Geoinformation support – impact on urban planning, environment and society

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Abstract: - As a consequence of increases in population and industrialization, society has become more complex for both government and other institutions, with the result that more complex and complicated tasks have to be performed. In order to find better solutions, more and more information is required. Having passed through the stages of agricultural and industrial societies, we now live in an information society. Creation of any Geographic Information System – GIS, for governmental and local authorities represents a very complicated process, where a complex of scientific, technical and organizational problems should be solved. These problems have a specific character in Romania due to particular features caused by general economic status, financial and social situation, and also, political changes.

Key- words: town planning, geoinformation, urban cadastre, GIS, database, municipality, spatial, management

1 Introduction

A significant factor of economic stabilization and development is the implementation of modern, efficient tools based on better Information Systems needed both for everyday land administration operations and for large-scale reforms related to land. GIS as modern technology of analysis and graphical-textual database processing method is a very important element in urban planning and also in environment resources management. This is a basic, crucial purpose in case of multifunctional spatial system.

Today, the Cadastral GIS offers specialized functionality for each stage of processing including the digital map creation, plotting cadastral and topographical plans, generating and combining geo-referenced data in order to obtain a validated relational geo-database.

The problem of town planning represents a very important activity regarding interdisciplinary interest for technical, economical and social development improvement; it can provide accurate and efficient solutions in order to cover basic needs of land administrative information and decision making for the Local Authorities.

At present, a particular attention is paid to using GIS-technologies for support of analytical activity and making effective decisions by the authorities of State Administration. An urgent solution of this problem is specified by three major circumstances:

- efficiency of management directly depends on organization level of the information support, because almost 70% of the total volume of management decision are related to territory.

Therefore, the need for a wide use of Geographic Information is evident;

- the demand for acquisition and processing of a large amount of interdisciplinary information from different branches of knowledge by actions of economic and natural factors are of a world-wide character. They require coordination and integration of all forces of neighbouring territories in order to realize the common projects. Integration of this thematic information, comparison and analysis by a human being requires to introduce any unified binding environment;

- cartographic method of representation, generalization, perception and analysis of cartographic information is particularly unique for knowledge analysis on territories, phenomena, events and processes involved.

International and national experience offers for this purpose a territorial GIS providing a unified spatial referencing for all required data for territory management. The main advantage of such system is a possibility for spatial analysis being a powerful instrument to reveal and investigate a character and interrelations of different phenomena and environmental objects. Constructing a GIS is a difficult process, where a complex of scientific, engineering and organizational problems should be solved.

As for Romania, they have particular features caused by general economic, financial and technical, physical, geographic and other peculiarities.

The first problem is the lack of digital cartographic base resulting from a weak material and technical
basis. Its creation represents a laborious process, especially, when a large volume of information is taken into account. This kind of work requires an appropriate production capacity, sufficient and efficient technologies for digital terrain mapping. The second problem is creation of different resources of the digital thematic geo-information on a unified digital cartographic base. Most of the existing sources of initial data are characterized by information isolation, incompleteness, contradictoriness, and duplication for their distribution. It is recommended to create a unified territorial cadastre including in one system all information on natural, material, technical and human resources. The main purpose is to overcome a narrow interests system and integration of various data and knowledge into a single territorial information infrastructure. The third problem concerns the construction of a special-purpose GIS for governmental bodies of different levels. Its solving requires development of modern GIS-environment; hardware and software for data protection, confidentiality, access delimitation to data bases and facilities; also software for general functions of executive power.

2. Problem formulation

Romania, as member of the European Union, must align to the quality standards of the other states. A short period strategy for the Romanian Cadastre policy, implies the implementation and improving of an efficient system for registration of the properties, in the whole country, related to European standards. A long period strategy for the same domain, implies the elaboration of a complete automatic database, unitary from the point of view of cadastral information and land registration, very easy to access and to administrate. Nowadays, the interest in cadastral systems is growing due to various reasons. Perhaps the most important is the fact that cadastre maintains primary information on land and on relationships between land and people. Land is the basic resource on which all economic activity depends. With the increasing population and deterioration of the environment, the availability of land decreases. This calls for better land management based on better cadastral information. The growing needs for cadastral information are accompanied by the fast progress in information technology. GIS, as modern tool of analysis and graphical-textual database processing method is a very important element in urban planning and also in environment resources management.

The problem of town planning and cadastral represents a very complex activity regarding interdisciplinary interest for technical, economical and social development improvement, being able to provide accurate and efficient solutions in order to cover basic needs of land administrative information and decision making for the Local Authorities.

Thus, the town planning and the territorial management aim to establish not only the spatial development directions, but also the general targets, such as: the social and economical development of the regions, a responsible utilization of human resources and the environmental protection or, the reasonable and efficient utilization of the territory. Much of the information the decision-makers have to take into account has a dynamic quality; the information changes continuously in time and space. In such a situation, the challenge is to maintain community services at a high level and stimulate change and development in spite of the difficulties. To be able to handle these challenges and problems in an efficient way, there is a need for improved planning and decision support systems.

The branch of Urban Planning Cadastre represents a key element of a unified regulatory system which also includes adoption of special urban planning legislation on regional levels of management and development of modern zoning methodology and ordinances. An important role of Cadastre in this context is to build a legal and technological foundation for an enforcement system of land use regulations for all owners (including real estate, environment, infrastructure, utilities regulations, etc.). GIS application can help municipalities and regional governments in environmental planning and sustainable development. At intensively stocked regions should be created multifunctional spatial systems which will help in a high effective exploitation and management of accessible social capital resources. At urban and out-of-urban high stocked areas the multifunctional exploitation rule of resources can concern nature resources (water, soil, etc.) and human resources (technical infrastructure, housing etc.). The sustainable development of specified spatial systems stands for economic-social and ecological equitable development. It results in a creation of more and more complicated and effective systems, such as multifunctional systems, which have a high economic, social and ecological effectiveness.

The consequence of the sustainable development implementation is a necessity of spatial system designing. Geographical Information System (GIS) can be such a tool.
It gives quick access of updating and analyzing of spatial database. A GIS is capable of integrating large amounts of geographic data from different sources and is able to respond to non-routine questions. As a result, it can be a most powerful instrument in the development of Environmental Information Management System.

3. Problem Solution

The rapid increase in use of GIS in all resource activities shows the need for better tools and techniques to collect, map, and integrate spatial data. In addition to the traditional technologies available, there are many modern tools and techniques which can be implemented to digitally achievement of spatial resource data in both the field and the office. In order to help resource managers make an informed decision on which technology to use, there are five categories of techniques available to collect and map these data:

1. Terrestrial Positioning Systems
2. Cartographic Reference Systems
3. Aerial Photography
5. Satellite Positioning Systems

The effectiveness of these new technologies could be increased by using artificial intelligence to alert the user to potential change.

A well designed Resource Management System will have wide spread utility as tool in various field of planning and forecast of sustainable ecological, social and economic development. The most significant development in such system is the integration and consolidation of all various data resources which are composed of urban and regional space. The data from different sources should be integrated by maintaining standards. Due to the wide variety of information sources, cooperation and coordination between users supplying the data is crucial. There must be willingness to share data and to supply them in a standardized format to the system (fig.1).

If the organizational problem is not solved, even sophisticated techniques or systems will be of no use in the field of environmental resources management.

Geographic Information System (GIS) is an assembly of people, equipment (hardware), programs (software), algorithms and procedures (methods) which ensure the processing, management, manipulation, analysis, modelling and visualization of spatial data in view of solving some complex problems regarding planning and territory management.
Main objects defined in Urban Information System of Timisoara are: parcel, sub parcel, building, property, duties, person, and property rights

Updating the Information System and its applications continue permanently improving solutions in: [4]

1. **Property information**: where, all communities have access to the national property system, or systems that permit property planning and administration, also illustration of community properties;

2. **Demography**: within this area are lots of databases for the total population, old care, social care, school children etc.;

3. **Public Utilities Planning and Management**: GIS systems for this area were among the first to be developed, and area is also well supported with such systems In Timisoara, most of the inquired communities use GIS systems for this purpose;

4. **Transportation Planning**: concerning transportation planning, there are some national projects, but in local communities there are hardly any GIS systems in use, although there are many traditional data base systems such as traffic flows, traffic capacity, traffic accidents etc.;

5. **Natural Resource Management**: for ages, paper bound thematic maps have been used to point out the occurrence of natural resources. Such maps have naturally been easy to translate into digital maps and thereby easy to implement in GIS systems. This kind of systems are frequently used in the communities;

6. **Environmental Protection**: the number of GIS systems is rapidly growing, due to the increased need of control and the environmental consciousness among the population;

7. **Urban and Regional Planning**: most of communities use GIS systems for urban planning. This is natural as the information content in the map is the basis for urban planning.

Transformation of the present informational system into database system supposes the organization of all information into separate files, which are closely, related one to another. The primary data processing for computation of the land surfaces for a property is quite simple at this first level but it becomes very difficult due to the huge number of parcels and owners and also to the existence of a great amount of corrections in the adjustment of the territory.

Designing a dynamic framework for planning and development, based on spatial information like Geographic Information System (GIS), can be created the master plan of any populated area.

The Master Plan is part of a larger process implying the use of Geographic Information Systems in order to develop an urban quarter. In this sense, the Master Plan is much more than a document for spatial development orientation; it is, above all, a strategic vision of the city based on directive principles that make a coherent combination of respect for natural balances, economic efficiency, market forces and social equity.

Timisoara is a large economic and cultural town in Banat region, in the west side of the country.

It is also the capital of Timis county.
The process of completing and updating the database is a continuous one, at present in Timisoara there are performed projects regarding the town cadastre, transportation, green and cemeteries cadastre. Today, the Cadastral GIS offers specialized functionality for each stage of processing including the digital map creation, plotting cadastral and topographical plans, generating and combining geo-referenced data in order to obtain a validated relational geo-database. [1]

![Fig. 4, Timisoara urban GIS – extract](image)

Depending on the extension of municipality and the development tendencies, the Town Hall of Timisoara is currently working on a third edition of the General Town-Planning Scheme. Its main goal is to ensure the harmonious development of the town with controlled growth. Timisoara metropolitan area includes the settlements situated at 30 km distance from it. The development decisions for this area are taken by the Metropolitan Consultative Council. *Specific strategies in Timisoara Urban Agglomeration*: infrastructure, housing, retail/commercial, industry and services, parks and environment protection, social balance, history, Academic, sport and leisure GIS. This concept implies the elaboration of an information system integrated at the level of all Town Halls as components of the Metropolitan area.

![Fig.5, Spatial development for Timisoara urban agglomeration - proposal](image)

3. Conclusion
The consequence of the sustainable development implementation is a necessity of spatial system designing; Geographic Information System (GIS) can be such a tool. It gives quick access of updating and analyzing of spatial database. A GIS is capable of integrating large amounts of geographic data from different sources and is able to respond to non-routine questions. As a result, it can be a most powerful instrument in development of any Information Management System. [4]

![Fig.6, Digital Map of Timisoara](image)

At present, considerable development of GIS-technologies and GIS-complexes are carried out in Romania and there is a good basis to create own standards for the Geographic Information System, especially for governmental and regional authorities. GIS can be regarded by two separated blocks, such as cadastral and analytical. The first block assures the function of inventory, database designing and maintenance, including information on natural and technical resources of a region. The analytical aspect provides tools for management and decision making. Such GIS-technology provides:

- inspection and detailed investigations of subject areas for information database
Fig. 7, Data import to the GIS platform

▶ adoption of a suitable GIS-environment

Fig. 8, Data control, GIS elaboration

▶ development of standard user interface
▶ database design for each information and thematic block with a simultaneous adaptation of standard user interface according to the defined subject
▶ development of information database structure with a separate information and thematic block extraction
▶ input data acquisition and spatial database generation

Fig. 9, Other facilities

▶ use of information database simultaneous with creation of standard query and thematic map libraries.

References