Development of GIS in urban planning agencies in Serbia – experiences of town Planning Institute of Belgrade

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1   INTRODUCTION

Transition reforming processes in Serbia during past two years created prosperous environment for very complex activities of numerous aid agencies. Owing to some of them the knowledge level about modern concepts and approaches in the field of strategic and urban development is significantly raised in big cities. Especially important was the impact and the effect of building governmental capacities action. During the last year on the highest governmental levels and in some prosperous local governments consciousness of ICT support importance in contemporary urban development management process is higher than ever. Now the problem is lack of capabilities for defining of comprehensive and coordinated action plan, which will initiate the development of primary ICT tools on a city level. On the other hand a large number of local planning agencies started with their own reorganization trying to increase efficiency and effectiveness, and most often they recognized an ICT support as a right way to do it. In many cases local GIS is initiated and basically performed by the planning agency without of local government initial support, but soon after had a acceleration role in further institutional ICT development.

In a first place, this paper will provide the oversight of ICT development levels in municipalities of Serbia. Interesting is that public institution ICT development is more rapid in some smaller municipalities than in Belgrade. Therefore, the paper will be more concentrated on presenting the process and problems of ICT development of City of Belgrade public institutions and governmental levels. Under the very difficult conditions Town Planning Institute as a major planning agency in Belgrade is making the big effort to increase work efficiency and effectiveness by using ICT tools. Of course, on an agency organization level the process of ICT implementation is suppressed with new problems. This paper will at the end present the overview of 6 month pilot project of initializing and conceptualizing the IS of planning agency and the results that ICT team succeeded to achieve. As a conclusion the action program for 2004. will be presented.

2   PROVIDING GOOD INFORMATION BASE – GIS WORLD EXPERIENCE

Operational support to the Strategic Planning and Management process is founded in modern ICT - Information and Communication Technologies tools. Usability of ICT tools is based on their capability to perform fast and complicated processing of spatially defined data and on their flexibility towards specification of real problems that are to be solved. In contemporary context, usage of ICT tools is imperative of successful strategic development planning and management.

Over last ten years a major development of ICT tools in a field of managing and planning urban development is observed worldwide. It lead to development of a wide range of specific information system solutions, producing numerous software applications, encouraging hardware innovations, and above all performing the serious impact to organizational changes of public service and governmental institutions. Variations between them occur as a result of differences in institutional and organizational capacities and developing policies in each specific urban environment.

2.1   What is GIS?

A Geographic Information System is the combination of skilled persons, spatial and descriptive data, analytic methods, and computer software and hardware - all organized in a system to automate, manage and deliver information through geographic presentation (Zeiler, 1999).

All GIS are built using formal models that describe how things are located in space. This kind of information system of object-oriented data modeling lets you characterize features more naturally by letting you define your own types of objects, by defining topological, spatial, and general relationships, and by capturing how these objects interact with other objects. A geographic data model is a representation of the real world that can be used in a GIS to produce maps, perform interactive queries, and execute analysis. Once we construct a map, we can use it to answer questions about the reality it represents on the questions, which cannot be answered by the pure environment observation.

Our interaction with objects in the world is diverse, and you can model them in many ways. It is clear that even a common type of geographic feature can be represented in a GIS in a variety of ways. No model is intrinsically superior; the type of map you want to create and the context of the problems to be solved will guide which model is best. The purpose of a GIS is to provide a spatial framework to support decisions for the intelligent use of earth's resources and to manage the man-made environment.

Geographic Data Models – GDM serve as the foundation on which all geographic information systems are built. A geographic data model defines the vocabulary for describing and reasoning about the things that are located on the earth. A unique quality of a GIS is its ability to integrate diverse types of data into a common geographic framework. Tying diverse data together gives you considerable freedom to explore the relationships between entities such as people, highways, land, stores, and natural features... A principal advantage of the geo database data model is that it includes a framework to make it as easy as possible to create intelligent features that mimic the interactions and behaviors of real-world objects. Some of the benefits of the geo database data model are:

- Users work with more intuitive data objects - Properly designed, a geo database contains data objects that correspond to the user's model of data. Instead of generic points, lines, and areas, the users work with objects of interest, such as transformers, roads, and lakes.
- Features have a richer context. With topological associations, spatial representation, and general relationships, you not only define a feature's qualities, but its context with other features. This lets you specify what happens to features when a related feature is moved, changed, or deleted. This context also lets you locate and inspect a feature that is related to another.
- Features on a map display are dynamic. When you work with features, they can respond to changes in neighboring features. You can also associate custom queries or analytic tools with features.
- Better maps can be made. You have more control over how features are drawn and you can add intelligent drawing behavior. Highly specialized drawing methods can be executed by writing software code.
- A uniform repository of geographic data. All of your geographic data can be stored and centrally managed in one database, whether it is locally centralized or spread on Internet,
- Many users can edit geographic data simultaneously. The geo database data model permits workflows where many people can edit features in a local area, and then reconcile any conflicts that emerge.
- Data entry and editing is more accurate. Fewer mistakes are made because most of them can be prevented by intelligent validation behavior.

2.2 What are the benefits of GIS use ication

GIS supports the strategic planning process in all phases, by providing good and proper information patterns referring to the questions than has been asked, in a flexible way. On the other side, GIS cannot be supportive if problem definition is not valid – it is not a tool for overcoming the planning concept weaknesses.

GIS enables permanent, efficient and valuable environmental data gathering, what is the one of the primary conditions for successful strategic planning model implementation. Spread network of data collecting units provide a significant time saving and than even more with ability of fast data overlapping. Than with inner validity control and generic capabilities provide effectiveness arise in sense of using more accurate and right information in specific problem solving. GIS provides appropriate problem identification information base. Its possibility to generate a wide range of data patterns related and understandable to all participants in a planning process makes possible accurate problem definition. GIS is substantive tool for providing information base for all necessary analysis methods witch has to be performed in strategic planning process.

Information systems of older generation ware union of linear databases abbot environment, which allowed search and processing of information. But, clear spatial visioning was missing. In that sense GIS made a significant progress. GIS technology has broadened our view of a map. Instead of a static entity, a map is now a dynamic presentation of geographic data. A map is the interface between geographic data and our perception. Maps utilize people's inherent cognitive abilities to identify spatial patterns and provide visual cues about the qualities of geographic objects and locations. Maps let you combine and overlay data to solve spatial problems.

2.3 Guidelines for initializing the GIS on the municipality government level

It is natural to start informatization with developing GIS, because it is fundamentally important for developing other of E-government ICT tools. That doesn't mean that other tools cannot be simultaneously developed. Basic principle of modern ICT tools development is: step by step, problem oriented development concept, client-server network oriented, on a unified common operational framework. Technological conditions in this moment are so flexible that development of ICT tools is actually independent from hardware and software. In operational sense, what makes GIS implementation effective is a good database design. And what makes a database design good is asking the right questions:

- How can GIS technology be implemented to streamline and improve existing government functions?
- How can GIS change the way a particular goal is achieved?
- What data will benefit the present organization most?
- What data can be gathered and stored?
- Who is, or should be, responsible for maintaining the database?
- What are data that we now possess and in what shape they are?
- Do we have professionals capable to develop GIS?
- Do our experts know what are benefits of using GIS?
- ...

How you answer these questions will deepen your understanding of GIS technology, as well as provide new insight into government organization and its functions. Database design for GIS implementation is like any other design. It starts with understanding goals and progresses through increasing levels of detail as information is gathered and you approach implementation. Designing GIS takes time and intensive work among all institutions, public services and their employees. The design process can be quite substantial. Here are some word experiences to ease the designing process and help ensure success:

- *Involve users*. By contributing, they will gain a sense of ownership and you will gain invaluable knowledge for your geodatabase design.
- *Take it one step at a time*. It is not necessary to create a complete detailed design all at once; design is an interactive and iterative process. You can progress in stages as appropriate for the needs of your organization.
- *Build a GIS team.* A wide range of information, skills, and decision making is required during this process. At different stages, your team will comprise various experts throughout your enterprise.

- *Be creative.* The initiation of a new project is a good opportunity to survey new technology and processes. There is considerable potential to enhance how GIS serves your organization's goals and objectives.
- *Create deliverables.* It is best to divide a large project into discrete and identifiable units of work. Project milestones should be defined to be no less frequent than two months or so. This will keep your project focused and earn management support.
- *Keep organizational goals and objectives in focus.* It is essential that the design and implementation process always be focused on the real requirements of your organization and its customers.
- *Do not add detail prematurely.* Add detail at the appropriate step. For example, do not try to define all of the validation rules for feature classes before geodatabases are constructed. Selectively introduce implementation details throughout the project so that the team can progress to the next step.
- *Document carefully.* The more complex the environment greater is the benefit from documenting your design. The use of business diagramming software is especially useful to communicate your design.
- *Be flexible.* The initial design will not be the final design as implemented. The design will evolve as your organization changes, new technology is introduced, and people become more adept with the technology.
- *Plan from your model.* Create an implementation plan that addresses your organization's key priorities in a manageable fashion. If you need to create new datasets, build the data management applications first.

World experience approve that, after more than 60 years of information and communication technology development, we finally come to the solutions of highest practical quality. Of course, we are still in the beginning of a new e-government era. But its importance is reflected in an international community decision to proclaim this field of work as a strategically important task.

Modern ICT tools are public sector product. In fact only 30% of GIS and DSS tools users are private companies whose business is related to spatial recourses. Their development is a result of all governmental levels needs to increase work efficiency and effectiveness. Nowadays development of these tools is a global activity, developers of ICT tools, although they are competitive, especially consider compatibility and adaptability of their products.

3   ACTUAL SITUATION IN SERBIA REFERRING TO DEVELOPMENT OF GIS

New Low on construction and building adopted in 2003 establishes Republic Agency for Spatial Planning that has authority, among others, to develop unique information system on environmental condition. Also in this low European standards of spatial units are mentioned, along with demand to produce planning solutions in digital form. This reflects aiming of government towards European and world standards in a field of developing GIS. Assumption can be made that in a further operational work of the Republic Agency closer definition and regulation of GIS development will be made.

3.1   Digital cadastre and spatial units register

One of the basic conditions of developing good and useful GIS is accurate cadastre. Cadastre evidence in Serbia is in very bad condition, since conducting of land register was divided from cadastre. So now we have a case that for big territorial parts we have cadastre evidence over seventy years old. Updating the cadastre leads toward numerous property and legal problems. Results of last year international conference on cadastre held in Belgrade, explain that world expert estimate work on updating cadastre to last for about 15 years with large amount of investment needed to accomplish it.

In this moment according to the expansion of Low on state measurement and cadastre from 2002, digital updating of cadastre is a task given to the Republic Geodetic Institute. This kind highly centralized organization of updating cadastre will slow down producing this essentially important part of Republic GIS. According to Low on spatial units register from 1989, and Low on Ministries, Republic Geodetic Institute is obligated to conduct graphic part of spatial units register, and for their unified coding is authorized Republic Institute for Statistic. Because of inaccuracy of single spatial unit register - cadastre parcel, validity of spatial units definition on all territorial levels is highly conditioned and has mostly administrative meaning. Therefore, of course, there is no accurate address register.

3.2   Geographic and topographic plans and statistical data

Republic Geodetic Institute has a primary task to produce all kind of geographic, topographic, orto-foto and other digital maps. It performs this activity by using the GIS tools. But, there are operational problems that occur. Mapping the data is done by the technology of making analog maps, which is not compatible with logic of GIS and DSS usage. In that way we get maps very hard to use in practice. Beside, this activity is managed in centralized way, and therefore is very slow and not compatible to the practice demands.

The same case is in a field of statistical data collection. Republic Institute for Statistic is authorized for performing the periodic collection of statistical data. The problem is that databases have the same linear shape as twenty years ago. For this large period the methodology of gathering the statistical data hasn't been changed, with excuse of providing the continuity with former data samples!? Anyhow a significant amount of data exists and, if a rather complicated procedure is passed, the data can be accessible to the public institutions.

3.3   ICT tools in public institutions for spatial planning and management

It is very interesting that inspire undefined legislative framework, there is a significant activity in usage of modern information and communication technologies in Serbia. These activities are not coordinated or conducted, but they produce results, which mustn't be underestimated.

Large number of public communal institutions and public institutions for spatial planning and management develops their own GIS tools, or uses already developed ones available on a global market. In that sense there is a significant number of local geographic databases, but they are, most often, not integrated, reliable or systematically developed. It is interesting that these institutions are concentrated mostly in a few big cities such as Belgrade, Nis, Kragujevac, Subotica, and Novi Sad.

Nevertheless there are some cases of local planning agencies or communal institutions that have some kind of geographical information systems. Usually those are communal institutions, mostly authorized for water supply and canalization management and sometimes the agencies (this is a result of very comprehensive actions of international agencies in this field) for city land construction.

In out context, actually, initiative for development and usage of ICT tools is not governmental, but result of practical needs, and aiming of public institutions increase their efficiency and effectives. This trend will be even more increased by implementing the new Low on construction and building, according to whom, planning activities are put on the market.
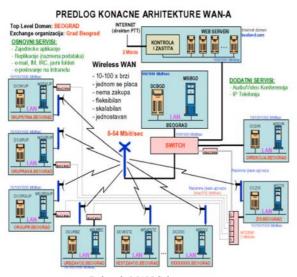
4   THE CASE OF CITY OF BELGRADE GIS

According the mentioned circumstances City of Belgrade started a certain activities on developing GIS. These activities have an enormous importance for all Serbia because the experiences of the capital city will be used as an example to all other towns. The problem is that in spite of the fact that Belgrade's public institutions are mostly ICT developed the governmental structure of Belgrade is highly complicated and complex, so management of GIS development is very difficult.

One of the very important public institutions is Town Planning Institute of Belgrade, as a most developed planning agency in country. For over 50 years it was the only planning agency officially authorized for Belgrade development planning. According to the new Low on construction and building a new legal working environment for planning agencies is established. Now planning activities should be done in a free market of planning agencies competition. Therefore the top management of Town planning institute started with strong ICT development of its business organization to increase the competitive advances in working market. At the beginning of 2003 the initialization of Information System of Town Planning Institute started.

4.1   Belgrade's Metropolitan Area Network

In last couple of years on high governmental level of City of Belgrade occurred an initiative for ICT development of city governance. This initiative included all governmental institutions, public communal enterprises, public planning agencies and municipality governmental structures (Belgrade has 16 municipalities).

Belgrade MAN Scheme

The Belgrade City government in 2002 financed the metropolitan hardware infrastructure establishment. In that sense an MAN is implemented, connecting the City Assembly, Secretariat for Urbanism and property, Directorate for city construction land and building, Town Planning Institute and Republic Institute for Statistic. According to future plans the MAN should be expanded on other public Secretariats, Directorates and municipality governances. Since that this network was in very low level of exploitation. The problem occurred because of undefined protocols of information collaboration and exchange.   Therefore the MAN was used only for e-mail and Internet.

In 2003 a new initiative for MAN development came from Directorate for city construction land and building. Since there is no city governmental body authorized for Belgrade ICT development a Committee for MAN was established. This committee was consisted from representatives of all public institutions of Belgrade and had a purpose to define initiatives in a field of ICT development and to propose them to the City executive board. So on the committee imitative a MAN in April 2003 infrastructure concept was accepted along with general criteria for development and usage of software.

At that moment the executive board of City of Belgrade made the decision that official software in public institutions should be: Microsoft Windows as operational system, AutoDesk – Acad, AcadMAP, PTW – Visum (software applications for traffic planning and design), ESRI – ArcView, ... ArcInfo, (GIS tools). According to that decision the buying contract between the software companies and City of Belgrade was accomplished.

This concept consisted only infrastructure definitions and it was concluded that next very important task is to define working polices, regulations and protocols of information collection, exchange and storage. Unfortunately this task got no time limits since there is no clear vision on city governmental level whose authority it is. So all further activities on developing Belgrade's MAN collapsed for some time. On the other side the institutions continued their own ICT development waiting for the moment when MAN issue will be in focus again. Therefore the Town Planning Institute took a strong action towards ICT increasing capacities trying to establish competitive advantage among other public institutions.

4.2   Town planning Institute GIS efforts

Information development of Town Planning Institute Business is the result of top management strategic decision to increase business efficiency and effectiveness with modern ICT usage. In 2001 producing the Master plan for Belgrade work was performed by using the modern ICT. On that occasion a big investment in hardware, software and employees knowledge was made. The aim was to produce a GIS of Master plan until 2003. Unfortunately this task was not fore filled. The reason is that there were not enough ICT knowledge capacities in the Institute especially in ICT development management. There was no employee with clear picture how ICT support the working process, what are the benefits of that and how the results can be achieved. In that sense the special team for ICT development of Town Planning Institute was established consisting of current employees and outside experts in this field.

In spring of 2003 a decision was made to produce a Program concept of Information System initializing and development. The program concept should consist of consideration results of several major topics: - diversity and complexity of working processes, - structures and quality of the analog and digital data, - inside and outside framework context, - existing infrastructure and human recourses, - possibilities of step by step implementation and investment, ...

After the six months of scanning and assessing the current resources a program concept was done and accepted on all management levels and at the beginning of 2004 the initialization of the information system started. During the Program concept definition some very interesting things and problems occurred:
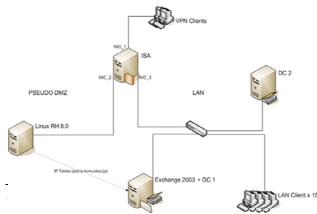
- Diversification of problems hierarchy according to the employee's position in the company organizational structure. For example the management structures main problems ware in a field of information support to the organization and monitoring the working processes (document management, project management, monitoring the working progress, information security, etc.) and than in a second place the issues of developing the GIS as a working process supportive tool. On the other side the employees complained on management organization and working information difficult accessibility. This kind of situation is on one side natural, but it produces difficulties in implementation action plan definition because conflict of interest between management and employees supposes different course of development.
- General resistance to the working process and organizational change. Interesting is that in spite of willingness to improve their working results the resistance towards reorganization was more expressed on an management level than among the employees. Probably because of losing job fear employees are ready to make an effort for increasing the knowledge and accept a new procedures. The management on the other side has a big reserve that necessary changes can be implemented. It seems that larger problem is in low knowledge capacities of management structures and actually necessity of their much larger working efforts that they had before.
- Problem of absence of adequate ICT management resources. In current situation in the Town planning institute there is no person educated enough in bought management and in ICT in urban development planning. In the same time there are no such human profiles on labor market. On the other side the tom management doesn't trust enough the outside experts. So this is a situation which slows very much the ICT development process and realization of GIS.

On the other side considering the GIS initialization potentials there are enough infrastructure and human resources. Producing the Master plan lead to the complete digitalization of Belgrade's territory on an accurate city block level. This is a result of accurate cadastre absence so parcels are not accurately defined. But block definitions are coordinated with statistical territory units and also an address system is aided to geographic entities. So far there are no relations between the graphical vector entities and statistical databases but because there was not enough developed infrastructure for GIS data base design (no data base software, not domain network, ...). Beside there is a large number of regulatory plans and other planning documents that are digitalized, then accessible data bases in other institutions, ...

In this moment the GIS development is just a task on the paper because the management still doesn't have a picture how to organize this activity and how to market then with it on a city level. So paralyzed with fear of changes officially nothing is going on...

4.3   Plans for further actions

Nevertheless, The Program concept of ICT development of Town Planning Institute proposed a strategic ICT development plan and the action plan for 2004. In spite that there was no clear respond from the management about them the budget for the first implementation action was approved thanks to the IS team effort. In this moment the project of finishing the local network infrastructure is in progress (150 clients). It means that in a month the domain client-server network will be established wit all necessary server services. Especially important is that SQL server will be installed which is basically important for further development of GIS.

According to he IS team 2004 Action plan proposal next step will be designing the database and restructuring the existing digital data. Than the operational work will be done in sense of relational connection of geographic and alphanumeric data.

In the same time the business management applications will be developed in order to assess management demands. The main strategy is to try the step by step implementation process providing a concrete results which will immediately lead to the efficiency appraisal. Whole this process must be followed with

formal and informal educational programs of all employees, especially management.

It is very promising that IS teamwork initialized some organizational restructuring. In this moment the establishment of new organizational unit is in the progress - Sector for informatics with definitions of new employment places. That is the opportunity for management problem to be overcome and to accelerate the GIS development.

5 CONCLUSION

It is very interesting conclusion that can be made according the experience of Town Planning Institute of Belgrade. Its case is referent because it is the planning Agency with largest ICT resources. It seems that in this planning agency the general Serbian problem is reflected in a smaller scale. That is the fact that there is not enough knowledge about modern concepts of strategic or urban development planning and management, especially among the people who are officially authorized to perform the management tasks. In the same time there are rather good potentials in infrastructure and human resources to perform ICT improvement.

Maybe the reason of this kind of situation lies in the fact that after the first victory of democratic forces in Serbia governmental restructuring was done by the "political trust" criteria, not "competent enough" one. So we have situation that governance leaders are only politicians not mangers. Fear of political traps force them to control and decide upon every action and when it is a question unknown for them than it is better not to decide than to make mistake, which will imperil theirs political position. It seams that as long as our transition process is conducted with leaders - they decide what is supposed to be done according to they knowledge and perception) not managers of participatory decision making process, our prosperity will have small tempo.

On the other side it is a question of time when the GIS will become a common tool, because the resources already exist. The planning agencies and public institutions that understand and see this fact can profit enormously from this situation. The question is who will be the one?

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