

Transdisciplinarity in Urban Planning for Future Challenges at the Example of Digital Transformation

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1 ABSTRACT

The tasks of spatial planning are becoming ever more complex as a result of the increasing and growing number of demands, such as climate change, digital transformation or densification. This increases the importance of inter- and transdisciplinarity in planning. Integrated perspectives are necessary for the sustainable design of future settlement and landscape areas. The understanding of other disciplines and views is crucial for a fair and expedient balancing of interests.

This paper aims to analyse and compare the views and assessments of three spatial disciplines: spatial development, transport planning and landscape planning. The topic of digital transformation provides an ideal basis for discussion, as it brings with it future challenges and uncertainties, besides all three planning areas are affected.

The basis for this is a broadly-based two-step Delphi study on the spatial effectiveness of digital transformation. In an online survey, the members of the professional associations from Switzerland of the three disciplines were asked to assess the changes in space caused by digital transformation. The survey was carried out as part of a research project at the HSR University of Applied Sciences in Rapperswil (Switzerland) with the aim of assessing future developments (Engelke et al., 2019). The research project deals with the benefits of digital transformation for sustainable spatial development and represents a research focus of the Institute for Spatial Development and the Institute for Landscape and Open Space at the HSR. The disciplinary differences and similarities are not in the foreground of the research. In retrospect of the survey, however, interesting and particularly important aspects for goal-oriented, joint planning can be identified, on which this paper focuses on. Topics such as the future of public space, spatial data usage and the role of public authorities were surveyed and are discussed in this article.

The aim of this publication is to elicit common and different assessments of the three professional groups concerning future space due to digital transformation. Using the mixed-methods approach, the survey results are compared quantitatively on the one hand and questions and comments are semantically analysed on the other. This methodological triangulation is necessary for a better understanding and comparison of different questions on a topic (Johnson et al., 2007).

Based on this, the paper shows how the estimations of spatial, landscape and transport planners diverge and how they see the future to change due to the digital transformation. The analysis identifies the greatest common challenges. It can be stated that there are different levels of knowledge and various visions of the future between the professional groups. Finally, proposals are made as to how the challenges can be tackled using the principles of transdisciplinary research and where the focus can be advantageously placed.

Keywords: integrated planning, future space, transdisciplinarity, digital transformation, sustainability

2 INTRODUCTION

The human habitat is confronted with more and more changes. Megatrends such as climate change, digital transformation but also globalisation or individualisation are changing spatial development. Thus, demographic change also brings additional and increased demands on living space (Wehrli-Schindler and Widmer Pham, 2019). However, the development and spatial impact of these megatrends in the future are subject to a number of uncertainties, which poses major challenges for spatial planning. This happens because the planning system requires that the course has to be set early on. In order to achieve or maintain a high quality of life despite the increasing demands and an uncertain future, different disciplines of planning must work towards common goals, which in the end must lead to sustainable development. In order to meet challenges in complex systems, several disciplines need to work together in research and be ready for practical application. The problem-oriented approach of transdisciplinary research is suitable for this (Hirsch Hadorn et al., 2005). This paper examines whether the prerequisites for transdisciplinary research in spatial planning are given and whether it is suitable for tackling future planning challenges.

The research question pursued in this paper is: What are the different expectations for the future development of space within planning disciplines and how can transdisciplinary research contribute to finding common solutions?

This question will be examined using the example of one megatrend in spatial development – digital transformation.

The basis of this study is a survey on the spatial effectiveness of digital transformation in Switzerland. The survey was part of a larger, still ongoing research project at the University of Applied Sciences in Rapperswil, Switzerland, which examines the benefits of digital transformation for sustainable spatial development (Engelke et al., 2019). The survey ran simultaneously in three different variants (see details in chapter 4 Methodology). A comparison of the results of the three professional groups was not the aim of the study but in retrospect appears to be worth an interesting analysis. Therefore, this paper shows additional insights to the role of planners in addressing future challenges. Three relevant thematic areas were selected and analysed to see how the questions, answers and comments of three planning disciplines differ. Thus, it can be worked out what the difficulties of transdisciplinary research are. The paper provides answers on how the participants of the professional associations assess the developments on spatial data usage, future of public space and role of public authorities in the future. Furthermore, the question could come up about whether these three planning disciplines need to be analyzed together, since each of these professions requires clear conceptual definitions. But as it comes to shaping future space, those three space relevant disciplines need to work together and therefore need a common base of knowledge and an understanding for different definitions and aims to succeed in this transdisciplinary work for shaping a sustainable future (Hirsch Hadorn, 2006).

Therefore, the first part of the paper analyses and presents the approach of transdisciplinarity in more detail and elaborates its role for planning.

Afterwards, the methodology and research design of data collection and data analysis will be discussed. The results of the analysis of the questionnaires as well as the survey results and comments are presented in the following part to finally discuss the results and to answer the research question in the context of transdisciplinarity.

3 TRANSDISCIPLINARITY

Transdisciplinary research is a type of research where researchers from different fields are integrated and work together at an issue, which has to be solved. Transdisciplinary research can be defined as a research that meets four features. First, it has to take into account the complexity of issues. Second, the diversity of different perceptions of issues in science and society will be addressed (Pohl, 2005; Pohl & Hirsch Hadorn, 2006). Third, the idealised context is not as important as practically relevant knowledge (Pohl, 2005). Or to put it mildly: abstracting science and relevant knowledge specific to the case are combined (Pohl & Hirsch Hadorn, 2006). Fourth, the knowledge contributes to a solution of a problem of common interest (Pohl, 2005; Pohl & Hirsch Hadorn, 2006). It has to be told that this is only one of many possible definitions. Regardless of the definition, it always "includes the transformation of attitudes, the development of personal competences and ownership along with capacity building [...]" (Hirsch Hadorn et al., 2006: 121). This suggests that researchers have an important role in the transdisciplinary process. An investigation of transdisciplinary research processes showed that researchers need several years to accept the culture of the other disciplines and to be able to work out together concepts with additional benefits. In addition, transdisciplinary teams tend to division labour at times with more pressure instead of working things out together (Pohl, 2005). This bears the risk that the advantages of transdisciplinary research will not be fully exploited and that towards the end of the research project only individual results will be put together instead of being able to present a common result.

In order to avoid this, Pohl and Hirsch Hadorn (2006) set out principles on how to make a transdisciplinary process successful. 1st principle: reduction of complexity by locating knowledge needs and participants. In complex systems, not everything can be captured, so the relevant links to resolve the issue must be worked out. 2nd principle: effectiveness by embedding in the environment. This means that an impact model is to be worked out which shows how the solution is to be implemented in practice. It also requires a target group-oriented processing of the results so that the results are effective in implementation. 3rd principle: integration

through open-mindedness. The third principle is the supreme principle for cooperation between disciplines. One's own point of view must be relativized as one among several and others must be accepted as equally relevant. 4th principle: reflexivity through recursivity. Project steps must be run through several times if necessary. To meet all the requirements for transdisciplinary research (see above) is not easy and the quality of the research project could suffer. Running through project phases several times, if necessary, and thus correcting the conditions for the development of knowledge can reduce this risk (Pohl & Hirsch Hadorn, 2006). However, through many uncertainties and this trying-out, there is the risk that "such models lack the explanatory power of basic and applied research" (Hirsch Hadorn et al., 2005: 125). As a consequence, the knowledge achieved from transdisciplinary research is not an ideal scientific knowledge which is universal, explanatory and proven. But the generalization of knowledge is nevertheless important, which can be achieved by transferring the models and methods to other settings and/or other issues (Hirsch Hadorn et al., 2005). Those principles are important to be kept throughout the entire research process stages that are identification and structuring of the issue, handling of the issue and setting in value (Pohl & Hirsch Hadorn, 2006). Another definition of the process stages could be abstraction (shared insight), realisation (problem solving) and translation (formulation of results and transfer) (Verheij-Jarren et al., 2015).

4 METHODOLOGY

The data being used for this paper is provided from an online survey, which was the first part of a two-step Delphi study of the larger research project (see chapter 2 Introduction). The research group is composed of three main areas of expertise: spatial development, landscape planning and transport (traffic, mobility) planning. Each of this group was conducting an own survey with different themes and questions. Members of the professional associations from Switzerland (FSU, SVI, BSLA) were being invited to participate in the survey. 88 spatial planners as well as 126 landscape planners filled out the questionnaire. 107 participants completed the survey for traffic planners. The participants were German or French speaking and the answers were anonymized.

The data analysis for this paper goes beyond the analysis of the original research project because another goal is being pursued. A more differentiated analysis must be carried out to answer the research question (see chapter 2 Introduction). Relying on a mixed-methods approach, in addition to the quantitative evaluation of the answers, a qualitative content analysis of comments as well as the questions was carried out. The goal and big advantage of mixed methods is not to replace either the quantitative or qualitative approach "[...] but rather to draw from the strengths and minimize the weaknesses of both in single research studies [...]" (Johnson and Onwuegbuzie, 2004: 14-15). This methodological triangulation allows a more differentiated analysis and conclusions can be drawn about the impact of the type of question (Johnson et al., 2007). Therefore, it is crucial to analyse the questions qualitatively because they are not exactly the same in the survey groups and they were asked from members of the corresponding professional associations. This is the only way to compare the statements and answers of survey participants from different planning disciplines on the same topics. The qualitative content analysis is conducted after the approach from Mayring's structuring. The codes for the coding system were deductively derived in the first round of analysis and enriched with inductive codes in the second. This interrelation of codes from preliminary investigations and the corresponding material allows a systematic structuring (Mayring, 2010).

5 CASE STUDY: SPATIAL, TRAFFIC AND LANDSCAPE PLANNERS CONCERNING DIGITAL TRANSFORMATION

In the following, the questions, answers and comments of the three professional groups of the Delphi study, as case study, are analysed and compared on the three topics of spatial data usage, future public space and the role of public authorities. The structure of the text will always be the same: first, the qualitative analysis of the questions, second, the quantitative analysis of the answers and third, the qualitative analysis of the comments are presented. After every topic, there is a short summary and conclusion drawn.

It can already be said here that the way the questions were asked differs in all the topics discussed later. The questions in the questionnaire of and for spatial planners were asked in a form of hypotheses. Which means there was a statement (p.ex.: "With data about the use and the user of space analyses become more precise.") and the question "Do you agree or not?". The questions of and for landscape planners were formulated in the same manner as the questions for the spatial planners. Compared to the other two questionnaires, the

questions of and for traffic planners were asked in a different form. They did not hypothesize but were asking mostly W-Questions (What, When, Why etc).

5.1 Future of public space

5.1.1 Qualitative analysis of questions

| Codesystem | Questions_Spatial Development | Questions_Landscape Planning | Questions_Traffic Planning | SUMME |
|----------------------|-------------------------------|------------------------------|----------------------------|-------|
| public space | | ● | | 4 |
| irrelevance | | | | 0 |
| need for action | ● | | ● | 2 |
| uncertainty | | | | 0 |
| change | ● | | | 3 |
| negative association | | ● | ● | 5 |
| positive association | | ● | ● | 5 |
| Σ SUMME | 4 | 9 | 6 | 19 |

Table 1: In which questionnaire the term “public space” or its meaning is mentioned, and in which form it is described (“Public space” above means in a neutral way). How to read the matrix: The bigger the point the more often the code is being coded in the corresponding questionnaire and code (relative size to line and column). The number is indicated with the sum at the end of the column and line. Example: The code “negative association” is coded five times, twice in the questionnaire of the landscape planners and three times in the one of transport planners.

As can be seen on the matrix above, public space is an issue in all three questionnaires. In the one about spatial development, public space is addressed in relation to autonomous driving and especially autonomous parking. The matrix makes visible that there are differences about how the questions have been formulated (see table 1). As for spatial planners, the questions ask more about whether there will be a change or not and whether there has to be done something about it. Even though the questionnaire about landscape planning was focusing on landscape outside of settlement, some sub-questions are also relevant to public open space within settlements. The questions in landscape planning as well as in traffic planning are more about evaluating the changes. The questions for landscape planners are more often formulated in a positive manner and the traffic planners' questions are more often asked negatively. An example for a positive thesis: "Social media can be used to guide visitors e.g. by providing information on good routes, attractive activities etc.". One example for a negatively formulated thesis: "High costs due to refitting of the transport infrastructure will be a negative consequence of fully autonomous vehicles." There are only a few questions on public space in the questionnaire of transport planners but many questions indirectly concern public space. For example, whether the importance of bicycle traffic will increase, or pedestrian traffic will decrease due to Mobility as a Service.

5.1.2 Quantitative analysis of answers

77% of the respondent spatial planners estimate that autonomous parking will change public space and there will be new requirements like entry and exit zones in central locations. A smaller majority thinks that the road space needs to be reconstructed due to the changed traffic flow. Another phenomenon emerging from digitalisation are micro-hubs, which are changing public space. More than 80% of all responding spatial planners think those will be part of a new infrastructure in city/town districts.

More than half of the participating landscape planners think that there will be new forms of local recreational use in the future. In the opinion of a majority, the requirements will also change due to changes in the composition of user groups. However, only 28% think that this will be smart workspaces and almost half of the participants think that augmented reality could influence the visitor management. 77% estimate that social media could have an effect for controlling visitors of recreational areas. Half of the responding landscape planners think that innovative municipalities will provide digital retreats in future as it will going to be a need.

The questions whether the importance of bicycle traffic will increase and whether pedestrian traffic will decrease due to Mobility as a Service did not get agreement of many participating traffic planners. However, about half of the participants think that there will be fewer parking spaces in central areas and that more space will be needed for transfers. Therefore, structural measures are needed to ensure that AVs (autonomous vehicles) can contribute to sustainable mobility (56% agreement).

5.1.3 Qualitative analysis of comments

| Codesystem | Comments_Survey_Spatial Developments | Comments_Survey_Landscape Planning | Comments_Survey_Traffic Planning | SUMME |
|----------------------|--------------------------------------|------------------------------------|----------------------------------|-------|
| public space | | | | 1 |
| irrelevance | ● | | | 4 |
| need for action | | | ● | 2 |
| uncertainty | ● | | | 2 |
| change | ● | ● | | 7 |
| negative association | | ● | ● | 10 |
| positive association | ● | | | 4 |
| Σ SUMME | 12 | 9 | 9 | 30 |

Table 2: In which comments in the survey the term “public space” or its meaning is mentioned, and in which form it is described (“Public space” above means in a neutral way).

The frequencies in the code system show that there were comments on public space in all three questionnaires. However, the corresponding associations are different (see Table 2). While landscape planners often simply note that there will be changes, spatial and transport planners more often evaluate the possible changes. For example, this was one positive comment of a spatial planner: “Public space will become much more important!” or an example for irrelevance: “In the short and medium term, these scenarios change the road space and its design only marginally.” Most comments of transport planners show the concern of a negative development through AVs. For example this one: “There will be more pressure to expand infrastructure when individual mobility increases and empty runs are made possible through autonomous vehicles.”

5.1.4 Conclusion to the analysis concerning future public space

The questions in the questionnaire for spatial planners were asked in a more neutral way. Nevertheless, many comments are evaluating. Most comments show either the irrelevance that there will be a change and that it probably will be positive for public space. Therefore, comments reinforce the answers given, except for the expression of irrelevance in certain comments.

Even though a small majority of the questions for landscape planners are either positively or negatively formulated, the comments are not very evaluating. This supports the answers the landscape planners gave. They estimate that there will be a change, but they do not dare to make a statement in one direction. They rather say that the digital transformation does not change much in public space concerning the scope of duties of landscape planners.

Transport planners, in contrast, seem to have a clearer opinion about how public space will change in future especially through fully autonomous vehicles. In a commentary, many participants underline that there could be capacity bottlenecks and that public space could become less attractive due to heavy traffic on the roads. Comments that there will be fewer parking lots needed in centres were considered a positive statement. This in fact is mostly the reason that spatial planners evaluate the development of future space as positive.

In conclusion, it can be said that the three disciplines do not have the same opinions on whether and how public space will change, as they are all having another focus on how to look at this topic.

5.2 Spatial data

5.2.1 Qualitative analysis of questions

| Codesystem | Questions_Spatial Development | Questions_Landscape Planning | Questions_Traffic Planning | SUMME |
|----------------------|-------------------------------|------------------------------|----------------------------|-------|
| Data | ● | ● | | 5 |
| irrelevance | | ● | | 1 |
| need for action | | | | 0 |
| uncertainty | | ● | | 1 |
| challenge | | ● | ● | 3 |
| negative association | ● | | | 1 |
| concerns | | ● | ● | 4 |
| positive association | ● | | | 2 |
| added value | | ● | ● | 5 |
| hope | ● | ● | | 3 |
| Σ SUMME | 6 | 14 | 5 | 25 |

Table 3: In which questionnaire the term “data” or its meaning is mentioned, and in which form it is described (“Data” above means in a neutral way).

As you can see on the matrix above (Table 3), the content analysis makes apparent that the subject “data” is of concern in any planning discipline studied. However, if only the graph is considered, the wrong

conclusion could be drawn that the subject of data did not play a major role in the spatial planners' questionnaire. However, an entire block of questions (1 out of 8 with 3 sub-questions) was devoted to this topic. This is also the case at the questionnaire of the landscape planners. Nevertheless, the topic of data also appeared repeatedly in the other question blocks, which is why most mentions were made there. In the case of the questionnaire for traffic planners, the subject "data" is only mentioned in other thematic question blocks.

The analysis of the hypotheses and questions makes obvious different formulations. It is noticeable that the questions asked by the spatial planners are positively formulated (example: "With these data, analyses become more accurate."). The formulations of the landscape planners are more widely spread. It is perceptible that neutral formulations (code "data") are also chosen rather than in the other two disciplines. An example for a neutral formulated thesis is: "Data on the use and the users of the landscape will become considerably more important in future for the control and steering of landscape use." The questions asked by traffic planners were more evenly formulated. There appear positive or negative formulations as well as indications of challenges.

Overall, most questions are asked with the positive association of added value or in a neutral manner. Concern was expressed on four questions (see Table 3).

5.2.2 Quantitative analysis of answers

Concerning spatial data, 88% of responding spatial planners estimate that analyses become more precise ("I strongly agree" or "I tend to agree"). Even 93% evaluate that these data will be the basis for simulations and design. The last of those three questions was about usage-based control. So, 73% of respondents think that data about use and users are enabling a usage-based control system. But it is to be noticed that the majority of the respondents said "I tend to agree" to this last hypothesis which is therefore more reluctant than euphoric.

88% of the surveyed landscape planners tend to estimate that the data about use and users will become more important in future. An interesting aspect is that there is hardly any majority at the question about the current significance of data in landscape planning. The same ambivalent distribution of answers is shown to the question if the accessibility of data is sufficient today. The current situation concerning options for evaluation of the data is estimated as insufficient from 62% of the respondents. Those answers are showing that the landscape planners are thinking more unitedly concerning the future but not about the present. 75% of the respondent landscape planners agree that digital data on the use and the users of the landscape will become more important in future for control and steering of landscape use. A majority of those estimates that there will be new technologies used for usage-data collection in recreational areas. Almost 50% also think that augmented reality will influence the management of the visitors in recreational areas.

To the question "What do you associate with digital transformation in the field of mobility and transport planning?", 93% of the respondent traffic planners were choosing the answer "broader data for traffic planning". Some questions about fully autonomous vehicles included questions about data. So, 52% of respondent traffic planners estimate a positive effect namely a more efficient traffic system on the basis of personal user data. But there is also concern expressed regarding the Data Protection Act.

5.2.3 Qualitative analysis of comments

| Codesystem | Comments_Survey_Spatial Developments | Comments_Survey_Landscape Planning | Comments_Survey_Traffic Planning | SUMME |
|----------------------|--------------------------------------|------------------------------------|----------------------------------|-------|
| Data | • | • | | 4 |
| irrelevance | • | • | | 5 |
| need for action | • | • | | 12 |
| uncertainty | • | • | | 5 |
| challenge | | • | | 5 |
| negative association | | • | | 0 |
| concerns | • | • | • | 14 |
| positive association | | • | | 2 |
| added value | | • | • | 7 |
| hope | | • | | 4 |
| Σ SUMME | 21 | 34 | 3 | 58 |

Table 4: In which comments in the survey the term "data" or its meaning is mentioned, and in which form it is described ("Data" above means in a neutral way).

As well as in the questions the subject "data" (especially spatial data on the use and the users of space) is mentioned in the comments of the surveys of each group. However, it is noticeable that there are hardly any

comments to data from the respondents of the survey for mobility planners. However, it seems to be of interests for the spatial and landscape planners, as they mention the topic in many comments. Concerning the survey for landscape planning, there are comments with a positive association as well as with concerns about the future or present. But it also shows that there is a certain uncertainty about the topic and especially a need for action (as it is not always specified from whom). It seems interesting that data is mentioned in various forms from the spatial planners, especially as the questions are mostly formulated in a positive manner.

In comparison to the formulations in the questionnaires, a difference can be observed in the frequency of the different associations. In the questionnaires, more questions were coded with the tag “added value” or “data” (neutral) than expressing concern. On the other hand, twice as many comments were made expressing concern than those that see an additional benefit in user-based data.

5.2.4 Conclusion to the analysis of spatial data in planning

In conclusion to the subject “data” in the group of spatial planners, there can be said that the questions are positively formulated. Most planners see an additional benefit from usage-based data especially for analyses and an added value of usage-based control (more reluctant though). Contrary, in many of the comments, uncertainty is expressed (p. ex. “I don't know if it's reluctance or impossibility”) or irrelevance (p. ex. “Having data is one thing. Changing behaviour is the other, best examples are climate change or biodiversity!”). The reasons for this difference between answers and comments are various. First, there could have been a “priming” through the positive formulations of the questions. In methodological research, the influence of the question formulation on the answers has already been investigated and proven several times (e.g. Strack, 1994 or Diekmann, 2014). Second, it could be that people who fully agree with the hypothesis do not feel the urge to make an own comment, but people who do not agree like to tell their opinion. Another explanation is that only people with a very clear opinion like to share it, and people who are unsure will not tell. This corresponds to possible sources of error which Martin (1984) already described in the analysis and evaluation of the empirical research method of the survey. An explanation could also be that they think positively about the future use of usage-based data but nevertheless show some uncertainty.

Among the landscape planners, there is no clear majority showing in answers concerning the current situation about data in landscape planning. The only clear majority gets the thesis that the options for evaluation are insufficient. This shows a clear uncertainty about the present situation. Questions about the future (especially usage-based data for steering landscape use) get more agreement. In comparison to the other questions about the present, this shows some hope for a better situation in future concerning spatial data. This confirms that there were many comments contributed in the survey for landscape planners and those are associated with a large variety of feelings (see Table 4). This is another indication that there is no common opinion among landscape planners concerning the additional benefits of usage-based spatial data in future.

Traffic planners chose a clearer way of asking than the other two questionnaires, consequently, there were more options to choose from. The answers of the surveyed transport planners show that data for them seems just to come along with digital transformation and the majority believes that data will be necessary for influencing routing for a better traffic situation in future. There were hardly any comments added to the subject of spatial data in the survey. Reasons for that could be different: First, this could be a result of the type of questions and options to choose (e.g. Strack, 1994). Second, data could be seen simply as a matter of fact and a means to an end for traffic planners. It seems that there is no need to question the future relevance of usage-based spatial data, which has already been investigated in many studies in different countries (e.g. Anda et al., 2016; Friso et al., 2018; Zannat and Choudhury, 2019). Or, in the discipline of traffic and mobility planning other subjects and problems are more of interest. This is illustrated by the number of comments which are contributed to the topic of selfdriving cars. However, the emotional factor to this topic should not be underestimated (Maurer et al., 2015).

Nevertheless, there were different questions asked in the three surveys, considering the analysis of the questions and comments, one can tell that there are different estimations and feelings concerning future planning about data among planners from the different disciplines. Spatial and landscape planners seem to share a certain uncertainty about the additional benefits and the usefulness of usage-based spatial data. The way of asking in the questionnaire of the transport planners makes it harder to interpret the estimation of the participants, but it seems that they are having a clearer opinion about the subject.

5.3 Role of public authorities

5.3.1 Qualitative analysis of questions

| Codesystem | Questions_Spatial Development | Questions_Landscape Planning | Questions_Traffic Planning | SUMME |
|-----------------------------|-------------------------------|------------------------------|----------------------------|-------|
| ☞ authorities | | | | 0 |
| ☞ missing power/competences | | | | 0 |
| ☞ no need for action | ● | ● | | 3 |
| ☞ need for action | | ● | ● | 2 |
| ☞ active role | ● | ●● | ●● | 13 |
| ☞ going with the trend | ● | ● | ● | 6 |
| ☞ reluctant | ● | | | 3 |
| ☞ overstrained | | | | 0 |
| Σ SUMME | 10 | 10 | 7 | 27 |

Table 5: In which questionnaire in the survey the term “public authorities” or its meaning is mentioned, and in which form it is described.

The matrix above (Table 5) shows that the role of public authorities in addressing the digital transformation to a sustainable development is an issue in every questionnaire of the survey. Also, the orientation of how the questions were asked is not completely different. Whereas the questionnaire of landscape and traffic planning is more asking about whether or not public authorities have or will have to take an active role to shape future space, the questionnaire of spatial development is more asking whether public authorities already are or will have to be going with the trend and adapt the digital transformation. One example for the code “going with the trend” would be: “Technological developments should be taken more into account by the municipalities.” For comparison one example for the code “active role”: “The players in spatial planning will be the drivers of digital transformation.” It is assumed here that the public authority is one of the players in spatial planning. One block in the questionnaire for spatial planners was used to ask directly about the current and future role of the actors. Questions about the role of the public authorities were asked by the transport planners only in the form of which complementary measures were necessary for sustainable mobility (which entails action by public authorities).

5.3.2 Quantitative analysis of answers

It is noticeable that the clear answer options “strongly agree” or “strongly disagree” were never chosen by the majority of spatial planners to the question whether the actors in spatial planning are reticent, adaptive or driving. This could be an indication that they are not sure about their own role. It is interesting to see that 37% of the participants tend to agree that actors are reluctant and exactly 37% as well tend to disagree about this. The same scheme is showing on the question whether actors are adaptive or not. In both questions, almost 20% strongly disagree. There is a larger part that denies the thesis that actors in spatial planning are drivers of digital transformation. The majority's rejection of each option underlines the fact that actors of spatial planning (including public authorities) are unsure of their current and future role in digital transformation. When the questions come to certain facts, the answers become clearer. The majority of the actors say that a smart home does not influence their professional activities (which involves public administration tasks) and therefore does not entail any actions in spatial planning. The same tendency can be seen with micro-hubs. However, the answers there are not so clear, and it is therefore not clear whether micro-hubs will have significance in spatial planning or not.

88% of landscape planners feel that authorities and decision-makers should increasingly include new technologies in planning and control. However, in detailed questions he majority concedes the authority only a passive role. Thus, most think that technological developments must be taken into account by municipalities and that emerging technologies must be pursued. Only minorities think that decision makers should actively improve the availability of data or use social media to guide visitors. Even though, almost 78% of the participants think that social media could be used to guide visitors and can be used for participation and communication. On the other hand, 18% only think that social media specialist units should be created within government agencies.

The majority of transport planners think that road or mobility pricing should be introduced, structural measures are needed, data to influence navigation systems must be provided and/or intelligent infrastructure should be introduced. Not much support was given to the options of a necessary reduction of the maximum speed permitted and a ban on vehicles that are not fully autonomous. All those measures entail action by public authorities.

5.3.3 Qualitative analysis of comments

| Codesystem | Comments_Survey_Spatial Developments | Comments_Survey_Landscape Planning | Comments_Survey_Traffic Planning | SUMME |
|-----------------------------|--------------------------------------|------------------------------------|----------------------------------|-------|
| ☒ authorities | | | | 0 |
| ☒ missing power/competences | | ● | | 5 |
| ☒ no need for action | ● | ● | | 3 |
| ☒ need for action | ● | ● | ● | 14 |
| ☒ active role | | ● | ● | 5 |
| ☒ going with the trend | ● | ● | | 4 |
| ☒ reluctant | ● | ● | | 5 |
| ☒ overstrained | | ● | | 2 |
| Σ SUMME | 11 | 21 | 6 | 38 |

Table 6: In which comments in the survey the term “public authorities” or its meaning is mentioned, and in which form it is described.

The role of the authorities is quite often mentioned in comments of landscape planners, but hardly any comments appear in the survey of transport planners. Some transport planners mention that the authorities need to do something in an active role, mostly they plead for regulation by the state. In all three surveys, the participants demand authorities in their comments to do something about this topic. This need is particularly pronounced among landscape planners. As well, only landscape planners state that public authorities especially municipalities often do not have the power or the competences to influence the current or future situation. They also claim that authorities are too reluctant and often overstrained with new technologies concerning landscape planning. Spatial planners mostly claim that actors (including public authorities) more often would like to use new data and technologies, but they often do not have access to these means.

5.3.4 Conclusion to the analysis of the role of public authorities

To conclude, it can be said that most planners see a need for action but not all the time in an active role of the public authorities. The variation of answers can be interpreted as uncertainty about what the role of actors like the authorities should be at the moment regarding digital transformation in planning. And also, about what their role should be in future. Comparing the three planning disciplines, it can be said that transport planners show the least uncertainty. The answers given mostly illustrate a quite clear agreement and many of the few additional comments made were about the same issue namely regulations. Furthermore, the answers of spatial planners show many uncertainties as there is hardly ever a majority achieved. Landscape planners show unsteadiness in their comments. Many of the landscape planners think that there is a need for action, a few of them think that the authorities are already in an active role, whereas some others think that the authorities are overstrained with the topic and quite a few think that there is not enough power or competence in public authorities to address the issue. None of the spatial or traffic planners made a statement in this direction. This could be an indication that the authorities give more weight to urban and traffic issues in connection with digital transformation than landscape issues.

6 CONCLUSION

According to the analysis of the topic data, spatial planners see additional benefits of data but nevertheless show some uncertainties. These uncertainties can also be determined in the answers and comments of the landscape planners about the current situation. But they show some hope for clearance and benefits of data in future. Transport planners seem to have a clearer estimation of the topic of data. There does not seem much to be discussed although usage-based data is said to be of use for mobility planning (i.a. Schmitt and Männel, 2017; Antoniou, 2019). A similar pattern can be seen regarding the theme of future public space. Landscape planners think that there will be new forms of recreation in future and that requirements for public open space will change. However, there can hardly any indications be identified about what will change and whether the development will be positive or negative. Whereas spatial planners mostly think that public space will change in a positive way. Comments indicate that public space could become more important and "better". A majority of transport planners show an opposite view to this estimation. They do not think that public space will change fundamentally and that there will rather be a negative development with more traffic due to the digital transformation. Concerning the role of public authorities, traffic planners seem to be most certain again. Nonetheless, every professional group analysed illustrates some uncertainties about what role the public authorities have to take, but they agree that there is a need for action. Landscape planners also think that public authorities are overstrained regarding digital transformation and landscape.

Overall, transport planners seem to have a clear view about how future space will develop. This could be based on the fact that many studies are already conducted on the topic. In contrast, landscape planners show

many uncertainties. They estimate that there will be a change due to digital transformation but cannot say what and how it will change. Spatial planners seem to be a bit less unsure than landscape planners but do not have such a straight vision as mobility planners.

These results of the analyses show that transdisciplinarity seems to be a suitable approach to study the subject of digital transformation, as a transfer to practitioners is of great importance concerning future challenges. One finding of the analysis is that within the research project there are different visions of the future among researches. Although the disciplines are used to work together, they still show another way of thinking. This is enriching for research but nevertheless a challenge for the research process. The different levels of knowledge among the professional groups were another major challenge identified, as some of them have a clear idea of the development and others show uncertainty and disagreement. This will make the transfer of the research results challenging. As mentioned previously, there are some principles in transdisciplinary research which must be respected and all of them are important. Through the analysis described here, however, it can be said that three of the four principles seem particularly important for the issue of digital transformation in space and the role of planners. First, the target-group oriented processing seems to be of much importance, as there is a different level of knowledge among practitioners. An impact model which shows how to implement the solution could be helpful for this. Second, the principle for open-mindedness is particularly important as there are other foci and yet still different visions from researchers as well as from the professional groups. Third, the last principle of reflexivity through recursivity has to be fulfilled. By running through project steps several times, knowledge levels can be adjusted and common visions can be developed. If these points can be successfully applied, then transdisciplinary research could help to resolve uncertainties of development in the practice of planners and to develop common visions so that the digital transformation can ultimately make a real contribution to sustainable development.

7 REFERENCES

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