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DEVELOPMENT AND IMPLEMENTATION OF STRATEGIC PLANNING SUPPORT SYSTEMS IN THE URBAN ENVIRONMENT AND HEALTH SECTOR BY APPLYING A GEOGRAPHIC INFORMATION SYSTEM IN THE REPUBLIC OF MACEDONIA

Sasko Martinovski[1*], Vera Simovska[1], Valentina Pavlova[1], Daniela Nikolovska Nedelkoska[1], Djorgji Manceski[2]

[1]Faculty of Technological and Technical Sciences - Veles, University of Bitola "St. Kliment Ohridski", Petre Prlicko 14, 1400 Veles, Republic of Macedonia
[2]Faculty of Economy, Djorce Petrov bb, 7500, Prilep, Republic of Macedonia

[*]e-mail: sasko.martinovski@uklo.edu.mk

Abstract

Nowadays we use a great number of various planning systems, the most known of which are the PSS - Planning Support Systems. With the advancement of the Geographic Information System - GIS, the PSS became an important component, while the GIS is becoming a more common and strategic part within these systems. It is applicable in all areas related to spatial planning and strategic planning in the health sector in the Republic of Macedonia

The scope of this research is the development and implementation of PSS by using GIS for constructing business models. Computers and GIS play a significant role in achieving this task through the collection and storage of required data, providing system models that can describe the current situation, to project the future and to assist in determining the best plan of the range of available alternatives.

The purpose of this research is to show the development and implementation of PSS, their greater use in other sectors besides urban planning, and the development of scientific concepts for their construction. In this context, we commented on the model for the impact of socio-economic factors on healthy eating, regarding the economic and social benefit (M_ISEFHE_ESB) to the Republic of Macedonia. This paper provides a brief overview of PSS which can be found in today's literature and practice.

Based on the proposed guidelines for the development of PSS and by using software support, we can build a good PSS, which will improve the manner of planning and state institutions in the Republic of Macedonia will have economic and social benefits, particularly in the health sector.

Keywords: *GIS, modelling, business model, PSS, M_ISEFHE_ESB, health care sector.*

1. Introduction

Human beings have always wanted to be in tune with the environment, society and with themselves, to create a balance between urban development and natural environment and to create the conditions for urban sustainability. The World Commission on Environment and Development has, since 1987, strived to preserve the harmony between man and the environment by applying a moderate approach of balancing economic development and the needs of society, without destroying the environment for future generations. Decisions made for certain urban areas affect the environment and always depend on the area of human interest. Local and national governments make decisions about land use and infrastructure that directly affect individual homeowners; business community; socio-economic development, profits and of course the environment. To harmonize this necessary space modelling, over time the obtained provided changes have received crucial meaning for effective environmental management. So, we need new methods and designs that will be scientific, comprehensive, adaptive, integrative and applicable. For this purpose it is necessary to integrate the natural and social sciences and their development of common ground, related to economic and other systems.

The field of spatial planning, the **G**eographic **I**nformation **S**ystem (GIS), as well as **I**nformation and **C**ommunication **T**echnology (ICT) have quickly taken a direction towards development and their integration is inevita-

ble. Today a number of different systems are used in the part of strategic planning, to support development planning in the urban environment, such as strategic **P**lanning **S**upport **S**ystems - **PSS** and **S**patial **D**ecision **S**upport **S**ystem - **SDSS.** With the advancement of GIS, the importance of PSS increases, and GIS applications under the planning support tend to be strategic and routine parts of these systems. GIS is an important component of PSS and geo-processing, charting, creating databases and modelling capabilities [1], [4]. However, the PSS does not consist only of GIS. They contain a range of traditional tools for economic and demographic analysis and forecasting, environmental modelling, transport planning and land use modelling. The development also gradually includes other technologies such as expert systems and decision support tools. Database management, visualization, spatial analysis and modelling are the main reasons of the use of GIS in urban planning and PSS. GIS is used for storage of maps and plans, socio-economic data, environmental data and models that can be used for planning, [2]. Planners can extract useful information from the database through spatial queries. In spatial analysis certain maps can be used to investigate the distribution of socio-economic and environmental data and display the results graphical and analytical way.

Many examples point towards the application of GIS in urban planning and general planning that is in any way connected with space. The application of GIS in urban planning of local government and the state is implied, and its application in the economy is always helpful and is of great assistance in the preparation of business models, but interesting to point out that GIS can also be applied in the health sector.

2. Overview of strategic planning systems in an urban environment

The efficient management with the problem of urbanization is imperative to use a good PSS to provide assistance in the planning process in terms of management, organization, coordination, monitoring and evaluation. A number of concepts and designs of the spatial PSS include instruments regarding the geo-information technology, primarily developed to support various aspects of the planning process, [3]. These include data collection, spatial analysis, data modelling, visualization and display, projection, preparing reports and participation and collaboration in decision-making.

There are many different systems that support urban planners in their decisions regarding urban development, where the question asked is: why is it necessary to develop a new system to support planning? In other words, what is missing in the existing PSS? Our findings, confirmed by other researchers, indicate that none of these systems fully consider the planning process, and in general, very few PSS's evaluate the planning process itself. A greater development of new concepts for PSS is required in this section to better understand, evaluate and manage the process of urban planning. In particular, the understanding and analysis of the planning process can not tell whether the decision or plan proposed for spatial planning can be achieved under the present circumstances. Other examples of PSS that are created with software support suggest greater complexity which can sometimes lead to difficult understanding of the system itself, but also for difficulties in its use. Examples confirming our previous example are SPARTACUS, PROPOLIS, [5], the models of TRANUS, [10], [11], MEPLAN, DRAM/EMPAL, LUTM, etc. For example LUTM is very specific software that can be used by specialists, while ordinary users involved in planning can't use it a lot. SPARTACUS and PROPOLIS are good projects, but they are like little models and don't include an understanding of the planning process itself, which we believe is important for these systems.

Current research and practice, made by known researchers in this field, as well as our personal final observations, go in several directions: the planning process requires knowledge, the development of new scientific methods and concepts that will enable easy use to planners, the development of PSS would be simpler and not spectacular (without too much 3D and without too much complexity). The modelling of the planning system should be more focused on developing a concept which will enable greater visibility or complete understanding of the planning process.

It is necessary to use GIS not only as a tool for analysis, but in most of the stages in the modelling phase, i.e. to use more GIS and PSS in the economy, food technology, health, nutritionism and other areas, except its application for urban planning. In the context of the latter, the GIS can develop models not only for the needs of urban planning, but also in the development of business models in the field of economics, food technology, biotechnology and nutritionism. Namely it makes sense to use GIS in many areas of the business environment, such as effective tax planning and management, promotion and/or promotion of investments, land use of natural resources (forests, water, etc...), planning energy facilities, public land management, infrastructure planning and management. It is important to note that it can be applied to planning in the health sector as an example to examine the impact of socio-economic factors on a healthy diet in order to improve the health status of the population in the Republic of Macedonia.

We believe that the concepts of building these systems need to be simplified, by using the principle of two simpler models, instead of a single complex system, but also the concept that can help in the understand-

ing and analysis of the planning process, and for the result to be better planning solutions and better acceptance of the system. These principles can be achieved if the concept of modelling in the creation of the PSS is presented in six phases (Figure 1), which define all the important features as entities in the E-R model (Figure 2): phase 1 - determining the goals (Goal) and interests (Interest); phase 2 - defining outputs,

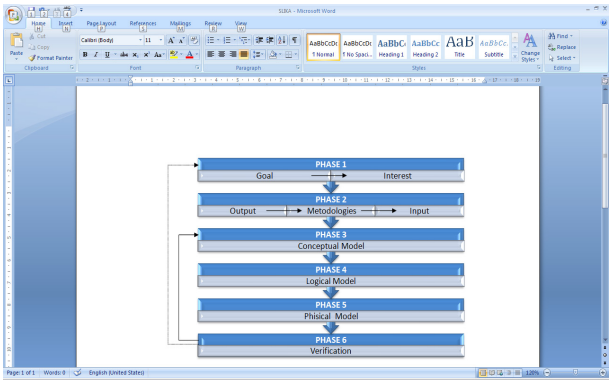

Figure 1. Phases of GIS modelling

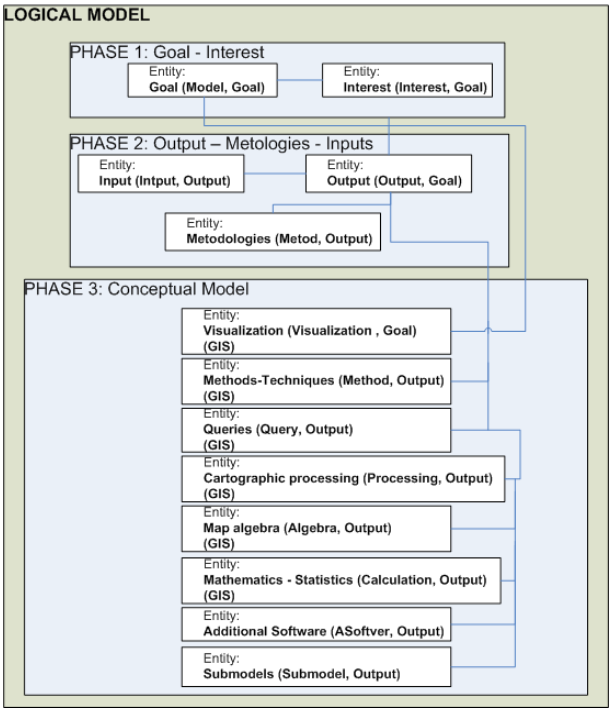

Figure 2. Logical model

methodologies and inputs (output - methodology - input); phase 3 - the conceptual model (Conceptual Model); phase 4 - logical model (Logical Model – Figure 2); phase 5 - physical model (Physical Model); phase 6 - check the model (Verification), and as a result of the verification the activation of a link back to phase 3 or phase 1 depending on the receipt of the planned outputs of the model (Figure 1).

With this concept we can achieve better understanding of the planning process (output as an entity is shown in relation to other entities in the phases of modelling), to use the principle of creating simpler models and to achieve better verification of the model as shown in the doctoral dissertation of Martinovski Sasko [9].

2.1 Overview of the development and implementation of the PSS and GIS in the Republic of Macedonia

The analysis, of the importance and use of the GIS in the territory of the Republic of Macedonia, has been conducted in the period from 2006 up till now. In the period prior to 2006, through USAID and EAR projects, GIS software has been donated in the majority of municipalities in Macedonia (ArcMap - ESRI company) as an incentive for development [9]. Some of the employees in the urban planning departments in each municipality attended training to learn the usage of this software. During this research, there were a number of discussions, with the officials (city planners, analysts, planners) in the municipalities and the City of Skopje and other smaller municipalities, regarding the manners of their strategic planning for the development of the urban environment in the Republic of Macedonia [9]. The subject of the research in municipalities was the planning of their strategy for the development of the municipality and the importance of GIS. Today, the general situation with the possibility of applying GIS is quite different. The GIS is being introduced or is already introduced in the majority of municipalities in the Republic of Macedonia as: GIS hardware, GIS software, digitization of spatial data and GIS training. However, the lack of easily accessible, accurate and complete data in the process of policy-making and strategic planning led governments of the Member States of the European Union to take measures to overcome this problem. The 2007 Directive of the European Parliament and the Council of Europe seeks to establish an Infrastructure of Spatial Information in the European Union (INSPIRE). The National Spatial Data Infrastructure of the Republic of Macedonia is in accordance with INSPIRE.

The analysis is made in Macedonia has shown that the PSS is not frequently used and developed, while some smaller municipalities don't even use this system. We believe that it is necessary to educate people on the functioning and concepts of PSS and GIS. The knowledge should be expanded further through an educational process in collaboration with companies using GIS and some educational institutions. Also, with today's growing hardware and software development and the reducing of their cost, the Internet has become a data source and method of communication in the planning process. There is plenty more important soft-

ware available for free and etc, and based on all these benefits, each local self-government must further the use and investment in the development of PSS, GIS software, hardware and training.

2.2 Proposal for the use of PSS and GIS in the health sector in the Republic of Macedonia

The proposed PSS and GIS systems have been adapted for use in strategic planning in the public health system. Pilot testing has been carried out using data on the diet, physical activity and the level of nutrition of the population in eight regions of the Republic of Macedonia, during 2011-2012. Thereto an examination was conducted on the influence of socio-economic indicators on the diet in order to improve the health of the population, [6], [7], [8], and the economic and social benefits for the country were set out as a general goal. Data on dietary habits were obtained from surveys conducted in all eight statistical regions in order to create the database. Economic data on the monthly income per family member in the country was taken from the state budget, as well as the statistical data from the State Statistical Office. This model can identify several factors that affect the health of the population, and public health strategies can be created on the basis of the indicators, for health promotion and disease prevention. Data can also be used in the domain of health care management. For example: economic indicators for the Budget for 2012, show that the amount required for the supply of insulin for diabetics is 9.1 million euros, and the budget provides for 368 million euros for the health insurance fund expenditures, of which 350,000. 000 euros are intended for the health insurance business, etc. So if we determine the socio-economic factors that influence healthy diet of the population, we would be able to plan preventive measures to reduce the cost of treating diseases, which would contribute to the economic and social benefit of the state [9].

From the analysis that has been made of the study of the population habits in Macedonia, we can make several conclusions through this model. For example, the typical results of the survey show an increase of renal disease associated with the drinking water intake. They showed that the number of renal diseases has increased in people who use water from the city water supply, i.e. a smaller number of the population uses bottled water. This is especially frequent in the Vardar statistical region of Macedonia. Also the percentage of cardiovascular disease for people who partake in fast and fat saturated food and have less physical activity, is greater compared to those don't partake this type of diet and do more physical activity. As output from the model we obtained other indicators that show the impact of education and family income on healthy eating habits. These results indicate a need for health education of the population.

Building models that will contribute to the economic and social benefit of the state is very significant, as is the previously described model and it can be used in public health. We find and recommend that there is a need to build such models.

3. Conclusions and proposed measures

- A number of support systems planning as applied in practice are very complex, and some even overload the planning process. Directions for building systems to support the planning, especially strategic planning, should be based on several principles, namely: first, the constructed model should be as simple as possible, i.e. to avoid complexity as much as possible, since it can be the reason for the inability of planners to use the model as ordinary users and/or rejection of the same; secondly, avoiding the building of an ideal model, and to create a model that will explain the planning process itself, which will be accepted and better application by users, and thus to obtain better planning solutions. We believe that the concept of building systems to support planning will integrate previously stated principles as entities in the E-R model.
- By applying this concept, a good system will be created and the way of strategic planning will be improved, allowing competent people from the municipalities, the state and citizens, to quickly, efficiently and accurately to make correct and timely decisions. New GIS models obtained by modelling in PSS for the development of the urban environment may affect the performance of municipalities, the state in general, in the area of urban planning, but also in all other parts of their jurisdiction.
- Research shows that to build a good PSS is required to use GIS, not only as an analysis tool but a great deal more as a way to include data from other databases that are important for the planning, and finally to create scenarios only for specific solutions, but did not to over do it (to avoid a spectacle), i.e. to be based on actual facts.
- The use of planning support systems and GIS should be expanded outside urban planning. New models that are not only exclusive for urban areas should be developed to include other areas which are in some way related to spatial planning, such as public health care in the Republic of Macedonia, for the country's social and economic benefit.
- Macedonian people need to be further educated on PSS and GIS. This instruction should include all those who in some way are related to strategic planning. We believe that GIS should be included in

the educational process in the Republic of Macedonia in cooperation with the academic institutions and GIS companies.

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