DATA in a Multi-D3 world

9 CONCLUSION

The bigger the data, in a holistic Multi-D city model, the more money you need to actualise. But there is no budget for the actualisation of the whole 3D-model in extra dimensions. So we motivate everyone in the city to co-create. Even with competitions we ask people to help with the updating and completion, with the use of mobile devices. „Gent in Multi-D“ is a digital instrument not only for, but also from, the citizens.

This is the foundation of a never ending big-data process in a Multi-D environment. When we think of the first digital drawings of the city about 30 years ago, realise what can we expect the next 30 years ? I predict an exciting future for Augmented Virtuality and a real time actualisation-process with mobile devices.

The virtual sky does not have a limit…A parallel digital world will be a copy of the real world, augmented with all kinds of dreams of citizens and city-designers that only will exist in a digital world, and not in real world. But, if you can dream it…

10 REFERENCES

Matthys Mario: Mijn gemeente in meerdere dimensies… Inspiratie uit het EFRO-project ‘Gent 3D, in 4de dimensie’. Gent, 2014.

How to Improve Accessibility of Natural Areas: About the Relevance of Providing Information on Accessible Services and Facilities in Natural Areas

Sabine Hennig, Thomas Sattler, Maria Wasserburger, Wolfgang W. Wasserburger

(Dr. Sabine Hennig, IFFB Geoinformatik – Z_GIS PLUS, Schillerstraße 30, A-5020 Salzburg, sabine.hennig@sbg.ac.at)
(Thomas Sattler, Nationalpark Gesäuse GmbH – Weng 2, A-8913 Weng im Gesäuse, thomas.sattler@gseispur.at)
(Maria Wasserburger, AccessibleMap Association, Rotenkreuzgasse 11/8, A-1020 Wien, maria@wasserburger.at)
(DI Wolfgang W. Wasserburger, AccessibleMap Association, Rotenkreuzgasse 11/8, A-1020 Wien, wolfgang@wasserburger.at)

1 ABSTRACT

Accessibility is a topic of increasing importance concerning all fields of life. This is underlined by current legislation as well as social meaning and economic benefits related to accessibility. Due to recent demographic changes in society characterised by steadily growing numbers of the elderly (with age-related physical deficits), enabling people with disabilities to manage their everyday independently gets even more important. However, in order to fully participate in life self-determined, the disabled demand for barrier free infrastructure in many ways. This is particularly true in terms of tourist and recreational activities in natural areas. At that, positive effects of being in nature (e.g. on people's physical health and mental well-being as well as integration and family solidarity) are even more relevant for disabled people than for others.

While many efforts exist on offering and improving barrier free services and facilities on-site, it seems that there is a lack of off-site material informing persons with disabilities of accessible services and facilities available in natural areas. That is surprising, since today, rapid advances in information and communication technologies offer many ways to provide digital, i.e. web-based solution suitable to impart all kinds of information and to meet the needs of disabled people. Concerning the spatial reference of nature-based recreation, i.e. in order to communicate location and spatial relationship of services and facilities, web-based maps are a central means of communication.

But, which information regarding tourist and recreational visits of natural areas is required by disabled visitors? How to present this information to the target group in an accessible and useful way? How to design and integrate web-based maps as powerful tool to impart spatial information? Based on research conducted within the project "senTOUR", this paper aims to offer suggestions for proving accessible digital information in order to support recreational and tourist activities in natural areas for disabled visitors, i.e. for the elderly who often suffer from age-related physical deficits.

2 INTRODUCTION AND RESEARCH QUESTION

Outdoor recreation activities, and in particular recreation in natural areas, have increased significantly over the last decades. This is well received since recreation in the outdoors has many positive effects on people's physical health and mental well-being as well as integration and family solidarity (Immoos & Hunziker 2015). This is even truer for the disabled for whom being in nature has an even stronger impact on quality of life than for the non-disabled (CA 2005). Besides this, several reasons exist why disabled persons today deserve special interest from planners and managers. As listed in Table 1, this refers to current legislation, social meaning of accessibility, and thereto related economic benefits.

Legislation	• Non-discriminatory policies, disabled people must be considered equally to other citizens
Social meaning	• Vision of a non-discriminatory society, where all individuals equally benefit from a wide variety of services and facilities • Fostering independent and self-determined living on the part of people with disabilities
Economic benefit	• Disabled people represent a large and growing market (worldwide), considering them as new audience might lead to better capacity utilization, season extension, expanding employment and volunteer opportunities • Suitable services and facilities support image building, image and quality improvement, create a unique selling proposition, improve competitiveness etc.

Table 1: Reasons why to consider disable persons (from BMWi 2013; EC 2004; URL 1)

However, despite the high awareness on the need to improve accessibility to the outdoors, and the many efforts, which by now have been directed towards this, there is still an under-use of such sites by the disabled. Among reasons for this, literature outlines the lack of information on accessible services and facilities available in natural areas (Arnade & Heiden 2007; CA 2005; NatKo & VdN 2002).

More than for other visitor groups, for disabled persons the decision to visit a site and/ or to perform activities in the outdoors relies on obtaining information. If there is insufficient information or information is not accessible at all, then the decision to spend time in a natural area is made difficult or might not be made

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at all. Lack of information on accessibility is one of the most significant barriers limiting the use of the outdoors by disabled people. Making information available to these people is one of the most straightforward problems to resolve. Thus, improving accessibility of a site, managers and planers must also consider production and distribution of information, communicating this (CA 2005; Neuschmid et al. 2012).

Imparting information regardless the domain (including also tourism and recreation in natural areas; c.f. Hennig 2014a) relies, today, even more on the use of digital, i.e. web-based products. According devices and applications play a pivotal role in our everyday life. We expect to be able to become informed at every time and everywhere, quickly and extensively, and in a way that meets our personal demands and needs (BITKOM 2012; IEB 2009; Meckel 2008; Walz et al. 2011). At that, rapid advances in information and communication technologies (ICT) not only allow creating alternative ways to provide information and to foster (interactive) communication, but it also supports the development of innovative solutions supporting people suffering from impairments in order to manage their daily life activities. This refers e.g. to possibilities to become informed and to allow interaction leveraging different human senses (visual, auditory, haptic), to use assistive technologies, and to leverage interfaces particularly designed to meet the needs of disabled people (Atkinson & Castro 2008; Neuschmid et al. 2013).

Concerning the visit of natural area visits, the usefulness of web-based maps is well-known (Eberle 2010; Hennig 2014a). Whenever spatial information is of relevance – such as for moving around in these sites –, maps offer numerous advantages. This refers to orientation, navigation, and way finding on-site as well as to become familiar with the area before going there, i.e. building a mental map of the site (DiBiase 1990; Golledge & Stimson 1997).

Despite the opportunities opened up by ICT for disabled people, compared to non-digital infrastructure, until now, in natural areas less attention was paid to develop and implement digital, i.e. web-based infrastructure for people with disabilities. Here several questions still remain open: (i) Which content is required by this visitor group to support, i.e. encourage natural area visitation? (ii) How to provide information being accessible and useful to this target group? and (iii) How to develop and integrate web-based maps being accessible and useful for the target group? These questions are answered based on experience and results gained in the “senTOUR” project (founded by the Austrian Federal Ministry of Transport, Innovation and Technology under the Benefit Program; duration 2014-2016). The main objective of the “senTOUR” project is to improve accessibility of natural areas on the basis of suitable information provision paying particular attention to the use of web-based maps.

3 BACKGROUND ON ACCESSIBILITY, THE TARGET GROUP, AND RECREATION

Providing suitable information to foster accessibility of natural areas regarding tourist and recreational visits requires, first of all, an in-depth understanding on nature-based recreation, accessibility, and the target group.

3.1 Recreational and tourist visits in natural areas

3.1.1 Recreational infrastructure

Recreation in the outdoors, i.e. in natural areas, is closely related to, and even relies on the availability of recreational infrastructure referring to different types of facilities, services and installations. Ranging from simple elements (e.g. sign posts, information boards) to complex facilities (e.g. information centres) recreational infrastructure is traditionally grouped under four categories: (i) natural attractions, (ii) manmade features, (iii) human resources, as well as (iv) services and events (c.f. Jurczek 2003; Swarbrooke 2001). More recently, this list has been expanded by a fifth category, digital infrastructure. This includes all kinds of ICT solutions in terms of information, communication and interaction with visitors which can take place before and during natural area visit as well as after experiencing the outdoors. Examples (to be used by desktop-PCs and mobile devices) are websites, booking and rating portals, social media tools, navigation systems, digital tour guides, and mobile Apps (CA 2005; Hennig 2014a; Waiguny 2007).

In order to enable disabled people to visit the outdoors, it is necessary to have natural and man-made elements being conceptualized, designed, constructed and implemented in a way being for this target group (URL 2). Insight into relevant aspects of accessible recreational natural and man-made elements is given in Table 2. Staff must be trained to handle situations with disabled persons, and events must be planned in line with demands of this target group (c.f. MEA 2012). Further, digital, i.e. web-based products must be developed and implemented meeting the needs and requirements of disabled people.

Relevant features	Selected characteristics and design aspects		
Parkings	Accessible for which types and degrees of impairment	Number of disabled parking spots; size and orientation of parking spots; signage (e.g. attention fields); location due to trail head, attraction etc.; installation of emergency posts	Relationship to other accessible features, services & facilities
Stops & stations		location due to trail head, attraction etc.; signage (e.g. attention fields) installation of emergency posts	
Transportation means		See existing standards on accessibility and transportation means	
Trails		Type (interpretation, panorama etc.) and description on surrounding environment (forest, lake etc.), length, width, slope, material, existence of narrow points, obstacles, stairs, shadowing, existence of railings	
Guiding systems		Type of guiding system (haptic: e.g. attention fields; Braille; visual: e.g. signage); easy to read and understand	
Information features		Number of elements; type of information features (boards, interactive elements etc.); which human senses are addressed; installation height (flexible or fixed); existence of attention fields	
Taking a break features		Type of features (bench, picnic sets); type of benches (e.g. with back); type of tables (e.g. under-rollable); accessible without stairs, close the trail	
Nature experience features/ Nature attractions		Accessible without stairs; close to trails; activities to perform their (what can be seen, experienced); size of the location (large enough for wheelchairs); material (e.g. slippery), existence of railings; existence of attention fields; installation height (flexible or fixed)	
Information centers		See existing standards on accessibility and exhibitions	
Toilets		Number, signage (attention fields) and guiding system Existence of (accessible) rest rooms See existing standards on disabled toilets	
Gastronomy/accommodations		See existing standards on accessibility and gastronomy/ hotels	
Provision of assistive technology (e.g. Swiss-tracks)		Availability (prices, conditions) Communication modes (sms, email, phone etc.)	
Safety issues		Network coverage, emergency posts, staff availability	

Table 2: Aspects of accessible recreational natural and man-made elements (from Hennig 2014b)

3.1.2 Tourism service chain

But, focussing on single elements is not enough. Comparable to journeys, visits to natural areas rely on the availability of various facilities and services that support all kinds of activities related to the stay. As presented in Fig. 1, this refers to (i) decision to visit the site and according organization (information incl. booking etc.), (ii) journey and arrival, (iii) familiarization with the destination on-the-spot (orientation, information), (iv) performing on-site activities and experiencing the destination (including mobility at the destination) (v) gastronomy , accommodation, shopping etc., (vi) return home (i.e. departure and journey), and (vii) memory-sharing (e.g. online). Elements related to these activities build up the so called tourism service chain (BMWi 2007; CA 2005; NatKo & VdN 2002). Here, it applies that only if attractive facilities and services are developed and implemented along the entire service chain, a complete service chain – as requirement for convenient holidays– exists. If one of the links in the service chain is broken or not suitable to the guest, then the visit may either end unsatisfactorily or may never happen (Bollich & Neumann 2005; Österreichische Bundesforste 2014).

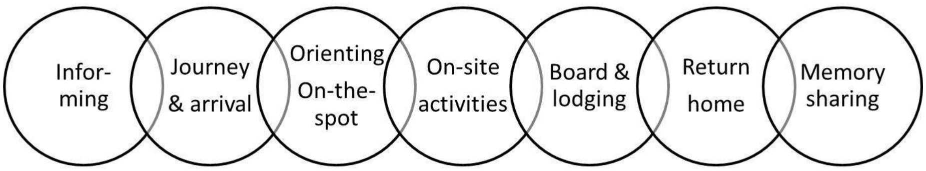

Fig.1: Tourism service chain (adapted from Waiguny 207; URL 3)

The provision of a complete service chain is as relevant for recreational and/ or tourist visits to natural areas: Also visits to the outdoors require for infrastructure in terms of information, arrival, orientation, moving around, on-site experience, departure, and memory-sharing. Regarding recreational visits by the disabled, all facilities and services along the service chain must be barrier free. Here, if only one element is missing, this does not just mean discomfort and/ or inconvenience for the guest, but - in the worst case – that “the chain breaks” and that a person will not be able to visit a destination at all. Thus, for instance, if suitable transport is not available, then the visit is unlikely to happen (CA 2005; Österreichische Bundesforste 2014).

At that, it has to be highlighted, that the first link of the tourism service chain, which refers to the provision of off-site information, is of particular relevance. As already outlined – even though this is just one among many links – on this first link it depends, if the decision to visit a site is made or not.

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3.2 Accessibility

Accessibility is defined as the ability to access the functionality and possible benefits of products, devices, services, or environments for people with disabilities. It describes the degree to which a building, outdoor area or other facility is accessible, i.e. can be entered and used by everyone – independently, without the need for special arrangements (EC 2004; URL 1).

Due to the growing relevance of ICT, accessibility today refers also to the accessibility of digital, i.e. web-based solutions. Described by the term web accessibility, it means that disabled people can perceive, understand, navigate, and interact with the Web, and that they as well can contribute to the Web. This asks for removing barriers that prevent access to websites by the disabled. Only if websites are correctly designed, developed, and edited, all users have equal access to information and functionality (URL 6).

In terms of web accessibility, digital assistive technologies play an important role. By definition assistive technologies is any object or system directed towards aiding disabled people in interacting with their environment in order to communicate with others and to accomplish a variety of tasks. With regard to digital products, it refers to technology that supports users in accessing and using software applications and websites, interacting with other technologies etc. Prominent tools are Braille display, Braille embosser, magnification software, optical character recognition, screen reader, and voice output. Among these, voice output, screen reader, Braille display, and magnification software are the most popular ones (Hennig et al. 2012; ITU/G3ict 2014).

3.3 Target group

The group of people asking for accessibility is not only large, but also quite heterogeneous: In the European Union, about 37 million people are considered of facing disabilities. If the definition includes other groups as well such as the elderly and further people requiring for accessibility due to several reasons, the number of people demanding for accessible environments is even greater. Thus, for instance, altogether, around 120 million disabled or elderly people in Europe would welcome improved access (CA 2005; EC 2004).

3.3.1 People with disabilities

People with disabilities include all persons that, due to physical, sensory, or cognitive impairment (which have a substantial and long-term adverse effect on a person's ability to carry out normal daily activities), are challenged by barriers and obstacles that prevent them from fully participating in the world. At that, disabilities may be present from birth, or occur during persons' lifetime (Atkinson & Castro 2008, URL 4). Barriers faced by disabled are as different as forms of impairment (Table 3).

Disability	Barriers and obstacles
Wheelchair	Stairs, steep ramps, vehicle boarding with stairs or other obstacles, narrow entrances, doors, passages missing space for turning the wheelchair, handles, push-buttons, door latch or mountings can not be reached no roll-under tables, washbasins etc.
Reduced mobility	Long distances, overcome differences in level (stairs, ramps etc.), steep gradients etc. Smooth, slippery surface of roads and sidewalks (in terms of unfavorable weather conditions), but also in buildings, leisure facilities etc. Severity and/ or degree of the barriers varies depending on which type of assistive technology is used (e.g. walking stick, walking frame)
Arm/ hand	Usage of railings, handles, push-buttons, door latch or mountings
Visual	Problems to orient themselves, navigate and find their way Low-contrast visual information causes stumbling and increases accident risk If information is not imparted in an auditory and/ or haptic manner, these people are lost
Hearing	Acoustic signals can not be perceived; if acoustic signals are not transformed into visual ones, these persons are lost Since the deaf often suffer from disturbance of equilibrium and anxiety states, being in dark often causes problems for them
Allergy	Different materials, food, pollen (hay fever) etc.
Learning	Problems to orient themselves in unfamiliar environments, and to use independently information as usually available due to missing reading and understanding skills
Mental	Not-familiar, unknown environments; not knowing what they expect there

Table 3: Impairments and to this related barriers and obstacles (from Berdel et al. 2003)

3.3.2 The elderly

Owing to specific, age-related deficits and alterations (e.g. reduction in stamina, mobility and sensory, i.e. visual and auditory acuity) many elderly people face barriers and obstacles just as the disabled. Their number not only is currently increasing, but it is also expected to rise further in the future due to the so called demographic change, resulting in a greater proportion of older people in society (EC 2004).

3.3.3 Other groups concerned

Other groups calling for accessibility are for instance (CA 2005): (i) all those people who experience temporary impairments, such as a broken limb, a heart condition, or general fatigue, (ii) accompanying persons such as families, friends and carers, since the implications of the resulting disability are often shared by them, and (iii) families with kids, which due to e.g. baby buggies face barriers, too.

4 METHODS

To yield insight into the current status of accessibility of natural areas, and to develop recommendations on how to impart information as needed to the target group (in a way suitable for them), several methods were applied.

The research put particular focus on protected areas, which often serve as an example and have a role model function regarding e.g. the development of new solutions in terms of nature-based recreation. Further, especially protected areas are challenged by accessibility: On the one hand, providing great natural and scenic beauty as well as environmental attractions, they have the obligation to be open to the general public (including disabled persons as well) for purposes of visitation and recreation. On the other hand, these sites have the responsibility to conserve and protect their natural environments. Expansion of all kinds of infrastructure must be well thought of as it not only can have negative impact due to the construction of infrastructure, but also since it allows and encourages more people to visit the site. This might be not wanted because of aspects such as wildlife disturbance, erosion, littering, and crowding.

4.1 Literature Review

An extensive literature review was undertaken to identify, review and report on relevant aspects concerning the accessibility of natural areas. This refers to (i) accessibility standards and guidelines regarding digital and non-digital products, (ii) reports and documents prepared by natural as well as protected areas, experts and stakeholder groups as well as umbrella organizations (e.g. tourism and recreation, protected areas, disabilities), and (iii) scientific publications on e.g. recreation and tourism, disabled people and accessibility and barrier freeness of digital and non-digital products.

4.2 Survey of natural area

A survey was conducted among large protected areas, i.e. national parks, biosphere reserves and nature parks, in Germany, Austria and Switzerland (autumn 2014). The questionnaire contained of 17 questions. Here, mostly open questions were used since this allows for specific and precise answers, and it gives the respondents the opportunity to answer freely, without being constrained to a supplied frame of reference. Due to more detailed answers a direct view into a respondents own thinking can be given (Roberts et al. 2014). The questionnaire was prepared using the online questionnaire design tool Survey Monkey. The questionnaire was distributed using email.

From 197 large protected areas the questionnaire was sent to, 68 (mostly nature parks) participated. The data collected through the closed questions of the web-based questionnaire was pre-processed (e.g. data cleansing) and statistical analysis using MS Excel and IBM SPSS. Analysis of data retrieved from the open questions was done through human coding. Following Roberts et al. (2014), this involved several steps: First, guided by the researcher's own prior theoretical expectations and reading of some examples, dimensions on which open data had to be coded were defined (i.e. coding categories). Second, human coders labeled responses with one or more coding categories. Third, once data had been categorized and coded, it was explained in terms of what is being said about the subject or theme. So, it became obvious to what categories are related, if and where trends and patterns exist, and if there are common themes emerging.

4.3 Analysis of analogue systems

Analysis of similar systems (AoSS) is a method well-known in the field of software engineering, requirements and usability engineering. Usually, this method is used to discover how others have addressed a related problem. Further, AoSS is applied to discover the most significant features of other products, i.e. systems that are similar to the product being generated. At that, all aspects of interest among existing similar systems are compared site-by-site based on criteria having the most direct implication for meeting system objectives. This creates an analysis that, on the one hand, is broad (due to the number of products reviewed), and, on the other hand, is deep (due to the number of features compared). Through comparing different systems, one can yield insights on why one item may be better (e.g. easier to operate) than other items. Further, it allows spelling out the pro and cons of the different systems and merging meaningful as well as adaptive solutions into one's own product (Nemeth 2004; URL 1).

Based on the questionnaire results, websites of a selection of large protected areas were studied in detail. Therefore an appropriate catalogue of criteria was elaborated. First, it focused on criteria related to aspects of web accessibility (i.e. in line with WCAG .0 principles), second, on kind of information offered to the target group including aspects such as position, visibility and findability of the information in the website as well as its structure, and, third - if available - on web-based maps (design, content, design, functionalities, linkage with other media such as verbal description of the map content).

5 RECOMMENDATIONS TO IMPROVE INFORMATION IN SUPPORT OF DISABLED PEOPLE'S RECREATION IN NATURAL AREAS

5.1 Web content accessibility

Even though, well-documented and well-approved standards of web accessibility exist (besides WCAG 2.0, ISO 28803, and EN ISO 9241 etc.), only a small number of protected area websites put these into practice. If considering the special needs of disabled people at all, focus is on visual impairments providing users concerned with the possibility to change font size, color and contrast as used in the website or to present content without images (c.f. Ötztal Nature Park, Austria). However, among the analysed websites particularly the solutions of Eifel and Harz National Park (both Germany) are outstanding due to accessibility. Both consider comprehensively WCAG 2.0 principles and guidelines. At that, the website of Harz National Park is priced with the BIENE award (Germany's most prestigious award for barrier-free design; URL 5).

As a basic principle, web applications today should pay attention to WCAG 2.0 to guarantee accessibility of its web content. This is a true for websites of natural areas. WCAG is a standard developed by the WordWideWeb Consortium (W3C) in cooperation with individuals and organizations around the world, with the goal of proving a single shared, internationally accepted standard for web content accessibility that meets the needs of individuals, organizations, and governments. The according documents explain how to make web content more accessible to disabled people. Web content refers to the information in a web page or web application, including natural information such as text, images, and sounds as well as code or markup that defines structure, presentation etc. In its second version, the WCAG has twelve guidelines that are organized under four principles (Table 4): being perceivable, operable, understandable, and robust. For each guideline, there are testable success criteria (URL 10). A short summary of the WCAG 2.0 guidelines is provided under URL 7; detailed information on web accessibility principles and guidelines can be found at URL 8.

Principle	Guideline (Name)	Guideline (Description)
Perceiv-able	Information and user interface components must be presentable to users in ways they can perceive	
	1.1 Text alternatives	Information and user interface components must be presentable in ways perceivable by users (e.g. verbal description on non-text content like images)
	1.2 Time-based media	Time-based media (audio, video): Provide alternatives for it (e.g. subtitle)
	1.3 Adaptable	Create content that can be presented in different ways (for example simpler layout) without losing information or structure
	1.4 Distinguishable	Make it easier for users to see and hear content including separating foreground from background (e.g. use of color, color contrast, audio control)
Operable	User interface components and navigation must be operable	
	2.1 Keyboard accessible	Make all functionality available from a keyboard
	2.2 Enough time	Provide users enough time to read and use content
	2.3 Seizures	Do not design content in a way that is known to cause seizures (e.g. red flashed)
	2.4 Navigable	Provide ways to help users navigate, find content, determine where they are
Under-standable	Information and the operation of user interface must be understandable	
	3.1 Readable	Make text content readable and understandable (e.g. due to language)
	3.2 Predictable	Make web pages appear and operate in predictable ways (on focus, on input)
	3.3 Input assistance	Help users avoid and correct mistakes (due to labels or instructions; error identification)
Robust	Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies	
	4.1 Compatible	Maximize compatibility with current and future user agents, including assistive technologies

Table 4: Overview on WCAG 2.0 principles and guidelines (from URL3; URL4; URL 8; URL 11)

In order to accommodate different situations that may require or allow greater levels of accessibility than others, the WCAG 2.0 distinguishes three levels of accessibility: A (lowest level; basic), AA (recommended) and AAA (highest level; ideal). Depending on the accessibility level, different WCAG 2.0 guidelines must be met by the particular website (URL 9).

5.2 Suitable information provision

Due to the relevance of the tourism service chains for recreational and/ or tourist visits to natural areas (see section 3.1.2), it is important that information provided does not focus on single features only, but that it reflects all aspects of the tourism service chain (Fig. 2). Accordingly, barrier free services and facilities must be presented, and relevant characteristics have to be outlined in detail (as e.g. listed in Table 2).

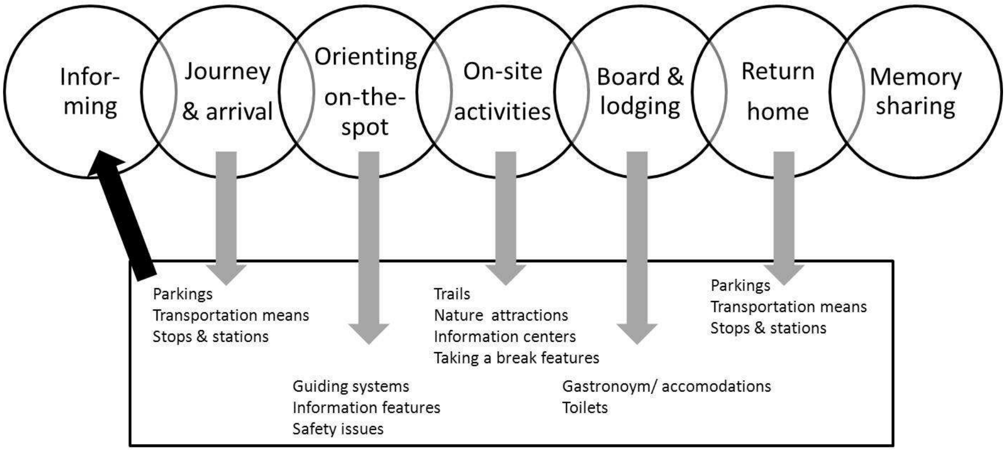

Fig. 2 Information content and structure reflecting the tourism service chain in terms of accessibility

Here, it is important that information on accessible services and facilities is easy find. Analysis of protected area websites show that relevant information is often hard to discover. Thus, where to find information required by the disabled should be providing at first glance (e.g. top-level of navigation-hierarchy) and adequately labeled (Fig. 3).

Fig. 3: Example for easy-to-find information; Schwäbisch-Fränkischer Wald Nature Park (URL 2)

5.3 Accessible web-based maps

In protected area websites web-based maps play an important role in support of planning visits (in advance of a visit) as well as for orientation, navigation, and way-finding on-site (Hennig 2014).This is as true for

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visits of disabled people to natural areas. However, only few protected area websites leverage web-based maps in order to communicate relevant (spatial) information to the visitors. If implemented they hardly pay attention to requirements of disabled people.

Based on the research results of several previous projects such as AccessibleMap recommendations giving guidance to develop and implement web-based maps exist. This refers to map picture design as well as range and properties of functions to be implemented – meeting in particular the needs of the visual impaired (c.f. Hennig et al.2012; Neuschmid et al. 2012). However, WCAG 2.0 recommendations provide relevant input in order to develop web-based maps to be accessible.

Regarding map content, information must reflect the tourism service chain. As shown in Fig. 4, it is important that the information related to the service chain is not only presented in the map, but that it also is verbally described (readable and/ or audible leveraging assistive technologies). This is in line with the first principle, first guideline of the WCAG 2.0 (provide text alternatives; Table 4). An example how this could look like is presented by the website of the German Meißner-Kaufunger Wald Nature Park (URL 13).

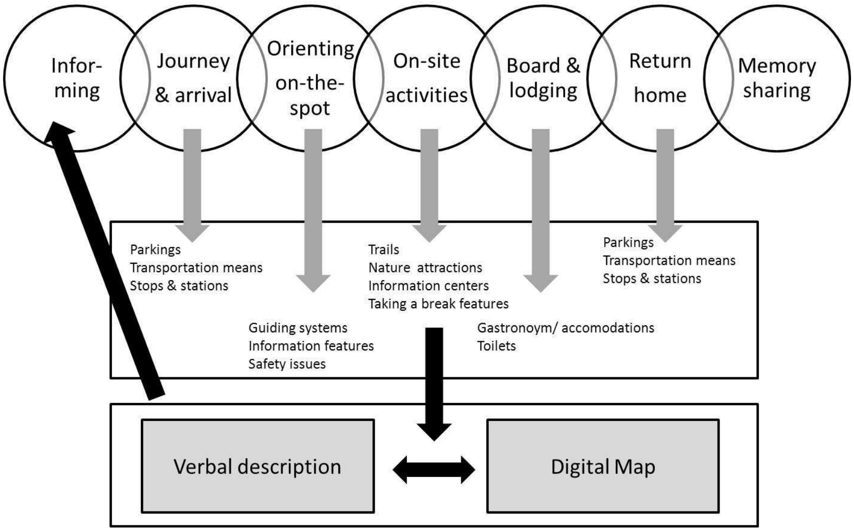

Fig. 4: Information content and structure reflecting the tourism service chain in terms of natural areas' accessibility

6 CONCLUSION

Accessibility is a topic that natural areas pay increasing attention to. While on-site accessible services and facilities are available, there is a lack of off-site information. However, providing information on existing barrier free infrastructure is an important precondition for disabled people in order to decide to visit an area or not. Therefore, today, web-based solutions and particularly web-based maps (due to the spatial reference of recreational activities) play a key role. Information must be presented being in line with WCAG 2.0 principles and guidelines, and it must be easy-to-find (e.g. findable at first glance). Further, information content must follow the so called tourism service chain. Using web-based maps, these can be developed applying e.g. recommendations on accessible web maps (i.e. map design, range and characteristics of functions; verbal description on the map content being readable, hearable). But, this asks for an appropriate database. Data must be stored in a suitable data model allowing providing information on accessible services and facilities. Besides developing an appropriate data model, this requires for having digital data as needed at one's fingertips.

Concerning the description and classification of accessible services and facilities in natural areas it is problematic, that on the one hand – even though barrier freeness plays a pivotal role for these sites – literature outlines a lack of standards on accessibility of the outdoors. On the other hand, there are no commonly accepted levels of accessibility like provided by the WCAG 2.0 regarding the accessibility of web content (distinguishing three conformance levels). Thus, there is urgent need for elaborating accessibility standards for natural areas and for defining accessibility categories. This might be very helpful when providing information to the target group.

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Intergovernmental Partnership, Assemble Together

Sylvianne Van Butsele, Kathelijne Toebak, Francis Beosiere, Inge Coelmont, Kathleen Maes, Ellen Van de Water

(Sylvianne Van Butsele, Ruimte Vlaanderen, K.AlbertII-laan 19 bus12, 1210 Brussel, sylvianne.vanbutsele@rwo.vlaanderen.be)
(Kathelijne Toebak, Ruimte Vlaanderen, K.AlbertII-laan 19 bus12, 1210 Brussel, kathelijne.toebak@rwo.vlaanderen.be)
(Francis Beosiere, Ruimte Vlaanderen, K.AlbertII-laan 19 bus12, 1210 Brussel, francis.beosiere@rwo.vlaanderen.be)
(Inge Coelmont,, Ruimte Vlaanderen, K.AlbertII-laan 19 bus12, 1210 Brussel, inge.coelmont@rwo.vlaanderen.be)
(Kathleen Maes, Ruimte Vlaanderen, K.AlbertII-laan 19 bus12, 1210 Brussel, kathleen.maes@rwo.vlaanderen.be)
(Ellen Van de Water, Ruimte Vlaanderen, K.AlbertII-laan 19 bus12, 1210 Brussel, ellen.vandewater@rwo.vlaanderen.be)

1 ABSTRACT

Today, here in Flanders and all over the world, hierarchical approaches are making way for network approaches. Processes are being redesigned, relationships are being redefined and local administrations are being given more autonomy. In Flanders, this means that new expectations are being created between the Government of Flanders, the 5 provinces and the 308 cities and municipalities.

The purpose of this paper is to show how 'Ruimte Vlaanderen', the Spatial Policy Department for the Government of Flanders, is taking a pole position in this shifting approach and how intergovernmental partnership is currently taking shape in urban planning.

2 SHIFT IN APPROACH

Spatial planning in Flanders has evolved considerably in recent times. After decades of strong, centralised management and control, responsibilities are gradually being shifted to the local policy area.

The trend toward decentralisation was accelerated by the economic crisis which occurred at the end of the last decade. The Flemish Government wished to have effective authorities during decisive times with measurable efficiency gains. The white paper on internal state reform (Witboek Interne Staatshervorming) (2011) laid the foundation for improved administrative cooperation. It was necessary to transform a controlling Flemish authority into a supportive Flemish administration, and municipal autonomy took its place on the agendas.

Ruimte Vlaanderen incorporated these goals into its mission statement (2012) and reorganised itself around this. The green paper on a spatial policy plan for Flanders (Groenboek Beleidsplan Ruimte Vlaanderen) (2012) confirmed this new policy philosophy and laid the basis for a network approach. The core tasks of Flemish spatial policy would be carried out in cooperation with actors and authorities, and a bottom-up initiative would be encouraged in this regard.

Joke Schauvliege, Flemish Minister for Environment, Nature and Agriculture, declared intergovernmental cooperation to be a strategic goal in her policy memorandum (2014). The municipalities, cities and provinces are the best positioned to take charge of policies pursued on their territory. The combination of tools and financial incentives will be geared toward strengthening administrative capacity and improving intergovernmental cooperation. Far-reaching subsidiarity still remains the common theme here.

3 ASSEMBLE TOGETHER

Management and supervision have given way to the assumption of responsibility and the assigning of trust. It is in the interest of all parties to cultivate a partnership and to work together. This poses questions such as: how do we build on partnership? How do we put far-reaching subsidiarity into practice? How do we improve intergovernmental cooperation? Ruimte Vlaanderen is doing this by 1) investing in the network that includes local governments, 2) cooperating on and learning from region-specific processes and 3) making adjustments to tools and processes accordingly.

3.1 Learning network

In 2007, Ruimte Vlaanderen took the first steps toward setting up a structural network model with the local governments by means of the Atrium Learning Network.

Municipal, provincial, Flemish and intermunicipal officials come together in trust at regular intervals to exchange knowledge and experiences. Networking events are organised around small, permanent peer review groups as well as larger groups on a regional scale. By doing this, Ruimte Vlaanderen introduced a

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change in culture and created a platform for informal consultations. Today this investment is undeniably contributing to shared and understood objectives. The atria form a convenient platform for co-creating spatial policy and for identifying relevant local initiatives and problems..

A smart move in this context is to build the Atrium Learning Network into a more goal-oriented initiative alongside the regular atrium system that utilises permanent groups. Ruimte Vlaanderen is doing this by organising 'atria on call' and by making a virtual network available.

3.1.1 Atria on call

The Learning Network is being deployed to organise 'customised' arrangements (based on target group or theme) named the 'atria on call' The aim is to gather local input so as to give further shape to spatial policy at the Flemish level. These atria are being used to co-create with local partners.

Two pilot atria on administrative capacity took place at the start of this year. These pilot atria form an interesting test case that demonstrates that the combined involvement of officials and local politicians creates added value.

In South-East Flanders for instance, the principles of spatial efficiency formed the subject of the group discussion. This was an indication that many municipalities are trying to figure out how to assume an active governing role. Ruimte Vlaanderen was expected to provide compelling and inspiring frameworks that would help with the negotiations. The aldermen and officials in attendance exchanged experiences concerning intergovernmental cooperation and civic participation, elements which testify to municipal administrative capacity.

In Antwerp, the theme of administrative capacity revolved around the benefits of hiring a municipal urban planning official at the intermunicipal level. The experiences related by the relevant intermunicipal company and mayor of the municipalities taking a pioneering role in this area provided a great deal of inspiration and insight. The subsidy for hiring an intermunicipal official is clearly a trigger; the official educated in spatial planning can make greater use of his or her ambitions on an intermunicipal scale, and an intermunicipal pool of workers offers organisational advantages. The story about the integral and strategic policy plan of the municipality of Nijlen showed that investing in such an official pays dividends.

3.1.2 Virtual network

In the pursuit of partnership, a focus on knowledge sharing and knowledge building is crucial. Until recently, much knowledge was locked inside email inboxes. This was hardly an efficient system.

Based on the aim to learn from one another, Ruimte Vlaanderen offered a accessible virtual platform that makes it easy for members to interact with each other. The decision was made to use Yammer, a virtual social knowledge network for professionals. The network is provided free of charge, and serves as a complement to the physical Learning Network: questions can be posed, any user may reply or 'like', events and reports can be posted, and information can be announced.

In one year's time, the network has turned into a success story. Even when separated by hundreds of kilometres, we are seeing municipalities helping each other. The Yammer network is utilised by more than 500 members each day.

To streamline its bottom-up operations and to guarantee an impact, Ruimte Vlaanderen also invested in a digital monitoring system. The local process managers of Ruimte Vlaanderen are picking up signals that contain within them suggestions which are relevant to Flemish policy or the Flemish monitoring agenda. These signals are brought up during consultations and where possible they are incorporated into the agendas for further improvement.

3.2 Fieldwork

Region-specific consultation processes constitute a new form of cooperation. Where its own territorial ambitions are high, Flanders can assume a lead role. But in most cases, the main keys in spatial development are in the hands of the local governments. The way in which Ruimte Vlaanderen is seeking to cooperate is demonstrated by means of three region-specific consultation processes: T.OP, BRV and pilots.

3.2.1 T.OP Limburg

Limburg is confronted with a major challenge. The economic and social landscape of the region will be drastically altered due to the closure of Ford Genk, just like it was back in the days when the coal mines were closed. In order to contribute positive momentum to this transformational dynamic and to attract investors, all socio-economic actors are devoting their efforts to the SALK (Strategisch Actieplan Limburg Kwadraat - Strategic Action Plan for Limburg Squared) project.

The spatial pillar of SALK is the Limburg Territorial Development Programme (Territoriaal Ontwikkelingsprogramma Limburg - T.OP Limburg). This development programme is intended to improve the coordination of economic and spatial development within the region and to create synergies and new opportunities in the process. T.OP Limburg is seeking win-win situations among Flemish partners, between bottom-up initiatives and goals at the Flemish level, between short- and long-term implementation processes and between the current state of affairs and what could be achieved. To this end, this is bringing many actors together. Their dialogue is being fed via research, spatial design and cartography. The task is to identify avenues for cooperation which are both desirable and ambitious, the ultimate goal of which is to arrive at shared implementation.

T.OP Limburg views categories as being more than just top-down or bottom-up.The distinction between government and entrepreneur is also becoming more vague. An entrepreneurial spirit among the public sectors is a success factor for area-based development. For the many actors working together on the RE-MINE project, a common denominator applies: decisiveness and the will to take action.

The gains being sought include: a broadening of support and visibility (also international visibility); the shared development of vision; cost savings via the coordination of investment agendas (Flemish and others); additional resources via fundraising (including on the European level); and joint action and effective implementation.

3.2.2 Testing BRV

The importance of developing a shared policy within a broad intergovernmental and social partnership also has an impact on the process of the spatial policy plan for Flanders (Beleidsplan Ruimte Vlaanderen - BRV). BRV will be the successor to the spatial structure plan for Flanders. This policy plan is focused on a strategic, dynamic and results-oriented spatial development policy. Via civic participation, partner dialogues and intensive cooperation with the other policy areas, Ruimte Vlaanderen has given extensive consideration to future spatial policy.

The partnership is recently broadened by getting local partners involved via a regional project initiative. Ten regional working groups distributed throughout Flanders, which together provide a representative sampling of current spatial issues, have begun work. The chairpersons are local stakeholders.The working groups are made up of Flemish and local partners assembled together. The working groups are testing the vision, strategies and concepts from the BRV green paper on the basis of actual practices. The intended result of this still-ongoing exercise consists of policy recommendations as well as a number of tangible quick wins to contribute momentum to local regional development.

3.2.3 Framework and pilots

The spatial vision and spatial concepts of the BRV are being realised in a more concrete and results-oriented way through thematic and region-specific policy frameworks. One of these policy frameworks being developed concerns urban regions, for example. It is designed to encourage governments and other actors to come together and form a municipal region and in doing so enter into a cooperation partnership. Within this partnership, a joint spatial development plan can take shape.

One key pilot project is the strategic project for the Antwerp urban region. Its project coordinator is being subsidised by Ruimte Vlaanderen for a period of three years. The City of Antwerp initiated an urban-regional partnership with its peripheral municipalities in order to address the demographic challenge. A consultation platform involving all administrative levels is enabling shared visions for spatial development to take shape and to be coordinated with each other. Via a declaration of intent, the majority of the south-eastern peripheral municipalities as well as Antwerp province have pledged their cooperation based on a recognition of the need for intermunicipal and intergovernmental cooperation.

The pilot project is an educational process in which Ruimte Vlaanderen identifies and facilitates, and where needed plays an integrating role with respect to the relevant Flemish policy areas. The participation of Ruimte Vlaanderen in Antwerp's urban-regional cooperation project moreover allows the policy framework on urban regions to be fed by means of empirical insights. The project is still in the early stages, and securing the mutual trust of the city and the peripheral municipalities is forming a major challenge. Once successful, the cooperation will unquestionably represent added value for the region's spatial processes and other ongoing projects.

3.3 Shaping the framework

Besides learning form each other and working together we ask ourselves: how to ensure far-reaching subsidiarity and equal partnership? What must be changed and how can we change it?

3.3.1 Financial incentives

The new spatial narrative of Ruimte Vlaanderen is aimed at making region-specific achievements in combination with our partners. The financial aspect is a driving force that often overwhelms the logic of spatial planning.

For this reason it would be appropriate to reorient the current subsidies for local governments towards a more selective and goal-oriented subsidy policy. The subsidy can bring partners together (administrative capacity) and align the local agenda with the Flemish agenda (direction). This implies that the subsidies be used to encourage local administrations to incorporate Flemish goals into the local agenda and to take the initiative towards intergovernmental cooperation and integrated regional development. A project call could specify the Flemish thematic goal that the project must address as well as the actions that are expected. At the same time, it must be possible to conclude a subsidy promise with municipalities and provinces when a Flemish ruling containing spatial tasks is implemented, based on the desired result and the agreements made.

3.3.2 Directing the process

For the governance model to succeed, an optimisation of the available set of instruments and stimulating tools (project calls, guidelines, example booklets, etc.) will be required to bring the partners on-board. Flanders is setting out its vision, programmes are being negotiated, agendas are being laid down, and responsibilities are being agreed upon and taken on. Ruimte Vlaanderen believes that policy coordination will be a core process. Ruimte Vlaanderen is identifying and responding to processes by proactively cooperating and by assuming an active co-director role from the sideline.

For example, Ruimte Vlaanderen has been taking an active role in addressing the situation surrounding youth centres that lack the proper zoning permits. The goal is to devise a comprehensive approach to problems facing the youth centres. A strategic plan approved by the Flemish Government is being implemented by means of close cross-policy cooperation between Visit Flanders and Ruimte Vlaanderen. Ruimte Vlaanderen is studying data on the status of permitting and planning and is assessing the intentions of local partners, municipalities and provinces alike, as they relate to planning initiative. Customised atria are being organised to encourage initiative among interested municipalities. In these atria, active and cross-policy area support is being proposed by Ruimte Vlaanderen and Visit Flanders.

4 CONCLUSION

The Flemish vision of urban planning policy cannot be realised on its own. It is strongly believed that urban planning goals will be reached if we can cooperate with local administrations and stakeholders.

Today, more than ever, the government is seeking to devote effort to far-reaching subsidiarity and decisiveness. Management and supervision have given way to the assumption of responsibility and the assigning of trust. Within spacial development everyone tend to agree that each administrative level must be able to play its own role. At the same time it is in the interest of all parties to cultivate intergovernmental partnerships and finding ways to work together.

Ruimte Vlaanderen is doing so by taking charge of processes and projects which represent a high priority for Flanders and by envisioning an additional role for itself within the governance model concerning relevant local initiative. A role as a bridge-builder and co-director from the sideline that consists in being committed to region-specific activities and directing local initiative, to process-oriented support and appropriate policy impact and last but not least to trust and knowledge sharing.

By so doing, we get a better picture of how intergovernmental cooperation can work out.

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Measuring Small-Scale At-Risk-of-Poverty in Germany – a Methodical Overview

Stefan Kaup

(Stefan Kaup, ILS – Research Institute for Urban and Regional Development, Bruederweg 22-24 44135 Dortmund, stefan.kaup@ils-forschung.de)

1 ABSTRACT

Regarding the EU 2020 initiative of the European Commision, one of the main targets for the next years is to reduce the number of people in or at risk of poverty and social exclusion in Europe by 20 million. (European Commission 2014a). This target aims different aspects of the financial setting and social participation of individuals and groups and has to be operationalizes in mesurable indicators, that could cover the major domains and dimensions of the complex theme (Copus 2014).

The latest publication of the German Federal Statistical Office speaks of 20.3 % of the German population affected by poverty or social exclusion. This term is a multi-variate definition based on indicators related to people at risk of poverty (16.1 %), people affected by massive material depriviation (5.4 %) and people living in households with very low income (9.9 %) (Destatis 2014a). It focuses mainly on the financial aspects. The first of the three indicators is measured by the so called At-Risk-of-Poverty rate, which is defined by Eurostat as the "share of people with an equivalised disposable income (after social transfer) below the At-Risk-of-Poverty threshold, which is set at 60 % of the national median equivalised disposable income after social transfers" (Eurostat 2014a). The underlying datasets for the German indicators come from the EU-SILC, an EU wide annual survey of income and living conditions (Eurostat 2014c). This survey provides the possibility to calculate statistics down to the NUTS 2 regions. A regional level that in Germany is called Government regions. For decision makers on the regional or local level, this computation is not good enough in terms of spatial resolution. So how to come to more useful numbers?

The author here discusses possibilities to create At-Risk-of-Poverty rates in Germany on a higher spatial resolution. An own elaboration based on a linear regression model is cross compared with an approach based on the German Microcensus.

2 POVERTY – THE THEORETICAL AND POLITICAL FRAMEWORK

Poverty as an expression has an absoulte and a relative meaning. Mainly in the context of less developed countries, the absolute term is in focus. It "measures poverty in relation to the amount of money necessary to meet basic needs such as food, clothing, and shelter" (UNESCO 2015). The UN Millenium Project indicates the eradiction of extreme hunger and poverty as its first Millennium Development Goal. For the operationalization of the goal extreme poverty is defined by an income less than 1 US-$ per day (United Nations Development Programme 2001).

In the European context there are no bigger parts of society under such depriviation of basic needs. In this environment poverty is defined as a relative measure for the integration of social groups into the overall economic situation of the whole society. It does not reflect a direct threat for the individuals lifes or well-being but it is a measure for the unequality of societies which could lead to social disharmony. "Relative poverty defines poverty in relation to the economic status of other members of the society: people are poor if they fall below prevailing standards of living in a given societal context." (UNESCO 2015)

"Prevailing standards" as given in the definition of the UNESCO is a pretty vague concept. It has to be underlaid with concrete statistical definitions to be well-measured. Therefore there has to be an agreement about wich information under which statistical procedure calculates the right or best fitting indicator for the concept. In 2001 the European Union has developed a set of 18 indicators in addition to the Lisbon strategy to measure poverty and social exclusion. These indicators are regulary produced for every European (EU) country. In reference to the place where they where agreed on, they are called the Laeken Indicators. (European Commission 2015)

One of the most prominent is the so called At-Risk-of-Poverty rate. It is calculated as the share of people with an equilized disposable income below 60 % of the Median income of the national state. (European Commission 2014b)

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3 MEASURING AT-RISK-OF-POVERTY ON A SMALL SCALE

The Laeken Indicators in general and the At-Risk-of-Poverty rate in specific are produced for the EU member states at the national state level. In many fields of decision making, this country wide view does not reflect the level of spatial detail that is needed to make good and suitable decisions. Regional divisions have to be made and therefore statistical procedures are needed to make valid and solid calculations for these (spatial) subgroups, these more or less "small areas".

3.1 The data sources

An important precondition to make good small area estimations for the At-Risk-of-Poverty rate is a suitable data souce. In general there are two types of source that estimations can rely on, census and survey.

Censuses have a long history in human societies, since it was an appropriate tool to estimate the tax income for the authorities. In the last decades, Germany had a lack of full census. The last one was held in 1987 (Western Germany) and 1981 (Eastern Germany) which means that there is practically no recent census data that could be used for an up-to-date calculation of At-risk-of-Poverty rates. With the regulation 763/2008 the European parliament and the Council of the European Union established common rules for a decennial provision of comprehensive data on population and housing. In Germany the first results from the first Census under that regulation in 2011 where published in 2014 but limited to aggregation data at city or regional level. The individual and household data sets are announced to be published during 2015. (Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder 2014)

The statistical institutions of Germany and the European Union carry out different surveys including information that could be used for the measurement of poverty. In Germany the so called Microcensus is the biggest one. It is a nearly 1 % sample of the population including 830 000 persons and 370 000 households. The first Microcensus was carried out in 1957 and since 1991 annual data is available for both parts of Germany (Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder 2015). The data sets have a regional identifier, the so called adaption layer (Anpassungsschicht). This regional level is a disjunct tesselation of Germany. Single regions should not be smaller than 500 000 inhabitants. That means large regional clusters for less populated regions. So the federal state of Mecklenburg-Vorpommern is subdivided into just three of them.

The European Union Statistics on Income and Living Conditions (EU-SILC) was launched in 2004 for the EU-15 members. It is a survey "aiming at collecting timely and comparable cross-sectional and longitudinal multidimensional microdata on income, poverty, social exclusion and living conditions" (Eurostat 2014b). The sample size is 28 000 persons in Germany (14 000 households) which is less than 4 % of the Microcensus sample.

3.2 The methodologies

The methodologies to estimate or calculate At-Risk-of-Poverty rates vary by the availability of the data. Despite the scepticism in official statistics on putting already established methods in use there is a lively advancement in the field of small area estimation (Münnich et al. 2013: 187). In general the approaches can be divided into design based and model based ones. Both of them include available informations from neighbouring or similar fields in their estimations. Design based approaches are the base of modern sample theory. They rely on sampling designs including random sampling, two- or more-stages designs. When small sample sizes occure, these design based approaches have very high variances of the estimation function. Model based approaches overcome this uncertainty by replacing the direct estimation by an indirect model based estimation (Münnich et al. 2013: 151 ff). Examples for design based estimators are the Horvitz-Thompson estimator and the generalized regression estimator. Examples for model based estimators are the synthetic estimator, the EBLUP (empirical best linear unbiased predictor) and EBP estimator (LEHTONEN et al. 2011: 13 ff).

It can be stated, that the advantages and disadvantages of design based and model based approaches stand opposite to each other. Therefore most of the modern small area estimations use compound estimation models. The best known approaches are the Fay-Herriot-Estimator (FH) and the Battese-Harter-Fuller-Estimator (BHE). They are both special cases of general mixed models whereas the FH uses data on an aggregated level (area level model) and the BHE on individual level (unit level model). (Münnich et al. 2013: 161 ff)

4 LATEST APPROACHES IN GERMANY

So far there are two recent approaches carried out trying to estimate At-Risk-of-Poverty rates for small areas in Germany. The first one comes from the Cologne Institute for Economic Research (IW), the second one is part of the ESPON project TiPSE – Territorial Dimensions of Poverty and Social Exclusion in Europe. Both approaches where published in 2014. They are built on different data sources and methodologies and therefore provide different distributions and interpretations.

4.1 The IW Cologne approach

The IW approach was based on German Microcensus 2012 data. This dataset consists of individual records including income values and the regional identifier for the adaption layer. The provided sample for the study is a 70 % subsample of the whole Microcensus of that year. The definition of relative poverty is according to the 60 % median income definition given by Eurostat (IW Cologne 2014). Figure 1 shows the calcutaled At-Risk-of-Poverty rates as provided by IW. In the approach, they extend the methodology by including regional prize niveaus as a counterbalance. They argue that poverty rates in regions having a low prize niveau compared to those with a higher one are not comparable. People with an income below that rate are under much higher financial pressure in high cost regions than in low cost regions. But since there is no counterbalancing in the second approach, we here focus on the flat At-Risk-of-Poverty rates as shown in the figure. The regional identifier for the adaption layer as the only one included in the data set causes that there is no intra-regional differentiation for the unterlying NUTS 3 regions in respect to the At-Risk-of-Poverty rate. By showing the NUTS 3 borders, the provided maps of the IW approach pretend to depict a detail of spatial distribution of the indicator that is actually not given. Especially in the more rural regions, higher number of NUTS 3 regions (up to seven) form one unique region for a common value.

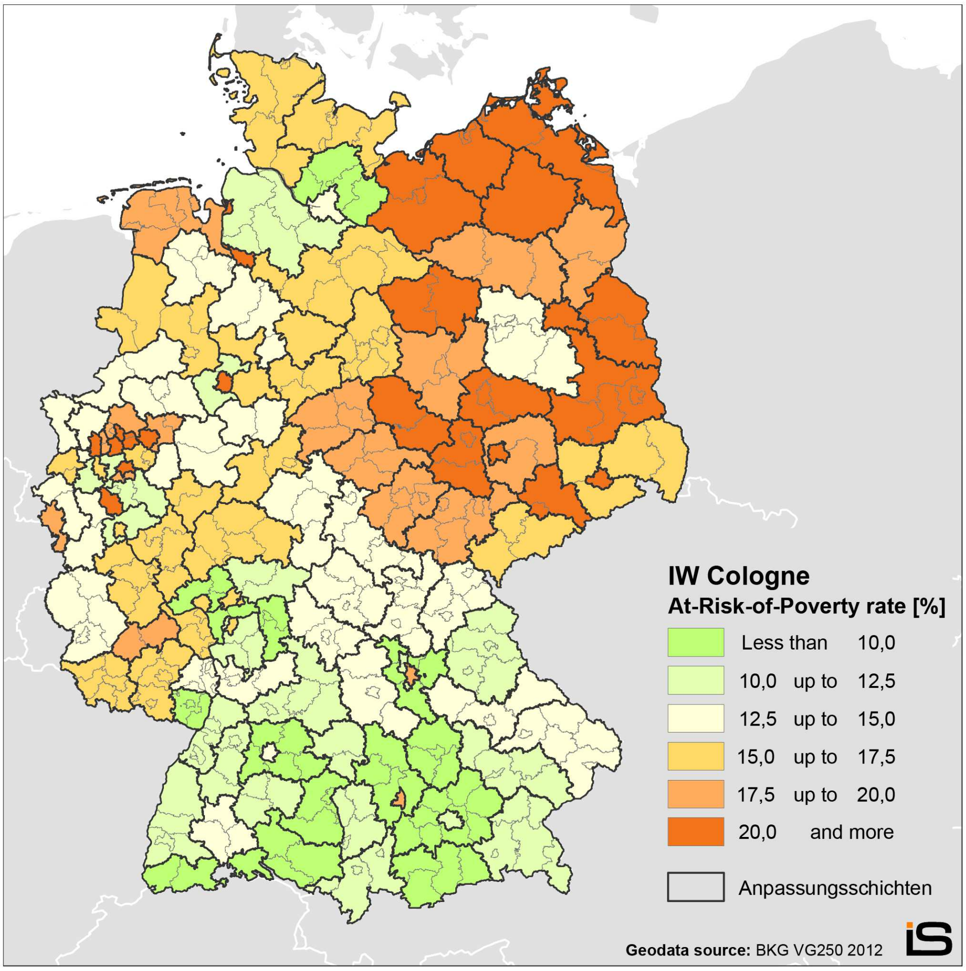

Fig. 1: The IW Cologne estimations of At-Risk-of-Poverty rates 2012 (IW Cologne 2014)

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The map of At-Risk-of-Poverty rates clearly shows a difference between the western and eastern parts of Germany. But on top of this west-east gradient an additional south-north one plays an important role. So the highest values can be found in the new federal states and eastern parts of Lower Saxony, lower values in the southern federal states of Bavaria and Baden-Würtemberg. Besides this macro regional differences, higher values seem to be found in core cities rather than in rural areas. Since most of the core cities are integrated into bigger adaption layer regions, this exposition is covered and can mainly be seen for the cities in Northrine-Westfalia (Bielefeld, Cologne, Ruhr area).

The approach relies on a strong database namely a Micocensus subsample. Since this is the biggest survey carried out by the statistical institutes including income attributes, it is the most reliable. The weakness lies in the regional classification system of the adaption layers. On the one hand, this (Microcensus) specific classification provides comparable regions in term of population number. On the other hand it combines NUTS 3 regions of different structur: cities with rural areas, central with remote areas. Combining these regions under a bigger one causes statistical effects that could cover intra-regional differences regarding the At-Risk-of-Poverty rate.

4.2 The ESPON TiPSE approach

The ESPON TiPSE approach is based on a linear regression model. This model uses precalculated variables from the Eurostat and the German Census 2011 databases. The indicators are available on NUTS 2 as well as on NUTS 3 level. The linear regression model is built on NUTS 2 data. At this level there are 39 regions in Germany representing the degrees of freedom in the model. The independent variables come from socio-demographic domains based on Eurostat, Census and Microcensus data 2010 and 2011. The dependend variable of the model is the precalculated At-Risk-of-Poverty rate from the German System Of Social Reporting (Federal Statistical Office and the statistical offices of the Länder 2013). Figure 2 shows the systematic of the variables used in the model.

Demographic characteristics
Population on 1 January – Less than 15 years [demo_r_pjanaggr3] Population on 1 January – From 15 to 64 years [demo_r_pjanaggr3] Population on 1 January – 65 years or over [demo_r_pjanaggr3]
Socio- economic characteristics
Employment in NACE A – Agriculture, forestry and fishing [nama_r_e3em95r2] Employment in NACE B-E – Industry (except construction) [nama_r_e3em95r2] Employment in NACE C – Manufacturing [nama_r_e3em95r2]
Housing characteristics
2 dwellings in the building Detached house, Semi-detached house, Terraced house, Other type of building
Socio- economic characteristics
Persons in employment, Unemployed persons At risk of poverty rate (NUTS 2)

Fig. 2: The ESPON TiPSE approach data sources

The correlations between the independend and the dependend variables are mainly strong. The weakest correlation is -0.25 (GDP) up to 0.89 (Unemployment rate). The model does not include housing costs and rely on already estimated At-Risk-of-Poverty rates at the higher regional level NUTS 2. These already include an estimation error since they are taken from Microcensus (survey) data.

After the calculation of the values using the covariates of the regression model, an additional factor is being calculated for each NUTS 3 region to synchronize the total number of people at risk of poverty with the total number on the including NUTS 2 region.

The model produces some very strong outliers that should be excluded from the interpretation. Especially in the NUTS 2 region DED5 (Region Leipzig) there are three NUTS 3 regions with very high At-Risk-of-Poverty rates. In addition three regions in Mecklenburg-Vorpommern and the region of Bremerhaven seem to be miscalculated.

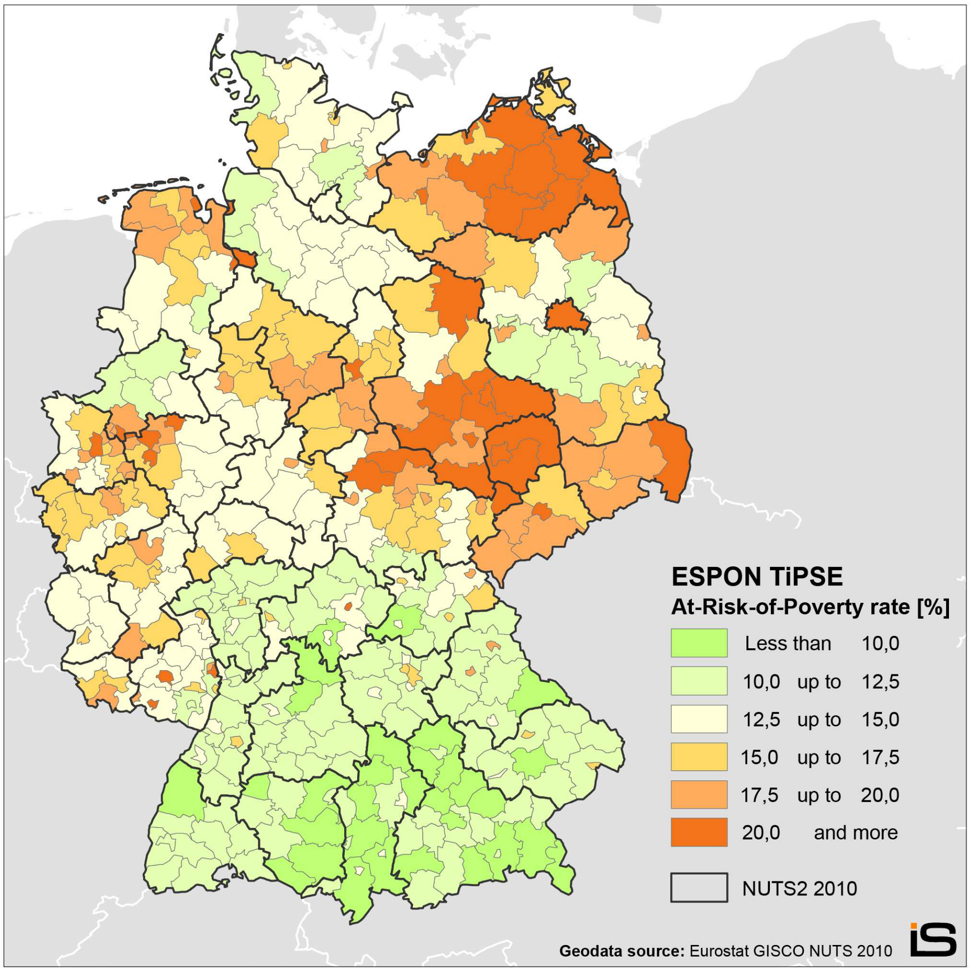

Fig. 3: The At-Risk-of-Poverty rates of the ESPON TiPSE project (ESPON Database 2015)

The map shows a spatial distribution of values, that is quite close to the IW Cologne approach.

Wide areas of the eastern parts of Germany show the highest values including Berlin. As an exception the Berlin surrounding regions of Brandenburg are at a lower level of At-Risk-of-Poverty. The southern regions of Germany in Bavaria, Baden-Würtemberg and Hesse show lower values whereby the northern regions of the western part of Germany are more complex to describe. The distribution does not follow macro regional gradients. Higher values can be found in the core cities of Northrine-Westfalia, the north-west and south-east part of Lower Saxony.

The spatial distribution of the values of course depends on the regression model and the underlying independend variables. High values in one dimension of the factors can cause a high output in the estimation. Although the variables correlate high with the At-Risk-of-Poverty rate, in some cases the dependency could be misleading. For example the old age dependency rate (people over 64 in relation to people between 15 and 64) is high correlated with the dependend variable. That means that where there are more people over 64 in relation to the working group, people are more likely to be at risk of poverty. (Because people aged 64 and older are more likely to be out of work and have lower income). Because some regions with high quality of life at the coast or in rural areas are pulling older people with higher income, the factor is wrong for them but still goes into the estimation for the region. The effect can clearly be seen in the north-western part of Lower Saxony including the islands and the coast.

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5 COMPARISON

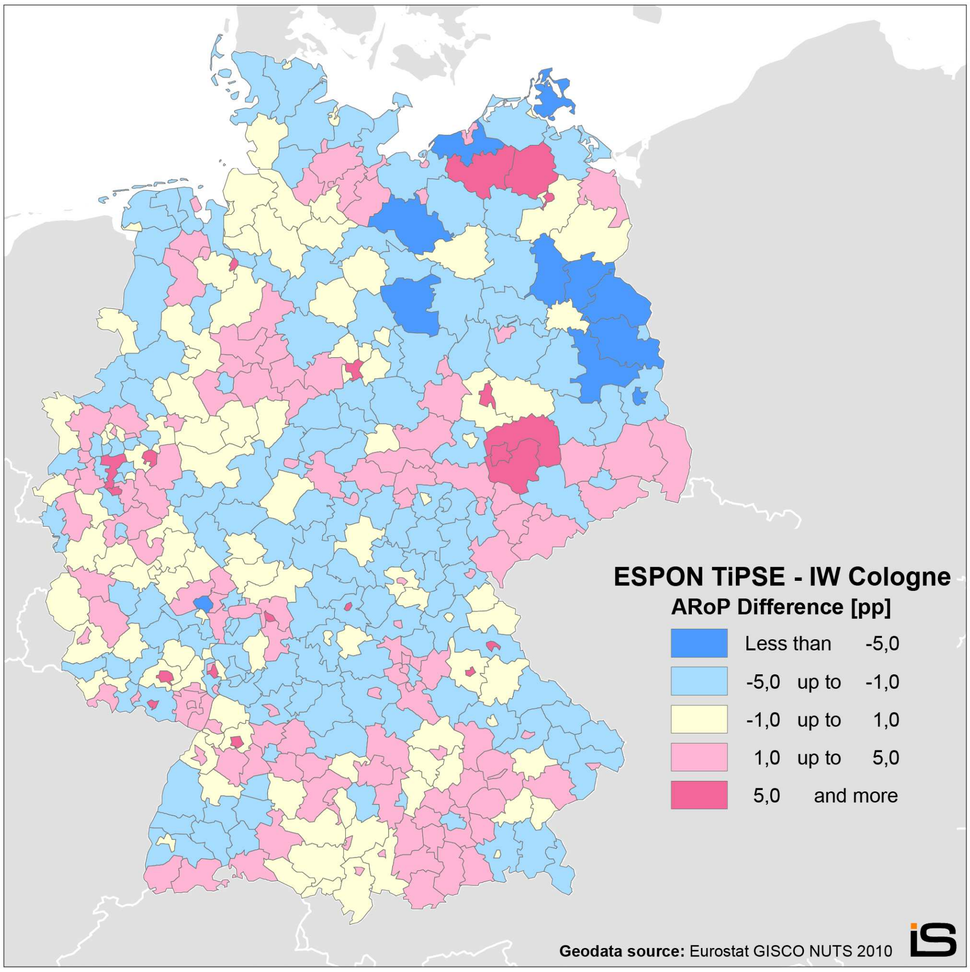

Fig. 4: Differences between the IW Cologne and the ESPON TiPSE approaches (Own calculation)

As already mentioned, there are clearly some outstanding overestimations in the ESPON TiPSE approach due to methodological restrictions and availability of variables. This has to be pointed for the NUTS 2 region DED5 (Region Leipzig) and for two regions in Mecklenburg-Vorpommern which should be excluded from the comparison. Besides that the both approaches do not neccesarily estimate the same values. Figure 4 shows the differences between them in percentage points (pp), where the blue colours mean higher values for the IW Cologne approach, the red colours higher values for ESPON TiPSE. Yellow coloured regions are at the same level of estimation.

The class of higher estimations of the IW approach with more than 5 pp (higher than ESPON TiPSE) is pretty small and include mainly regions in eastern parts of Germany, in particular the eastern, Berlin surrounding regions of Brandenburg. In the western federal states it is only the city of Frankfurt am Main.

The class of higher estimations of ESPON TiPSE with more than 5 pp (higher than IW Cologne) mainly consists of core cities in western parts of Germany that don’t build their own addaption layer region. This could be a statistical effect of the regionalisation in the Microcensus data that combines regions with high and regions with low values which average in the bigger adaption layer region.

The classes of inequality up to 5 pp show a more disperse picture. The most visible effect is that the ESPON TiPSE approach calculates higher values for the NUTS 3 regions being part of bigger metropolitan regions but not the core cities themselves. This can be states for the regions of Munich, Stuttgart, Frankfurt am Main, Dresden, Hannover, Hamburg (northern parts), and the Rhein-Ruhr area. The IW approach estimates higher values for the more remote areas.

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Methodologies for Collective Future Explorations in Actor and Action-Oriented Territorial Development

Annette Kuhk, Jan Schreurs

(Dr. Annette Kuhk, KULeuven, Department Architecture, Planning & Development research group, Kasteelpark Arenberg 1 bus 2431, B – 3001 Heverlee, annette.kuhk@asro.kuleuven.be)

(Prof. Dr. Ir. Jan Schreurs, KULeuven, Department Architecture, Planning & Development research group, Kasteelpark Arenberg 1 bus 2431, B – 3001 Heverlee, jan.schreurs@asro.kuleuven.be)

1 ABSTRACT

Future explorations are an essential component of spatial planning. In this, the complexity of issues often requires a collective learning process. We find this future-orientation for instance in scenario analysis and research-by-design, which are developed and used by distinct research or professional groups. Being part of different (paradigmatic) frameworks can hinder a combined use. In this paper, we explore how integrating - or at least interrelating- concept-driven and design-driven future explorations can contribute to imagining complex man-environment relations. In this, we study how a widened understanding of 'boundary objects', based on the initial definition from Star & Griesemer (1989) can help to integrate these approaches in planning practices. Thus, this paper aims to focus on the roles of different kinds of boundary objects, from shared concepts and shared problematisation to shared methodologies.

The study is developed for the government-funded Policy Research Centre for Spatial Planning in Flanders that accepted the challenge to scientifically support the development of co-evolutionary and cyclical planning approaches. Closely related to this ambition, we initiated several experimental Living Labs as a test bed for innovative tools and implementation strategies. The paper discusses the preliminary outcomes and relevance of a collaborative research project and collective learning experience that is intended to be continued until December 2015.

2 INTRODUCTION: COMMITMENTS IN FUTURE EXPLORATIONS

Imagining the future of cities and regions involves a complex set of actors, disciplines, fields of expertise, interests and voices. Even with only two disciplines involved – e.g. concept-driven approaches and design-driven future explorations being developed respectively in scenario analyses and research-by-design – one can still feel the need to create a shared understanding and a shared methodology to support or to enable the joint construction of socio-spatial imaginaries. The exploration of probable, possible or desirable futures is a challenge to all participants: imagining a different here and now urges actors to leave known comfort zones, yet at the same time to bring in their knowledge and experiences in order to assessing the plausibility and feasibility of proposals on future development. Then also, imagining plausible alternative futures is no non-committal exercise: it presupposes engagement of professional and social knowledge, as well as taking responsibility within a planning process. Combining explorative and committed aspects is similar to 'rehearsing the future'. It is an attempt of paving the way for novel discourses, developing alternative routes in decision-making and innovative practices, imagining new set-ups, at the same time playing for real and realizing playful situations.

Current contribution reflects on the construction of 'boundary objects' to find a middle ground between different types of actors. The reflection is based on the experiences from two experimental living labs. Even if they are experimental, the living labs are developed in a real-world setting, which implies that the proposed innovations are always contingent upon historic paths dependencies, situated in actual manifestations of spatial development and considering 'ranges' in future variations. In such prospective exercises, actors are committed to forward their particular experiences, knowledge and interests.

The paper starts with a brief positioning of the Flemish living lab experience in contemporary challenges in Flanders (i.e. pressures and potentials in peri-urban areas, polycentric development in cross-border settings, the governance challenges that come along these, etc.). A second section then intends to clarify central notions for the development of a methodological reflection on future explorations and collective learning experiences on spatial issues. We then turn to two particular challenges in building a common ground between actors, which are the development of shared methodologies and shared problematisation. The concluding reflection focusses on the role and challenges in using future explorations and living labs in spatial policies.

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3 LOCALISED LIVING LABORATORIES: FUTURE PROSPECTS FOR PERI-URBANITY IN FLANDERS

The Flemish Policy Research Centre for Spatial Planning is currently developing two experimental Living Labs, in order to test and to further explore innovative coalitions and practices through a collective learning experience. The living labs focus on two particular peri-urban areas, which are a suburban strip along the N16 regional road (i.e. connecting Temse to Willebroek, with vast industrial areas as well as polynucleated, spread residential fabrics and fragmented green, open spaces), and on the relatively dense Dender-valley at the West of Brussels (i.e. a river that flows into the river Scheld).

Figure 1: Schematic positioning of two living lab areas, in relation to the central axis between Antverp and Brussels and Charleroi, (source of the basic map is the green paper for spatial planning Flanders, RV, 2012).

3.1 Spatial Living Labs

Generally speaking, a living lab is "a user-centric innovation milieu built on every-day practice and research, with an approach that facilitates user influence in open and distributed innovation processes engaging all relevant partners in real-life contexts, aiming to create sustainable values." (Bergvall-Kåreborn e.a., 2009:3). The concept of "user-centred environments for open innovation" (Schaffers e.a., 2010:1) originates from R&D environments, i.e. to develop innovative technologies using rapid prototypes cycles. The main focus there is on "confronting the user with technology" (Veeckman e.a. 2013). Basic features of living labs can be summarised as follows:

- Different kinds of users are involved in an early stage, and on a continuous base, with the aim to result in a sustainable stakeholder partnership and agreements between partners.
- Living labs aim at open innovation (Chesbrough, 2006): there is a basic openness towards various possible solutions forwarded by different partners, innovation can come from external resources as well.
- A 'lab' is not merely a test bed for innovations that have been developed in a closed expert laboratory and desktop research setting, it rather is an incubator for innovation in collaboration with (end-)users.
- Innovation is expected to be the result of collaboration and co-creation, it can also be widened towards 'democratic innovation' (Von Hippel, 2005) with a larger audience participating.
- Innovations from living labs start from a real-world setting, and intend to alter a relatively local setting. However, it can also lead to changes on a more systemic level, which mostly require then accompanying policy innovations in order to transfer novel practices.

The notion of living labs has meanwhile been translated to other domains such as rural or urban development (cf. Schaffers et al., 2010; Gopnik et al., 2012), and the meaning of the concept has been stretched into many different directions: "The concept of Living Labs has also been defined as an environment (Ballon et al., 2005; Schaffers et al., 2007), a methodology or innovation approach (Bergvall-Kareborn, Holst &Stahlbröst, 2009; Eriksson et al., 2005), and organisation, an innovation intermediary (Schuurman, Lievens, De Marez

&Ballon, 2012), a network (Leminen &Westerlund, 2012) or a system (EnoLL, 2007).” (Veeckman e.a., 2013, p. 5). We further develop this observation in the discussion on ‘shared methodologies’ in section 5.1.

3.2 The wider research context

The ‘Living Labs’ are a short term assignment for two years, developed in a cooperation with different actors in the Policy Research Centre for Spatial Planning in Flanders (i.e. ‘Steunpunt Ruimte’). The research in this consortium is organized into different tracks of inquiry: while the research on ‘polycentrism’ (WP1) and ‘resilience’ (WP2) mainly investigate properties of existing urban and regional (physical as well as social) networks and their capacity to resist strain, the research on ‘future explorations’ (WP3) meets the challenge of embedding this understanding into possible transformation strategies. Future explorations can be developed together with monitoring and evaluation (WP4) as an integrated part of (cyclical) strategic spatial planning. The main challenge in the policy centres research is to explore latent possibilities in existing spatial configurations, matching the exploration of possible futures to real social, spatial and policy constraints.

The ‘Living Labs’ are developed in a cooperation of different actors in the Policy Research Centre, and particularly in overlap with WP3, i.e. the investigation of methodological issues with the development of future explorations in spatial planning. The Living Labs and WP3 share a focus on studying and/or developing localizing agenda’s, and an interest to develop future explorations with a complex variety of stakeholders. Whereas the primary focus in WP3 is on methods, and particularly on scenario’s and research-by design, the study also analyses future explorations in relation to a wider planning context, as well as to underlying scientific paradigms. The study intends to develop methods through case-based learning for tangible, complex spatial problems. The Living Labs are both an incubator for novel spatial approaches in specific real-world settings, as well as a test bed (and/or incubator) for methodological issues such as the use and development of boundary objects in complex, multi-actor settings.

4 CENTRAL NOTIONS FOR A METHODOLOGICAL REFLECTION ON COLLECTIVE LEARNING EXPERIENCES

The main objective of a methodological reflection is to clarify guiding principles for research practices. Its ambition reaches further than a description of methods, i.e. tools, techniques or processes. This is particularly relevant in inter- and transdisciplinary settings with actors that draw on different theoretical and methodological perspectives and experiences. Typically, the development of future explorations in spatial planning requires an involvement of a multiplicity of actors with different backgrounds, interests and voices. The orchestration of processes to accompany an exchange, negotiation or even collaboration deserves being critically assessed. Before we turn to the case study, we briefly would like to clarify two central notions in this methodological reflection, i.e. on the setting of collective (and situated) learning initiatives and on the ambition to create boundary objects in these multi-actors settings.

4.1 The setting: collective (and situated) learning initiatives

The awareness over the wickedness of spatial development has profoundly questioned approaches in which plans, models and visions are developed at a desktop of individual experts. Instead, the complexity of issues at stake legitimates investing in multiple sources of expertise, and/or in a joint production of knowledge. Another legitimation lies in a pedagogical reasoning, which emphasises the social nature of learning (cf. Vygotsky). A less rationalistic argument for collaboration lies in the observation that spatial planning decisions are fundamentally political, i.e. leading to the (re-)distribution of resources and an intervening in the allocation of rights and responsibilities (cf. insights on collaborative planning, Healey, 1997).

Ideally, the joint production of knowledge over a complex spatial planning issue would lead to a form of collective learning, in which each of the participants can capitalise on the resources of others. The Flemish administration has organised a series of initiatives, which qualify to various degrees as collective learning experiences. We here think of ‘partner dialogues’ and ‘working groups’ in the run-up to a white paper and Spatial Policy Plan, or the efforts to collaborate over so-called ‘Territorial Development Projects’ or ‘Strategic projects’. Other examples of collective learning experiences are the ‘Labo XX’-collaboration with the Flemish ‘bouwmeester’- or the unique project of the ‘Metropolitaan Kustlandschap 2100’. In a collective learning setting, openness precedes reciprocity: only with a fundamental openness towards a heterogeneous group of participants, there is a chance to learn from one another’s experiences and expertise. With this

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condition fulfilled, there is an expectation that the creation of knowledge in a collective setting could transcend the mere sum of knowledge available in a given group. Collective learning breaks with the expert-audience, teacher-student, professional-laymen dichotomies, and appreciates the relative value of contributions from different participants, e.g. the fresh look from the outsider, the uninhibited question of a laymen, the localised concern of an inhabitant, the theoretically grounded insight from an academic or the prospective imagination of a child. It hereby essentially also questions the power relations at play in spatial planning practices (cf. Healey, 1997).

Area-based living labs create another particularity: the collective learning experience departs from a real-world, localised setting. The gatherings therefor often take place in particular and 'situated' spaces, i.e. including a field trip to relevant locations, organising a gathering at a meeting room of a local business or the city hall, searching combinations between 'representing spaces' and 'experiencing spaces' and/or being involved in actual practices (e.g. discussing issues in a real setting of a local commission for spatial development). The particular location adds in itself a layer of knowledge: the setting for learning is located IN the subject of concern, i.e. in the region that is studied. The possibility to organise collective learning processes as a 'situated learning' experience (cf. Lave, Wenger, 1991) enriches the production of knowledge with the location being an 'actor' in the process of shared problematisation. Place (i.e. the explicit presence of a specific location) matters in the building of localised capacities. According to Lave and Wenger, learning in a community of practice needs to be situated in an authentic context, i.e. the context in which the knowledge is to be applied. Whereas the location in area-based living labs creates a common context, the discourses, languages, interests and expertise of different participants can still largely vary. The ambition to mediate in this heterogeneity through the creation of boundary objects is discussed in the following section.

4.2 The ambition: creating boundary objects

The concept of 'boundary objects' was defined by Susan Leigh Star as a model to describe and to explain how it is possible that many different actors and viewpoints can cooperate, despite the tension due to the extreme heterogeneity of the group (Star, 2010). 'Boundary objects' are an analytical concept to explain how different actors manage to cope with both diversity and cooperation (cf. Schreurs, Kuhk, 2014). They are as "objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and becomes strongly structured in individual-site use. These objects may be abstract or concrete. They have different meanings in different social worlds, but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds" (Star & Griesemer, 1989, p. 393).

Since our primary concern is to factually bridge barriers, we have to ask questions about the nature of the concept. How broad is the scope of boundary objects? What kind of 'boundaries' are we dealing with? And what can play the role of 'object'? "'Boundary' is seen as "shared space where exactly that sense of here and there are confounded. These common objects form the boundaries between groups through flexibility and shared structure – they are the stuff of action" (Star, 2010, pp. 602-603). Clearly, commonness and sharing are more important than delineating and dividing. 'Object' also has a meaning beyond common parlance. "An object is something people (or, in computer science, other objects and programs) act toward and with. Its materiality derives from action, not from a sense of prefabricated stuff or "thing"-ness. So a theory may be a powerful object." (ibid., p. 603)

Boundary objects can thus be used, interpreted and elaborated in different ways. They typically do not perfectly fit, but do allow individuals and (sub-)groups to elaborate on their own authority. Then also, boundary objects are repeated and re-interpreted, and therefore often gain an almost 'iconic' status. Boundary objects are flexible and robust at the same time. The objects induce a discussion that acknowledges different perspectives and understandings, which in itself is a precondition to create shared understandings. Boundary objects allow discussing (1) understandings on differentiations and classifications, or (2) on the identity of single units in such classification. They can also be used to instate (3) a shared understanding between different groups of actors (relating to different aims) and consequently also function as a (4) 'method of common communication'. Star & Griesemer describe these four types of boundary objects as ‘repositories’, ‘ideal types’, ‘coincident boundaries’ and ‘standardised forms’ (Star & Griesemer, 1989, pp. 410-411).

While this list of types of boundary objects was not meant to be exhaustive (Star, 2010: 603), it shows the broad understanding of the concept. Wenger builds on the typology of Star & Griesemer, to describe how boundary objects can serve as connectors (Wenger, 2001, p. 107), which closely follows Star’s description: “boundary objects are a sort of arrangement that allow different groups to work together without consensus” (Star, 2010, p. 602). In one or another way, such boundary objects have the capacity to bridge group imaginaries and sociocultural schemata. A particular characteristic is that of ‘modularity’, which stresses that different perspectives that are linked to one boundary object are complementary. Star stresses that the ‘form’ of boundary objects should be seen as ‘organic infrastructures’ that emerge out of ‘information and work requirements’ for doing things together in a local group (Star, 2010, p. 602). Also, boundary objects are marked by ‘abstraction’, which enables ‘accommodating’ different interpretations. Last but not least, boundary objects are also marked by certain standardization. In a later article, Star emphasizes the intrinsic dynamic character of situations in which boundary objects play a crucial role, notwithstanding a gradual standardization. She “began to think of standards and boundary objects as inextricably related, especially over time” (Star, 2010, p. 607). An explanation was looked for in a non-linear course of interrelated processes of group-formation, de- and reconstruction, while defining and redefining what should be fixed and what can be kept flexible: “Over time, all standardized systems throw off or generate residual categories. […] As these categories become inhabited by outsiders or others, those within may begin to start other boundary objects … and a cycle is born” (Star, 2010, p. 614).

In conclusion, it can be said that boundary objects are coexistent and malleable, i.e. changing over time, yet also with a potential to gradually become an accepted standard. Co-production is essential in the making of boundary objects and method standardization (cf. Schreurs, Kuhk, 2014).

5 BOUNDARY OBJECTS IN LOCALISED LIVING LABS

There are different instances with the development of area-based living labs in which the development of boundary objects can be productive for collaborative and collective learning. The need to develop boundary objects can be motivated as follows:

- There is no standardized, generic methodology for living labs in spatial planning. The architecture of a living lab requires a process or selection and articulation, and possibly also negotiation. A first connector therefore is needed with the design of living labs, in order to develop a joint methodology for living labs, i.e. through the positioning and/or integration of scenario-analysis, research-by-design, experiences with transdisciplinary or actor-relational-approaches, perspectives from transition thinking, evolutionary planning or social innovation.
- Then also, the living labs enable links between different research tracks in the Policy Research Centre (i.e. on water management, migration policies, ecosystem services, mobility, housing, etc.), towards an interdisciplinary, and more ‘collaborative’ production of knowledge. Also here, the building of a shared understanding is essential for collective learning.
- Last but not least, the heterogeneity of living labs is largely defined by the participants. Boundary objects are essential to facilitate communication between researchers and different stakeholders in such living Labs.

5.1 Towards shared methodologies

5.1.1 The need to make the implicit explicit

Living Labs do not follow one standardized, generic methodology. The notion refers to a range of possible approaches, such as a more business-oriented logic, a ‘lead user’ concept (cf. von Hippel, 2005) unto wide participatory approaches for ‘crowdsourcing’ (cf. Howe, 2008). Then also, the introduction of the living lab concept to spatial planning can alter the concept. Equally, planning could be altered with the introduction of living labs: “Planning work is not just about the substance or specific context of issues…It is also about how issues are discussed, and how problems are defined and strategies to address them articulated. Questions of process as a result are as important to local environmental planning as questions of substantive content” (Healey, 1997, p.85).

Based on a closer analysis of scientific journal databases, the Finnish researcher Sirkku Wallin identified three types of urban living labs (cf. Wallin, 2015, p.2). The first type is a series of technology-driven living labs, for instance leading to city-wide experiments or pilots to enhance local mobility services. Wallin notices that the role of the users remains very limited in this constellation. The second type of living labs produces urban artefacts, e.g. through the co-creation of public spaces. The third type of initiatives that were described as an 'urban living lab' focuses on vision-making, mutual learning, deliberation and new models of local governance. The different approaches in area-based living labs are mirrored in different planning styles, ranging from technocratic approaches that focus on solving particular, limited problems to socio-cratic approaches with an aim to mediate in a complex actor setting.

For the two experimental living labs on peri-urban development in Flanders, there was only a limited set of agreed guiding methodological principles at the start of the initiative. Quite a large part of principles in the building of a shared methodology are the result of negotiations, e.g. at the 'curatorium'.[1] This gathering of four professors and two senior assistants, recently also joint by an expert from the Flemish administration of spatial planning, was organised more or less every two months. The 'logbook', in which the process of building living labs is documented and reflected upon, has provoked discussions on specific methodological issues, e.g. about the level of ambition of the living labs, on the openness and/or the level of inclusion of particular actors, the valorisation objectives of the living labs, and so on.[2] Each member of the 'curatorium' contributes to the building of a shared methodology based on own experiences, knowledge, backgrounds and interests. The following paragraphs attempt to illustrate how this collective learning and co-construction of knowledge on the functioning of living labs in spatial planning developed. It illustrates the process of developing a shared, yet tailormade methodology.

The development of localised living labs for spatial planning in Flanders joins a wider array of experiences and methodologies, amongst which knowledge on actor-relational approaches (Boelens, 2009), experiences with future explorations and scenario-analysis (Kuhk e.a., 2011), reflections on evolutionary, cyclical or adaptive planning (cf. Bertolini, 2010), a view on transition management, systemic approaches and the need to build strategic territorial alliances (Coppens, Allaert, eds., 2014), knowledge on social innovation (Moulaert e.a., 2013) or on participant design- scenario workshops (Cox e.a., 2014).

The link with actor-relational approaches and strategic territorial alliances have been explicit references as of the start of the area-based living labs, already in early negotiations with the commissioning authorities (i.e. the department of spatial planning in Flanders). The other frames of reference have been included only gradually and/or often more implicitly. It has been a process of progressively growing insights to develop a shared methodology for the two experimental area-based living labs.

5.1.2 User-orientation and iterations

The logbook served as a reminder to also situate the particular experiments in Flanders in a wider range of living lab experiences. In this, Chesbroughs description of 'open innovation' has been an important point of departure for the Living Lab concept. 'Open innovation' assumes non-linear, cyclical innovation processes (cf. Chesbrough, 2003; Veeckman e.a., 2013) with iterations, feedback loops and hands-on, formative evaluations. This can for instance be realised through 'open innovation platforms' (Feldman, 2007). The complexity of planning issues, the uncertainty over contextual factors or the multiplicity of actors involved urges the development of similar processes, which translate into a series of actor- and action-oriented approaches, stressing the importance of collective learning. This is equally emphasized in the publication "The Urban Connection, An actor-relational approach to urban planning" (Boelens, 2009), in which the author advocates for planning approaches that explicitly consider a multiplicity and diversity of actor perspectives. The reasoning and legitimation for such efforts is based in the observation that contemporary planning practices often experience path dependencies and lock-ins, whereas at the same time, alternative practices emerge as a response to a significantly revised social context. However, these novel practices often stand little chance to be implemented, valorised or transferred to a greater scale (cf. Boelens, 2009, p. 8-9).

[1] Participants to the curatorium are: Luuk Boelens, Jan Schreurs, Michiel Dehaene, Tom Coppens, Marleen Goethals and Annette Kuhk, more recently also Liesl Vanautgaerden.

[2] The process, design and architecture of the logbook is based on earlier experiences that were developed in integrative design trajectories for the Master Programme in urban planning at the Sint Lucas School of Architecture (In this, A. Kuhk was lecturer for the theoretical component).

Another argument to promote investing in multi-actor collective learning initiatives is the observation that scientific theories on spatial planning seem to develop at a large distance from daily practices (ibid., pp. 183-189). A series of case studies in the publication illustrates the relevance of the actor-relational approach (ARA): "Space is always relational (...), it is constantly co-structured by the reciprocal interaction between (leading) actors and their networks, e.g. strategies and (institutional) settings" (ibid., p. 11). The author concludes that the examples from practice are promising in order to develop a novel and more robust form of urban planning with flexibility and a strong practice orientation (Boelens, 2009, p. 197). Such an 'outside-in' approach that starts from stakeholders (as opposed to an 'inside-out' approach that starts from governments) could be developed in different stages (ibid., pp 193-197), e.g. starting from a first inventory of actors and values, development of potentiality maps, bilateral talks and round tables, development of business cases or pilots, according coalitions and possibly also the widening of new practices. The use of maps is essential here since it enables to represent territories related to interpretations of different spatial uses, i.e. shaped (and shaping) actor relations to physical spaces. Mapping is one of four ways to navigate through the complexity of spatial planning issues (ibid., p. 172-177, based on Deleuze and Guattari, 1980). The process of mapping is preceded, yet often also accompanied by an unravelling and a reconstruction of the existing, which is a process of 'tracing'. Then again, potentials cannot be realised unless matching partners can be found. The relevant structure to navigate through complexity here is a 'diagram', e.g. to represent relationships and transformations thereof. Last but not least, the realising of novel practices equally requires knowledge about a wide field of 'agencements' such as laws, regulations or institutions (and the potential to change these) to be able to estimate the likelihood of potential developments in spatial planning. The fourfold Deleuzian cartography –traces, (potentiality) maps, (actor) diagrams and 'agencements'- has become a shared fundament in the methodology for the experimental living labs.

Other references in the methodology of the experimental living labs have been experiences in research-by-design and particularly also the 'synoikos scenario workshops', e.g. in the European 'Thought for food'-project (T4F) with a case in Roeselare Hoogleden (cf. SPINDUS-project, Segers e.a., 2013). The aim here was to test 'participatory urban design' in a real-world setting, as a method for social innovation (i.e. approaches to enhance social interactions and basis needs for specific social groups). A significant resemblance to the actor-relational approaches is the starting point, which are, in both approaches, local actors. Then again, the SPINDUS project has an explicit focus on social innovation, which seems to be no sine qua non condition for the ARA approach. The observation of this difference with regard to taking an explicit normative position has equally been discussed in the 'curatorium'.

The 'architecture' for the T4F project is based on synoikos processes and on the 'Netzstadt' approach (cf. Oswald Baccini at ETH Zürich; Oswald, Baccini, 2003). The aim is to create strategies for development and to launch project ideas based on the contribution of a multiplicity of actors, similar to the ARA. The project started from a morphological and physiological research, which is partly comparable to a process of 'tracing'. The results of this were presented in a first workshop, which lead to 'scenarios' (comparable to the stage of 'mapping'). These are hypotheses about possible pathways for more sustainable spatial development over a period of 50 years, with an indication of the 'change agents' (similar to a process of 'Diagramming'). The experience from this participatory urban design approach as well as from a variety of research-by-design projects has been valuable in developing potentiality maps for the living labs. The multi-valence of such design-scenario hybrid, which integrates images and narratives, is expected to also contribute positively to a more continuous, dynamic, strategic and inclusive planning process (cfr. Schreurs & Kuhk, 2011, p. 346). Vandenbroeck agreed with the expectation of added value, but stresses the need to use strong boundary objects to integrate approaches from planners and designers, in order to also operationalize the use of both scenario analysis and designerly research in planning practices.

The T4F experience equally sharpened the focus on the importance of iterative and cyclical developments: building a shared understanding requires a methodology that structurally builds on reiterations. Neither the Deleuzian ways to navigate complexity (i.e. tracing-mapping-diagramming-agencying) nor the architecture of synoikos workshops (i.e. inventarising- scenarios and scanning directions for development – indicating change agents) should be read as linear processes: it requires many iterations with local and regional actors to sail across the complexity of spatial planning issues (cf. evolutionary planning, Bertolini, 2010).

The experiences from actor-relational approaches, participatory and designerly approaches (with their emphasis on future-orientation and on experiment), which are at times combined to scenario-thinking, are

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moulded into a methodology for two experimental area-based living labs on spatial planning in Flanders. This has lead to following guiding principles:

- To (pro-)actively and continuously reflect on the building of a shared methodology, which is supported by systematic documentation in a logbook as well as a by the frequently organised feedback on the subject of concern as well as on methodologies in a 'curatorium' (cf. designerly approaches),
- To consider a multiplicity and diversity of actor perspectives as of the beginning of the living labs (cf. actor-relational approaches, synoikos-workshops as well as essentials of living labs itself): not only is innovation expected to emerge from co-creation, the development of novel coalitions can itself be an innovation in complex (spatial planning) issues,
- To develop the living labs as non-linear, cyclical innovation processes (cf. evolutionary planning), with explicit attention for reiterations and moments of consolidation: in this, it is important to also identify gaps in the knowledge production, and to use progressive insights and/or the participation of other actors for a next iteration (cf. also literature on uncertainties and on wicked problems, which are defined and redefined instead of being 'solved'),
- To navigate through the complexity of spatial issues by means of tracing, mapping, diagramming and agencying (cf. actor-relational approaches, based on Deleuze and Guattari, 1980),
- To foster a reflection on more continuous, dynamic, strategic and inclusive planning processes (cf. also hybrid combinations of images and narratives as can be found in scenarios and designerly approaches).

5.1.3 Systemic approaches and strategic development

Prior to the living labs, there has been another ad hoc, short term assignment at the Policy research Centre for Spatial Planning, i.e. the 'expertforum'. The group of experts accompanied the writing of the white paper on spatial policies during two years. In this, Coppens and Allaert pointed at a central dilemma in spatial planning: whereas several aspects in the business-as-usual are fiercely criticised for their negative impact on for instance traffic congestion, water management, bio diversity, food- and energy facilities or effects on health and environment (Coppens e.a., 2014, p. 40), it seems to be increasingly difficult to actively steer societal systems and as such also the development and the use of spaces. The members of the expertforum expected that transition management could potentially offer a way out of this impasse. The starting point is an analysis of broader socio-technical regimes which focus on (1) tangible and intangible structures (e.g. network infrastructures or systems of regulation), (2) on the dominant images, values, paradigms and discourses (e.g. the importance of juridical stability, or the strong individualization in spatial development in Flanders), and (3) on routinely system behaviours (e.g. discrepancies between permits and enforcement). With a certain number of similarities to this approach, the analysis of dominant images or worldviews has also been the subject to explorative scenarios (cf. Kuhk e.a., 2011), as well as to the 'theories des cités' (Boltanski, Thevenot, 1991) or to subsystem approaches in public policies (cf. Kuhk, 2013, pp. 42-44).

A common assumption in the literature on transition management is that the measures to resolve systemic conflicts are generally conformist and only rarely innovative on a systemic level. Measures may temporarily appear to be functional, whereas they essentially reinforce an existing lock-in (which is, from a systems perspective, essentially a dysfunctional evolution, e.g. using breakdown lanes as a measure against congestion and/or other symptom control). Another example is the exuberant regulatory framework in spatial planning, which attempts to summarize even complex conflicts in high density areas in an encompassing regulatory context. In an attempt to adjust regulations for every combination and variation, the regulatory systems becomes rather dysfunctional than facilitating (e.g. creating 'exception decrees' and 'repair laws', ibid., p. 47). Transition management argues that socio-technical regimes have a persistent stability, with little possibility to actively steer the regime. In future explorations and scenario analysis, a closer analysis of thresholds and path-dependencies is expected to shed a light on these kind of syrupy processes (cf. Hendriks, Toonen, 1991).

At the same time, there have been also numerous examples of socio-technical regimes that change quite radically, often at relatively short notice and starting from small-scale innovations. Niche changes can, under certain conditions or so-called 'windows of opportunity', be applied on a larger scale.[3] Transition management does not aim at steering towards one specific 'optimum', but it is primarily striving to accelerate the process of change in the direction that is more sustainable.[4] Solutions are a priori not determined, but found in the course of the process (cf. Coppens e.a., 2014, p. 45).

The living labs depart from a similar logic: the issue setting (or 'problematisation') and the possible approaches (or 'solutions') are both defined by all relevant actors involved, from the beginning of the process. The expertforum expected innovations to develop in new and unexpected connections of actors, including actors from niche networks. The novelty then would be a result of unexpected linkages between actors who previously were in relatively separate worlds, e.g. social organizations with private operators, energy suppliers and food producers, hobby farmers with water companies, etc. If these innovative coalitions evolve into a system level, they can turn into 'strategic alliances' (ibid., p. 49). Innovative practices in space can then also result in a system-wide transition. There is an important flipside to this coin though: even if novel practices function well in particular niches and particular locations, the effect on a larger scale needs to be considered carefully. The reassessment of systemic levels both considers potentials as well as possible negative externalities with a generalised application of novel practices. The debate over systemic and strategic implications can complement the series of guiding principles for area-based living labs:

- To reassess proposals for change with regard to effects in broader, dynamic socio-technical regimes and wide contextual changes, in order to avoid myopia on the local real-world setting (cf. transition management as well as explorative scenarios), which also includes an assessment of the potential to innovate on a systemic level.
- To particularly also consider actors from niches (cf. strategic alliances and transition management),
- To consider the potential of turning novel coalitions into strategic alliances (cf. strategic alliances),
- To study thresholds and path-dependencies for the development of novel practices (cf. scenario-analysis and wider future explorations).

5.2 Towards shared understanding and problematisation

As can be understood already in the road towards a shared methodology, the Policy Research Centre is a nexus of inter- and transdisciplinary interactions and endeavours. The scientific consortium is composed of several research groups from three different universities and their faculties. In its functional and research relationships with Flanders' administration and the cabinet, many more different disciplines are involved. By deciding to explore two experimental living labs (and as such also the living lab methodologies), the focus is extended well beyond traditional socio-spatial issues and concerns. All these different loci of governance, science and daily practice are embedded in complex 'backgrounds'. A shorthand notation for this complexity is: those are constellations of attitudes, knowledge, and practices. The Policy Research Center would therefore be a rich locus for (experimenting) inter- and transdisciplinary research. There are drawbacks however: interdisciplinary research is not evident. Paradigms and theory-constitutive concepts are both formative of and resulting from disciplinary practices, but they are structurally different for every discipline. Differences in knowledge, methodologies and attitudes can easily hamper cooperation, mutual understanding and even communication. From the set-up onwards, the proposal anticipated to this multiplicity. Trying to construct a 'foundation' for a common understanding, a coherent body of underlying metaphors, theories and images was foregrounded.

With little signals of an effective absorption by researchers, alternative routes towards common understanding were searched for in setting up two experimental living labs. The following paragraphs briefly present main elements in the original 'foundation' for a common understanding as well as later steps towards shared understanding and problematisation through setting up living labs.

5.2.1 Towards a common conceptual framework for Policy Research on Spatial Planning

When the program of the Policy Research Centre for Spatial Planning was set up, a system-perspective - with the 'ecosystem' as an associated metaphorical concept - was meant to operate as part of a common

[3] These conditions have been extensively studied in so-called 'subsystem approaches' in public policy studies (cf. overview in Kuhk, 2013, pp. 42-44.

[4] Cf. earlier: discussion on explicit normative framing for living labs.

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conceptual framework. It was hoped this could generate a minimal ‘logic’, at least a minimum of coherence between different research tracks. Taking specific care for coherence was an obvious measure because, from the start of this research program, the practice of interdisciplinary approaches is said to be one of its strongholds. Interdisciplinary collaboration requires more than shared concepts though, which points at a rather limited understanding of boundary objects. We believe there is a considerable potential in constructing shared ‘lenses’ to help inter- and transdisciplinary work. Within the research-proposal, they were elaborated in terms of a combination of a common conceptual framework, a shared methodological framework (i.e. all work packages will develop and apply similar concepts, related to a ‘systems’-lens), a shared procedural framework (i.e. a similar research logic, bi-annual dialogues, a charrette halfway etc.), and active integration management. This structural given would allow combining a broad array of different domains (e.g. systems theory, morphology, mobility, climatology, sociology, planning or governance), kinds of knowledge (i.e. concepts and methods) and experiences. In this way, interdisciplinary work could become a fruitful ground for innovation and critical assessment. Thus it was hoped.

Being aware of the rather abstract nature of the notion ‘ecosystem’, two metaphors were also foregrounded in order to clarify and to mobilize the concept. It was hoped that an experiment in mobilising ‘ecology’ as a metaphor would contribute to planning theory. In recent years, the use of the term ‘ecology’ has boomed in planning and design literature (e.g. Mostafavi & Gareth, 2010; Palazzo & Steiner, 2011). While ‘ecology’ has been a leading metaphor in many analytical endeavours, examples of its use in planning practice are rather sparse. Investigating potentials, thresholds and challenges of its use as core of a common research ‘language’ is therefore relevant. To be clear: mobilizing this metaphor does not imply that all issues and methods have had to belong to be seen as part of the domain of natural or biological ‘ecology’. The descriptions of a city as an ‘artificial ecology’ (Allen, 1999) or the statement that one should take care of ‘physical as well as social and mental ecologies’ (Guattari, 1989) exemplify the profound as well as broad meaning of the concept. The associated metaphorical concept of ‘metabolism’ was also considered as a promising choice for spatial planning to more effectively describe challenges such as climate change, water problems or energy flows (cf. Beatley, 2000). Then again, references to landscape ecology would allow developing an ecological perspective for the study of spatial developments in operational terms. For instance, this can lead to identifying interrelations between spatial structures such as matrixes, patches, corridors (cf. Dramstad, Olson and Forman, 1996) and spatial strategies such as interweaving, bundling, (de)concentrating, (de)fragmenting, flows, rescaling, which are then also linked with concepts such as ‘stocks’ and ‘flows’ of people, water, space, material, capital, information, energy (cf. Angélil & Hebel, 2010).

5.2.2 Local laboratories: Boundary objects in local laboratories and Living Labs

As described in previous sections, the Policy Research Centre became aware that boundary objects (i.e. shared concepts and metaphors) and standardized methods (cf. Star &Griesemer, 1989) have to be actively looked for or created. They can help to construct flexible but strong ties, which can provide a substantial base, as well as a reflexive (and communicative) turn to research.

Until now, several thematic, territorial and methodical boundary objects have been developed, e.g. a shared interest for ‘resilience’, a common focus on a ‘reference’ case area, and a wider use of ‘what if’-approaches for hypothetical and evaluative thinking in variants. The metaphor of ‘ecosystem’ was not picked up easily and is only recently and gradually becoming an important conceptual boundary object. It intended expressing a flexible systems view on ecology and referring to abstractly delineated territories, which act as a vague reference to a possible field of application for the different work-packages. But it cannot be stated that the conceptual, methodological and procedural set-up was explored up to its ultimate coherence. Therefore different boundary objects are to be more actively constructed to facilitate even more the collaboration and integration between different research tracks, as well as within work packages. In the meantime, a growing need for boundary objects emerged throughout multiple collaborations for within case-based ‘living laboratories’.

Within the context of the Policy Research Centre, we plea for a more intensive analysis of deeper understandings that can explain the value-propositions of different actors, e.g. based on images that focus on specific concepts or metaphors over others. Sustaining this ambition, the process of the living labs is documented – and as such also discussed and further developed- in the ‘logbook’ as well as in a ‘state-of-the-art’ capturing of the issue setting. As already mentioned earlier, the logbook report of the process forwards questions regarding methods and the standardisation thereof, as well as questions and proposals with regard to concepts and metaphors as boundary objects. By doing so, the process of developing a living lab becomes in itself a result transferable to other professionals and stakeholders.

The preliminary definition in the focus of current living labs is inspired by the contemporary policy context (i.e. thematic focus in different policy frames) as well as by the research context (i.e. thematic and territorial focus in different research tracks). In the area of the regional road N16, there are issues of for instance spatial efficiency, development of urban regions and collaboration on the level of public facilities. Along the other case – the Dender-valley at the West of Brussels- we expect to find issues of ecological, social and economic resilience, but also, and again, issues of spatial efficiency and collaboration between different centres, related to mobility issues. Concepts such as 'resilience', 'spatial efficiency', 'urban regions' or for instance the metaphor of 'metropolitan appeal' are central in the development of the regional Spatial Policy Plan. Whereas the thematic focus of these policy frames was inspirational to define a first zoom-in on specific areas, the development of living labs in a real-world setting allows to also capture the needs and restrictions, the values, uncertainties and path dependencies as experienced and articulated on a local level. The framing, images, metaphors, methods and boundary objects are different for various disciplines, scales of intervention and professional backgrounds that are represented in the living labs. The de- and reconstruction of local narratives is developed as a continuously evolving 'state-of-the-art'-text (SoA). These writings contribute to the development of a shared problematisation, based on observations from site visits, findings from document analysis, insights based on interviews, focus groups, lectures and studio's as well as discussions in the 'curatorium'. The state-of-the-art description of the issue setting in both living labs are presented to local actors (for a methodological triangulation, i.e. to receive feedback on conclusions drawn from observation and surveys). The SoA is not merely a description of results from a process of tracing (i.e. reconstructing the existing) though, it also introduces a discussion on future possibilities, which closely relates to the representations in potentiality maps. Doing so, the SoA paves the way for a 'diagram' of actors and an identification of 'lead partners' necessary to realise these potentials.

Similar to developing a shared methodology, also the introduction of novel concepts in the living labs requires several iterations before being common and equally understood. The representation in potentiality maps, negotiations with local actors, the consolidation through written text such as the SoA, the logbook or the assignments, intermediaries up to conclusions from studio work as well as discussions in the 'curatorium' or in meetings with the commissioning authorities all add to building, questioning and re-assembling boundary objects. Some concepts are taken up easier than others: the naming for different 'experiments' in the living labs for instance became common references, whereas other notions were only picked up after 'repetitive offering'. For instance the referring to the experiments in the Dender-valley as being a 'plantation' within which 'seeds' are being planted for what could become a more generalised transformation, proved to be an appealing image. Then also, the notion of 'living ribbons' is taken up: it refers to the high number of vacant ground-floor units in relatively abandoned shopping streets, yet adds a prospective element to it. The suggestion to turn these into lively places acknowledges the future potential of the sites.

A conceptual twist from a different domain is the introduction of a 'why not?' perspective, being complementary to 'what if' questions. Also here, the notion introduces novelty: whereas a 'what if' proposal subscribes to a logic of being 'different than a business-as-usual' (retrospective), a 'why not' idea stresses the potential of what can come (prospective). These are but few examples of boundary concepts 'under construction' to (re-)assemble a shared understanding and/or to open space towards novel appreciations for the areas along the N16 and the valley of the Dender.

6 CONCLUDING REFLECTION

The two experimental living labs demonstrate qualities and challenges in collective learning processes that focus on highly complex issues in a multi-actor setting. Living labs are expected to be incubators for novel cooperation, novel insights and practices that are based in real-world local settings. In order to live up to these expectations, it is quintessential to actively search for boundary objects as a shared space between different actors. With little handles to develop living labs as area-based innovation platforms for spatial issues, we experienced the need to reflect on shared methodologies as well as a shared concepts and problematisation. In current paper, we attempted to document this process of reflection and joint construction. As such, the living labs can become both an incubator for novel spatial approaches in specific real-world settings, as well as a test bed (and/or incubator) for methodological issues.

The reflection on building a shared methodology principally intended to trace the different inputs that were considered in the shared, yet tailor-made approach for the area-based, research-driven living labs. Important inputs are for instance the actor-relational approach, research-by-design experiences and/or the combination with scenario-analysis, transition management approaches and evolutionary perspectives on planning. The methodological reflection results in a set of explicit guiding principles, e.g. on the building of novel coalitions, on knowledge production, on the navigation through complexity, the embedding in planning approaches, the relation of innovations to a broad, systemic level as well as the focus on identification of path-dependencies.

The area-based living labs are developed as a hybrid methodology that incorporates both narrative and design-driven approaches. In order to develop these, Vandenbroeck proposed to rely "on the notion of metabolism as a basis for building spatially-oriented scenarios" (Vandenbroeck, 2011, p. 83). Constructing scenarios on characteristics of metabolic flows in the city (e.g. material vs. immaterial flows, infinite vs. infinitesimal) can help the designers to accept the scenario-framework as a rich source of ideas: "Whilst the result of a conceptual analysis, the suggestive and spatially relevant nature of the defining uncertainties did connect with the designers' imagination. Hence, the scenario framework was able to insert itself as a potent 'boundary object' between two spheres" (Vandenbroeck, 2011, p. 78). When Vandenbroeck builds his plea to use strong boundary objects to mediate between different groups of professionals, he refers in the first place to a shared understanding that builds on the metaphor of metabolism. Whereas we agree that this kind of metaphor, which acknowledges complexity by its nature (i.e. fostering creative imaginaries, adding to a multi-dimensional understanding, etc.), has the potential to bridge between different actors (i.e. planners and designers) and their methods (here scenarios and designerly research), we would argue that inter- and transdisciplinary settings also require the shared building of strict methods. Likewise, Star & Griesemer's typology of boundary objects seems to suggest that the link between different groups of actors (i.e. 'social worlds') can be realized through a shared understanding on the subject of concern, represented by 'boundary objects' (i.e. concepts to describe single units, classifications and relations), as a well as through a shared method, which requires a degree of 'methods standardization' (Start & Griesemer, 1989, p. 392). With the example and plea from Vandenbrouck, the development of shared methodologies and shared problematisation - as documented in the logbook and the state-of-the-art text for the living labs - cannot be seen separately. The construction of boundary objects will possibly be a critical element in the success of living labs. Boundary objects are constantly being reinvented, they are developing as the actors and the context are changing. As such, also this reflection on the methodologies and concepts in two living labs is a discussion text, to be altered with the next future experiences.

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PUMAS Voyage: A Participatory Approach towards Healthy School Travel

Till Schümmer, Federica Del Piccolo, Martin Mühlpfordt, Giuseppe Mella

(Dr. Till Schümmer, FernUniversität in Hagen, Universitätsstraße 1, 58084 Hagen, Germany, till.schuemmer@fernuni-hagen.de)
(Dr. Martin Mühlpfordt, FernUniversität in Hagen, Universitätsstraße 1, 58084 Hagen, Germany, martin.muehlpfordt@fernuni-hagen.de)
(Federica Del Piccolo, City of Venice, Mobility and Transport Department, Sustainabile Mobility Office, VialeAncona 59, 30173 Mestre Venice, Italy, federica.delpiccolo@comune.venezia.it)
(Giuseppe Mella, City of Venice, European Policies Department, San Marco 4299, Venice, Italy, giuseppe.mella@comune.venezia.it)

1 INTRODUCTION

Schooltravel plays an important role in the development of citizens' mobility. For students, school travel is the first way of commuting, for parents it is often the first context in which they take responsibility for traffic conditions motivated by the care for their children. Consequently, the reflection on school travel is part of the general curriculum in some countries (e.g., in Germany, cf. KMK, 2012). At the same time, school travel is an important field for participation in general. By involving in school travel planning, children and parents can in an ideal case experience a child friendly city that takes into consideration the competencies and needs of children.

This larger view on the relationship between cities and children gained attention through the Child Friendly City (CFC) programme of the United Nations Children's Fund (IRC, 2004). It aims at a high commitment to children's rights in the development of cities, including among others, the rights of children to express their opinion for changing their city, increased participation of children in social life, better road safety, less pollution, and green spaces in the city. Given the fact that school travel is a big step for children in taking responsibility for their mobility in the city, it should be considered as an important field of action for a city that wants to become a CFC in the above sense. In Italy, the CFC has a long history. In 1998, the Ministry for Environment initiated the Sustainable Cities for Boys and Gils (CSDBB) initiative (cf. CORSI, 2002). Consequently, Italian CFCinitiatives among others focussed on "reduction of air pollution, […] enhancing green spaces, […] promoting mobility, [… and] participation." (ibid, pp. 170f.) A fundamental factor for a child friendly city is the "direct involvement of children in the initiatives proposed." (ibid.). In the following years, the encouragement of free movement has become an integral part of the Italian CFC initiatives (IRC, 2005, p. 37f.). It also became clear that this topic has to involve not only children but also their parents, teachers, and city planners.The authors of the report already observed that opening up the process leads to a higher level of complexity (ibid., p. 41).

Within the European project PUMAS that investigates sustainable urban mobility planning in the Alpine space, one pilot activity coordinated by the City of Venice focused on a multi-stakeholder process for the participatory planning of healthy and safe school travel in the sense outlined above. The goal of the pilot was manifold: Children and parents should reach an increased awareness on healthy and safe school travel, all stakeholders (children, parents, teachers, planners, and politicians) should engage in a process for identifying challenges in local school travel and envisioning new ideas for a healthier and safer school travel, and finally, low-cost measures should be implemented and other measures planned in order to raise the perceived empowerment and responsibility of the stakeholders for their city. The initiative was planned as a technology-supported participative process. A mobile participation software, PUMAS Voyage, developed at the FernUniversität in Hagen, enabled situated communication and participation of different stakeholders.

Within this paper, we first summarize existing approaches for participation and empowerment in the context of school travelplanning and identify reasons why such activities are needed and why they contribute to a child friendly city. While the current state of the art provides valuable examples for school travel planning, we assume that new technologies can be an additional way for reaching the goal of a participative initiative towards a child friendly city. We present and describe an integrated process for school travel planning that can be applied in primary schools and outline the various stages in which awareness on traffic behaviour is established and communication takes place. It makes use of the PUMAS Voyage applicationto reflect on current school travel behaviour and envision new solutions. The process and the technology have been applied in six primary schools in Venice. We report on experiences with the process and the technology involving a large number of students and parents and show how the participating students, parents, teachers, and planners developed a vision for a safer and healthier home-school journey. Finally, we provide an outlook on how these insights of the process will lead to concrete measures in the updated mobility plan of Venice.

2 RELATED WORK ON PARTICIPATORY SCHOOL TRAVEL PLANNING

2.1 Participation Processes towards school travel in a CFC

Taking a look at existing activities and literature on school travel planning, we can identify several goals and motivations for engaging in school travel planning and improving travel conditions for the route from the individual students' homes to the schools.

(1)Improving healththrough activeschool travel (AST): A frequent theme in school travel research and practice is the improvement of health through increased physical activity. Instead of using motorized modes of transport, students should be empowered and encouraged to walk to school or use their bicycle.Although working with adults, BELON et al. (2014) have provided indications that there is a relationship between the physical activity and the community environment. The authors used the PhotoVoice method to better understand this dependency. Participants of the study were asked to take pictures of places in their environment that encourage or discourage physical activity. In a subsequent interview, they could comment on these pictures. The authors showed that physical and sociocultural aspects were the main hindrances for physical activity. Among physical hindrances were dirty or demolished sidewalks or too much traffic preventing a safe use of the bicycle. Sociocultural arguments against physical activities included, e.g., the car culture that lets people use the car even for short distance trips. When raising awareness for improvements of school travel, both sociocultural and physical aspects should have their space. We argue that physical aspects can well be captured using photos and textual descriptions. Sociocultural aspects, on the other hand, require a space for telling stories about social interaction. A participation process should thus encourage students in telling their story.

(2)Increasing road safety for school travel. Although the total number of fatal accidents with pedestrians or cyclists decreased by approx. 9.5% from 2009 to 2013 (data based on WHO (2009; 2013)), the number of approx. 1.000 fatal accidents in Italy is still high enough to let parents and children fear an accident on their school journey. This fear is reported from other countries as well, e.g., a PhotoVoice study with school children from 4th to 6th grade who frequently expressed their fear of being hit by a car (FUSCO et al., 2012). This personal feeling is in line with political roadmaps: road safety is one of the five minimum objectives of a Sustainable Urban Mobility Plan (SUMP, WEFERING et al., 2014, p. 8). A participatory approach to school travel planning should seriously communicate on personal safety fears of children and parents. It should raise awareness on danger spots as well as safe traffic situations.

(3)Reducing air pollution created by motorized (individual) traffic to schools: Besides the positive effect on child health outlined in the first issue, the reduction of motorized transport also has a positive environmental effect. From a child's perspective, the access to clean air can be seen a fundamental child's right. This need is shared by a growing number of citizens: it is also a minimum objective of SUMP (ibid.). Since CO2 is invisible, children need to establish a mental model in understanding the effects of air pollution. Graphical tools, such as info graphics, could support this process.

(4)Increasing the feeling of ownershipfor the city, i.e., the perceived level of influence and the possibilities for participation. The study of FUSCO et al. (2012) showed that children can have detailed perceptions on their environment. They are capable of detecting spaces that require improvement and may even contribute a perspective that adults have lost. With FUSCO et al., one could even say that children have not yet undergone a process of estrangement from their environment. Frequent references to the natural and social environment made in the PhotoVoice study of FUSCO et al. could be indicators for this thesis (children, e.g., took photos of leaves or trees that were important for them; they reported that they stopped to interact with other people or animals on their school trip). Adults, in contrast, often rather aim at time efficiency when planning the school travel.

The CFC initiative also emphasizes the involvement of children:"Their active participation as citizens and rights-holders is promoted, ensuring them the freedom to express their views on 'all matters affecting them' and making sure that their views are taken seriously – in government, in their neighbourhoods and schools and in their families." (IRC, 2004, p. 2).

We argue that an ideal process for school travel plan development should foster participation using the children's language. For first grade children, this language is often visual. The use of sketches or other graphical forms could help to involve children as active planners. At the same time, not all planning-related aspects can be reduced to a simple language. When communicating about locations, maps are an efficient means for adults to focus the communication. Instead of abandoning this means, we assume that children can understand the language of the map when exploring this together with adults. One promising approach could be to pair children and parents in these phases of the process.

Ideally the different motivations result in concrete measures. Current research has frequently addressed the following activities:

(5) Creating a school travel plan: School travel plans (STP) are mandatory in many regions of the EU. The content and the process how they are developed vary from region to region. For instance, in the UK, the Travelling to School Initiative (TTSI) has coordinated the creation of school travel plans. 2009, 81% of the schools in the UK had a STP in place (TAYLOR, 2010). Although a systematic review of the UK STPs cannot be included here for space reasons, we can summarize that most of these plans include not only proposals for routes to school but also aim at raising awareness for a healthy and safe school travel. Therefore, the plans make visible the current modal split (gained through surveys), include testimonials of students apprising AST and also report on issues in the village or city that prevent children from AST (ranging from missing or narrow pathways over unsafe road crossings up to polluted roads).

(6) Planning and implementing mobility measures is thus the consequent next step after the development of a STP. Our literature study showed that some of these measures can be developed at low cost and are under control of the school. For instance, NEWSON et al. (2010, p. 26) reported on a case where a school opened a second entrance for children walking to the school. This entrance was from then on the high priority entrance so that it was clear for children and parents that walking should be the preferred mode of transport. As discussed for the role of child participation, the implementation of concrete mobility measures may reach the limits of the possible participation. Not all ideas are feasible from financial, technical, or political perspectives. Nevertheless, we think that an approach for STP should allow participating children to envision their future school travel and share these dreams with the school community and beyond.

2.2 Current tools for supporting participative planning in school settings

Technology support for the goals outlined above requires that data on school travel behaviour is captured, discussed, and manipulated to develop new visions for a healthy and safe school travel plan. Computed data can support students in becoming aware of their travel behaviour and the joint interaction on future visions can lead to a shared understanding of SUMP in the shared physical environment.

To address these needs, we investigated different fields in which aspects of our requirement set were addressed before: mobile blogging for mobility andcollaborative geographic information systems (collaborative GIS).

(1) Mobile blogging systems have become more relevant, the more capabilities the technology offers. They especially support situated reflection (SCHOEN, 1983). Early works in the context of school mobility relied on the use of feature phones. BAMFORD et. al (2008) report on a feature-phone-based system that allowed students to capture their school travel and add geo-coded pictures and comments. The system aimed at teenagers (12-13) and was tested in a group of 30 students. Since it built on simple technology, there was no means for manipulating the pictures. But interviews showed that even with a limited technology, the students started to reflect on their school travel.In a later study, the authors report on traffic-related reflection (POOLEY et al., 2010): one participant, e.g., complained about traffic lights making the bus stop too long. The study also showed that students started to capture places they like, such as their favourite tree. This indicates that mobile blogging can support the understanding of students' school travel behaviour. However, the interaction mainly focussed on the interviews. Direct interaction between students was not intended.

(2) Mobile collaborative GIS, such as the one proposed by ZORITA and BALOIAN (2013), go one step further by structuring the interaction process in the application: Students were provided with an application that allowed them to take pictures of locations with problems or opportunities in an urban area. Each comment was uploaded to a shared map so that it became visible for their course mates. They could then comment the pictures and initiate a discussion. The application was develeoped for undergraduate students.

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In the context of our setting, a much simpler and child-oriented user interface and process will be needed to be accepted by the children.

3 A PROCESS AND TECHNOLOGY SUPPORT FORSCHOOL TRAVEL DEVELOPMENT

Motivated by the concrete setting of six schools in Venice, we designed a process that combines the strengths of the travel planning aspects discussed in the previous chapter. The process especially addresses children from 3rd to 5th grade. While the focus lies on the school children, we also approached parents, teachers, politicians and planners and convinced them to participate in the process. It is supported by traditional and computer-based technology accessed with a tablet computer. Phases of collaborative co-located interaction alternate with phases of individual or small group reflection on the route or at home.

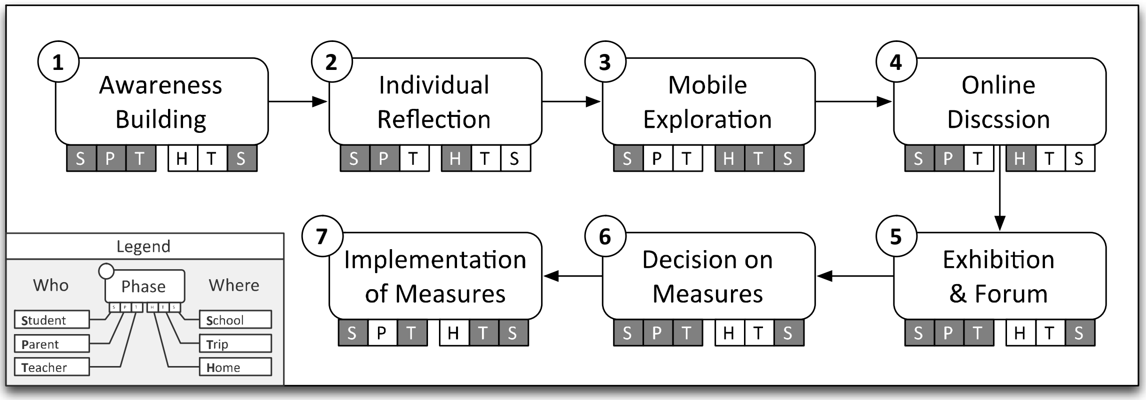

Figure 1: The Process for Participatory Home-School Trip Improvement

The process and the main participants in each phase are outlined in Figure 1.Steps are shown as rounded boxes. The small letters below each box indicate who participates in the phase (students, parents, or teachers) and where the interaction takes place (at home, on the trip to/from school, or in the school). If a white letter appears on a grey background, the phase is intended for this participant or location.

In the remaining part of this section, we will provide a summary for each phaseand outline the intended interaction in the specific phase as well as some anecdotal experiences made in the phase.

(1) Raising awarenesson the importance of healthy home school-journeys through group brainstorming in the school (without the use of computer technology). Participants: Students, parents, and teachers; Location: School.

Figure 2: Reflection on the feelings related with the school-travel and the modal split (right).

The goal of this first phase is to sensitize the students on the first three issues (health, road safety, and air pollution) so that they understand the need for improving their school travel. Four offline activities were conducted at the schools: (1) A large public whiteboard was used to collect impressions of the school travel. Students were asked to complete the sentence “My school travel is …” with coloured chalk on the board (Figure 2, left). The board was located at a central place at the school, visible for children and parents when entering the school so that it reminded students on the subject every morning. (2) Children were invited to stick a symbol with their mode of transport to a large banner (Figure 2, right). This helped to better understand the modal split of the school community and to raise attention on a shared responsibility for school mobility. (3) Based on the data expressed on the modal split banner, the school earned a ranking of its current mobility efficiency. We used a A-D colour scale as it is known for efficiency information sheets of electronic devices. The slogan "La miaScuolava in classe A" ("My school goes in class A") served as a motivator to improve the school's modal split. (4) Finally, students "planted" paper flowers in the school yard and next to the main paths to the school. The goal of this action was to trigger a visionary mode and increase the feeling of ownership for the school and the roads leading to the school. Students should grasp a feeling of how a more colourful and natural green environment could look like.

(2) Individual reflection on the home-school route supported through computer technology. Participants: Students and parents; Location: At home.

Children and parents draw their route together on an on-line map and think about both, attracting and danger spots along the route. A wizard guides the students in this phase. They first locate their home. The school was already assigned by the teacher before the teacher gave the access token for the application to the student. Now the task of the student is to connect home and school using points in the map that lie on the student's typical school road. Students can select different means of transport by clicking on the respective icon (the mapping is shown in the left screenshot of Figure 3). Once the route is complete, the PUAMS Voyage application analyses the route and provides feedback on the CO_2 footprint of the trip in order to raise awareness on the environmental effects. Since CO_2 is not visible, we decided to use an info-graphic that explains the environmental characteristic of the route. The sample shown in the right part of Figure 3 explains that the provided route would produce 97kg CO_2 per year and that a tree would need approx. 4 years to convert the CO_2 again. The effect of this graphic typically was that children started to think about the sustainability of their school travel.

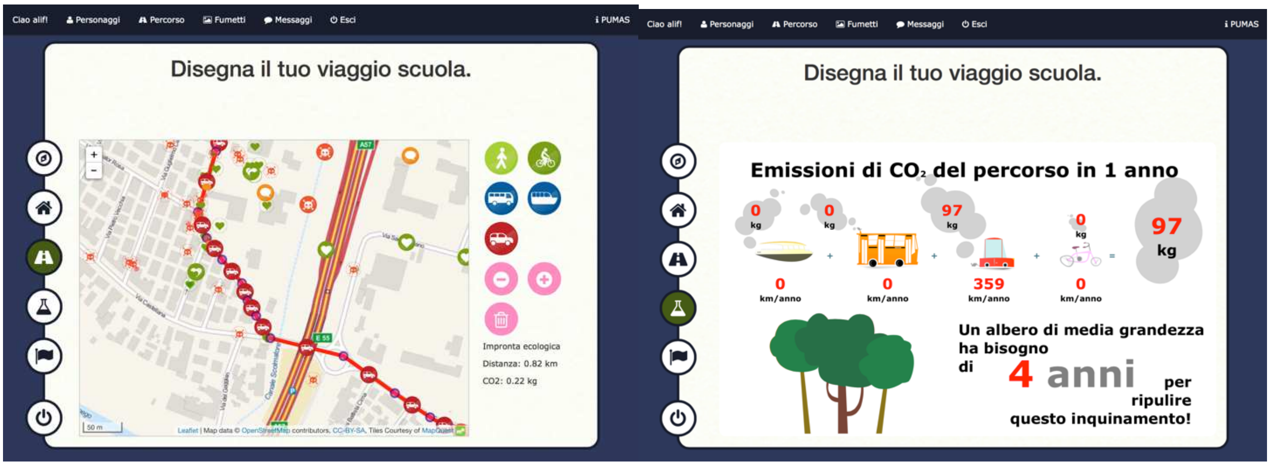

Figure 3: Mapping the way to school and analysing the personal travel behaviour in the context of sustainability.

The third step of phase 2 requests another look at the route. Children and their parents shall think about danger spots and nice places along the route. Each student was asked to contribute at least 2 spots of each type. They can add a spot by selecting the spot type and then clicking on the map. The system will show a dialogue where the children can add a title and a description. Finally, all spots and the use of different means of transport are visualized in a comic strip that will become relevant in Phase 3.

Our experience with this second phase is positive. Most of the 134 students who contributed meaningful routes were able to map their school trip without any difficulties. Some students forgot to do the mapping. For these students, the mapping was done immediately before phase 3. Since their parents were not with them that day, facilitators of the PUMAS Voyage project had to assist the children. Approx. 5 students created unreal routes. One student explored the map and created a route around the globe. For future applications of the approach, one could imagine to have a geographic corridor restrict larger detours. Teachers should also be involved more closely in this phase. They could monitor the progress of the students and remind them of their mapping task. This could ease the start of Phase 3 and establish a shared understanding of the current process.

The documented school travel behaviour was more sustainable than expected. 104 students (78%) reported that they walk at least parts of the route. 24 students (18%) said that they would use the bike for a part of their trip. 28 students (21%) said that they would use the car, although only 12 students drove the whole route by car (others walked the last part of the trip). Compared to the banner with traffic symbols used in Phase 1, we could observe that participants of Phase 2 less frequently said that they would use the car to reach the school (12% compared to 21%). This was probably due to the fact that students were only allowed to put one icon on the banner in Phase 1. The possibility to select different transportation modes thus could lead to a more detailed picture of the school’s travel behaviour (the sample size is too small to make a reliable statement on this thesis).

(3) Mobile exploration and future vision using a mobile application on a tablet computer. Participants: Students; Location: At home, on the school trip, and at the school.

In this central phase of the PUMAS Voyage approach, students document their trip in a mobile application on tablet computers while travelling from their home to the school. The mobile application tracks their location and allows them to create a comic story about their trip. They can take pictures of interesting places and paint their ideas onto the photos to show how they envision an improvement of these places.

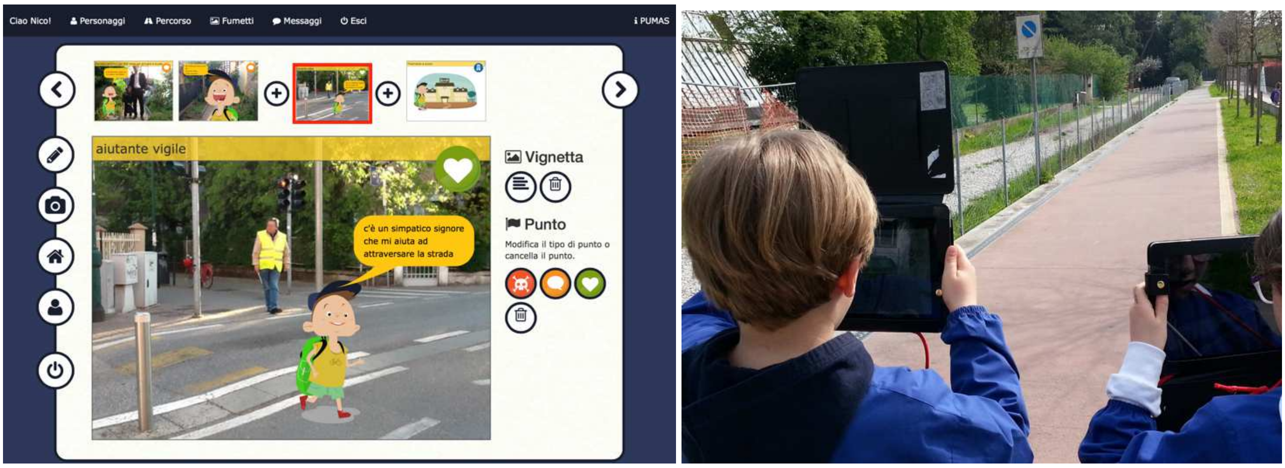

Figure 4: Mobile capturing and annotation of the home-school trip.

We equipped two classes at a time with tablet computers that they could keep for two weeks. During the first day, facilitators of the PUMAS project accompanied the students in small groups. On subsequent days, the students took pictures alone or together with their class mates (Figure 4-right). The app either shows a map with their route and the positive and negative spots. To add a new spot, the students enter the comic mode and press the camera icon. The system then takes a picture using the tablet’s built-in camera and adds it as a background image to the comic frame. Students can assign a type (the icons next to the “Punto” heading in Figure 4-left) and place avatars on the picture. They can also place a microphone image on the picture to visualize that they were speaking with a person. Avatars and microphones can have speech bubbles so that the students can use the characters to tell their personal story. Freehand drawings can be used to create a vision of future road constructions or other changes of the environment.

The students’ feedback regarding the comic creation was very positive. They had fun picking places they considered as important. In average, each student created 17.8 slides (M=15). About 43% of these slides had photos and an avatar or a caption explaining the photo, 20% included freehand drawings and 9% contained a photo and freehand drawings. Some students also took pictures of their families accompanying them on their trip to the school. Some of these slides were deleted in the finalization phase of the comic. Minor technical problems were related to the use of the tablet (missed PIN code or password). Some students were disappointed that the tablets were security protected so that they could not use the tablet for installing and playing with new games. In these cases, the tablet remained unused during the two week period. Other students only used the tablet for some days. However, in average, the application was used for 12.4 days (M=7). The most active user continued to use the system for a total of 69 days (from a personal computer at home). Less motivated students thus should be reminded to work on their stories during the two week period. Since not all teachers of the involved schools took the PUMAS Voyage project as an opportunity to learn about traffic, geography, communication, and other related subjects in their classes, the Voyage activities remained side activities. For future applications, one should ensure a strong teacher commitment so that the creation of travel stories becomes an integral part of the lessons.

(4) On-line discussion of comic storiessupported by a traditional web application. Participants: Students and parents; Location: At home.

The goal of the fourth phase was to share the individual comics with other class-mates again. After the students returned the tablets, they were asked to visit the web page of the PUMAS Voyage system and explore spots of the other students.

Figure 5: Exploring hot regions on the map and participating in a discussion on dangerous locations within the comic.

Points were shown on a school issue map as semi-transparent dots (Figure 5-left). The more spots a place had, the darker was the colour on the map. It became clear that the navigation to the spots was the biggest challenge in this phase. Users wanted to maintain an overview and at the same time be able to distinguish the different spots. We decided to work with detail maps (the small map in the upper right). By clicking on a point in the large map, the system zooms the detail map so that it shows the 5 closest points. Titles and descriptions for the five points are displayed in the text area. Clicking on such a message opened the detail in the comic. Here, users could add comments or vote for the spot. In the example sown in Figure 5-right, the student warned that the bicycle path is dangerous since flowerbed stones were used. This observation of one student was confirmed by another participant of the PUMAS Voyage pilot. Two people actually voted for this danger spot with the result that it received a higher priority in the following discussions.

Only 21 of the 134 students participated in the discussion and contributed comments. The average number of comments per user was 4.7 (median = 2). The main problem of this phase was that it ran in parallel to Easter vacations. We assume that most students did not want to think about their school travel during vacations. After the vacations, the teachers did not get back to the task. The Voyage project was on hold until it gained a new momentum in Phase 5.

(5) Face-to-face exhibition bringing the digital artefacts created in the previous phases back to the school community. Participants: Students, parents, and teachers; Location: School.

Figure 6: Students exploring the comics of their peer students (left) and rating these stories (right).

We selected the format of a (paper-based) exhibition for Phase 5. All comics of a school were printed together with a detailed map for the specific comic. Students and parents were invited to visit the exhibition, rate for the individual scenes (by attaching a “like”-sticker to the scene) and add comments. The exhibition

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was open for several days. The main advantage of this phase was that the whole school could visit the exhibits. Ideas created in Phases 2-4 thus received feedback from a wider audience.

Our experience with the exhibition was very positive. Parents stopped when bringing their children to the school. In 5 schools, special focus sessions were held to which all the parents were invited. On average 80-100 parents and teachers joined these sessions. The 6th school decided to involve all parents in the exhibition. Over 300 people visited the exhibition and engaged in face-to-face discussions about the issues identified in the stories. In all schools, approx. 2.500 students were involved to vote on the slides. In order to distinguish the child opinion and the parent opinion, two kinds of stickers were issued, one for parents and one for children. Stickers were widely used during the exhibitions.

(6) Planning of concrete measuresin traditional workshops held at the schools. Participants: Students, parents, and teachers; Location: School.

For those issues that are of general interest, a participatory planning group is established. The purpose of this planning group is to collaborate with city planners and other stakeholders and plan changes around the school building (again in a participatory face-to-face setting).The proposals made by children should be carefully analysed by planners and transformed into a design that can be implemented. Regular meetings with the school community are needed to ensure that the proposed solutions are still satisfying the needs expressed in the comic scenes.

During the pilot project in Venice, a planning group was established at each school. The group collaborated with city planners. Twice, the collaboration was opened up to the whole school community to ensure that all stakeholders stay involved. The outcome of the planning group was a collection of low-cost and high-cost measures. Based on this output, additional departments of the Venice municipality were involved and checked the feasibility of the plans.

(7) Implementation of measures in selected schoolstogether with the students.Participants: Students and teachers; Location: School and parts of the trip.

While extensive reconstruction of the environment often requires long planning and negotiation processes as well as a large financial budget, there may also be opportunities for mobility improvement that can be directly carried out. The results of the plans developed in Phase 6 should be separated into low-cost and high-cost measures. Low-cost measures should be implemented immediately with the help of the school community while high-cost measures should become a part of the planning strategy of the city (e.g., part of the city’s SUMP and the school’s STP).

But even low-cost measures may require the participation of the mobility department of the city (e.g., when public roads or paths are concerned). But the concrete implementation can be carried out by the school. These measures should be carried out as part of the process so that the participating children and parents see a direct impact of their activities.

Figure 7: Participatory implementation of measures

In the PUMAS project, it became clear that low-cost measures should concentrate on visual aspects (e.g., colouring the road or placing traffic signs) or temporary traffic calming measures. Figure 7 shows how the entrance road of one participating school was changed at the end of the participatory process. Again, children were actively involved in painting the road or creating new signs using abandoned traffic signs from the City of Venice. The feedback on these measures from the involved stakeholders was very positive.

High-cost solutions will be described in the New Mobility Plan to be adopted by Venice Municipality and realized in the next years.

4 TECHNICAL BACKGROUND OF THE PUMAS VOYAGE TOOL

For space reasons, we only summarize core aspects of the PUMAS Voyage software architecture. The server is built using the Web framework Ruby on Rails. The client is an HTML5 offline web application that permits a high level of interactivity.

The software runs on tablet computers that are connected to the PUMAS Voyage server (a part of the PUMAS ASC) via a 3G network. However, the connection quality varied in different locations of Venice so that the availability of the PUMAS Voyage server could not be guaranteed. Thus, we pre-configured the clients so that each student found all relevant data for the client application already cached on the system.

Data stored locally includes information on points of interest, routing information for the home-school-trip, and comic sketches in which the participants commented their trip and included avatars and photos. After the web application was installed on the device and added to the home screen, the students could interact with the application without any communication to the server. Whenever a user takes a photo or paints on a comic slide, these changes are only done locally, which significantly improved the responsiveness of the application. The only aspect of the application, that was not available in offline mode, was the map data (since it was retrieved from an externalMapQuest server). In situations where this data was not available, the application only showed the local data, i.e. the points of interest, route data, and comic data.

Once the application had Internet connectivity again (either through the 3G network or via a wireless network connection), the application synchronized local changes with the Ruby-on-Rails server.

The discussion phase of the PUMAS Voyage application was implemented as a classic web application where the application data was requested from the server on-demand.

5 SUMMARY AND LESSONS LEARNED

School travel planning and practice is an important aspect of a Child Friendly City. It helps to establish awareness on health, safety, and environment-related mobility issues and is one of the first fields where school children take responsibility. In this paper we presented a process and tools for facilitating participatory school traffic planning. The process has shown to work well in a pilot with six schools in Venice involving in total over 3.000 stakeholders. Students and parents became aware of the importance of health, safety and environmental effects of car use and approached active school travel modes.

For the City of Venice, the whole process was an important component of the overall mobility plan (that has a special focus on sustainability). Involving children in this planning process helped to reach a high level of participation, which is key for Sustainable Urban Mobility Planning (SUMP).

The PUMAS Voyage application developed in the context of this project can support the process by employing a method of comic-oriented story-telling. In our experience, this extends the PhotoVoice method with support for creating a future vision. Children appreciated that they could draw their visions of the future. Being heard in the discussions and seeing parts of their visions implemented let them take ownership for their city. The tool is currently transformed into a commercial product and we plan to make use of it in other school travel planning settings as well as other participation processes where storytelling can be a good way for envisioning the future.

Besides these positive results, the study also pointed to some caveats: Especially when working with schools, the commitment of teachers and the integration of the process with the “normal” lessons is a crucial success factor for phases with remote interaction (Phase 2 and Phase 4 of the proposed process). Schools, parents, teachers, and children need constant reminders to keep up a high participation level. Where this works, the process and the technology can lead to promising participation in a Child Friendly City.

6 ACKNOWLEDGEMENTS

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Research on Regional Development and its Operating Mechanism under the Background of Information: Take China as an Example

Jiayan Fu, Zhu Wang, Jiaojiao Sun

(Dr. Jiayan Fu, College of Civil Engineering and Architecture, Zhejiang University, No. 866, Yuhangtang Road, Hangzhou, China, fujiayan513@qq.com)
(Prof. Zhu Wang, College of Civil Engineering and Architecture, Zhejiang University, No. 866, Yuhangtang Road, Hangzhou, China, wlb-art@163.com)
(M. S. Jiaojiao Sun, College of Civil Engineering and Architecture, Zhejiang University, No. 866, Yuhangtang Road, Hangzhou, China, 3947087@qq.com)

1 ABSTRACT

The information society, as a main circumstantial background of modern regional development, is the era cradle of region's deepening core connotation and evolving layout form. This article analyses the chief influenced factors of information society, and considers that the regional development under the background of information breaks through the limitation of time and space. Meanwhile, according to the industrial organization promotion, spatial structural optimization, basical information infrastructure and other fields of region, authors elaborate the present situation and characteristics of the regional development. Therefore, this article puts forward the innovative operating mechanism of regional development.

2 INTRODUCTION

In the 1950s, John von Neumann invented the computer. In the 1990s, the number of Chinese computer users increased exponentially. The computer popularization and rapid Internet development changed human beings' production and life way, what made their work, education, shopping and hospitalization break through the limitation of time and space. Computer and Internet reconstruct the function distribution within the region, what's more, push Chinese society into a completely new information age. The concept traditional region which is relying on time, place and space have already changed. Human activities are no longer limited to specially appointed locations.

3 PRESENT SITUATION OF THE REGIONAL DEVELOPMENT UNDER THE BACKGROUND OF INFORMATION

At the age of informatization, various aspects of region will change and development as well. From three aspects, which is spatial structural optimization, industrial organization promotion and basical information infrastructure, authors elaborates the Chinese present situation of regional development.

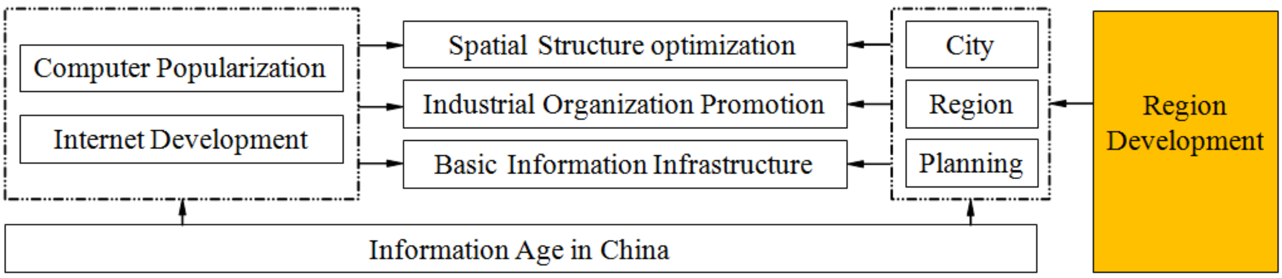

Fig. 1: The relationship between information background and regional development

3.1 Spatial Structural Optimization

City is belonged to region. And it has four basic functions, which is living, working, transportation and rest.[1] Because of the permeation into every aspect of living and working, however, the concept of region or city under the background of information may be different from the past. Therefore, spatial construction could be mixed. On the one side, Living room can not only be used for living, but also for working or activity space. On the other side, working room will no longer be districted in a traditional office.[2] It can be replaced in the house or on the car. For example, Beijing Wangjing Small office and Home Office (Designer: Zaha Hadid).

[1] Athens Charter. C.I.A.M., 1933.
[2] Yang Zhangxian. Study on regional development and response of urban planning in the information age, Northeast Normal University, PhD thesis, 2011.

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So, it liberates the spatial limitation and realizes the seperation of production and management. What's more, due to the breakthrough of time and space, the burden of traditional and physical transportation will be released by electronic transmission way invisibly.

3.2 Industrial Organization Promotion

Information has the great permeability through each traditional industries. For instance, Chinese traditional architectural industry is always in the evolution. In the view of its exploit, design, production, management, sales and other links, informational method can make a higher productive efficiency and a more reasonable resource distribution come true. Then, it injects new vitality into the traditional industries.

The experience of the developed countries showed that informatization can promote industrialization, improve product quality, better production environment and reduce energy consumption. Even if it will increase 30% of the cost of investment, but can get 85% of the economic returns. Therefore, China, as a developing country, following the pace of the information age, the traditional industry is also slowly transformed.

3.3 Basic Information Infrastructure

Actually, in the early 1970s, China has already started a comprehensive construction of basical information facilities. With more than forty years passing by, China completed some achievements. Different from some countries, Chinese rural area reached 95% of the whole land area. And rural area always in a development of backward. However, the permeation of informatization has promoted the integration of city and rural construction, as a major breakthrough. In addition, in educational and scientific areas, it achieves a great progress in resource sharing. The number of academic Internet users from research institutions, educational organization or universities is very large.

4 RESEARCH AND IMPROVEMENT OF OPERATING MECHANISM IN CHINESES REGIONAL DEVELOPMENT

The operation mechanism of Chinese regional development is quite complex which contains a variety of contradictions. As each kind of contradiction is on a high or low position, it will make different influences. Therefore, we need to grasp main problem before coping with secondary problem, step by step. (Fig. 2)

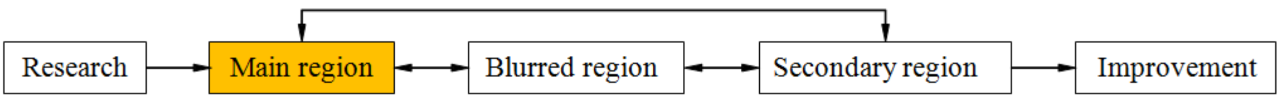

Fig. 2: The relationship between primary and secondary regional development

4.1 Chief Planning on main region

According to the environment bearing capacity, exploit density and development potention in different region, we should plan patterns of population distribution, economy and land towards the main region in the future comprehensively. And then, we will make the function orientation and development direction of the main region clear. The intensity and order of development should be under macroeconomic regulation. Gradually, it will form a sustainable spatial patter which population, economy and environment could coordinate with each other.

4.2 Coordinating Planning on secondary region

China has vast territory and abundant resource, which make its various regions be in unbalanced development with significant differences. Thus, a macro program is only a direction. It is unable to suit everyone's requirement and implementation in different local conditions. It is needful to create some secondary region planning, whose standard is lower than the national level, which is prepared due to each regional characteristics. We are looking the influence of secondary region in the province rather than in nation.

4.3 Comprehensive Planning on each region

When each region is in its personal development, at the same time, it is necessay to balance the overall planning in national level. However, through the exchange and cooperation between A region and B region.

What's more, it would promote common development and "1+1>2" effect could be achieved. For example, In order to coordinate the region spatial structure, industrial organization and basic infrastructure, China has approved the implementation of the northeast region revitalization planning, the central region rise planning, the Yangtze River Delta regional development planning successively. (Table. 1)

Time	Name	Region	Contents
2007	Northeast Region Revitalization Planning	Liaoning Province, Jilin Province, Heilongjiang Province, East Menggu Region	(1) Development foundation and overall goal. (2) Urban development and urban-rural integration. (3) Independent innovation and innovation Region Planning. (4) Social undertakings and public service.
2009	Central Region Rise Planning	Shanxi Province, Anhui Province, Jiangxi Province, Hubei Province, Hunan Province	(1) Planning background and great meaning. (2) Overall purposes. (3) Energy materials and base construction. (4) Complex transportation center construction. (5) Resource utilization and environmental protection. (6) Social undertakings development.
2010	Yangtze River Delta Region Development planning	Shanghai, Jiangsu Province, Zhejiang Province	(1) Development basis and background. (2) Strategy direction and development goal. (3) Regional construction and coordinating development. (4) Resource utilization and environmental protection.

Table 1: Examples of comprehensive planning on each region

5 CONCLUSION

The regional development under the background of information make a great influence on the cities and human beings. Mutual integration and penetration between city and region is more and more strong, which are all towards the diversification direction. Therefore, city becomes a real "region's city". Informatization brings the regionalization and globalization, what's more, it makes a spatial structure optimization, upgrading industrial organization and closing social relations. At the information age, the desalination of center and periphery can participate into the competition in different levels and enhance the operability of planning.

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SensorMapRT – a System for Real-Time Acquisition, Visualization and Analysis of Mobile Sensor Data in an Urban Context

Jan-Philipp Exner, Daniel Broschart, Daniel Steffen, Peter Zeile, Hartmut Schächinger

(Dr.-Ing.M.Sc. Jan-Philipp Exner, University of Kaiserslautern –Department of CAD & Planning Methods in Urban Planning and Architecture - CPE, Pfaffenbergstraße 95 67663 Kaiserslautern,exner@rhrk.uni-kl.de)
(M.Sc. Daniel Broschart, University of Kaiserslautern –Department of CAD & Planning Methods in Urban Planning and Architecture - CPE, Pfaffenbergstraße 95 67663 Kaiserslautern,daniel.broschart@ru.uni-kl.de)
(Dipl-Inf. Daniel Steffen, University of Kaiserslautern – AG wearHEALTH , Gottlieb-Daimler-Straße 47 67663 Kaiserslautern, steffen@cs.uni-kl.de)
(Dr.-Ing. Peter Zeile,University of Kaiserslautern – Department of CAD & Planning Methods in Urban Planning and Architecture– CPE, Pfaffenbergstraße 95 67663 Kaiserslautern,zeile@rhrk.uni-kl.de)
(Prof. Dr. med. Hartmut Schächinger, University ofTrier – Head of Department of Clinical Psychophysiology, Johanniterufer 15 54290 Trier, schaechi@uni-trier.de)

1 ABSTRACT

The use of wearables in citizens' daily life will increase significantly in the coming years. By analyzing these sensor data, it is possible to detect the emotional well-being in urban areas, which is highly relevant for urban planning purposes. Through the combination of several physiological and other sensor data such as GPS, "stress spots" in the urban environment can be recognized and located. A major objective of this project is therefore, to combine and evaluate various research approaches in the field of human as sensorswith wearables. This is the reason why the project group will be an interdisciplinary cooperation between spatial planning, psychophysiology and computer technology.Together with the project partner cities of Neustadt an der Weinstraße and Pirmasens in the German Federal State Rhineland-Palatine, the project group aims to show exemplary the influence of potential stressing factors in the urban area such as traffic and noise and creates scientifically-robust models of stress detection in urban areas. Besides this, a visualization for planning purposes with the tool GeoVisualizer as well as an evaluation of the resilience of such informtion and their potential use for urban planning is aim of the project.

2 INTRODUCTION

The use of sensors for infrastructure technology or to measure environmental stateis widely practised in various research fields. Meanwhile, miniaturized, wearable sensors for gatheringvital data such as heart rate or arterial blood pressure is becoming more and more popular also for non-experts, especially during times of booming wearables. However, there is just a little effort to combine environmental data with personal vital data. In particular, the use in urban and spatial planning for the detection and prevention of critical (stress) zones has not taken place yet. Due to the fact, that human vital data does not allow direct conclusions on the urban environment, a deep medical and psychophysiological interpretation is needed. A major objective of this project is therefore to bring together the various research approaches in the field of human sensory assessmementwith wearable sensors. The project group forms a interdisciplinary cooperation between the field spatial planning, human sensory assessment, psychophysiology and computer technology which in futurewill be indispensable for this research field.

3 THEORETICAL FRAMEWORK

3.1 Sensordata in urban planning

"In the next century, planet earth will don an electronic skin. It will use the Internet as a scaffold to support and transmit its sensations. This skin is already being stitched together" – this quote from fifteen years ago describes a vision of a world interfused with sensors and connected via the Internet (Gross 1999). Thus, sensorsand computers evolve in beingsmaller, cheaper and more powerful. They are ubiquitousin our everyday life and producea flood of sensordata, which allows urban planners a new scientific perspective.This data is produced by conventional sensors (climate sensors for temperatur, humidity e.g. or traffic measurements) as well as from citizens, because they are carrying the sensor devices (mobile phones, tablets, wearables e.g.) with them every day.Through the further development of smartphone technology in recent years starting from "ubiquitous computing", the all-time data connectivity, "pervasive sensing", in which integrated into the smartphone sensors can be used as sensor networks in urban environments (Martino et al. 2010). In this context Goodchild describes the phenomenon "Citizens as sensors" (Goodchild, 2007), where citizens take on "Measuring Tasks" voluntarily in the form of "Voluntered Geographic

Information" (VGI). Other authors are using the terminology for this phenomenon as "People-Centered Urban Sensing" (Campbell, et al., 2006) or just "urban sensing" (Cuff et al., 2008). All approaches have in common that citizens want to be increasingly integrated into planning processes. With these new approaches targeted data and process support can be produced. The citizens are acting as active sensors in an urban context. Mark Weiser's vision of "ubiquitous computing" becomes reality (Weiser, 1991). This contextual changes, described as "urban sensing", means "a fundamental change to the application, interpretation and motivation of science and engineering in the fields of politics and aesthetics as well" (Cuff et al. 2008).

3.2 Mapping Emotions in an urban context

In the combined field of human sensory and spatial planning methods, following approaches in basic research are already known: We start with "mental maps" by Kevin Lynch (1960), where the test subjects had to draw a map of the city that was under investigation only from their memory.The approached method was criticized, because the participants must have very good drawing skills. With the use of GPS technologies for reconstructing the traveled distance by the subjects in the city these limitations could be minimized. The localization of stress points or areas of anxiety within a city in a virtual context was first conducted by Sorin Matei (2001). These were the first virtual "emotional maps". The first example of the creation of “emotional maps“ using data from psychophysiological monitoring (skin conductance) and GPS data to do the positioning of the measurement results in urban areas yielded Christian Nold with the art project“Biomapping" (2009). Other examples of the collection of "human collected sensor data" can be found in the approaches of the MIT SENSEable City Lab (Martino et al. 2010, Resch et al. 2011). The measurement of human emotions in spatial planning is based on the approach to take advantage of people as sensors and at the same time producers of environmentally induced emotionaldata in real time (Exner et al. 2012). For the measurement of human emotions the so-called BMS Smartband can be used to determine physiological changes of the body related to its environment. This so-called approach of psychophysiological monitoring enablesto read emotional states due physiological data (eg. Skin temperature changes) (Kreibig, 2010).

The project aims to address this shortcoming by providing a new approach for extracting planning relevant data from wearable sensor data.Potential areas of use are in the domain of urban planning for decision support and the evaluation of ongoing planning processes.Working with methods of psycho-physiological monitoring to identify georeferenced stress reactions in towns has been carried out by the Department of CPE in an experimental form (Zeile, et al. 2009; Exner, et al. 2012;. Zeile, et al. 2013). Considering the thesis of Kreibig (2010) the resultingemotional reactions could be visualized by physiological parameters such as skin temperature. This was for example used in various projects perceptioning the city of Alexandria (Taha et al.2012), or in the area of barrier-free planning (Bergner &Zeile 2012). In all of these experiments the data had to be post-processed manually which was time-consuming. A future task, therefore, must be to automate the operation process to obtain truly representative statements and to enable a real-time analysis and interpretation of data. In addition, the quantitative and qualitative evaluation methods in the field of human sensors must be reconsidered and validated again with the help of physiologists.

3.3 Visualizations of sensor data

In order to achieve a target-oriented and tailor-made visualization in the third dimension, a specific tool is needed. The 3D-visualization of data is a common feature of modern geographic information systems (GIS). In the past many "stand-alone" applications and plug-ins have been developed to do so. The use of current visualization concepts and methods from the field of computer graphics (for example, information visualization) remained, however, often reserved for experts. Basis for this project is a preliminary project between the partners CPE, urban sociology and Augmented Vision from University of Kaiserslautern, which shows the potential of the prototypical platform GeoVisualizer.At this point theduring research developed software GeoVisualizer by Professor Didier Stricker builds on, which can also be used by non-visualization experts to create a meaningful representation and get a quick impression of underlying geo-referenced data (Steffen et al., 2013; Michel et al., 2013). The application GeoVisualizer is based on the NASA World Wind SDK. The open source SDK provides a 3D Virtual Globe API. In addition, the GeoVisualizer application was developed based on the Java Web Start technology.

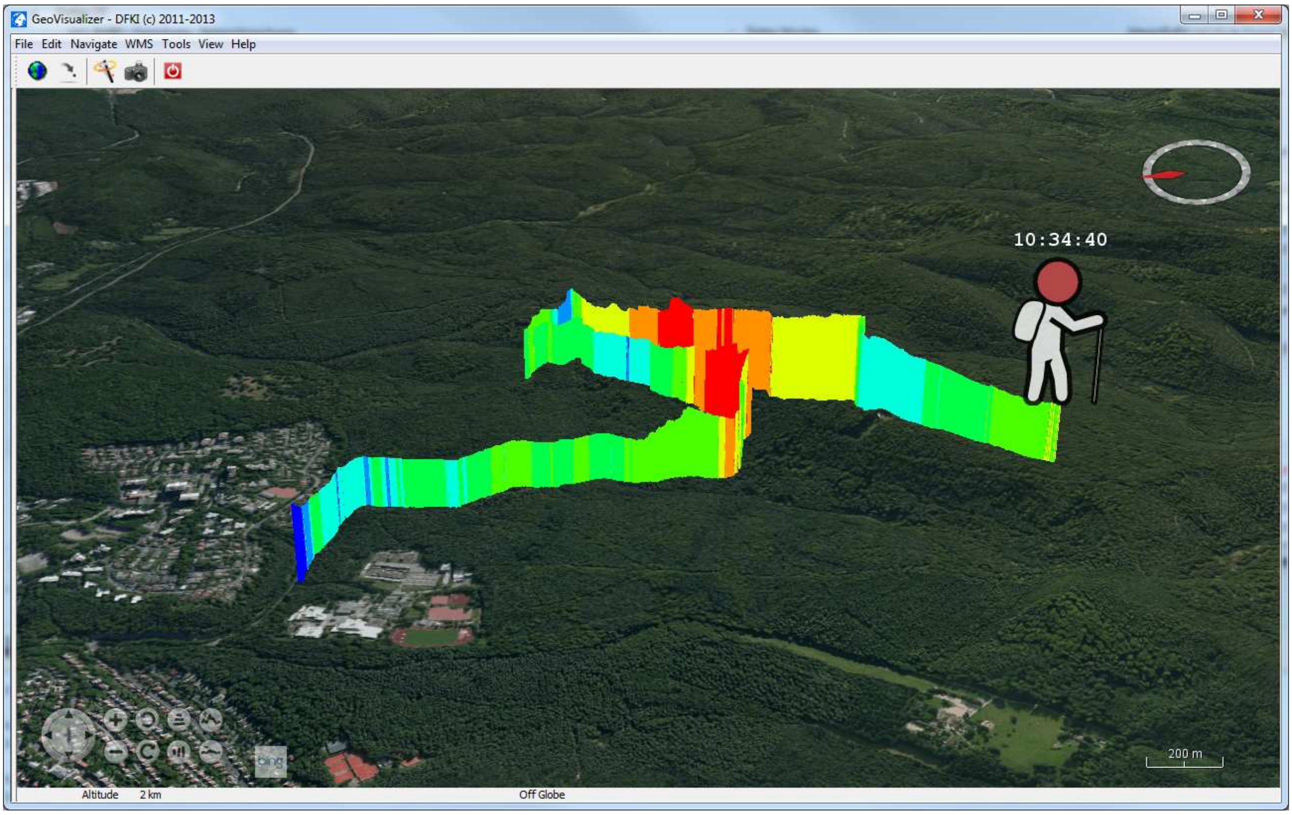

Figure 1: Visualizaiton of human sensory data with GeoVizualizer(DFKI 2013)

Further aims of GeoVisualizer are on a simple operating concept and a flexible and extensible application architecture for the representation of geo-referenced 3D and 4D data. In this case the fourth dimension is obtained by adding the time factor to the geo-referenced data, which allows the animation and the interactive explorationon the one hand and the analysis of the data on the other hand (Steffen et al., 2013; Michel, et al. 2013).In this research area developing the software in terms of its near real-time data-processing as well as an open interface for direct implementation of human sensory data is an important step.

4 IMPLENTATION AND STUDY CASES

4.1 Preliminary studies

The focus in preliminary studies was on the calibration of the used wearable devices under laboratory conditions from Professor Hartmut Schächinger at University of Trier.His department has embracing experience in non-invasive collection and interpretation of cardio-respirative indicators (Schächinger et al., 2001). To measure the native heart rate of the test persons the BioHarness3 by Zephyr was used. To calibrate BioHarness3 the test persons went through different situations wearing the heart rate monitor. While the heart rate changes individually and of course in different situations like sitting, walking, e.g. these situations had to be simulated first. After detecting the individual baseline of the native heart rate the test persons had to lay down, sit and walk around to simulate the different positions of their body to the accelerometer they were wearing as well as the heart rate monitor. In the next situation the test persons had to sit again while reading out loud from a book. The following PASAT-test was also a mind-demanding task where the test persons were sitting as well. After that the test persons were challenged in physical-demanding tasks, going downstairs, walking, going upstairs and riding a stationary bicycle. The left part of the following figure shows the native heart rate measurement of one of the test persons.

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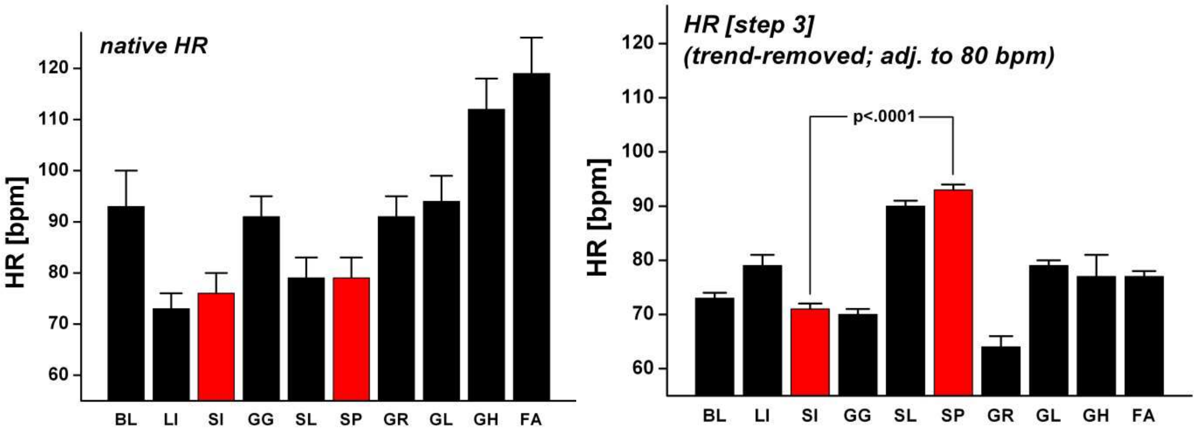

Figure 2: Native heart rate of one test persons (left); heart rate with removed motion trend (right) (Schächinger 2015)

If you look at the native heart rate (HR) you can see that the heart rate is always higher in situation wherethe test persons were demanded physically. As you can see in the right part of the picture the HR changes to the contrary if you remove the motion-trend. Situations where the mind ofthe test persons is demanded are showing the hightest heart rate now. This means that you can detect an actual emotion related heart rate response after removing the trend of the motion.

4.2 Studycases

The project was set up in cooperation with two cities in the German Federal State of Rhineland-Palatine. The validation of the platform and the results occurs in cooperation with the city of Neustadt an der Weinstraße and the city of Pirmasens based on different scenarios. Both areas are close to the city center and where chosen due to the possibility to create a varying test walk for the test persons with their devices. One of the goals of the project was to show the external impacts of the urban environment to the human body and so the test person's walks were designed, to embrace a variety of urban situation like traffic noise, traffic crossings and in alternation to it also quiet areas.

Figure 3: Study testbed Neustadtwith path (Google Inc. 2015)

The area in Neustadt is located close tothe trainstation. Start ofthe path is on the western side and close to B39 with its heavy traffic. Passing this street, there will be a first crossing of B39 which will lead the person to the trainstation square which will bring them in a more silent situation. After this section, the path leads towards north, with an additional crossing of B39 and the following walk towards the pedestrian area.

Figure 4: Study testbed Pirmasens with path(Google Inc. 2015)

Start of the path in Pirmasens is a business district towards direction south. The next section will be a bridge crossing of the B10 with its heavy traffic which will expose the test persons to traffic noise and probably also blowing winds. After this crossing, the persons follow the L482 towards west where they will experience the noise impacts fromtraffic passing by. After this, their routes leads them in a more quiet residential area from which they head towards north to pass B10 over a bridge again.

5 SUMMARY

The aim of this project is to develop a modular platform for high-performance detection and near real-time, intuitive discussion and analysis of results obtained from mobile sensors. First results of some field tests indicate a correlation of the measured data and the envirmonmental circumstances especially in terms of external influences for the test persons like noise from crossroad traffic e.g..Further the study intends to develope an easy to use tool set with good visualizations which can be used by planners on one side, but also which is scientifically correct in physiological ways. Extensive tests will prove the suitability for daily use and a real-time vizualization is also on the roadmap. Issues like data privacy and protection are of course important in the light of measured human sensory data, though they are not in the focus of this reserch project and have to be discussed in complementary research projects.

6 ACKNOWLEDGEMENT

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Smart Solutions for the Development of Rural Communities

Roberta Soligno, Francesco Scorza,Federico Amato, Gianluca Cascini, Daniela Savino,Beniamino Murgante

(University of Basilicata, University of Basilicata, 10, viale dell'Ateneo Lucano, 85100, Potenza, Italy, federico.amato@unibas.it, beniamino.murgante@unibas.it)

1 ABSTRACT

United Nations report "World Urbanization Prospects" (2011) predicts that 90% of European population will live in urban areas within 2050. New development processes in cities, as well as regeneration of existing degraded areas, are often made in the perspective of building a smart city. Generally, there is an attempt to design smart mobility, smart management services, smart tourism, etc.. Intelligence of a city is, however, erroneously measured as a function of the amount of technological infrastructures made available by administrations. Such infrastructures have to be considered as means to exchange information and ideas. Therefore, people, following the development of ICT and the increasing diffusion of smartphones and tablets, become users and at the same time creators of new urban landscapes, developed through the integration between physical and virtual spaces. This model of smart city is usually associated to huge metropolitan areas, where a high number of users justifies the large investment needed for ICT network implementation. In this paper we will analyse how the concept of smart city applied in rural context should assume very different connotations focusing more on issues of participation and collaboration between citizens and administrations to find economically and environmentally sustainable solutions for local problems.

2 BOTTOM-UP DECISION MAKING PROCESS: A COMMUNITY-BASED APPROACH

The concept of participation is very difficult to clearly define, because of the complex framework and the experimental nature of any participatory process.

Public participation to planning processes can be defined such as policies, techniques and strategies that are able to involve citizens and stakeholders in decision-making, and to support decision-makers in defining shareable scenarios for future development of cities.

Participation is, therefore, an approach which tries to obtain active involvement of different stakeholders in a planning process, in order to ensure a final, useful and usable result, closer to their needs.

Considering this point of view, some important factors can be underlined.

First of all participation involves people who using space, local actors, final beneficiaries that are determined depending on the case and the size of the project, according to appropriate considerations and analyses. There are no fixed rules, but specific features of the place interested by interventions allow to identify them.

Then, participation should imply the existence of a final result: there is the need to get at a proposal that could be more or less accepted by institutions. Everything that does not produce a proposal is not participatory planning, but simple consultation.

Sherry Arnstein (1969) described the detailed aspects of participation, highlighting the possible manipulation that could concern participative processes. Through the metaphor of a ladder, Arnstein identified eight levels of participation, divided into three parts.

Bottom rungs are “Manipulation” and “Therapy”: these describe levels of "non-participation" that have been contrived to substitute for genuine participation. Their actual objective is not to enable people to participate in planning or conducting programs, but to enable power-holders to influence participants.

The second band is “Tokenism”, that includes “Informing”, “Consultation” and “Placation”: these levels describe conditions where citizens have not the power to insure that their views will be considered by decision makers; so only power-holders maintain the right to decide.

The higher rungs are “Partnership”, “Delegate Power” and “Citizen Control”, levels of “citizen power” that describe increasing degrees of decision-making clout of citizens.

However it should be clarified that ‘participation’ does not mean giving city government to people: for this task, citizens already elect institutional representatives, whose responsibility is to define and to implement policies.

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Participation has not to be the ultimate goal of governments, but it has to be considered as a valid support. Citizens ask for a level of participation allowing the construction of programs and public initiatives tuned with their priorities and their needs (Arnstein, 1969) and this means a democratic process, a collective construction of decisions.

2.1 Bottom-up and top-down approaches in planning

In recent decades, removal of typical hierarchical relationships adopted in planning processes has been announced several times, theorizing a sort of convergence towards planning models that combine top-down policies, promoting the prescriptive feature of the plan, and bottom-up initiatives that increase value of local specificities introducing flexibility (Murgante, 2012).

It is usually supposed that "bottom-up policies are not adopted because of the lack of effective top-down policies" (Musco, 2009). This is not a contradiction: even if bottom-up policies derive from social needs, they have to be included by local administrations, under the current top down framework.

According to Murgante et al. (2011), during 1960s the transition from a purely top-down approach to a 'reticular interactive' one interested strategic planning: knowledge and imagination of society began to play a fundamental role in order to discover desirable scenarios. If we consider Harvard (Bryson, 1987) and Minnesota (Bryson, 2004) models, SWOT analysis became a central instrument to examine internal and external environments, producing a stakeholder analysis taking into account organizations, groups, people and all citizens, who can have a key influence on strategic processes.

Adopting the reticular approach, there is the widest possible involvement of all potential stakeholders in order to avoid possible conflicts which could stall the whole process and, above all, create a broad and shared planning vision.

Visioning concerns not only actors, who can be represented by institutions, but it also considers the possibility that collective knowledge may stimulate the search for optimal solutions.

According to research of convergence between bottom-up and top-down approaches, a plan sends and receives impulses from its community: on one side, it defines what are nonnegotiable uses, defining constraints that should intercept safeguarding instances; on the other side, stakeholders propose possible transformations. A plan has to pursue the need of preservation and transformation, safeguarding collective interests and avoiding, at the same time, the possibility to lose any private investment (Pazienti, 2002).

In order to involve more people in planning process, it is fundamental to distinguish between simple citizens and organized stakeholders: stakeholders are influential subjects for an initiative, while in great part of cases citizens' opinions provide ideas or claims that often remain unheard. This distinction is important because, in our view, citizens could give impulses in terms of needs, claims, demands, imagination, ideas, projects, which can be accepted or not by a plan (Murgante, 2012).

Visioning methods have been adopted in a lot of cases, in order to define fundamental and significant bottom-up contributions: one of these is the "workshop", a method which allows to identify the most significant requests and to choose priority ambits of intervention, through a careful analysis of needs and local problems.

Unfortunately, this approach has been often applied in contexts where decision makers do not wish to share decisions with the community.

2.2 Community involvement in decision-making processes: from Advocacy to Wiki-planning

In 1960s some experiences, developed in USA, underlined that a low level of quality of life is closely connected with the capacity of communities to define their own living conditions (Jacobs, 1961).

The strong rooted ness of residents to places where they live is a key factor in determining quality of towns and neighborhoods, because it generates people desire to contribute to choices affecting their territory.

A first attempt to involve a large number of citizens in decision-making process was done by "Advocacy Planning", a theory conceived and supported by Paul Davidoff (1965).

According to Davidoff's idea, a planner has to be pluralist and to represent different interests, especially the low-income people's ones: he argued that a planner not only has to analyze social problems in order to find solutions, but he also has to be a sort of lawyer for weakest social groups.

"Advocacy Planning" is strictly connected with another theory called "Community Planning": adopted in 1960s, it represents a planning approach that carefully analyzes citizens' interpretations of places where they live, giving less importance to technical and expert knowledge. In this view, planning is not only a technical activity: it is also a political activity in which the information produced by dialogues and comparisons with local communities is fundamental for governments.

One of the most important exponents of this community-based idea is Forrester(1999): he encourages public sector to learn social and environmental values through participative processes, because a participated plan could be easily adopted without subsequent changes and its objectives reflect ideas supported by inhabitants.

Another form of citizen involvement is "Placemaking": rooted in community-based participation, it aims at creating livable places in cities through the interaction between designers and citizens.

The concept behind Placemaking was originated in 1960s, by several authors like Jacobs (1961) and Whyte (1980), who offered innovative ideas about design of cities.

The approach considers community opinions as a fundamental instrument to improve urban spaces: a direct knowledge of a place can give significant information about its functioning, its problems and about people priorities.

This information is then used to create a common vision for public places. This vision can quickly evolve into an implementation strategy, beginning with small-scale, do-able improvements that can immediately bring benefits to public spaces and to people who use them.

Since 2000, the diffusion of ICT has introduced important innovations about governance and democracy: the use of Internet can integrate traditional approaches to participation, as it can be a mean to inquire about citizens opinions concerning administration and decision making processes.

Traditional participatory methods are often inadequate and inefficient: these types of interaction presuppose physical presence of citizens during organized meetings, but in a lot of cases people who can really help participation have not the possibility to attend such meetings. Unfortunately, economically active population (employers, professionals, entrepreneurs, etc.) does not have enough time to participate, consequently only children and elderly opinions are collected.

Moreover, the participative phase begins when programs or projects have been already defined, and this fact causes a general mistrust towards public administration.

These are not occasional situations in traditional participative processes: we could affirm that a useful solution come from electronic participation, based on an asynchronous interaction.

In particular web platforms, expressly conceived to participated processes, can offer instruments encouraging a constructive dialog among citizens, technicians and PA, that helps the identification of specific objectives and that allows to inform a large number of people about the results of the process, obtaining a great reply about community's desire.

In Wiki-planning approach, citizens unconsciously reach the higher levels of Arnstein's ladder, helping the typical steps of planning.

The advent of Web 2.0, where people are voluntary sensors (Goodchild, 2007), allowed high levels of interactions thanks to the transition from a one-way to a two-way approach: in the first citizens are simply informed on what the contents of a plan are, while in the second one people can express their ideas, that could influence choices of the administration (Murgante, 2012).

Social platforms can lead from a closed model of decision making based on professionals government and representative democracy where participation is mainly relegated to election (Noveck, 2009), to an integration of representative democracy and weak forms of direct democracy, where a decision maker has the possibility of directly consulting citizens in order to take a particular decision.

We could say that Wiki-planning theory derives from Advocacy Planning: Davidoff's idea made citizens aware of their own role and so they became able to balance the power of big public and private agencies. In Wiki-planning these actions take place through the help of virtual environment and cloud services and all people have the same position on the scale of responsibility.

3 LOGICAL FRAMEWORK APPROACH

Already used in the '70s, the LFA method can be now defined as an effective technique to analyze problems in order to identify objectives and activities that could solve them. It is therefore a mean that improves quality of projects, through an analytical approach to design and management of programs oriented to obtain specific objectives.

The use of the LFA allows:

- to clarify purposes and to justify the existence of a project;
- to clearly define key elements of a project;
- to analyze project formulation at an early stage;
- to facilitate communication among all parties involved;
- to measure success or failure of programs.

Moreover, the method has got a lot of vantages:

- it ensures the analysis of fundamental problems and local criticalities, in order to provide better information for decision makers;
- it is a guide for a systematic and logical analysis of key-elements that form a well-done project;
- it improves planning, underlining connections between project elements and external factors;
- it provides a better instrument for monitoring and analysis of project effects;
- management and administration benefit from standardized procedures that collect and assess information.

The use of this approach is strictly connected with the setting of development projects: these types of projects have the aim to bring desirable changes in the contest of implementation and in society in general. The definition of future expectations is a very important step because it makes possible to check at a later stage the measure of program success related to its objectives and to target groups (NORAD, 1999).

With a synthetic operative definition, we can affirm that LFA is based on the design of the logical nexus framework in which a project is characterized by input of resources, implementation of certain activities and outputs that should contribute to desired future objectives.

Input, output and activities are therefore the base elements of the project. However they are not factors that influence its success: it depends not only on factors that can be controlled by project management, but also on a series of external assumptions. During design phase and implementation it is necessary to analyze and to control these external factors, because they could be the main cause of project failure (NORAD, 1999), even if everything has been realized as expected.

So LFA can be considered useful not only in the early stage of project concept design, but also during the implementation of projects.

This approach is composed of two phases:

- analysis: this phase examines the existing situation in order to develop the desired future situation and to identify some strategies to achieve it; the analysis is done with the help of stakeholders, who contribute to the definition of main problems and objectives;
- synthesis: strategies are made clear in order to be applied; the Logical Framework Matrix allows to identify activities that have to be undertaken, available resources, resources that have to be found, and it allows to verify coherence and relevance of choices as regards context of implementation.

In the stage of analysis we can find:

- situation analysis, that is in turn composed by analysis of stakeholders, of problems and objectives;
- strategy analysis.

Instead, in the stage of synthesis we find:

- logical framework matrix;

- implementation.

In particular problems and objectives are analyzed by means of a problems and objectives tree.

First of all there is the need to find the focal problem derived from the available information about the existing situation. Then, the construction of the problems tree allows to organize problems considering the relationship between causes and effects.

While the problems tree provides the negative image of reality from stakeholders' point of view, the objectives tree, which is its dual, outlines the desirable future, rewording all problems and making them into objectives (positive statements).

The last tree allows to select the strategic axes of the project.

These strategies became feasible projects through the help of the Logical Framework Matrix (LFM).

Matrix construction allows two levels of reading, referring to:

- overall and specific objectives of the program, expected results and activities which have to be undertaken to reach them (vertical axis);
- concreteness, relevance and measurability of each objective, result and activity, on the basis of objectively verifiable indicators and sources of verification.

In the framework proposed by Las Casas et al. (2009), we can find two types of indicators: efficacy indicators, which measure the degree of objectives achievement, and effectiveness ones, which measure the relation between resources used and realized products.

<table>
<tr><td>Intervention logic</td><td colspan="3">Objectively Verifiable Indicators</td><td>Sources of Verification</td><td>Assumptions</td></tr>
<tr><td>Overal Objective</td><td>Context Analysis
1. Objective Pertinence
2. Objective Relevance</td><td>Efficacy Indicators</td><td>Effectiveness Indicators</td><td></td><td></td></tr>
<tr><td>Project Purposes</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Results/ Outcomes</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Activities</td><td colspan="4">Inputs</td></tr>
<tr><td colspan="6">Preconditions</td></tr>
</table>

Fig. 1: Logical Framework Matrix (Las Casas et al., 2009).

We can say that LFA is an operative tool to establish strategies and guidelines for project implementation and to understand the logic behind the project so that any changes are necessarily conformed to overall project design.

4 REFERRING TO THIS PAPER, THE APPROACH IS PRESENTED AS A SUPPORT FOR A PARTICIPATIVE WORKSHOP EXPERIENCE, WHERE IT ALLOWED TO DEVELOP STRATEGIES, CONSIDERING THE NEEDS OF INVOLVED GROUP AND LIMITING THE UNCERTAINTY THAT CHARACTERIZES A DEVELOPMENT PROGRAM. THE EXPERIENCE OF GLORENZA

"Hack my town" workshop was presented as a challenge, a "hackathon" among Universities in order to find solutions to "smart villages and territories" problems, but it was more than a challenge: it was an occasion of cultural exchange and meeting among Universities coming from different places and fields of study (cfr. http://hackmytown.unibz.it)

Sponsored by Free University of Bolzano, it took place in Glorenza, a small medieval village located in the North of Italy, in Val Venosta, near to Swiss boundary.

Participants experienced how a small mountain village can become a smart village through the synergy between students and their professors, stimulating from one side scientific discussion and from another side a creative environment, where new conceptual solutions can be found.

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The workshop lasted three days: the work was developed during the second day, after a meeting with the local community that provided us a lot of information about the city and local problems.

In spite of the short available time, the collected information allowed to develop significant solutions, optimized by a bottom-up approach that involved local people to highlight issues of the place: the involvement of citizens and local administrations may allow to avoid waste of public resources focusing the attention on local community motivations.

The meeting with citizens showed that the most important problems perceived by the community were connected with the two pillars of local economy: agriculture and tourism.

Local people underlined that agriculture is almost only based on apple growing: at first, this cultivation was situated in less extensive areas, but then global warming has led its presence also at higher altitude levels.

The use of pesticides in industrial apple growing has led problems to other cultivations and to livestock and this fact has represented a relevant concern for local community, which aims at introducing new agricultural practices based on different types of crops and at ensuring earnings for farmers.

As regards the tourism, we can say that it represents one of the most important development axes.

Stakeholders consider Glorenza such as a " tourism thermometer" thanks to its historical beauties. Even if the village is very attractive, tourism connected to historical and cultural riches seems to be not enough exploited: there is the need to attract more people for a longer period.

Problems might be caused by seasonal tourist traffic: people visit Glorenza above all during summer, while wintry tourism presents some difficulties.

Summer holidays are favored by high naturalness of the area and by a large number of activities such as hiking or climbing.

Cycling has a great importance: there is an extensive network of bicycle paths and the rail network of Val Venosta allows transporting bicycles, making connections easy.

At summer end, Glorenza begins to empty: during winter people prefer to stay out of the city, near to the ski lift.

Moreover, tourist accommodation has problems too: there are some small hotels with few beds, and so they are not able to accommodate a large number of people.

Stakeholders denounced also a weak cooperation among local administrations: for example, regarding Adige river, which is an important territorial resource, there are a lot of discussions but measures cannot be adopted because municipal districts aim at asserting their own interests.

Finally the meeting underlined some considerations about the local community.

According to stakeholders, people are characterized by a strongly traditionalist and conservative culture, which leads to lack of interest towards the village and some constraints towards innovative changes, such as the use of internet and technologies. Medieval beliefs persist among people: for example, property is generally inherited only by the eldest male.

Many initiatives, as open-air markets or cycling tours, meet people dissent, because they bring noise in the city. As a main example of people behavior towards innovation, stakeholders remembered that in the past Glorenza did not become the terminus of the railway line because of its inhabitants that opposed the action with a referendum.

All collected information during this meeting have represented the base knowledge to understand what are positive and negative features of the place and to focalize the attention on particular resources that should be valorized. Through these information we have defined main investigation areas.

5 THE PROJECT

In this section of the work the project development is described.

We point out elements connected to the application of the methodology in the specific "workshop" activity in order to demonstrate their usefulness.

In Glorenza case, this approach has been used to find rational solutions for village problems reported by the local community and to elaborate bottom-up strategies that could be considered a valuable support in the development of the area.

As previously described, LFA is composed of a phase of analysis and another phase of synthesis.

The analysis phase includes:

- contextanalysis;
- evaluation of concerns emerged during the meeting with local community;
- S.W.O.T. analysis;
- problems and objectives tree;
- strategies identification.

The phase of Synthesis includes the Logical Framework Matrix.

Concerning the case study, it is important to underline that the implementation of workshop activities in Glorenza was based on only 3 working days. Such a short time allowed us to consider only some specific aspects in context analysis.

So results discussed in this work have to be considered as a preliminary, not exhaustive attempt.

Val Venosta territory is characterized by very high environmental values: there are many protected areas, as SIC (Site of Community Importance) and ZPS (Special Protection zone), and Parks.

The area is served by mobility infrastructures of Autonomous Province of Bolzano and is crossed by one of the most important roads, linking Italy and Switzerland: SS 41 starts from Sluderno and ends in Tubre, at the mountain border post of Müstair , passing through Glorenza.

As regards the population, today Glorenza has 898 inhabitants: comparing official population data from National Statistical Institute between 2004 and 2014, there are not particular critical points in population structure, except a slight tendency to growing old.

Geo-statistic assessment of population density, based on Kernel's method, shows a concentration of people along Val Venosta valleys and underlines a marginal position of the town compared with the nearby towns of Sluderno and Malles.

About tourism, the local system called Malles-Venosta, that includes 5 municipalities (Curon Venosta, Glorenza, Malles Venosta, Prato allo Stelvio and Tubre), counts 1500 beds divided between hotels and other forms of tourist accommodation.

This local system looks peripheral compared to the surrounding context regarding the accessibility to tourist services.

Referring to Val Venosta system, web-mapping of facilities and services, developed through the reuse of web open data, underlines a fragmentary system, concentrated in villages that could be considered as the "doors" of the closely natural system.

People concerns emerged from the participatory meeting allowed to identify the main problems according to the specific point of view of Glorenza local community.

Summing up, it can be said that first of all Glorenza stakeholders denounced a risk linked to an agricultural practice based on a monoculture: the territory is interested almost exclusively by apple growing, an intensive cultivation that causes the alteration of the agricultural landscape and the excessive dependence of local economy on one seasonal production.

Concerning tourism, people underlined a marked drop in wintry flow of visitors, caused by the relative distance of Glorenza from ski lift plants, closer to other towns in the valley.

Moreover the village seems to have a supply of accommodation facilities limited to a small number of guests.

Finally there were some considerations about cultural features of local community linked to traditional and conservative forms of economical and social organization.

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Glorenza people seem to be resistant to current forms of innovation (social, technological, economical, etc.) and not very inclined to contribute to village improvement, a typical behavior of isolated mountain communities.

The results of the analysis have been represented by S.W.O.T. matrix.

Strengths include:

- presence of a great environmental and cultural value;
- high architectural quality of the medieval town;
- good level in preservation and maintenance of the historical centre;
- balanced population structure;
- economical wellbeing of population;
- high quality of road infrastructures and mobility connection to provincial main centers for services.

Among the weaknesses we find:

- cultural features of local community, mainly based on traditional and conservative attitudes;
- scarce community involvement in decision-making processes and in territorial management;
- agricultural practice based on a monoculture;
- low level in the transformation of agricultural row material (milk, fruit and vegetables);
- widespread lack of interest among people about internet and technologies, or, in other terms, innovation;
- marked drop in wintry flow of visitors;
- lack of integrated prospects for tourism development.

Opportunities are:

- Glorenza's leading role in the territorial identity of Val Venosta;
- funding opportunities from European Union programs and policies;
- geographical proximity with strong economic systems (CH,AU);
- investments in internet high speed connection.

Finally, threats includes:

- lack of community collaboration to find innovative forms of development and cooperation;
- higher development of the nearby cities compared to Glorenza;
- lack of cooperation among tour operators and lack of trust towards new forms of tourist accommodation.

The problem tree, showed in the following figure, shows problems identifying causes/effects logic: this elaboration has highlighted the inadequate exploitation of environmental and cultural resources as focal problem.

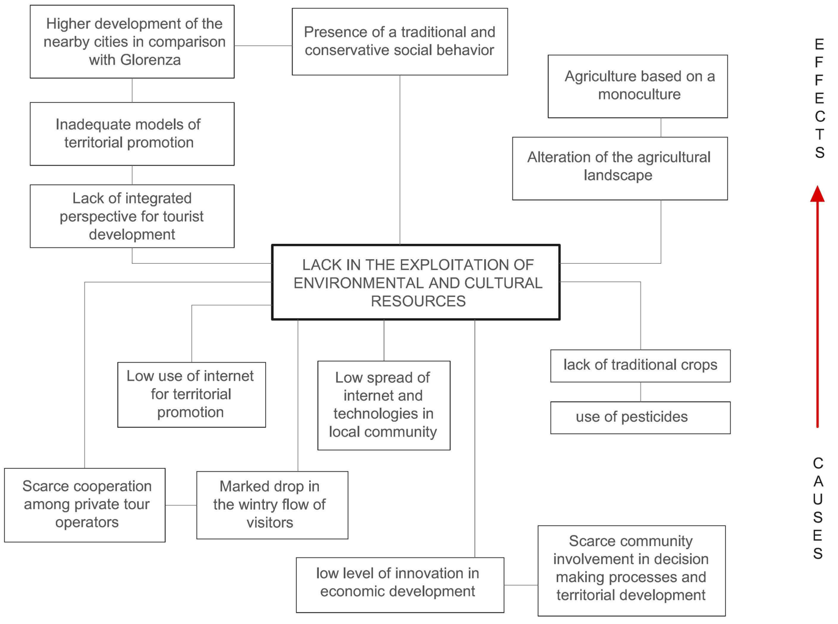

Fig. 2: Problem tree.

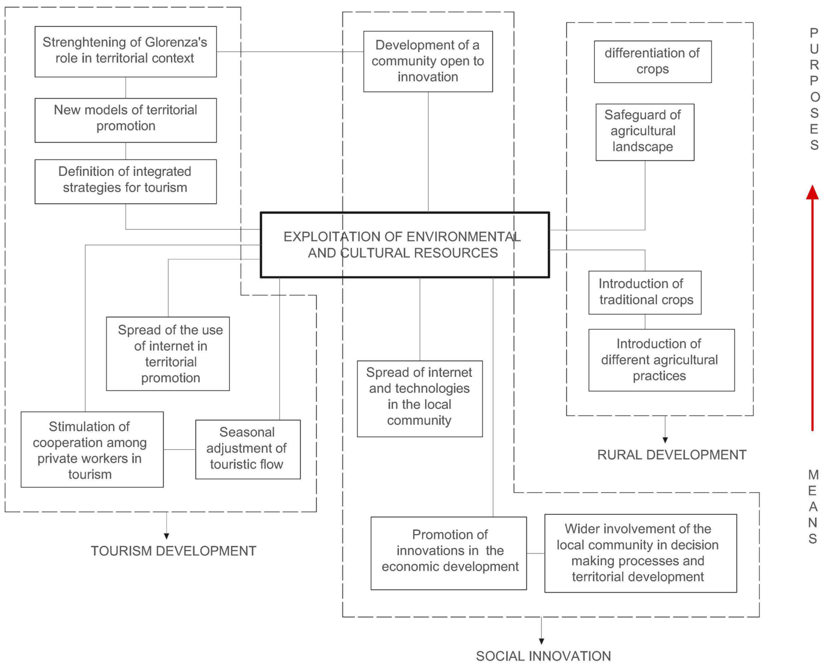

Fig. 3: Objectives tree.

Social innovation theme represents a transversal strategy, which can be considered as the fundamental basis (also the precondition) for territorial integrated development: main actors (individual citizens and associations) have to be part of a participative community, that considers itself able to contribute to territorial growth.

So, it becomes necessary to invest in “citizens’ empowerment”: in this way people realize they are able to improve the quality of their life and so they become aware of their central role.

Glorenza’s community will become a “smart community”, if citizens are involved in decision making, reporting their needs and possible solutions for city problems.

In a “smart” viewpoint, information spreading is relevant for community involvement: in Glorenza, investing in ICT means first of all bringing people near to web opportunities through education and knowledge.

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As regards tourism, public and private actors have to work for the safeguard of Glorenza's historical heritage because it represents a unique resource in the wider Val Venosta area, and they also have to promote innovative changes in tourist services and supply chain, in marketing and branding.

Rural development aims at exploiting environmental resources and at protecting rural traditions.

SOCIAL INNOVATION		OBJECTIVELY VERIFIABLE INDICATORS: Efficacy Indicators	OBJECTIVELY VERIFIABLE INDICATORS: Effectiveness Indicators	SOURCE OF VERIFICATION	ASSUMPTION
OVERAL OBJECTIVE	Development of a smart community open to innovation				
PROJECT PURPOSES	O.1 – People's involvement in decision making processes	N° involved people/ Tot	Shared projects and saving of resources	Questionnaires	Decisions based on the citizens'needs
	O.2 – Larger use of internet and technologies	Δ N° people that use internet and technologies		Questionnaires	Improvement in the spread of information
	O.3 - Development of a city that can be considered as a node for innovation networks	N° events; N° participants	Increased profitability of tourism in relation to the events	Tour operators' data; Departments for relations with research Institutes	
RESULTS/ OUTCOMES	P.1.1 – Participatory planning workshop as a support for the territorial management	N° stakeholders; N° meetings			Presence of participants that represent the widest number of stakeholders' needs (associations, institutions, technicians ...)
	P.1.2 – Space and equipment for meetings	Capacity	Management costs/ m²	Project data	Space that are always available and equipped
	P.1.3 – Open Data portal in order to increase government transparency and accountability	N° accesses	Available data/ Investment Updated data/ Available data	web	Presence of citizens that choose to collaborate with the local administration
	P.2. - Courses that help the spread of digital technologies and social networks	N° qualified persons; Improvement in the knowledge of technology	N° Qualified persons/ Investment		Citizens' participation
	P.3.1 - Conference center	Capacity	Management costs/ m²	Project data	
	P.3.2 - Conference and workshop	N° conferences and workshop that are realized N° participants N° involved institutions	N° organized events/ Investment		Improvement in the spread of knowledge
	P.3.3 - Agreements with national and international research centers	N° involved research centres		Publications	Synergies among institutions and research centres
ACTIVITIES		INPUT			
	A.1.1 – Individuation of stakeholders; Organization and implementation of workshops				
	A.1.2 – Selection and adaptation of public places				
	A.1.3. 1 - Data research A.1.3. 2 - Creation of suitable open datasets A.1.3. 3 - Implementation of the portal A.1.3. 4 - Data monitoring and data update	Provincial Fund; European Regional Development Fund (ERDF) 2014/2020; Qualified staff for the implementation of the portal.			Presence of a public authority able to favor transparence and cooperation
	A.2. - Organization and implementation of training courses	European Social Fund (ESF) 2014/2020; Specialized agencies for the implementation of training courses			Citizens' participation
	A.3.1 – Selection and adjustment of public spaces				
	A.3.2 - Organization and implementation of meetings with Universities and organizations that support business growth	National and International Researchers			Cooperation with research centres and Universities
	A.3.3 - Networking actions	European Structural Fund 2014/2020			Cooperation with research centres

Fig. 4: "Social innovation" strategyMatrix.

We can speak about "endogenous development" if the local community will cooperate in the selection and the promotion of territorial high value and resources as inputs for the construction of strategies.

Territorial identity is a very important element because it makes a place different from another one: the reintroduction of typical products is a relevant strategic mean for rural valorization and its contribute can improve the image of the area as a whole.

For each strategy, Logical Framework Matrix has been created to clarify operational terms of implementation: the matrix identifies overall goals, project purposes, activities and results, highlighting principles of effectiveness and efficiency in public expense and verifying relevance and consistency of choices.

The figure 4 represents the first Matrix related to "Social innovation" strategy.

As regards the social innovation, the overall objective is the development of a smart community open to innovation. The project expects:

- people involvement in decision making processes;
- larger use of internet and technologies;
- development of a city that can be considered as a node for innovation networks.

TOURISM DEVELOPMENT		OBJECTIVELY VERIFIABLE INDICATORS		SOURCE OF VERIFICATION	ASSUMPTION
		Efficacy Indicators	Effectiveness Indicators		
OVERAL OBJECTIVE	Reorganization and exploitation of local resources				
PROJECT PURPOSES	O.1 – Strengthening of the summer tourism	Δ N° Tourists / year (June - September)	Revenues in the summer months/ Total revenues	Corporate data	
	O.2 – Increase of the wintry tourist flow	N° Tourists / years (except summer months)	Revenues (October - May)/ Total revenues	Corporate data	
	O.3 - Qualification and development of the tourist services and the supply chain	User satisfaction level	Increase in efficiency / Investment	Questionnaires	Coherence with the expectations of the target groups
RESULTS/ OUTCOMES	P.1.1 - Historical and artistic itinerary	N° points of interest of the itinerary		Project Data	Increase of the attractiveness of the place through local cultural resources
	P.1.2 - Programs and catalogues (also online)	N° distributed copies	Compared with the investment		
		N° online access		Web	
	P.2.1 - Public transport service that links Glorenza to the ski lift plants	N° users / month	Compared with the investment	Provincial Agency for Mobility	Presence of tourists that choose the public transport
	P.2.2. App for the monitoring of the transport service that can provide useful information about the lines, the waiting time and any critical weather condition	N° download		Provincial Agency for Mobility	
	P.3.1 - Efficient organizational models and qualified staff	N° qualified persons/ year	N° qualified persons that work in the tourism industry		
	P.3.2 - Beds (B&B)	N° arrivals e presences / year	Presences/ available beds	Corporate data	Coherence with the needs of the target groups
		N° Beds	Compared with the investment	Corporate data	
	P.3.3 - Certification for the tourism businesses	N° certified businesses		Chamber of Commerce	Increase of the competitiveness of the tourist services
	P.3.4 - ICT services for the accommodation facilities and the restaurants	N° accomodation facilities and restaurants with ICT services/ Tot	Compared with the investment		Increase of the competitiveness of the tourist accomodation
ACTIVITIES	A.1.1 – Project and implementation of the itinerary	INPUT	Provincial funds for tourism development		
	A.1.2. – Project and implementation of the catalogue, also with multimedia devices				
	A.2.1. 1 - Selection of the routes		European Regional Development Fund (ERDF) 2014/2020; Provincial funds		
	A.2.1. 2 - Organization of the bus lines				
	A.2.1. 3 - Design and implementation of the ticket offices				
	A.2.2. 1 - Information gathering		European Regional Development Fund (ERDF) 2014/2020; Experts on data management		
	A.2.2. 2 - Creation of open datasets				
	A.3.1 – Organization and implementation of training courses		Provincial funds; European Social Fund (ESF) 2014/2020		Participation in training courses
	A.3.2. – Design and implementation				
	A.3.3 – Certification services for the tourism businesses				
	A.3.4 – Financial incentives for the ICT services		European Regional Development Fund (ERDF) 2014/2020		Presence of companies that take advantage of the financial incentives

Fig. 5: “Tourism development”Matrix.

The first purpose of the project is connected with the organization of participatory planning workshops and the creation of an open data portal in order to promote interactions among PA and local community and then to increase government transparency and accountability.

According to the principles of openness and transparency, in this way, public administration redefines relations with citizens, thatcan have a continuous monitoring of the undertakendecisions.

Project activities include also networking among Universities and research centers and the organization of conferences and meetings in order to introduce innovation and development into the area.

European Structural Funds may be used for this purpose.

The second strategy concerns “Tourism development” (figure5).

Reorganization and enhancement of local tourism development aims at:

- strengthening of summer tourism;
- increase of wintry tourist flow;
- qualification and development of tourist services and supply chain.

In Glorenza, summer tourism is already well organized, then the project proposes the integration of hiking and outdoor activities, carried out during the summer, valuing the historical and architectural beauties in the city center that differentiate the village from the neighboring ones.

The project aims at the creation of an itinerary that can valorize them, since they are tangible expressions of local culture, and the development of programs and catalogues for the visit.

The problem of seasonal tourism is mainly caused by the relative distance of the city from ski lift plants: the project intends to propose the creation of appropriate public transport services, monitored through smart-phones which provide useful information about lines, waiting time and any critical weather condition.

Accommodation facilities require a reorganization: there is the need to integrate the current offer with other forms of hospitality, such as "bed and breakfasts", which could be more suited to user needs.

In order to qualify tourist offer, the plan provides training courses for staffs and the diffusion of ICT services for the effective promotion of tourist accommodation and restaurants.

In order to preserve landscape and rural peculiarities of the area, the project provides the strategic line called “Rural development”(figure6).

The specific purposes are:

- introduction of traditional crops such as pears and apricots;
- development of organic agriculture;
- development of a commercial chain of agricultural products.

The diversification of crops is based on the introduction of other typical cultivations, different from growing apples. Therefore it is necessary to awoken farmers towards the opportunities offered by the rediscovery of these typical crops and the possibility of a local production, in order to add more value to agricultural sector.

The alteration of agricultural landscape, caused by pesticides, leads to consider the hypothesis of an organic agriculture development with the creation of new production rules and of new production facilities.

As for the commercial chain of agricultural products, the project includes the development of a local distribution system, linked also to tourist and cultural exploitation, and the participation of producers in national and international marketing events.

Then, the development of business networks can also favor:

- the increase in competitiveness and productivity;
- the diffusion of know-how;
- the innovation development;
- the certification of production process;
- the internationalization of companies;
- the cost reduction of business management.

RURAL DEVELOPMENT		OBJECTIVELY VERIFIABLE INDICATORS Efficacy Indicators	Effectiveness Indicators	SOURCE OF VERIFICATION	ASSUMPTION
OVERAL OBJECTIVE	Protection of the rural landscape and exploitation of its peculiarities				
PROJECT PURPOSES	O.1 – Introduction of traditional crops and diversified farming practices	T/year products on the market	Compared with the investment	Rural Development Program; Provincial offices	Presence of farmers that trust the introduction of traditional crops
	O.2 – Development of organic agriculture	T/year products on the market	Compared with the investment	Rural Development Program; Provincial offices	Presence of farmers that choose organic farming
	O.3 - Development of the commercial chain of agricultural products	N° trading companies N° products on the market Δ local products on the market	Compared with the investment	Chamber of Commerce; Rural Development Program	Synergy with activities for tourism promotion
RESULTS/ OUTCOMES	P.1.1 - Pears and apricots	HA of apricot and pear plantations	Compared with the investment	Land registry office	
	P.1.2 - Product certifications	T/ years certified products		Chamber of Commerce; Product certification bodies	
	P.2.1 - Production rules for organic farming	N° farms that adopt organic standards		MIPAAF (Ministry of Agriculture and Forestry)	Presence of a large number of farmers that comply with the rules
	P.2.2 - Processing plants of organic products	N° processing plants	Compared with the investment	Chamber of Commerce; Provincial offices	Finished products are brought on the market
	P.2.3 - Organic certifications	T/ years certified organic products		Chamber of Commerce; Product certification bodies	Rise in value and in competitiveness of the local products
	P.3.1 - Shops and food tastings connected with tourism	N° shops		Chamber of Commerce; Web	
	P.3.2 - Marketing of local products	N° sales networks (also online)	Compared with the investment	Chamber of Commerce; Web	
	P.3.3 - Business networks	N° combined companies	Rationalization of business charges	Chamber of Commerce	Increase of the national and international competitiveness
ACTIVITIES	A.1.2. ; A.2.3 – Product certification services	INPUT	Private funds		
	A.2.1 ; A.2.2. 1 – Financial incentives for farmers that choose organic agriculture		European agricultural fund for rural development (EAFRD); Provincial funding		
	A.2.2. 2 - Implementation of the processing plants of organic products				
	A.3.1 – Development of a local distribution system considering typical products as suitable elements to characterize the tourist supply		European agricultural fund for rural development (EAFRD); Provincial funding		Cooperation between agricultural sector and tourism
	A.3.2 - Participation of the producers in national and international marketing events		Incentives offered by the Chamber of Commerce; Private funds		
	A.3.3. 1 - Selection of companies for sharing the goals of innovation and competitiveness		Incentives offered by the Chamber of Commerce; Private funds; Provincial funding		
	A.3.3. 2 - Formulation of a common program				
	A.3.3. 3 - To draw up a contract				

Fig. 6: "Rural development" Matrix

6 CONCLUSION

Referring to methodological aspects, the use of LFA proved appropriate to develop bottom up strategies during a participatory workshop. The steps of the method agree with the basic actions in the implementation of a workshop:

- identification and analysis of expressedproblems;
- definition of objectives and activities to solve them;
- to foster a rational approach to the formulation of bottom up strategies.

The strict application of the method has allowed us to analyze problems expressed by the local community, acting as a guide to a systematic and logical analysis of connections among key elements of a well-structured project.

The introduction of smart solutions in a small rural context could be not very easy: Glorenza is, in fact, characterized by a limited predisposition for both technological and social innovation.

For this reason, there is the need to prepare citizens for necessary changes, making them aware about opportunities that ICT tools can give.

The project experience has shown a particular value as it led to interact social groups, experts and representatives of public administration.

If these activities became more widespread and systematic, they could lead to effective strategies and development projects based on people needs and on goalssharing.

The described approach could represent a model for spreading participatory workshop applications, based on LFA method, in other peripheral areas characterized by similar social, environmental and economic features.

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Some Futures for the Belgian Coast 2100, a Case Study of Research by Design on Regional Level

Charlotte Geldof, Jan Zaman

(Spatial Development department Flanders – Ruimte Vlaanderen, Division Research and Monitoring (AOM), Kg. Albert II laan 19 bus 11, 1210 Brussels. charlotte.geldof@rwo.vlaanderen.be)

(Spatial Development department Flanders – Ruimte Vlaanderen, Division Research and Monitoring (AOM), Kg. Albert II laan 19 bus 11, 1210 Brussels. jan.zaman@rwo.vlaanderen.be)

1 ABSTRACT

In this paper, we want to explain our findings from recent research by design on regional level that is initiated by the Flemish Spatial Development Department Ruimte Vlaanderen.

We elaborate further on our conclusions on the article "Can research by design on regional level help to introduce new concepts in spatial planning?" (Zaman Geldof Geens, 2014) and add more results on recent research by design on regional level on the Belgian Coastal area for 2100 (Metropolitaan Kustlandschap 2100). Furthermore we elaborate new findings based on the comments we received by the audience of the ISOCARP 2014 congress in Gdynia and the Quality-forum Regional Research by Design (RRD) we organized in Brussels.

Main issue is the question if paradigm breaking research by design (Janssens 2013) is possible in a policy context. Another issue is the idea that research by design has to evolve during the process on 4 scale-lines as described in previous article. The issue to involve more stakeholders during the design process to obtain a more 'realistic' level is discussed. The importance to go back to an bigger scale and scope level after having focused more to get to a more comprehensive result seems to be very important. This means that some kind of evolution path is to be explored to become more performant research by design on regional level.

2 CAN RESEARCH BY DESIGN ON REGIONAL LEVEL HELP TO INTRODUCE NEW CONCEPTS?

As shown in our previous paper, we gradually established in the past 10 years both (real) design and research by design on a regional scale in our administration of Spatial Planning Division, by doing it ourselves or by leading a external design team. Through a design attitude we analysed, reframed, represented and projected possible futures of a wide range of spatial challenges. With this knowledge, we are now trying to change of method by dividing current research projects into small topics, by which we try to establish the essence of designing on a regional scale. This gives us additional insight in the research by design process.

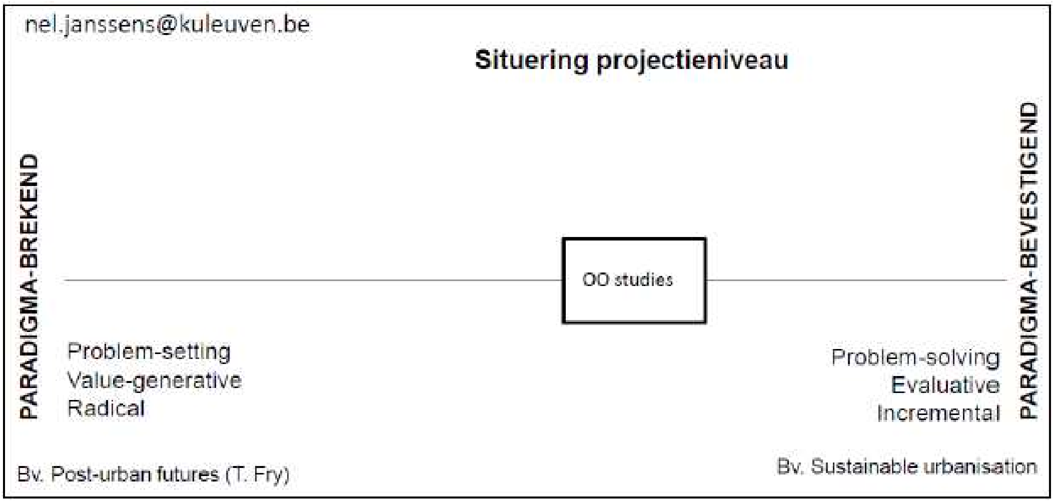

Figure 1: Scheme situating our past research by design projects between paradigm breaking and paradigm confirming (Nel Janssens, presentation during the Flemish spatial research conference, Brussels, November 2013)

During the past 2 years, we tried to move the research along the 4 following scale-lines, where the two opposite sides of the 'scale-line' are to be explored in an iterative process:

- from 'easy to understand' to 'comprehensive'
- from 'one sharp opinion' to 'a widely shared view'
- from 'strategic' to 'operational'

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- from ‘utopian’ to ‘realistic’.

This is inspired on the remarks dr. Nel Janssens formulated in the spatial research conference of November 2013. On a continuous scale between ‘paradigm confirming’ and ‘paradigm breaking’ research by design, our work remains nearly in the middle, without moving from one end of the scale and back. This iterative method will give far more interesting results.

First steps of this iterative research process can be shown in the Metropolitan Coastal Landscape 2100 project. In this paper we will present first results and methodological approaches while dealing with the paradoxes between paradigm confirming and paradigm breaking research in a policy context.

3 METROPOLITAN COASTAL LANDSCAPE 2100

3.1 Climate change and Belgian coastal area

The “Metropolitan Coastal Landscape 2100“ is a cooperation between de department of mobility and public works, the agency for maritime services and coast, Ruimte Vlaanderen and the Flemish Government Architect. The purpose of the study Metropolitan Coastal Landscape 2100 is to develop long-term building blocks through ‘regional research by design’ for the coastal zone.

The "Coastal Landscape" refers to a cohesive whole landscape of the maritime area and the coastal territory, which is being concretely on the coastal zone with the sea, the coastline and coastal polders. In a metropolitan coastal landscape function different spatial entities such as port, roads, beaches and homes in a complementary and equal way and are linked together in a productive interaction. This requires a combined stakeholdersapproach covering the community level, with provincial (Province of West-Flanders) , regional (Flanders) and national (Belgium) level.

By setting the time horizon in 2100, is a long-term approach for projective research prepared taking into account climate change.

The insights are useful for the current projects for the Flemish Bays project of the Department of Mobility and Public Works (MOW) and the Agency for Maritime Services and Coast (MDK), for the development of the Spatial policy plan Flanders, prepared by RuimteVlaanderen (RV) and for detecting potential pilot projects in the framework of the activities of the Flemish Government Architect Team (TVB).

The long term horizon is necessary to incorporate long term uncertainty on the extent of sea level rise. Depending on the regional climate scenario (figure 2, Climar) the storm protection could have to raised within 2, 27 meters (sea level rise + storm surge) in the warm + scenario. These high sea water levels will probably coincide with an enormous amount of water from land due to more winter rainfall and extreme weather conditions (storm). The gravitational water evacuation system that exist nowadays in Belgian/Flemish Polders will no longer function in these conditions.

Table II: Climate change scenarios 2100

	M	M+	W	W+	WCS
Air temperature	+ 2° C	+ 2° C	+ 4° C	+ 4° C	+ 4° C
Change air circulation	No	Yes	No	Yes	Yes
Winter precipitation	+ 8 %	+ 14 %	+ 16 %	+ 28 %	+ 28 %
Wind velocity	0 %	+ 4 %	- 2 %	+ 8 %	+ 8 %
Summer precipitation	+ 6 %	- 20 %	+ 12 %	- 40 %	- 40 %
Sea water temperature	+ 2.5 °C	+ 2.5 °C	+ 3.5 °C	+ 3.5 °C	+ 3.5 °C
Mean sea level	+ 60 cm	+ 60 cm	+ 93 cm	+ 93 cm	+ 200 cm
Storm surge level	+60 cm	+80 cm	+80 cm	+130 cm	+240 cm

Figure 2: tabel II, extract from CLIMAR (2011) final report Evaluation of climate change impacts and adaptation responses for marine activities,

Thus, the long term perspective forces us and other stakeholders to look for other solutions than the standard reinforcement of dikes. Even under current conditions, the MDK agency is already using new innovative techniques that are closer to natural sand deposit processes.

3.2 Intersectoral and interdisciplinary collaboration is needed

The objective of Metropolitan Coastal Landscape 2100 research is to develop long-term ‘building blocks’ for a sustainable and resilient coastal region through regional research by design. The study looks ahead to the coastal zone , -including land and sea-, in 2100 from a transnational perspective. The adjacent Province of Zeeland of the Netherlands is involved, as well the French Departement Nord - Pas-de-Calais. This all requires intersectoral and interdisciplinary approach.

As pointed before, the results of the regional research by design project can be usefull to the ongoing elaboration of the White Paper on the new Spatial policy plan Flanders (Spatial Development department Flanders – Ruimte Vlaanderen), of the Flemish Bays project (Department of Mobility and Public Works), and the implementation of the Master Plan for Coastal Safety (Agency for Maritime and Coastal Services – Coastal Division), and of the agenda of the Flemish Government Architect and his ongoing 'open calls' on the shore front. Also the Province of West Flanders is a partner, presented regarding the revision of the land use plan shore and dike and the Provincial Structure Plan / Coast area.

To frame this intersectoral approach, there was the opportunity in 2012 of the institutional innovation by the creation of the new LABO Ruimte (spatial development laboratory). It acts as a free research area for the Spatial development Department (RV) and the Team of the Flemish Government Architect (TVB). It has to prepare divers policy themes with a spatial impact and had to test them in a perspective of territorial cohesion while true agendas temporarily were released to accelerate to think out of the box. For MKL2100 project we worked with four experts (Joost Schrijnen, prof. A. Loeck, prof. P. Meire, Luc Vandamme) and the above mentioned administrations.

In the framework of the cooperation in the LABO Ruimte, a protocol was signed with Team of the Flemish Government Architect (TVB), the Department of Space Flanders (RV), the Agency for Maritime and Coastal Services (MDK) and the Department of Mobility and Public Works (MOW).In partnership with the Province West Flanders – Area, we elaborated specific development to nourish the long-term study of the spatial potential of coastal area which wecarried out under the heading "Metropolitan Coastal Landscape 2100".

Metropolitan Coastal Landscape 2100 is addressing to coastal communities in the Province of West-Flanders who are at most risk or have the greatest scope for opportunity from climate driven coastal change. These range from communities with residents in low-lying rural marshes to densely populated urban centres and include a number of diverse disciplines (coastal safety, mobility, housing and architecture, tourisme, …and sectors such as the Department of Mobility and Public Works, the Agency for Maritime and Coastal Services-Coastal Division, of the Flemish Government Architect.

The interdisciplinary approach is necessary for research on the long-term and about climate change.

During this period, several studies are devoted to resilient space and mitigation & adaptation on climate change. From the spatial research community, the results of the investigation CcASPAR and the CLIMAR and CCI-HYDR studies, and the study ' toward a climate proof Flanders with spatial policy ' are best known. In this latest study, commissioned by Spatial Development department Flanders – Ruimte Vlaanderen anddeveloped by Alterra Wageningen (WUR) a guide model for the coast has beenincluded.

Also on national level (Belgium), the preparation and presentation of the draft of the Marine Spatial Plan of the Belgian part of the North Sea (FOD Environment) has been translates into a definitive Belgian Marine Spatial Plan (2014).

Both the scientific findings as the policy plans of different sectors were to be considered which resulted in a interdisciplinary approach; the executing teams were multi-disciplinar (architect, urban planners, landscape planners, coastal experts, coastal defense ingeneering,....), the workshop also (waterexperts, urban planners on different policy levels, tourism, housing, ..) and the broader stakeholdersworkshop involved scientifics (in ecosystems, policystudies, coastal defense ingeneers, environmental research, …) with different administrations and also the steering comitee involved scientifics (ecosystem services, human settlements,..). A common language therefor has to be found.

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3.3 Horizon 2100 and applied future explorations

The available studies related to climate change show that the biggest challenges for the coastal zone arise in the long term. The Masterplan Coastal Safety can with a reasonable certainty protect the coastshore against a 1000yearly storm until 2050. The different climate models (IPCC, CLIMAR) show that the effects of climate change will continue in much stronger after 2050. It is therefore necessary to, from the uncertainty that hangs, elaborate solid models to examine the possibilities for a future spatial policy on the coast.

The Flemish Bays Project also uses these long-term 2100 horizon to anticipate to what could possibly come after 2050 and to review its short-term planning in order to take no-regret measures.

Long-term thinking is needed because the coastal impacts of climate change combined with all other spatial claims, will be amplified. Changes in natural systems will contribute to pressure on the economic system (agriculture and water, ports and activities, ..). Therefore, a long-term perspective is also helpful. The Interreg IVa project -Entre 2 Mers / Between the 2 seas- : Coastal Communities in 2150 was also looking at the coastal zone in a long term perspective.

In the field of long-term projections that must work with relatively large uncertainties, future explorations and speculations are used. The judgments are validated through the involvement of policymakers and experts in the planning process. This can be organized through a wide range of interactive methods. 1

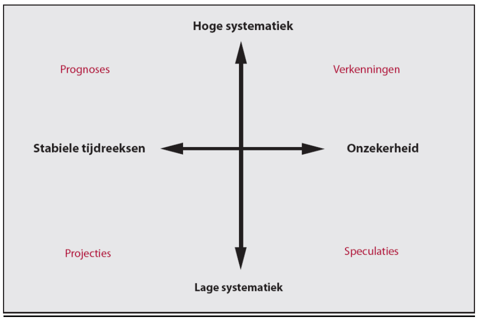

Figure 3. Overview of the different concepts to look to the future. The concepts are placed relative to the degree of systematics (vertical axis) in the analysis phase and the availability of data on the other hand translated in degree of uncertainty (horizontal axis, more to the rightside the more uncertain). You find prognoses, future explorations (verkenningen), speculations (speculaties) projections (projecties). (to Dammers, 2000, in Verlet, De Smedt, 2010)

Research by design is a useful method to make long-term forecasts and future speculations, to discuss them in interdisciplinary and intersectoral workshops, to visualize and develop divergent future visions. This happened both in the broad stakeholderworkshop dated 11.2013 as in phase 3 of Metropolitan Coastal Landscape 2100.

3.4 The whole MKL2100 -research trajectory: an accumulation of knowledge to be shared

The Metropolitan Coastal Landscape 2100 research project is divided in 4 phases going from looking back into history and understanding the problems and chances for the future (phase 1), to determine the main question and territory (phase 2), to elaborating 4 divergent long-term futures (phase 3) to elaborate a realistic program constructing a global integrated vision and executing pilot project (phase 4).

The trajectory is divided into four phases covering 2012-2015... Phase 1 to 3 contains the investigations within LABO Ruimte. Currently, phase 3 has been completed and the final reports will be recently put on-line on the MKL2100 project website. Phase 4 is the transition path from a research within the lab space LABO Ruimte to a Spatial Programme on the coastal zone. (See 3.5 in this text)

This is a brief overview of each phase of the regional research by design.

3.4.1 Phase 1 (9/2012 to 2/2013)

Phase 1 (9/2012 to 2/2013) was an exploration and methodological analysis, and included an exhaustive and comprehensive historical analysis (necessary to the future projections of phase 3), a section on current functioning of the coast system, a benchmark to international reference projects and a formulation of potentials, opportunities and challenges towards 2100. This phase was carried out by the planning office BUUR (B) in collaboration with ALTERRA Wageningen UR (NL) and commissoned by Team Flemish Government Architect, in collaboration with the other partners.

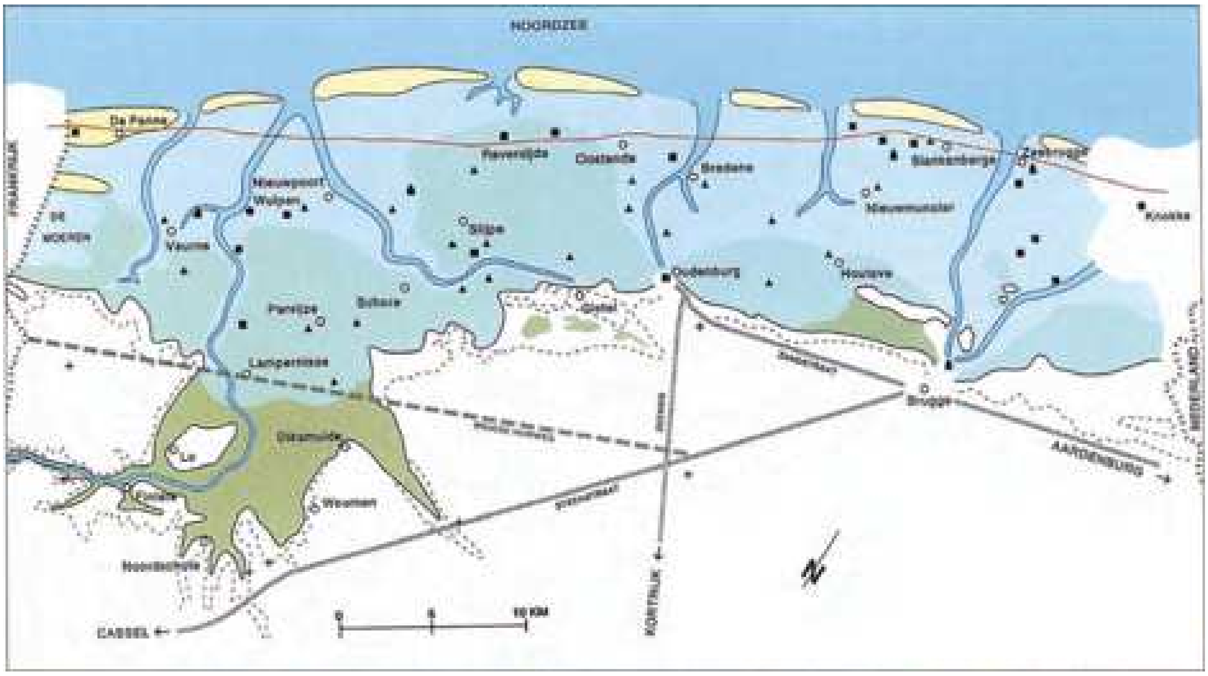

Figure 4, historical dynamic system oft he Belgian coastal area, 1st Century A.D., according H. THOEN, 1978

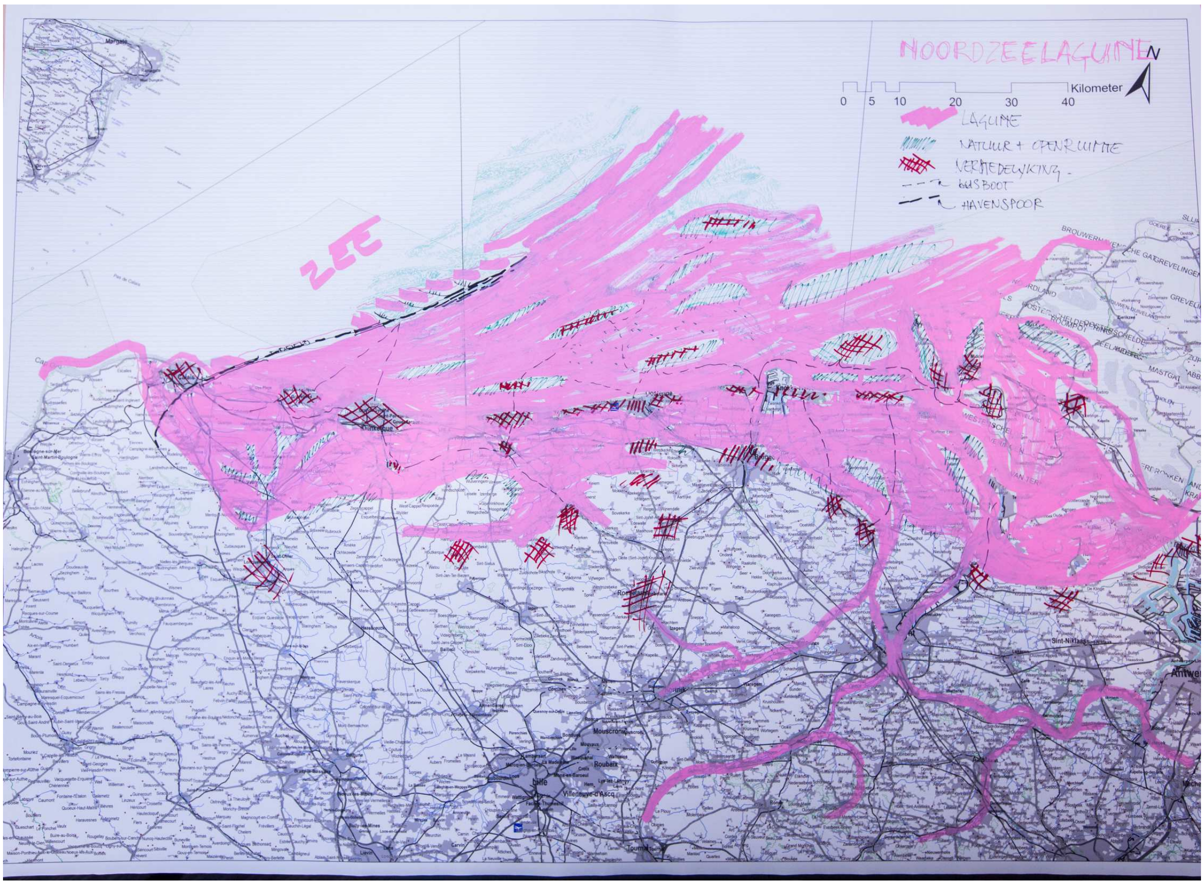

Figure 5, one of the extreme vision drawn by participants of the Broad Stakeholderworkshop MKL 2100, nov 2013.,

3.4.2 Phase 2 (3/2013 to 6/2013)

Phase 2 (3/2013 to 6/2013)is where the design assignments were formulated and imagined. This draft of a research by design agenda and questions were formulated and structured in a number of ‘landscapes’. So the assignments were structured by using a basic layer (the "Conditioning landscape” –voorwaardscheppend landschap), coupled with three thematic layers called landscape of residence (verblijfslandschap), mobility landscape (mobiliteitslandschap) and productive landscape (productief landschap). On top is a metropolitan ambition prioritized, seeking to add value and organize synergy. This phase was carried out by the landscape office H + N + S (NL) in cooperation with the ingeneering office Deltares (NL), supplemented by the expertise of Atelier. 1: 1. In this. phase the steering group was supplemented by Luc Van Damme, who was formerly leader of the Flemish Bays project in MOW. This phase was commissoned by Team Flemish Government Architect in collaboration with the other partners.

3.4.3 Broad stakeholder workshop (Ostend, 14. 11.2013)

Broad stakeholder workshop (Ostend, 14. 11.2013) was held with relevant transnational policymakers (France, The Netherlands, Belgium, Flemish Region, Province of West-Flanders, 10 Coastal Municipalities) and relevant sector administrations and scientists to to inform and involve them during the further process. The study results of the previous phases were explained (Alterra, Deltares), there were several future-oriented workshops (led by Trizoom and involved adminstrations) and a discussion was held with representatives of the partners and scientists (chairman S. Kerger). The website was used as a communication tool to share the evolutions in the process, inform about reports. The 90 participants from mainly administrative level gave a very constructive and innovative contribution to the foresight and was very usefull to broader the scoop of phase 3. This stakeholder workshop was conducted by Ruimte Vlaanderen in collaboration with the other parnters and especially with the Province of West- Flanders.

3.4.4 Phase 3

In Phase 3 (12/2013 - 12/2014) we organized data and constructed 4 diverging long-term future visions through two stakeholder workshops, different feedback on the research by design process and held a confrontation with existing policy context. The final results of phase 1 and phase 2 and the results of the Broad Stakeholder Workshop November 14, 2013 formed a good basis for this explorative research by design. The tender RV AOM / 13/8 "explorative research by design for Metropolitan Coastal Landscape 2100" was announced in European and published. The contract was awarded to the consortium ‘Atelier Visionary Coast’ (Architecture Workroom (B), XDGA architects (B), Maat ontwerpers (B), H + N + S landscape architects (NL), supported by Deltares (NL) and IMDC- Technum (B) and ran for 8 month. The steering committee remaned unchanged.This was commissioned and guided by Ruimte Vlaanderen and MOW in collaboration with the other partners.

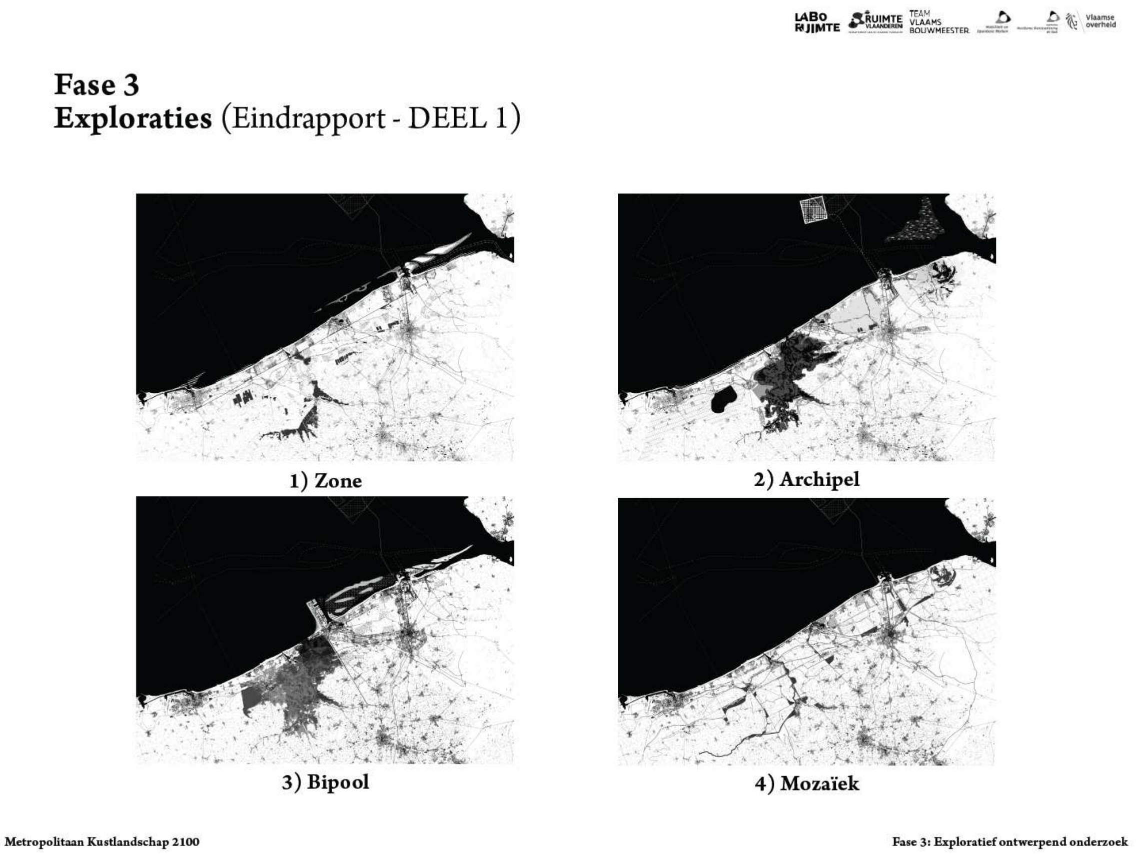

Figure 6, overview of the 4 diverging long-term futures, according to Atelier Visionaire Kust, 2014 (AWB, XDGA, MAAT ontwerpers, HNS landschaps architecten)

3.4.5 In Phase 4 (2015 -..) is current. See 3.5 below

3.5 Fasing out of the laboratory: from research to a territorial program

In phase 4 (2015- ..) we will investigate how potentially relevant long-term building blocks can be implemented by ‘promoters’ TVB, Ruimte Vlaanderen (RV), MOW Department Mobility and Public Works (MOW) and the Agency for Maritime and Coastal Services devision Coast (MDK) and the Province of West Flanders, in coalition with relevant partners and are converted to a area- integrated PROGRAM with two tracks:

- Track 1: a forum / platform around one area-specific long-term vision for the entire coastal zone, in which the various actors and policy levels are involved
- Track 2: pilot projects: establishing concrete realistic projects, activities and studies that can be launched shortly in cooperation with relevant actors and that work further on the common knowledge coming from phase 1- phase 3

The conclusions of the whole research by design require the continuation of this process bet on those two tracks. Moreover, we must also accommodate a conversation around an area long-term vision for the entire coastal zone, in which the various actors and policy levels are involved and the experiences of the pilot projects are included in the global vision. To this end bilateral talks are to be hold with potential partners (ANB, ILVO, VMM, VLM, ..) for possible area-pilot projects. A overall communication during the whole process is performed with internal and external partners by a website, and publication (October 2015) and a 2nd Wide stakeholder workshop is provided (June or September 2015); this will help to bring the research project into to the next stage of a program with more realistic elements and a consolidation and commitments about actions. The steering committee now accompanies this process every two months.

Currently, an estimated phase 4 is drawn out to divide the financial contribution by the promoters, as provided in the protocol.

4 COMMENTS OF QUALITY FORUM ON REGIONAL RESEARCH BY DESIGN

In november 2014 we presented our ISOCARP paper and the work in progress to an independent expert panel. They pointed out that we tend to mix ‚vague‘ with ‚abstract‘ and that there might be a conceptual problem with the overall aim to do open research within a context of policy preparation. The latter firmly poses the question wether the ambition of having an open mind is possible inside an administration that is supposed to work for a Minister or a overnment. Even if conditions today in RuimteVlaanderen are allowing a free (more or less) scientific approach to all kind of research, the expert panel questions this position. They expect that taking position will inevitably be part of the decision making process, and most probably happens even while defining the research topic and method.

The first is more deeply rooted in flemish regional planning, where planners tend to use generic concepts while hoping that someone else will put them into practice. For the regional research by design project, the expert panel advises to be precise, even when using abstract phrases or concepts. According to the expert panel, this is the only viable way to overcome the vagueness of some research projects up to now.

5 EVOLUTION PATH TO BECOME MORE PERFORMANT RRD

In order to move along the different scales, mentioned in the introduction, we will permanently have to mind the fact that every step should be part of the iteration and dialectics between the oposite ends of the four scales.

- from ‘easy to understand’ to ‘comprehensive’
- from ‘one sharp opinion’ to ‘a widely shared view’
- from ‘strategic’ to ‘operational’
- from ‘utopian’ to ‘realistic’

This means that some kind of evolution path is to be explored to become more performant research by design on regional level.

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In the fourth phase of MKL2100, we will develop operational, realistic, easy to understand ideas and proposal, that could be put into practice on the very short term. This is necessary in opposition with the utopian, strategic, comprehensive, sharp opinion point of view of the third phase. As difficult as this might prove to be in a political context, the concrete small scale proposals of the possible, will later give feedback and inspiration to (again) utopian thinking. Only if we can realise a full circle, one full iteration, we are able to understand how this method might be usefull both as a research method as in a real life political context.

6 CONCLUSIONS

It is a long way to finish this iterative process and many obstacles may be seen. Nevertheless, once the full iteration discribed above will be done, we hope to construct a relevant long-term vision with pilotprojects towards a resilient climate proof coastal area.

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Stakeholder Participation in North-West Europe: Lessons Learnt from Green Infrastructure Case Studies

Jost Wilker, Karsten Rusche, Christine Rymsa-Fitschen

(Dipl. –Ing. Jost Wilker, ILS – Research Institute for Regional and Urban Development, Brüderweg 22-24, 44135 Dortmund, Germany, jost.wilker@ils-forschung.de)

(Dr. Karsten Rusche, ILS – Research Institute for Regional and Urban Development, Brüderweg 22-24, 44135 Dortmund, Germany, karsten.rusche@ils-forschung.de)

(Dipl. –Ing. Christine Rymsa-Fitschen, ILS – Research Institute for Regional and Urban Development, Brüderweg 22-24, 44135 Dortmund, Germany, christine.rymsa-fitschen@ils-forschung.de)

1 INTRODUCTION

Participation and governance approaches gain more relevance to improve the quality, acceptance and legitimization of planning and implementation. There is a need for strategies that unite public, private, scientific and community sector stakeholders for working jointly on innovative, sustainable solutions. This is especially important as local authorities are facing significant cuts with relation to staff and finance. Thus, considering and embedding stakeholders' input is becoming increasingly difficult, while it is at the same time becoming more and more relevant to give all groups of society the opportunity to have a say in planning to ensure that it meets their requirements and is carried out most effectively. Increased efficacy in participation is highly needed under the given circumstances and only achievable by advancing planners` understanding with local stakeholders' expertise (Mackrodt & Helbrecht, 2013; Young & McPherson, 2013; Faehnle et al., 2014).

In Europe there is not one sole planning system and thus, participation is carried out differently with regard to the planning culture in each country. The international focus is very important as many parallel approaches to participation in different countries need to be taken into account within the context of their respective planning culture. Furthermore, as participation is still an ongoing process and in development in theory and in practice always new aspects and methods appear, it is getting more and more complex, but needs always to be adapted context-wise. So, to learn from best practices in other countries, it is important to keep the planning backgrounds in mind when transferring promising approaches from other national contexts.

One of the most relevant planning topics in this sense is green infrastructure, "defined as a strategically planned network of high quality natural and semi-natural areas with other environmental features, which is designed and managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings" (EU Commission, 2013:7). Strategic approaches for green infrastructure are still rare and institutionalization efforts of environmental or "green" governance are underdeveloped. However, in the case of GI planning stakeholders' preferences and values regarding their environment are valuable information for decision making and their integration in green infrastructure planning is hugely relevant as green infrastructure`s multiple benefits for society are not rewarded enough. The consideration of adequate stakeholders at the right phases of green infrastructure planning processes and the choice of suitable participation tools are essential for a sufficient provision of public resources (Luyet et al. 2012).

This paper investigates examples of different green infrastructure case studies in Belgium, the UK, Germany and the Netherlands and evaluates their participation concepts considering the case studies` planning families. Thus, country and planning family similarities and differences related to participation in green infrastructure investments are identified and explained with the evolved planning culture in each country. By this means, we want to highlight the relevance of the planning-cultural context for efficient participation related to the example of green infrastructure. To address the need for more effective participation we illustrate GI stakeholders` views on the projects` participation concepts. This means that a key element in our investigation is to look at the difference between participation desired by stakeholders and the opportunities offered by local administration.

2 PLANNING CULTURES AND PARTICIPATION

Spatial planning is usually considered within the context of a national framework. Within this framework, several dimensions of planning are elaborated as physical planning, land use constraints, development incentives, environmental considerations and participation issues. The nature of public participation varies as much as spatial planning systems, and is equally affected by the specific historical, cultural, geographical and governantial backgrounds in different countries (Town and Country Planning Association 2007, 15, Rymsa-Fitschen et al., 2014).

When characterizing legal and administration systems, usually five "families" are identified within Europe (see Newman & Thornley 1996):

(1) British

(2) Germanic

(3) Napoleonic

(4) Scandinavian

(5) Communist-Centralist

As shown in Figure 1, this research paper discusses the results of case studies within a Northwest European context. So, we only discuss those relevant planning families in more detail. In our case, these are the British, Germanic and Napoleonic ones.

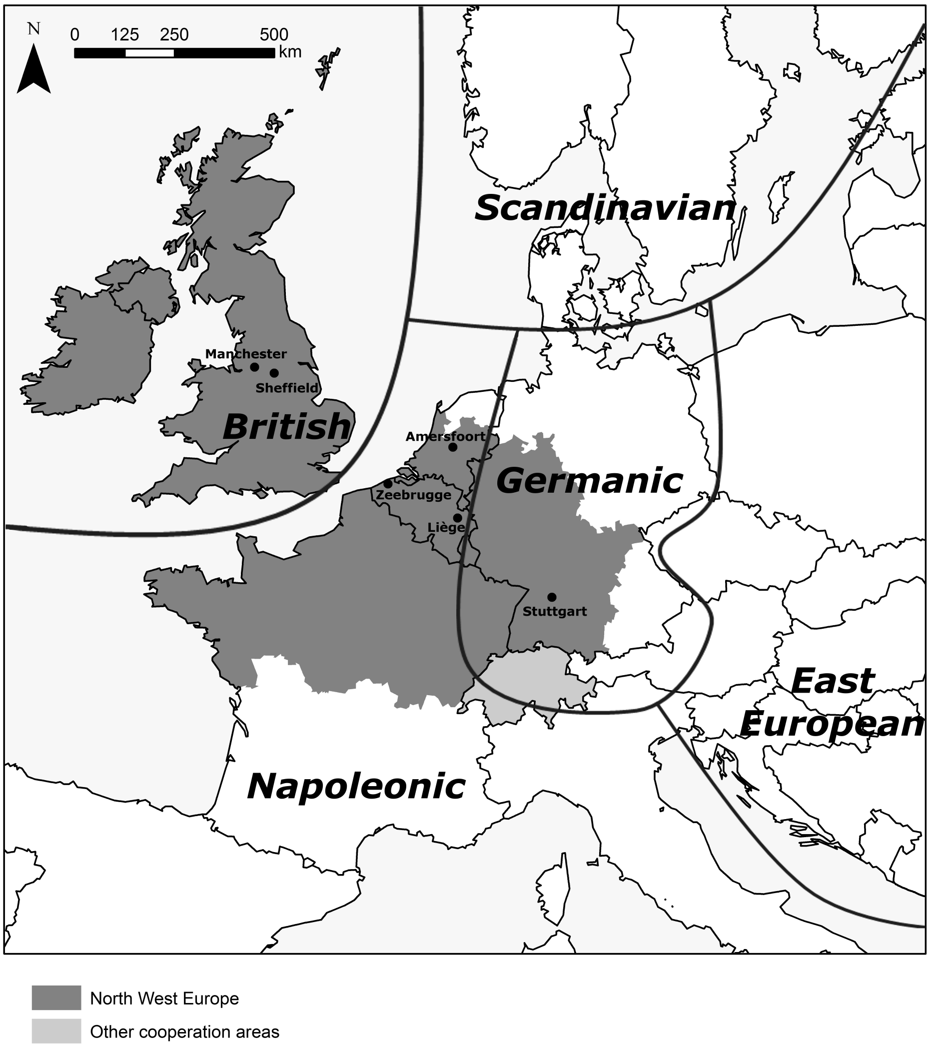

Figure 1: Map of case studies and planning families. Own illustration adapted from Newman & Thornley 1996.

The British planning family is grounded on the common law system. This means, it builds up on a long tradition of decisions based on decisions and relates to cases rather than being encoded in specific constitutions. The main controlling power is quite centralized, as the budget control is at the more national levels of government. In the UK, it is government policy to give stakeholders a better opportunity to participate in decision-making "and even, where appropriate, transfer control of assets to citizen groups" (EIPP 2009:11). White papers have been published promoting participation and setting a duty on public authorities to involve the public. All 400 local authorities in the UK were expected to apply participatory budgeting till 2012. Nevertheless, there is an enormous gap between the capabilities of planners to involve stakeholders effectively. Culturally, public officials are sceptical regarding participation and its benefits such like politics that follow their own policy direction. However, the well organized and highly institutionalized civil society provides huge potential to overcome these limitations (see EIPP 2009.)

The Germanic planning system is characterized by high civic engagement. Participatory structures in planning are established since 30 years as the German building law defines public participation as a duty. This means that most formal participation is restricted to local and municipal level. At federal level, referenda, are for example forbidden. Participation is focussed on information and consultation. Innovative approaches to participation are mostly only found at local level such as participatory budgets. This has to been seen in the context “the current approach of the German government to citizen engagement, which is strongly influenced by notions of social capital. Civic engagement is not seen primarily as participation in political decision-making, but as a broader concept encompassing everything from donating money to volunteering and showing moral courage. Civic engagement is to a large degree self-organising. This in turn means that government practice and policy focuses on the consequences and costs of social and community engagement” (EIPP 2009:16) resulting in a reservation of the administration and traditional politicians towards participation and its impacts in Germany. Citizens are also disenchanted with politics and the polity. But while the government is set to improve the conditions for social volunteering, demands to improve direct access of citizens to decision-making forums remain lower down the agenda (see EIPP 2009).

The Napoleonic planning family is based on a very strong national code of planning regulations that creates a hierarchy of plans that are binding for lower-level administrations. Therefore, participation as a measure to change and react in planning is not a standard approach in policy making. Due to changes in society, this rather schematic classification does not hold anymore especially for the countries of Belgium and the Netherlands, which are the ones from the Napoleonic family that are within our case study approach.

In the Dutch case there has been a long tradition of opening the strict planning schemes for a participatory approach. In the Netherlands, participation became more and more popular from the 1990ties, mainly as a tool to strengthen public acceptance and implementation of decisions, when the delay of many large scale infrastructure projects caused resistance by the affected stakeholders. New ways of participation aimed at involving the public at early stages of policy development to include stakeholders` input already in the problem definition process and the gathering of ideas and proposals for project alternatives. Ministries also experimented with new forms of participation and at the local level interactive policy-making giving stakeholders a role in the decision making process was seen as key to re-connect politics and citizens. Now, stakeholders get involved as early as possible and reasonable in the planning process with the aim to really influence it (see Enserink et al. 2003).

In Belgium, some aspects of participation to planning processes are defined by law (the different legal settings for the three regions, with slight variations). As still the traditional legal frame by law, which defines minimum requirements for participation, is dominant. The most important tools are public hearing and various forms of consultative commissions. The duration of a public hearing can vary from in total 3 times 60 days for Regional Plans to once 30 days for individual projects of renovation to give the general audience the chance to react. Associations from civil society intervene to announce public hearings to the interested public. The procedure is almost unchanged since the 1970s. Public hearings are held on both supra-local and local level, for instance for the presentations of Regional Development and Land Use Plans, of provincial and of municipal plans. It is recently also used for the acceptance of local interventions such as the neighbourhood contracts. Informal participation tells its own story in Belgium as different large towns can look back on very active interest groups, for instance. Typically in Belgium is that as large scale projects are often planned with few stakeholders involved, backed from the argument of governing efficiency through enlargement of scale while the local scale of neighbourhoods and districts knows a very vivid multiplicity of associations as for instance neighbourhood associations (see Kuhk et al. 2006).

In summary, it can be stated that participation in getting more and more important in each of the three planning families. For our research, it is important to have a deeper look at how approaches and attitudes towards participation are changing and how this may be influenced by the planning-cultural backgrounds and histories. To be able to more specifically differentiate between the extents in which participation is taking

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place in the case studies, it is important to classify the used participation measures based on the level of interaction that they offer to the public participants.

In spatial planning, this interaction can range from being just informative up to full empowerment. Between these two extremes, there are mid-way levels of participation. Consultation would be one step further than information, because the public opinion is asked for and at least considered for further decisions. After this, collaboration would be a more integrative step that opens more to peoples' perceptions by taking their ideas not only into consideration, but having rules on how these influence decision-making results. The next step that links to empowerment of the public is co-decision, in which power is equally distributed when decisions are made (Luyet et al. 2012).

3 CASE STUDIES AND METHODS

The investigated green infrastructure case studies are spread over four different countries in North-West Europe: Belgium, Germany, the Netherlands and the UK (see Figure 1). Accordingly, they are belonging to the Napoleonic (Amersfoort, Liege and Zeebrugge), the Germanic (Stuttgart) and the British (Manchester, Sheffield) planning families. Thus, their approaches to participation differ significantly, but, still, they have their common ground in green infrastructure planning and its strategic planning processes.

The types of green infrastructure investments also feature a wide thematic variety (see Table 1). While the Amersfoort investment, for example, is about the transformation of a former hospital site into an expansion area for a city park where the municipality and stakeholder groups are jointly acting as equal partners in a public private partnership, Sheffield's investment site is an example of converting a derelict site to an open green space where residents and 'friends of groups' were used to discuss land transfer, maintenance and design of the new park. Both investments applied different participation approaches such as meetings, open space method and world cafes in the Amersfoort case, where the public private partnership developed the final redevelopment and management plan, and meetings and workshops in the Sheffield case, where only the design issue was to be discussed corporately.

On the basis of the different case studies we identified traditional and novel participation methods that are of importance in green infrastructure planning and management. These case studies give us the opportunity to demonstrate and compare different participation processes. As discussed above, we have to take into account that every planning process is affected by its arrangement in the legislation and regulations of the particular country. Also, planning implementations are depended on the administrative system of each country, since mechanisms, processes and formal / informal relations between administrative sectors, shape up and enable planning implementations (Healey and Williams 1993).

We analyse the case studies' participation concepts related to their employed methods and their degree of involvement. In addition, we focus on the differences and specifies of GI participation in the respective planning families. We do this by using a mixed empirical approach. In the case studies, relevant stakeholders of each investment were chosen by the project manager. Those groups of relevant stakeholders were surveyed with a questionnaire about their experiences with participation in general and with relation to the specific project, their opinion on how future involvement approaches should be conducted. In the next step, those stakeholders got together in a focus group format to discuss the questions of the survey in more detail and face-to-face.

4 RESULTS

The results of questionnaires and discussions (N=50) in each case study region are summarized in Table 1.

The case studies are sorted according to their planning families and their respective countries. Accordingly, there is a horizontal bar chart for each green infrastructure project, which depicts two important aspects of participation methods usage. On the one hand, the dark grey shaded bar indicates up to which degree of participation the individual participation methods were used in each case study. On the other hand, the light grey shaded bar indicates the potential level of participation which this method is capable of. So, both can be used to compare achieved and potential levels of participation. Those can then be mirrored to general statements in our interactive approach to identify a possible gap between expectations of planners and the public on green infrastructure planning.

The most important general result of our empirical approach is that stakeholders in all case studies share the desire to be an active part of green infrastructure planning projects from the very early stages on. So, they do not only want to be asked on design alternatives, they already want to discuss on the development of ideas and on conceptualising projects. In addition, the majority of stakeholders stated that they want to be involved in planning projects to a higher degree than they are involved at the moment. More specifically, they want to be integrated in decision making by collaborating, co-deciding and being empowered.

Looking at Table 1, these general results are supported by the considerable gaps between achieved and potential degrees of participation. In this aspect the concept of planning families is very important, because it underpins and helps to explain differences between case studies with diverging planning cultural backgrounds.

At first, looking at the results for the British case studies in Manchester and Sheffield, some issues can be raised. Referring to the range of methods used, there is a mixture of rather traditional with contemporary measures of participation. For all participatory approaches, the degree of participation is at least one level lower than its potential. This kind of planning approach is in line with the characterisation of the British planning family. Due to the current political requirements of local neighbourhood action, more interactive and project-focused methods need to be implemented, while city administration seems to stick to well-known and approved measures.

Planning Family	Country	City	Project description	Methods	Level of involvement				
					Information	Consultation	Collaboration	Co-decision	Empowerment
British	United Kingdom	Manchester AND Sheffield	Urban food growing as meanwhile use of brownfields AND Neighbourhood Park renewal	Presentation					
				Social Media					
				Opinion Survey					
				Site Visit					
				Meetings					
				Round Table					
				Focus Group Interviews					
				Workshop					
				Workshop (local fun day)					
Napoleonic	Netherlands	Amersfoort	Park enhancement through conversion of a hospital site	Social Media					
				Open Space Method					
				Meetings					
				World Café Workshop					
Napoleonic	Belgium	Bruges AND Liège	Creation of a green corridor along a large scale infrastructure development AND Conversion of a former military area to a new green space	Meeting					
				Interactive Website					
				Round Tables					
				Social Media					
				Opinion Surveys					
				Site Visits / Exploratory Walks					
				Charrette					
				'Talking with friends' Workshop					
				Experts-Workshop					
Germanic	Germany	Stuttgart	Regional route of industrial and cultural landscape heritage	Reports (Press Campaign)					
				Social Media					
				Meetings					
				Symposia					
				Site Visits					
				Workshops					
				Round Tables					
				Performative Participation					
				Legend:	possible level of participation in general (Source: Luyet, 2012, p. 215)	methods as used in case studies			

Table 1: Achieved and potential participation in case study regions. Own illustrations.

Results for the Napoleonic family differ quite significantly between each. The Dutch case study is a blueprint of a participatory approach, because it uses a mixture of methods that integrates almost all possible degrees of participation. Here, only minor gaps between achieved and potential degrees could be detected. While the case study in Flanders is quite similar to the Dutch in its way of enforcing active stakeholder participation, especially the Wallonia case reflects the Napoleonic family characteristics. There are many different methods used in this case study, but they are mostly used to inform the public rather than to integrate them equally in the decision making process. According to these results, the delineation of planning families needs perhaps to be changed. The Dutch speaking regions – in our case study approach – form a set of innovative regions that are open to intense stakeholder participation, while the French speaking regions are behaving more like top-down Napoleonic planning authorities.

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In the Germanic family, the results can be seen quite similar to the UK. Here, there are still remaining gaps between the potential and achieved degrees of participation, but planning authorities seem to be used to exploit stakeholders' opinions in a collaborative way.

5 CONCLUSION

This paper examines the differences in participatory approaches between Northwest European countries. It does this by analysing survey and interview results and relating those to the planning-cultural background of the case study nations. In essence, the need for a more open and participatory approach is well recognised by planners and stakeholders. Nevertheless, there is a need to integrate the public to a higher degree in the planning phases. Also, people want to be included in decision making from the beginning of projects rather than at their end. In the sample countries seems to be a tendendy to implement more open participatory measures, but this is not done with the same rigourness in each planning family context.

While the Dutch speaking case studies seem to be very keen to integrate stakeholders innovatively in decision making, German and UK cases are relatively more reluctant to change their traditional approaches. This is even more true for the French speaking regions, that begin to open up for higher degrees of participation, but mostly stop at the levels of information or consultation.

Comparing this tendencies with the planning family backgrounds, those results can be expected for the Germanic and UK families. Based on long traditions, laws and cases, approaches to planning do not open up and change very quickly. Interestingly, in the Napoleonic countries, especially the Dutch speaking regions seem to have a leading role in opening up top-down planning for more bottom-up, participation-lead approaches.

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Sustainable Mobility as Essential Ingredient for Vibrant Cities: 3 Cases in Point

Pierre Laconte

(Pierre Laconte, President Foundation for the Urban Environment, Hon. Sec. Gen. International Association for Public Transport – UITP)

1 ZÜRICH

Achieving smart urban mobility: the case of Zürich 1985-

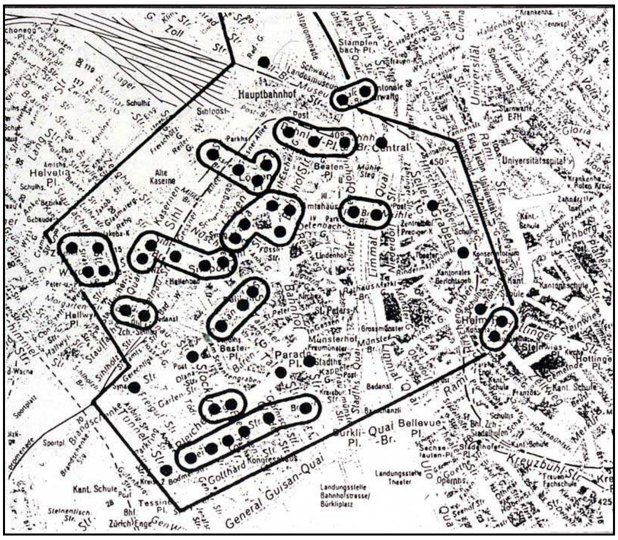
1.1 Zurich's traffic management

In Zurich, trams and buses enjoy absolute priority on-street. When approaching a traffic light the sensor (seen on the lower left) ensures they have a green light at any time of the day. The reliability of timetables makes public transport the city's fastest mode of transport. Modal split is around 80% in favour of public transport. Taxis are not allowed to use public transport lanes.

Ill. 1. Trams and buses enjoy priority at any time.

Zurich's traffic management includes traffic calming.

Traffic calming is ensured by adapting the traffic light system (a much shorter cycle favours pedestrians, cyclists and public transport).



Ill. 2. As the cycle of traffic lights has been shortened they are no longer synchronised, thus no "green waves" of more than a couple of traffic lights.

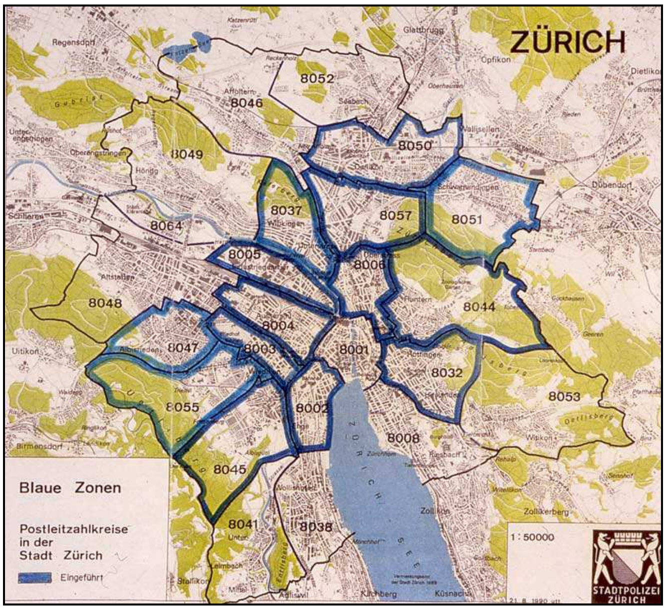
1.2 Zurich's parking management.

The highest political ingenuity, however, lies in a parking policy favouring local voters.

Only Zurich-registered residents (the voters) benefit from unrestricted on-street parking in their district (see map), while drivers entering the city from other districts or from other municipalities have a maximum of 90 minutes' free parking time (blue zone).

This measure triggered a large movement of inhabitants back to the city, benefited the public car parks and has been politically very rewarding for the city fathers, while suburban rail travel has been improved.

This system could be applied in any city where commuters come from other electoral districts.



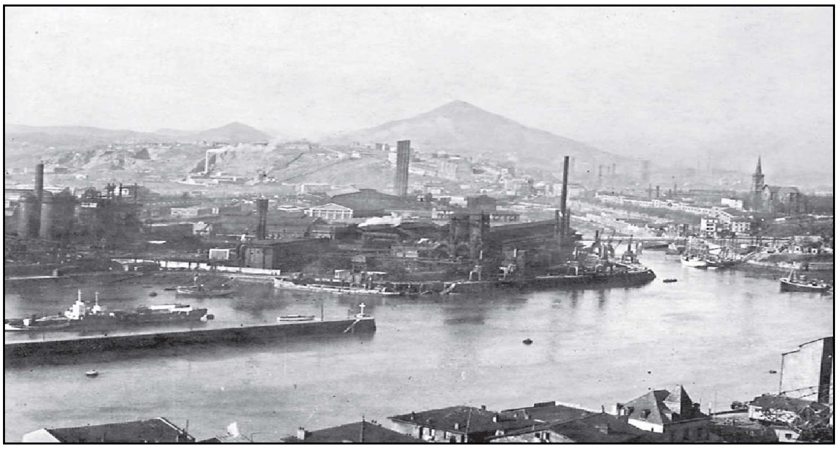
Ill. 3. Zurich: map of districts. Residents enjoy unlimited parking only within their own district.

2 BILBAO

Urban regeneration through public-public partnerships: the case of Bilbao 1989-2012

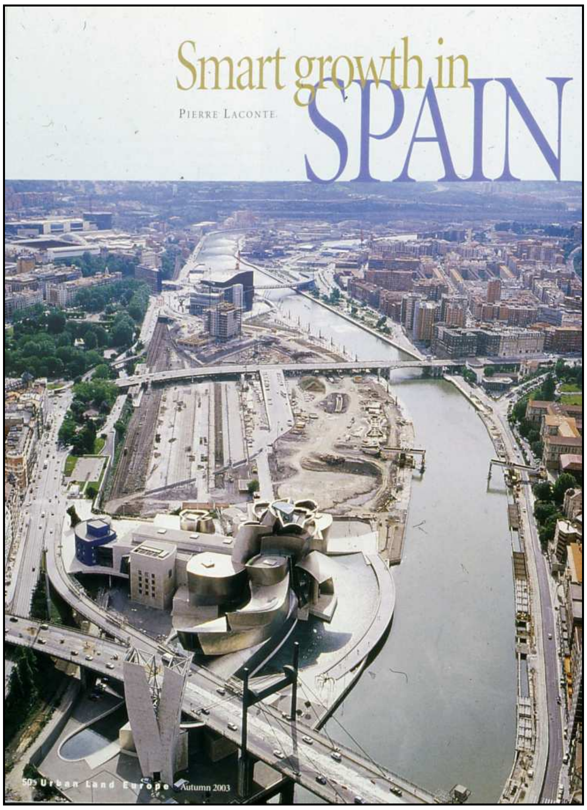
2.1 Bilbao's reconversion.

The steel industry, which had prospered for many years, was wiped out by the 1989 economic crisis. Industrial land was re-used for new activities, based on services and culture, while preserving architectural heritage.



Ill. 4. View of Bilbao's industrial area along the Ría.

The regeneration programme for the derelict industrial area along the Ría, owned by several public bodies, from local to national, was unified by a public-public partnership embodied in a common public redevelopment corporation - Ría 2000. The two anchors for new development, at each end of the site, were the new Guggenheim museum and the congress and concert centre.



Ill. 5. View of the industrial area, after clearance (Source: Laconte 2003)

The regeneration was achieved by selling the land available between the two anchors for offices, housing and commerce.

The huge financial surplus was used exclusively to enhance connectivity and further urban regeneration.

The master plan's implementation was completed in 2011.

Ill. 6. The regeneration programme was finalised in 2011 (office tower by Arch. Cesar Pelli).

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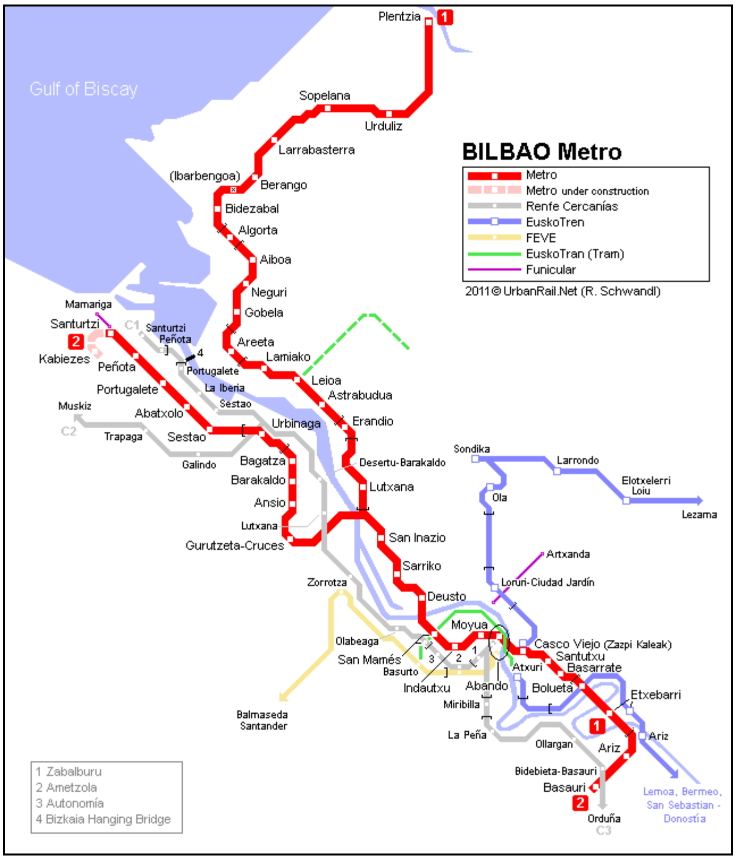
Ill. 7. Thanks partly to the surplus achieved from the sale of the former industrial area a new tramline was built along the Ría.

2.2 Bilbao Transport

A new tram line serves the canal side in the urban centre, reducing traffic and parking space and adding to the citizens' quality of life.

The metro runs partly on a new alignment (with stations designed by Norman Foster) and partly on reused former regional railways, ensuring enhanced connectivity throughout the city and its region.



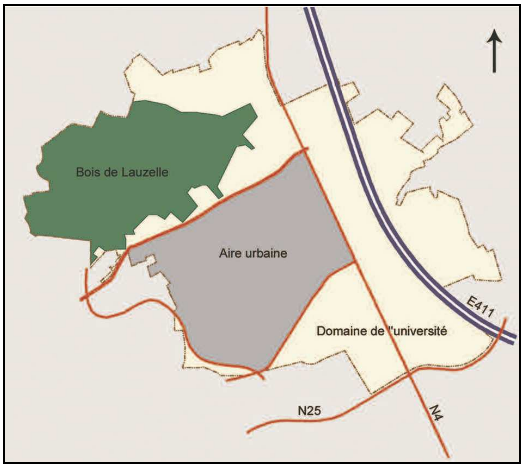
Ill. 8. The new Metro partly uses old regional lines.

3 LOUVAIN-LA-NEUVE

Sustainable mobility in the new university town of Louvain-la-Neuve (Brussels) 1972-

The university town of Louvain is one of the oldest in Europe. Obliged to leave Louvain because of language legislation, the University decided to develop a new town on the model of the old university towns. For this purpose it bought 920 ha of agricultural and forest land in a rural area close to the Brussels-Namur road (N4). (Laconte 2009)

The central part was set aside for urban development; forest land in the north was preserved. The overall master plan and architectural coordination of the new university town was entrusted to the Groupe Urbanisme-Architecture (R. Lemaire, J.-P. Blondel and P. Laconte). Political uncertainty dictated a stop-and-go approach.



Ill. 9. The map shows the land acquired by the university in 1969, the part to be urbanised in grey and the part reserved as forest in green. The E411 motorway had not yet been built at that time.

The first phase (1972), close to the existing road, was built around the Science Library, an iconic building seen as the cathedral of a university town, with its plaza (parvis), its university buildings, its housing for both students and non-students, and its shops and restaurants (architect A. Jacqmain).

Ill. 10. View of the initial phase (1972). All streets are pedestrian, with access and parking underneath.

From 1976 the new underground railway station – built thanks to the foresight of the national railway company, became the centre of the development, including an adjacent shopping mall. The tracks are to be covered by the shopping centre extension.

This rail link ensured maximal regional connectivity.

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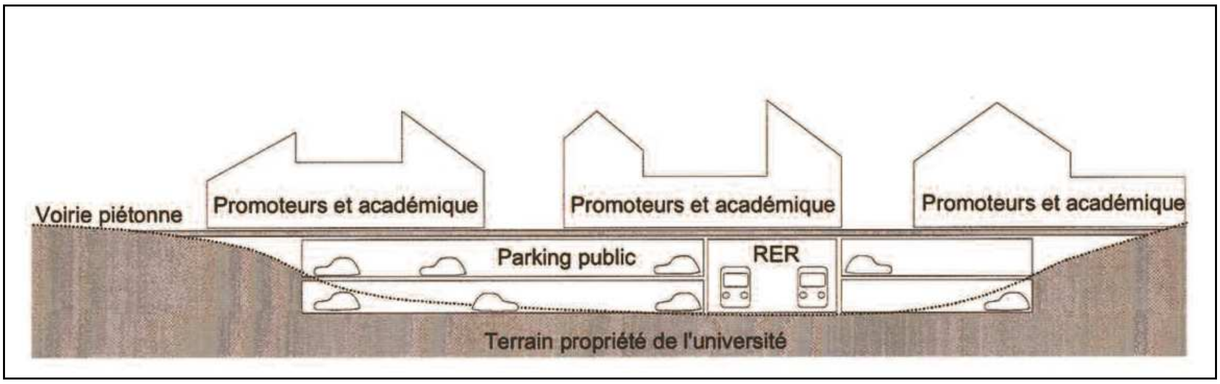
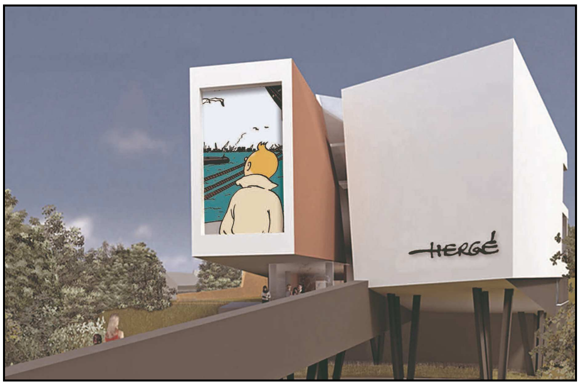
Ill. 11. a) View of the station seen from the tracks. Tracks are presently in open air but will be covered by the shopping mall extension. b) View of the street entrance to the railway station. All streets are pedestrianised and combine university buildings, housing, retail and cultural services. Land remains the property of the University and is leased to investors. All motorised transport is located underground or in the periphery.



Ill. 12. The functioning of the slab. The diagram shows how the ground below – essential for long-term connectivity - remains the property of the university while the infrastructure and buildings are leased (for up to 99 years) to public and private investors.

Ill. 13. View of one the numerous small piazzas on the pedestrian street network. The trees are growing on the slab. Cars are parked underneath.

Ill. 14. (To be added) Louvain-la-Neuve university town: all storm water is led to a reservoir which appears to be a lake, which saves infrastructure costs and attracts housing investment.



Ill. 16. The Hergé Museum, close to the railway station (Arch Atelier de Portzamparc, Paris)

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The Importance of Participation in Regeneration of Peripheral Urban Spaces: the Experience of "Serpentone Reload"

Federico Amato, Sara Bellarosa, Giuseppe Biscaglia, Luca Catalano, Antonio Graziadei, Annalisa Metta, Beniamino Murgante, Maria Livia Olivetti, Pasquale Passannante, Annalisa Percoco, Gerardo Sassano, Francesco Scaringi

(Federico Amato,University of Basilicata, University of Basilicata, 10, viale dell'Ateneo Lucano, 85100, Potenza, Italy, beniamino.murgante@unibas.it)
(Sara Bellarosa, NUR Association, 6, Via Rocco Scotellaro, 85100, Potenza, Italy, sbellarosa@gmail.com)
(Giuseppe Biscaglia, Basilicata 1799 Association, 1, Piazza Crispi,85100, Potenza, Italy, gvbiscaglia@gmail.com)
(Luca Catalano, Osa Architettura e Paesaggio, 175, Via Cristoforo Colombo, 00174, Roma, Italylucacatalano@osaweb.it)
(Antonio Graziadei, Paesaggi Meridiani Association, 24, Via Pienza, 85100, Potenza, antonio@paesaggimeridiani.it)
(Annalisa Metta, Dipartimento di Architettura, University of Roma Tre, 10, Largo Giovanni Marzi, Roma, Italy, annalisa.metta@uniroma3.it)
(Beniamino Murgante, University of Basilicata, University of Basilicata, 10, viale dell'Ateneo Lucano, 85100, Potenza, Italy, beniamino.murgante@unibas.it)
(Maria Livia Olivetti, Dipartimento di Architettura, University of Roma Tre, 10, Largo Giovanni Marzi, Roma, Italy, marialivia.olivetti@uniroma3.it)
(Pasquale Passannante, NUR Association, 6, Via Rocco Scotellaro, 85100, Potenza, Italy, passannantep@yahoo.it)
(Annalisa Percoco, Municipality of Potenza, Piazza Matteotti, Potenza,Italy, annalisa.percoco@gmail.com)
(Francesco Scaringi, Basilicata 1799 Association, 1, Piazza Crispi,85100, Potenza, Italy, f.scaringi@me.com)
(Garardo Sassano, Paesaggi Meridiani Association, 24, Via Pienza, 85100, Potenza, gerardo@paesaggimeridiani.it)

1 ABSTRACT

Suburbs are often very contradictory places. Despite great part of urban population live there, these parts of cities are mostly considered as degradation places. The topic of suburbs regeneration is relevant today. Nevertheless, often expensive interventions implemented by local authorities fail to regenerate their public spaces, increasing the degradation condition.

This paper presents the experience of "Serpentone reload", a workshop based on participatory reactivation of abandoned or underused spaces and buildings in "Cocuzzo/Serpentone" neighbourhood in Potenza (Basilicata, Italy).

The workshop particularly focused on the reuse of the "Ship", an underground building with a park coverage completed in 2010 and designed by the firm Archea. The "Ship" has been forgotten and not used for long time, not only by the neighbourhood, but by the whole citizenship, because it has been perceived as an extraneous element and the result of an imposition from the top, definitely not the outcome of shared choices.

During the workshop, the "Ship" ("Nave" in Italian language) has become an art centre called N.Av.E. (New Expressive Adventures – Nuove Avventure Espressive in Italian), a place capable to host temporary events (expositions, lectures, theatre and dance performance, movies projection, etc.). Such a choice has allowed the neighbourhood and the city to take back that "object" so hated as ignored.

The experience is particularly significant, because it shows how low cost interventions, realized with citizens involvement and participation, could contribute to the regeneration of peripheral urban areas more than expensive and complex imposed interventions, which often do not take into account dwellers real needs and expectations.

2 NEW PLANNING PARADIGMS"LIGHTER, QUICKER, CHEAPER"

Small actions to achieve great changes: at glance it can seems a pun, but it contains the key of a new approach to the city.

Traditional approaches to planning define rules, parameters and indices, produce choices and great transformations, pursuing the ambitious research of permanent and definitive solutions, that most often do not take into account the changing nature and the extreme dynamism of the urban organism.

The scenarios imagined by urban plans in several cases are out-dated before being implemented, mainly because of the rapid changes of the initial conditions and the unpredictable and often innovative uses introduced in the meantime by the inhabitants.

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Consequently urban landscapes often are full of unfinished or abandoned "relics", unnecessary infrastructure, empty or underused, public spaces without meaning for the community, rural fragments trapped within the urban fabric only by chance, saved by buildings.

Massive urban transformations are almost always characterized by significant public investments in interventions, spreading over several years, high soil consumption, scarce involvement of local communities, production of unused urban spaces at the margins of great interventions (the so-called "urbanscrap"), devastation of fragile suburban and rural landscapes.

In many cases these "heavy" interventions do not provide significant and lasting improvements to inhabitants life quality.

An alternative way to these interventions, taking into account the poor produced results, is emerging, with increasing success and efficiency; a new approach to urban design based on the following three terms "Lighter, Quicker, Cheaper" (Bravo, Carmagnini, Matityahou, 2013).

This approach, based on the need to do less and better, using the few available economic resources in a more effective way, rethinks city starting from its built part.

The movement Everyday Urbanism (Chase, Crawford, Kaliski, 2008) considers fragility and potential of built city, often hidden, as a strength, in order to give space to "fragments of happy cities that continually take shape and vanish, hidden in the unhappy cities" (Calvino, 1996). Possible and current strategies are then based on reactivation and reuse of fragile and marginal places and abandoned or underutilized buildings, refusing to find permanent solutions. This logic is based on micro-temporary interventions, a sort of "urban acupuncture", or tactical urbanism (Lydon, Bartman, Garcia, Preston, Woudstra, 2012), producing sustainable benefits on the whole urban organism revitalizing parts of forgotten city, encouraging their re-appropriation by inhabitants.

Examples of successful experiences consist of temporary projects characterized by strong innovation and social creativity, related to the world of culture, associations, start-up projects of temporary strong innovation and social creativity, related to the world of culture and associations, start-up of small enterprises and handicrafts, etc.

The temporary reuse has the great advantage of maintaining the process open, ensuring adaptability of the project to urban dynamics changes and different needs and demands that might occur over time. Another important aspect that characterizes new scenarios of contemporary city is an active inhabitants involvement in transforming and managing the urban landscape.

There are a lot of examples of unstructured groups of citizens who undertake voluntary actions in taking care of portions of the city.

The success of such experiences is the evidence of efforts of local communities in improving the current city and in shaping the city of tomorrow.

From a planning point of view, errors made prove that the city must be thought by people who live in it and interventions must be the result of participatory processes, containing bottom-up instances, avoiding decisions imposed by few people. Shared decisions inevitably have greater strength and a better chance of success.

From the citizen point of view the achievement of participation spaces requires a great effort of responsibility and civic sense towards what is shared.

The road is imagining and building together, a city of space reuse, involvement and sharing, a community as a place for everyone as the result of a common effort.

3 THE EXPERIENCE OF SERPENTONE RELOAD

3.1 A ship in a mountain town

"Serpentone Reload” experience, started with a workshop held in September 2014, having the aim to study “Cocuzzo” neighbourhood in Potenza (Basilicata, Italy), is based on previously described principles.

In 1998 the Italian Ministry of Public Works published a call, with the aim of low quality suburbs regeneration. The main aim was to improve the quality of neighbourhoods with lack of environmental quality and services, paying particular attention to the recovery of buildings constructed in modern periods and energy efficiency improvements.

The Ministry selected and funded forty-six projects. The project submitted by Potenza Municipality, concerning the regeneration of two neighbourhoods, "Poggio Tre Galli" and " Cocuzzo", has been included within this funding.

The first neighbourhoods the typical example of a dormitory suburb. The second one is characterized by high complexity in terms of housing with strong social conflicts. In this neighbourhood, despite considerable accessibility problems and an enormous lack of public spaces, the hugest housing of the city is located. This building, entirely devoted to social housing, is five hundred meters long and forty meters tall and has a sinuous shape which generated the name "Serpentone", literally big snake. This huge building based on "Unitéd'habitation" principles became a symbol of urban decay in a suburban area of the city.

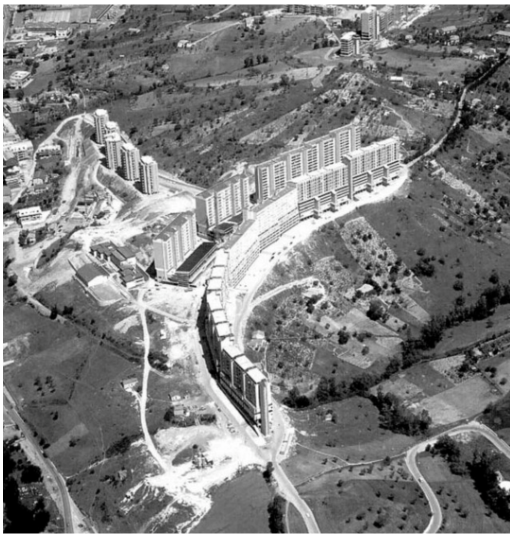

Fig. 1: The "Serpentone" shortly after its completion, when it was disconnected from the central part of Potenza; the subsequenturban development has included the neighbourhood in the urban part of the city.

The regeneration project, funded by the ministry in 1998,was based on the following elements:

- lowering of two floors of the building, realizing a multifunctional roof with a heating system;
- accessibility improvement;
- realization of underground parking;
- creation of a huge square.

In the adjacent area of Poggio Tre Galli neighbourhood the construction of new social housing, a parking area and a neighbourhood square was planned.

The whole project was funded for more than 10 million euro by the Ministry, 2 million euro by the local organization of Social Housing management (Azienda Territoriale per l'Edilizia Residenziale, ATER), 625,000 euro by Potenza Municipality and 4,8 million euro by private investors.

However once obtained funding, the project was radically changed.

Enric Miralles was commissioned to work on the design of a large public space in Cocuzzo neighbourhood. Unfortunately after few months a cancer was diagnosed to the architect, which caused his fast death. The project was then assigned to the architect Marco Casamonti. His idea of improving the urban space of Cocuzzo neighbourhood was based on the transformation of Via Tirreno, the only road of the neighbourhood, in a large park. The proposed project considered the strengthening of a road surrounding Serpentone and Serpentino, a building similar to the first with a smaller size and distant few meters from it.In this way the road that separates the two huge buildings could be destined to park.

The main idea was to transform Via Tirreno in a green corridor "animated by the presence of rocks" in the lower part of the neighbourhood and a "ship" with huge concrete sails ten meters tall in the upper part.

To date, the ship is the only part of the regeneration project realized. This impressive concrete object, since its creation, is at the centre of a strong controversy. Today the ship, made with significant public investments is basically not used.

The roof garden is totally abandoned, forgotten both by residents and municipality, which stopped all kind of maintenance. The huge "cargo", the space under the roof garden, was never completed.

The interior space looks like a construction site, making difficult to image specific uses for it.

The Municipality, despite the important amounts of resources invested in the construction of this huge space, usesit as a deposit. The impact of the ship on the quality of the urban space is bad.

The idea of the park, the metaphor of the ship and the rocks appear distant and elusive. This ship stranded between two large buildings, “Serpentone” and “Serpentino”, caused the occurrence of significant problems. Partially obstructing the only way crossing the neighbourhood, compromising accessibility because the interventions of the road annular network have been realized only partially. Furthermore, the impressive body of the concrete ship inhibits correct lighting to the first floors of “Serpentino”

Fig. 2: A view of the "ship" from the arcades of "Serpentone";the ship inhibits correct lighting to the first floors of “Serpentino”.

The ship, therefore, caused a decline in quality of life for residents, who, as a protest against the municipality administration, unable to collect needs and requirements, have continued their daily life in perfect indifference as if it never existed. It is not uncommon to meet inhabitants declaring proudly that they had never stepped on the roof garden of the Ship.

In this context the workshop “Serpentone Reload” has developed, on September 14-21 2014, with four main objectives: project and participation, strategies, communication, implementation.

Project and participation means designing, through the active involvement of citizens, interventions able to define and characterize areas of aggregation, socialization and interaction within Cocuzzo neighbourhood.

These interventions have always been realized through the actual technical skills of participants, taking into account availability of resources and time.

Strategy means working on identifying initiatives and events designed to encourage sharing of workshop space.

Communication refers to the identification and definition of the best strategies of networking intervention and initiatives related to it.

Realization finally implies how project interventions have to be realized in self-construction by citizens. In this way the sense of belonging to a community becomes stronger. All citizens feel involved in a small and voluntary urban transformation, transmitting enthusiasm and pleasure of taking care of a small and collective garden.

3.2 Story of a method of a territorial re-animation

Serpentone Reload was imagined as a workshop in which participants were at the same time actors of a path specifically created for them and interpreters of the reality submitted to them.It was not a traditional top down participatory process due to the lack of institutions, nor a result of a re-appropriation bottom-up process.

Serpentone Reload was an educational experience with the aim, more than working on space configuration, to suggest several new uses of abandoned or underutilized spaces. The awareness of places potentiality has been promoted, organizing meetings between citizens on one hand and practitioners, students and artists and the other hand.

"Territory is the use made of it"(Crosta, 2012); starting from this definition Cocuzzo neighbourhood could not be analysed or reinterpreted starting from spaces as architectural places, but from the use or non-use that the local community makes of it. Paying attention to everyday practices, the first part of the workshop attempted to define various neighbourhood identities, investigating recognizable practices in the neighbourhood and around it.

A first introduction of the place occurred through a series of urban ethnography tools, identified and tested by coordinators and then proposed to participants, in order to activate knowledge between participants and neighbourhood and to build tools for the analysis of the place and the possible needs expressed by citizens.

Cognitive walks in the neighbourhood have been conceived to explore a portion of everyday neighbourhood activities through clichés and citizens telling. Attention of participants and their objectives were aimed at identifying actions that consider existing daily practices.

Interviews with experts selected by coordinators on key issues concerning the neighbourhood, tried to investigate not only their personal visions, but have deepened the individual discourses as a synthesis of collective paths.

This sort of anthropological exercise, based on neighbourhood walks, informal meetings, experts interviews, observation forms of place life, has been the starting point of the working week.

Some key elements have been identified and submitted to participants attention: identity, clichés, conflicts, relationship with the ship.

Identity of Cocuzzo neighbourhood is characterized by a negative stigmatization diffuse in the whole city of Potenza, which inevitably is reflected in a negative self-perception by the neighbourhood.

The cliché related to this social representation describes Cocuzzo neighbourhood as a dangerous, degraded, peripheral and inhospitable place. The improvement of neighbourhood connection with the central part of the town changed completely the whole geography of the city.

But what are the "common places" of the neighbourhood in the true sense? Do they exist? Are they used as such or are they abandoned and empty? The ship is one of them, but not used, nor valorised; on the contrary, in the collective imagination of the whole city, is one of the best expressions of neighbourhood degradation. Another key element of the neighbourhood is conflict: social mixing realized in the neighbourhood (Serpentone and Serpentino, social housing, are clearly separate from the other buildings) produced a clear socioeconomic and spatial distinction. All the inhabitants are joined against the ship, which can reconstruct a social fracture catalysing a sort of hate against the intervention.

The negative assessment shared by everyone is not based on its use, but it is the result of a sort of political imposition of an expensive and not understood intervention.

This reaction of strong rejection made the ship invisible, and therefore unusable, for local residents. A form of passive resistance to decision-making approach imposed from the top that, obviously, did not take into account citizenship needs. This passive reaction accentuates the expropriation (or its perception) of public space, already occurred with the ship construction.

These are questions and issues resulting from analyses and surveys before the workshop.

Walking, observing, meet crossing the place were useful in creating a specific knowledge of the place, where each participant was able to compare their own knowledge of the place with the representation provided by neighbourhood inhabitants.

After a walk in the neighbourhood it was asked to each participant to immediately provide a question to motivate his activities within the workshop, immediately establishing what were priorities and interests of each participant. During the workshop they were asked to update this question according to the newly received information.

The methodology of this workshop was based on an analysis of needs defined with the objects of the research and on several measures of territorial re-animation based on local specific skills.

Outputs of the performed analyses were the basis of a common reflection developed in the second part of the workshop, mainly based on project and self-construction activities.

In the case of Serpentone, also temporary interventions, in the construction of small artefacts, that often characterize tactical urbanism approach, appeared to be incongruous and "out of scale". Geometric and symbolic-perceptive aspects have been considered. The first one compare small artefacts to the size of the ship and residential buildings, the second ones analyse in which context these interventions can be useful. In this case small artefacts are suitable only at proximity dimension, without having any impact on relations between the neighbourhood and other parts of the city.

It was therefore considered more useful to address workshop contribution towards forms of activation of ideas and proposals. A path of project-action-event has been activated, more incisive on awareness level than on space configuration and intentionally quite ephemeral.

Due to workshop shortness it would not be possible to build relationships with the residents, able to define a clear and comprehensive idea of shared expectations and projects.

The risk was to catapult in the neighbourhood one more unrequested "object" or "collection of objects", with a great probability to create the same rejection mechanisms that characterized the initial situation. Hence, the desire to work on "almost nothing" in physical terms and instead having a huge production in terms of imagination, open to new places interpretations which would generate persistent transformations in a slowest time. Two actions have been pursued: a concrete and immediate possibility of use the ship and its roof-garden, to build a new shared imagination. In the first case, a game mechanism has been adopted: the game of "It can". Engaging students attending neighbourhood schools, an attempt to reverse the prevailing attitude of complaint and dissatisfaction with the ship has been tried, in order to highlight all possible enjoyable things that it was possible to realize.

The result was a surprising, large and inventive list of opportunities, emerged at first with suspicion, gradually with a lively succession of proposals. Several opportunities have been immediately concretised, animating the park with games and meetings, which have demonstrated with simple and instantaneous concreteness, the possibility to live the ship and its garden, only apparently unfriendly. Others have produced micro-places, made by workshop participants with the inhabitants, realizing basic gardening activities (selective cuttings of tall grass, pruning of existing trees and removal of dead ones, planting a precious Liriodendrum tulipifera, arranging seasonal flowering plants) and setting up spaces for games (a sandy track for bowls, a mini football, volleyball and basketball fields). The strength of these operations, although so minute, was to evoke a spontaneous mark of names: the Solarium, the Playground, the Ascent, the Well, the Mirador, indicated by signposts on original drawing, immediately become meeting places.

Fig. 3 (left): Workshop participants guide students from school to the "ship". Fig. 4 (right): The Solarium, "space created during the workshop, attracts children and local residents.

The second action has been working in the direction of a gradual removal of the suffering neighbourhood stigma. The ship was the emblem of "internal" stigmatization, generated by the same inhabitants. It was necessary then to try to exorcise the negative connotation, using game and irony. The ship appeared stranded. It was necessary to put it into a harbour, able to speak about effervescence, flurry of activity, relationships, coming and going, voices, departures and returns, loves, adventures, explorations. The port was supposed to be the whole neighbourhood, which consequently was imagined such as a swarm of ships and boats, arriving and departing from somewhere.

Fig. 5: Few games built by workshop participants were enough to bring the neighbourhood children on the ship.

Hence the idea of using a simple object came: the paper boat, too familiar and almost universal. Miniaturizing the ship was a way to tame it, have it friend, make it harmless, through a game. Thus, the cargo became a laborious and joyful place for paper boats production. Around the tables of work, a heterogeneous community of workers has alternated: workshop participants, neighbourhood children and their families, representatives of associations and local authorities. The construction of the small paper boats became a ritual of the community: sitting around the tables, while their hands, more and more skilled, bent the paper, people talked about their stories, showing not only worries and discomforts, but also desires, concrete proposals, expertise to make available. During the workshop days, the cargo has hosted a permanent laboratory of small boats, stimulating, in the "distracted" repetitiveness actions, talks, secrets, stories and variegated forms of hospitality.

If you know how to make a paper boat it takes no more than a minute: with the workforce of participants, inhabitants, students, it has been possible to produce in a week ten thousand small boats with a really collective work.

Thousands of small boats have animated Serpentone "harbor": in rows, more or less ordered, or in groups (as grouped in the race) invaded the garden, braving the strong winds of a September Sunday.

The small boats covered parked cars; simulated flower gardens; marked paths, indicating interesting trajectories to follow in the meadow; sailed in the fountain, where finally the water returned.

A further issue has been added: the ship cargo, a generous space for quantities of certain beauty never used except as improper deposit. At the port inauguration, the ship opened its cargo space and showed its shipment: an instant-exhibition of videos reporting the neighbourhood, realized by workshop participants, and wonderful images by the photographer Salvatore Laurenzana.

Fig. 6 (left): In the cargo of the "ship" workshop participants, neighbourhood residents and members of municipality administration building paper boats. Fig. 7 (right): The small boats invade the roof garden of the "ship", defining paths that lead to the various activities undertaken.

The exhibition marked the opening of the art centre N.Av.E. - New Expressive Adventures (coordinated graphic image within the same workshop has been defined).

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4 RESULTS

4.1 "Shape is emptiness and precisely the emptiness is shape"

The challenge of "Serpentone Reload" was to involve neighbourhood residents and to reverse the negative sentiment expressed in general by the city against the ship, which had, not without reason, a national importance for the inconsistency of the project. Hence the idea of the project to build a multidisciplinary path starting a participation process to build active citizenship for continuing the garden maintenance and the spaces below. Between September and November residents have organized a school of gardening for garden maintenance, with weekly appointments of shared work. An annual calendar, on the model of an horticultural calendar, has been produced and distributed among inhabitants, where every month is accompanied by useful recommendations on the activities to be carried out in the garden.

Workshop activities also allowed to focus the attention of the whole town on Cocuzzo neighbourhood. At the same time, inhabitants realize all the potential that a structure such as the ship would have, as a sort of point of interest for the neighbourhood and for the city.

Here, Sariputra, form is emptiness and emptiness is precisely form (Heart Sutra). This Buddhist quote is a good metaphor for the image of the implementation idea. For Buddhism vacuum means the absence of itself, not only from a spatial point of view, but also from a time point of view: this implies that each element and phenomenon of the internal or external reality, is not only interconnected with the other, but it is also provisional and interconnected with the provisional nature of the other elements and phenomena. It determines a structure that is relative, relational and, at the same time, transitory, impermanent.

In that "empty" context the idea of a space that should not have to tend to a fixity structure, but maintains its performative fluidity was experimented.

Continuing the Buddhist metaphor, the empty "quarry", was intended as figures background that show their contours only through the reciprocal action between them, interaction guaranteed and made possible by the same background. The potential of that "empty" space has been used not only during the workshop, but also as a result, some activities of the City Festival of Hundred Stairs, which deals with dance and performative arts, were made in N.Av.E..

Fig. 8: The ship cargo has become the stage for performances of "City Festival of Hundred Stairs".

The real meaning of this activity was to show some of the potential of N.Av.E and what could be the future: a performative place able to take many forms in relation to the dynamics of participation achieved. Several meetings and seminars have been held to compare this experience to important similar experiences in Italy and Europe. In order to continue the place narration, it was thought the creation of short-time workshops about cinematographic writing to collect the experience of stories made by inhabitants of Serpentone and transpose them into a movies script. A public discussion has been opened and several social or cultural associations, theatrical or musical groups, requested to help to navigate N.Av.E as a privileged place of their activities serving the neighbourhood and the city.

5 CONCLUSION

Serpentone Reload laboratory was an innovative experience made available to different involved actors:

- to decision-makers, because it offered the opportunity to experiment inclusive policy processes and has demonstrated the power of regeneration of minute actions, in short times with few resources;
- to participants, young designers that have directly verified the possibilities to build a project that actually has not built any artefact, nothing tangible, measurable and quantifiable, understanding that this way is not a waiver of the project, but on the contrary it is an intentional amplification;
- to inhabitants, who accepted to question their refusing positions and to trust in themselves and their landscapes.

Many projects of public space share the tension to affirm opportunities and destinies in a very wide repertoire of co-creation.

In the same way Serpentone Reload, calls the project to reflect on their responsibilities and their own instruments with a reflection, factual and active, on public participation, often devalued.

Participation is devalued when it is confused with the consensus. When decision makers and designers abdicate their duty of projection of the future assuming roles of mediators that collect and nourish the wish list of their voters or customers. Experiences such as Serpentone Reload show that participating means sharing skills and points of view, finding solutions that are not accomplished but that continually become, taking place through time, modelling itself on the living body of the city.

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Urban Emotions – Tools of Integrating People's Perception into Urban Planning

Peter Zeile, Bernd Resch, Linda Dörrzapf, Jan-Philipp Exner, Günter Sagl, Anja Summa, Martin Sudmanns

(Dr.-Ing. Peter Zeile, TU Kaiserslautern, CPE, zeile@rhrk.uni-kl.de)
(Dr. Bernd Resch, Z_GIS Salzburg, bernd.resch@sbg.ac.at)
(Dipl.-Ing. Linda Dörrzapf, TU Kaiserslautern, CPE, Linda.doerrzapf@googlemail.com)
(Dr.-Ing. M.Sc. Jan-Philipp Exner, TU Kaiserslautern, CPE, zeile@rhrk.uni-kl.de)
(Dr. Günther Sagl, Z_GIS Salzburg, guenther.sagl@sbg.ac.at)
(Anja Summa, Universität Heidelberg, Computerlinguistik, summa@cl.uni-heidelberg.de)
(Martin Sudmanns, Paris Lodron Universität Salzburg, martin.sudmanns@stud.sbg.ac.at)

1 ABSTRACT

This paper introduces the research field "Urban Emotions" – an interdisciplinary approach combining not only spatial planning and (geo-) informatics, but also computer linguistics and sensor technology methods. A new set of methods will be formed for the area of urban and spatial planning, resulting in a fundamental change of the understanding of planning. One of the main objectives is the involvement of citizens into planning processes. Therefore, new techniques are developed to collect and analyse data on the emotional perception of space and provide it to the people and also planners. Not only the human perception in the context of the city, and the combination with human sensory processes are contents of this paper, but also the critical discussion of these effects to privacy issues. Based on the topics "mental maps" and psychogeography in combination with the field of digital emotional urban tagging, the potential of integrating objectively quantified emotions in the context of citizen participation will be explained. In the following, partly established and partly experimental methods for collecting and analysing "Urban Emotions" will be introduced. Based on two studies, the possibilities of transfering these methodsinto the planning praxis will be shown on the one hand and on the other hand the potential for further development for other disciplines will be more evident.

2 INTRODUCTION

Spatial Planing is a cross-section discipline that considers all spatial and social structures within in a city. In an ideal case, a good planning process weighs all public and private issues to minimize conflicts and to get a good planning result. Jane Jacobs, one of the pioneers of a bottom-up and people centric planning approach, concluded: „Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody" (Jacobs 1961, p. 238). The question is: How is it possible to integrate all of these issues into the planning process? Also how can citizens' perception of urban space be measured and how can new technological approaches help in this way?

The Urban Emotions approach figures out the use of new biostatistical and sensoring technology to develop a new method set, that creates a new point of view to the "city as a body" and can be used in in urban planning processes. A new understanding of planning, influenced by network society (Castells 1996; Benkler 2006) is described in the academic discourse (Streich 2012a), in which bottom-up participation processes with a proactive embedding of citizens is the core element. Also smart city concepts could be taken into consideration in these new planning approaches. The change from "digital cities" to "intelligent cities" was easy to follow, even the potential for spatial and urban planning. The possibility to collect geodata in near realtime and to generate information about spatial processes open up new possibilities in analysing cities. „Realtime cities" combine the physical world with virtual space over sensor networks and sensor technology. Forerunner in this scientific apporach is the SENSEable City Lab from Massachusetts Institute of Technology (MIT). They shaped the term „real-time-city" by creating dynamic visualisations, in which they presented the (body of) the city as a pulsing unit or organism. Projects like Real-Time Rome (Calabrese et al. 2010), LIVE-Singapore! (Kloeckl et al. 2011) and the Copenhagen Wheel (Outram, Ratti and Bidermann 2010) used ubiquitous senor technology (f.e. in Smartphones or over collected cellullar networ data sets) for a better understanding of humans interaction and mobility in cities. These spatial, temporal and spatial-temporal patterns help in research activities in identifiying urban processes and to characterize special social-cultural movements and developments. In all these cases, it is important to mention, that only citiziens can make a city really "intelligent" (Batty et al. 2012). This interaction between citizens and urban spaces in a digital society is worth to discover. „Urban Emotions aims to address this shortcoming by providing a human-centred approach for extracting contextual emotion information from technical sensor data

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(measurements from calibrated bio-sensors) and human sensor data (subjective observations by citizens)“ (Resch et al. 2015b, p. 200). The results should be used as a new kind of decision support system and can create a new perspective to ongoing planning processes (Zeile et al. 2014). „Like this, the realization of a Smart City is not only to be tackled from a technological viewpoint (as most previous research efforts did), but from a human-centred viewpoint that claims that a city requires “Smart Citizens” to be intelligent itself“ (Resch et al. 2015b, p. 200).

3 STATE OF RESEARCH

The aspect of emotions in planning is a rather new approach even if planners and thinkers of 20th century had it always considered only using different wording. However, it was more closly linked with perception in planning, mental maps, psychogeography or even anthropocentric planning views. The mental maps studies, basically known from Kevin Lynch and the research of “The image of the City” analyse the „quality in a physical object which gives it a high probability of evoking a strong image in a given observer” (Lynch, 1960, S. 9). Lynch moves the observer in to the center of reflection and that gives his studies an anthropological perspective on the city. So Lynch sees the people moving in the city space to be as important as the structural and physical elements. „We are not simply observers of this spectacle, but are ourselves a part of it, on the stage with the other participants. […] Nearly every sense is in operation, and the image is the composite of them all“ (Lynch, 1960, S. 2). The research on the city had a very visual perspective and did not consider – or sometimes only as side issue- other sensual aspects. Closly related to the mental maps is the psychogeography which came up during an urban transformation process in Paris in the 50s. In addition to lots of political groups which fought against the urban plans and the capitalism in this time (Castells 1975/2012 p 45ff.), the group of "Situationist International” was established, which had largely influenced the concept of psychogeography. Hart defines it as „a slightly stuffy term that's been applied to a whole toy box full of playful, inventive strategies for exploring cities. Psychogeography includes just about anything that takes pedestrians off their predictable paths and jolts them into a new awareness of the urban landscape” (Hart, 2004). The ideas of mental maps and methods of the Situationists have influenced a lot of research studies in the present time, using modern, innovative tools (mobile devices, Social Media, etc.) to explore the city space, e.g. the “Blake Walk” in London (Whitson & Whittaker, 2013, S. 2-3) or „Forschungsreisen International” in Vienna (dérive-Zeitschrift für Stadtforschung, 2015).

Topics like sensor-driven data gathering and human sensory assessment are, from a planning point of view, closely linked with spatial monitoring approaches. A distinction is made between inductive and deductive monitoring. Deductive monitoring is described as the observation of phenomena over a time span, integrated in a Geoweb-supported planning processes and organized by planning institutions who are interested in the gathered topic (Streich 2011, p. 235). “Opportunistic Sensing“ (Andrew T. Campbell et al. 2006; Lane et al. 2008) is an example for deductive monitoring: Data from the direct spatial environment of the users is collected, analyzed and divided again instantly on the Internet. Sensor technology is “in situ” (Wetter 2009). Also, participatory sensing concept (Burke et al. 2006) describes a type of deductive, user centric, monitoring. It is based on the "crowdsourcing" phenomenon (Howe 2006; McConnon 2006; O’Reilly 2007), a predecessor of Goodchild’s concept of "Citizens as Sensors" (Goodchild 2007) and his "Volunteered Geographic Information" (VGI). With these types of sensor networks, both, citizens and experts can share information and local knowledge about (spatial) phenomena.

The repertoire of methods for urban planning is significantly enriched by the use of such "sensor" technology; traditional deductive planning approaches are enriched by inductive ones, which are an expression of crowdsourcing processes in bottom-up planning mode (Streich 2014). “Most important, however, humans themselves have turned out to be excellent sensors. Many provide information without any extra effort, just by carrying around a mobile phone" (Siegele 2010, p. 6). Further, "they provide local information and site-based knowledge available [...] and users are thus equally to consumers and producers of information" (Roche et al. 2012). Traditional, deductive planning approaches are enriched by inductive and bottom methods, supported with sensor technology (Streich 2012b). A similar approach, close to Goodchild’s “citizens as a sensor” is the “people as sensor” definition (Resch 2013). People as sensor represents a model in which not only electronic devices produce data sets, but people generate subjective measurements by recording their subjective, individual perceiption or observation. These “human sensors” can supplement or sometimes replace expensive and specalized sensor technology and sensor networks.

"This revolution in tracking human and other motion in digital form enables the collection of multiple attributes at the finest of scales of urban observation (…). This extends well beyond geography, however, to the collection of much non-geographic information which is nevertheless tagged to place and hence understandable in both spatial and temporal terms" (Batty 2010, p. 575). Some academic and economic projects are for example Nokia's "Wearable Eco-Sensor" concept (The Future of Things 2007), "On Line Disaster Response Community" (Laituri and Kodrich 2008), or "Lift Lab" (Girardin et al. 2008).

Affective perception of people's environment in combination with crowsourcing approaches was investigated by Klettner (2013). Though, in this approach, there is no realtime sensor technology. Realtime visualisations of geo-social networks or social media like Flickr, Twitter, Foursquare, Facebook, etc. was made by Neuhaus (Neuhaus 2011). A systematical evaluation of spatial or planning relevant issues was not realised. The use of psycho-physiological measurements in urban space, for instance, to map emotions was made by Zeile et al. (2009), or with the help of smartphone data and social media data to get collective human behaviour patterns by Sagl et al. (2012). „These new data and information layers can provide additional insights into the development of both the physical and social structures of inherently complex and dynamic urban environments" (Resch et al. 2015b, p. 200). In research fields of security, aspects of perception of urban spaces and subjectiv felt security is getting more and more important. Salesses et al. (2013) examine, how the perception of safety of test persons changes during watching randomised Google Street View image pairs. The ratings were aggregated in a city map and compared with criminal statistics. The result was a large-scale image of perceived safety into four cities (Boston, NYC, Linz, Salzburg). The methods based on a subjective rating of a statistical situation and the test persons were not in situ. There was no embedding of people, the situative urban context was also not considered.

Despite of all advantages to embed actively "human sensors" into planning processes, privacy issues in combination with spatial planning are very important. There were only general statements concerning privacy, f.e. by Roßnagel (2007) and Gaycken (2013). How the planning discipline should handle these problems is still only posed as a question (Streich 2011, p. 147).

4 METHODOLOGY

Urban Emotions is providing a human-centred approach to extract contextual emotion information from technical sensor data (measurements from calibrated bio-sensors) and human sensor data (subjective observations by citizens). The results can be used in urban planning for decision support and the evaluation of ongoing planning processes (Zeile et al. 2014). It is a human-centred viewpoint based on the insight, that Smart Cities need "Smart Citizens", and technology should only support them.

Figure 1 illustrates the Urban Emotions approach, combining four steps: 1) detecting emotions using wearables, 2) "ground-truthing" these measurements using a smartphone-based the People as Sensors Smartphone App in near real time, 3) extracting emotion information from crowdsourced data like Twitter (detecting the type of emotion), and 4) correlating the measured and extracted emotions. The mapped information can then be used in urban planning processes (Resch et al. 2015b).

The Urban Emotions concept is of a trans-disciplinary nature. It consolidates the know-how and perspectives of at least five additional scientific disciplines, namely GIScience, computational linguistics, sociology psychology and computer science. The result is a tool with a direct feedback of citizens in ongoing planning and design processes, and represents a new form of a decision support system.

5 MODES OF MEASURING PERCEPTIONS AND EMOTIONS

5.1 Tagging

Tagging is an easy way to get information from users concerning urban phenoma of a city. An evaluated approach is the RADAR Sensing concept (Zeile, Memmel and Exner 2012). Based on the RADAR Infrastructure (Resource Annotation and Delivery for Mobile Augmented Reality Services), the user can contribute and manage arbitrary types of geocontents. With RADAR, it is possible to process very simple representations of geocontents and to use complex and multidimensional objects. One result of this open and flexible structure is the RADAR SENSING App. A detailed description of the system architecture and system features is available online (Memmel 2015), the use in urban planning is described by Zeile et al. (2012). The RADAR SENSING app was developed for AndroidOS and JSON allows efficient processing of information to exchange arbitrary data types. The users only have to register using the RADAR-SENSING Web frontend and install the RADAR SENSING app. There , they can rate positive and negative votes by using predefined categories. If there is one category missing, a free one is also possible. After the vote, the app detects the user's position using multiple sensors (preferably GPS) and displays the position on a map. If the sensor did not locate a precise position, the user can still do a manual correction of the position. By switching back to the RADAR Web Interface, a nearly realtime visualisation of the tagged point is possible. It is free to chose between a presentation of all points or a density map of the tagged attributes (Zeile, Memmel and Exner 2012).

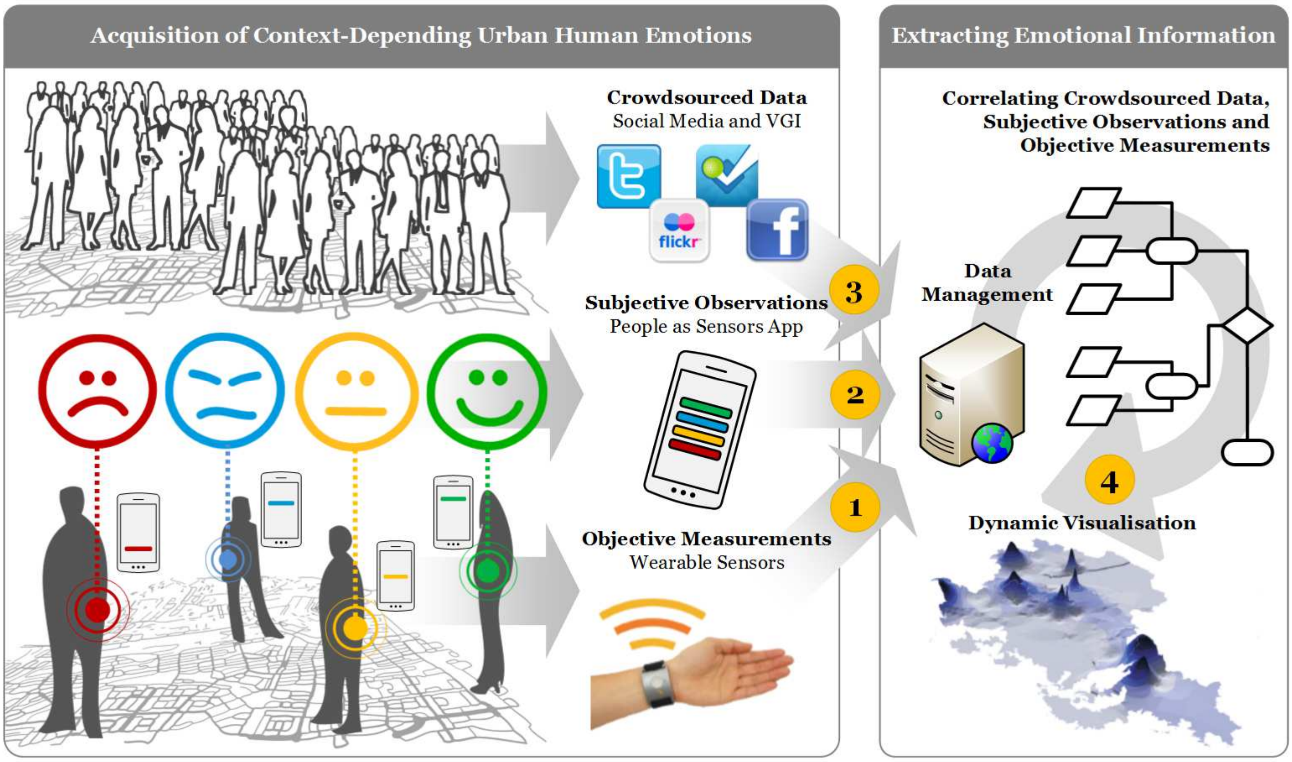

Figure 1: Urban Emotions concept: 1) emotion sensing, 2) ground-truthing using People as Sensors, 3) extraction of emotion information from VGI, 4) correlating measured and extracted emotions; plus visualisation and enrichment of urban planning processes (Resch et al. 2015b)

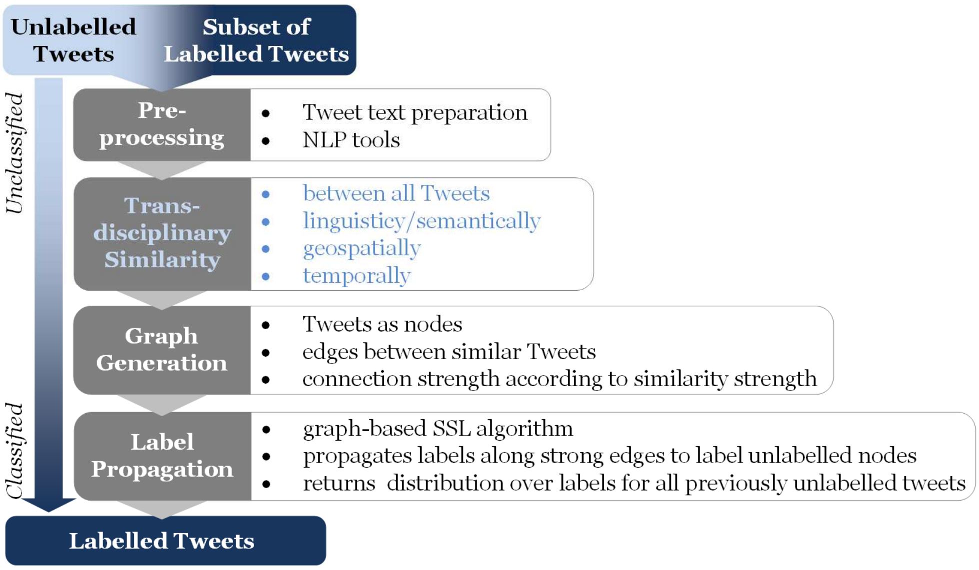

Figure 2: Label propagation algorithms for unlabelled tweets to identify classified emotions in tweets (Resch et al. 2015b)

5.2 Extracting Social Media

The basic concept of extracting emotions from VGI was introduced by Resch, Summa et al. (2015b). The extraction of emotion information from user-generated information, such as Twitter, Flickr or Facebook posts is a promising research direction. In particular, the development of interdisciplinary methods as a link between Geoinformatics and Computational Linguistics is the main focus. Figure 3 shows a recently developed method to assign emotion categories automatically from Twitter Tweets (Resch et al. 2015b).

In Figure 2, a method is presented using a label propagation algorithm to identify emotions in tweets and classify these into appropriate categories. An integrated algorithm was created using methods of geoinformatics and computational linguistics. This integrated approach based on the concepts of distances, clusters and similarities exist in both domains and can be combined natively in a graph-based algorithm.

5.3 Groundtruthing – People as sensors app

The Operation mode of the groundtruthing app is explained in detail by Resch, Sudmanns et al (Resch et al. 2015a): Similar to the tagging approach, users have the possibility to submit their personal impression of a situation. The new aspect in this app is, that also physiological sensor data can be gathered and combined after submitting them via Sensor Observation Service (SOS) to a central server. Because of the modular architecture of the app, it is possible to use it as standalone, "only impression submitting" mode, or to link new technical (environmental) sensors. If the user wants to be instantly informed about the measurements, the collected datasets have to preprocessed, harmonised and checked continuously. At the same time, the biostatistical data have to be set in relation to the collected subjective feelings, to get qualitativ information about the sensor detected arousal or perceiption of the test person. With the combination of theses datasets, the "type of emotion" can better be classified, the trigger of an emotion can be idenitified (better) and even the intensity of emotion can be analysed (Resch et al. 2015a, pp. pending).

Simply summarized, the workflow of the app follows these five steps:

(1) Notification (time based, location based, trigger based) to give a rating of the personal perception or emotion

(2) Statement of Emotion, detecting the potential spatial context and rating the intensity of emotion

(3) Automatical tagging of place and time

(4) Transmission to the server

(5) Visualisation (in near real time) to get a visual feedback

The app works like a link between digital, automatical physiological sensor data and the personal rating of the situation.

5.4 Biostatistical Data

Like mentioned in the above section, gathering of bio-sensor data is / could be the core element of urban emotions. This is called psychophysiological monitoring, and measures the arousal of a person over the change in body reactions (body physiology). A variety of assesment methods for measuring emotions is available (Schumacher 2014). Identifying "emotional stimuli" with a picture database , the so called IAPS (International Affective Picture System), in which a collection of pictures shows different human experiences and the users can rate them with the attributes 'positive', 'negative' or 'neutral' (Bradley and Lang 2007). The 'startle reflex', a peripheral physiological parameter is another measurement method. The idea is, that negative stimuli can be detected by a reflex of the neck or the eye (eyeblink). This reaction can be measured by two electrodes, placed under the eye. This setup can measure minimal muscle tensions which are an indicator of negative stimuli (Geyer and Swerdlow 2001). Like the IAPS, the startle is not suitable for the use in "real world", outside a laboratory. Therefore, only the following psychophysiological methods are proposed at the moment: Measuring a combination of body temperature and skin conductance (Stern, Ray and Quigley 2001; Boucsein 2012) or using the additional heart rate (Fahrenberg and Myrtek 2001; Schächinger 2003; Myrtek, Aschenbrenner and Brügner 2005). A lack of these methods is (still) that only negative emotions can clearly be identified as "stress". „According to emotion researchers, when a negative experience occurs, the skin conductivity increases and the measured skin temperature decreases" A well-known example in extreme mental stress situations is known as 'cold sweat' (Bergner and Zeile 2012).

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6 CRITICAL ASPECTS ON DATA COLLECTION

Dealing with such sensitive data is a huge challenge for the research. The user is permanently in a kind of conflict between participative motivation and concern for privacy. The postulated freedom in the network is equally exposed by commercial companies who use the data for their own purposes (Caesar, 2012). This dilemma can also be found in the use of Internet, Smartphone and related devices where "lack of clarity, commercialization and information overload have to continiously and critically observed. Nevertheless, it can be stated that the benefits of using social media in terms of legitimacy, transparency and democratization through citizen participation outweigh "(Caesar, 2012 p 84).

In an empirical study on the use of sensing applications and active involvement in research of mobile users, conducted by Ludwig and Scholl, it was outlined that the fear of the user that data is accessed by other users or even companies is a huge barrier. Thus, it is necessary to use „appropriate communication tools to inform about the intention of required access. Otherwise, the danger is that users do not begin or end participation "(Ludwig & Scholl, 2014: 148). The Chaos Computer Club called the Smartphone one " a location bugging device". What Smartphone data can show and especially tell about us and our behaviour, has been demonstated already by several research studies. It is obvisous that the user becomes more and more sceptical – and this "only" considering location data. As a mobile user, he probably produces the most sensitive data that may be collected in real time. Adding other parameters such as private messages or biostatistical data, even more data protection is requiered.

The concerns about data protection and privacy require a more detailed analysis of the challenges and possible solutions. It is less about technical hurdles, but rather to raise awareness of the user of the dangers, but also the potentials for the participation in city and urban planning. The benefits of sensor data for urban planning have to be shown to the users. How Shilton describes: "Participant engagement in privacy decision making must also be fortified by supporting social structures" (Shilton, 2009). It should therefore be noted that apart from technical protection mechanisms rather the people and transparency, openness and awareness towards the user should be addressed. Campaigns, public debates and blogs can contribute to social acceptance, as well as accountable consent forms (Shilton, 2009).

7 CONCLUSION

The research of Urban Emotions will contribute to the involvement and participation of citizens in the spatial planning. Already in the 1960s, researchers elaborated the question of how the perception of urban space could be used in the planning process. The toolset of methods for planners at these times was mainly limited to questionnaires, interviews etc., but all-embracings tools for geostatistical analysis were missing. This situation has changed radically nowadays. New technologies such as smartphones and biostatisical devices now offer ways to cope with participatory processes in a more effective and human-centered way. The objective and subjective measurements of human feelings and perceptions in terms of urban circumstances like architecture or traffic represent the basis for the extraction of contextual emotion information in a fine-grained spatial and temporal resolution. Technological advances in sensor technology, smartphones and networks as well as the evolution of web 2.0 and social media enable new opportunities for networking and the collaboration of different research domains - these possibilities are not limited to geoinformatics and spatial planning. The potential applications for urban planners are manifold and lie especially in urban design processes, but also in safety issues in traffic planning for example. A vision, from a planning perspective, is, that the results of these measurements will be part of weighing process in public decission processes in the future. Contextual emotion information can be a new type of validation in urban monitoring processes, if the stakeholders and the government are open for this innovative planning approach (Resch et al. 2015a). Though, privacy issues have to be discussed in an open and transparent way to inform and clarify the methods. Furthermore, questions concerning the technical implementation are as important as the ethical or privacy rights. Spatial planning should recognize these potentials and the potential risks in order to create an embracing participation process.

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