GIS as Knowledge Maps in Group Decision Making

D. Klimešová, H. Brožová

Abstract— The geography plays a very important role in many decision-making problems. Many spatial problems are complex and require the use of analysis and models and an interdisciplinary and group approach to their solution. Decision-maker (typically groups of people) selects the best solution among several alternatives according to his/her knowledge. A geographic information system (GIS) allows us to visualize, understand, analyze and interpret geographical data, information and knowledge in many ways that shows relationships, patterns, and trends in the form of maps, globes, reports, and charts. The mathematical model and its solution also support information and knowledge formalization and sharing among group members. GIS can be viewed in three ways - the database view, the map view, and the model view. Our aim is to formalize correspondence between these items. In this paper we discuss group decision-making process using GIS, various forms of knowledge maps in GIS and models in GIS. Our aim is to formalize correspondence between these items. We will show selected examples of knowledge maps in GIS application.

Keywords— Decision-making, GIS, information layer, knowledge map, model.

I. INTRODUCTION

In today market situation companies and organizations are faced with decisions in an increasing complexity and dynamics of social, economic and technological problems. Unfortunately our rational decision is very much limited by our processing capabilities. Therefore ICT based decision making support help to solve management problems and to manage knowledge and leads to competitive advantages for the organizations. Usage of information systems, decision support systems, knowledge systems and modeling and simulations is discussed by many authors, for instance [26], [24], [2], [42].

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Spatial decision-making, targeting market segments, planning distribution networks, responding to emergencies, and many others - these problems involve questions of geography. Also the effective enterprise in the field of agriculture needs interdisciplinary practice across the economics and management together with applied information technologies.

Because the complexity of decision problems is increasing the main decision-making agents are typically not individuals, but groups of people. A group of decision-makers is involved into decision process.

Group of individuals must decide, must choose the best solution. Understanding of what decision-making involves, together with effective techniques, will help to produce better decisions.

Spatial character of decision problems is also a cause of their complexity. Spatial problems are often semi-structured or ill-defined because all of their aspects cannot be measured or modeled.

Complexity of decision problems is increasing also due to multi-criteria character of majority solved problems. The large group of multi-criteria models has to be applied in decision-making process.

Essential tools for solving of these problems are geographic information system (GIS), mathematical models and knowledge maps and group decision-making approach.

GIS, maps and models represent special forms of (data, information and) knowledge formalization. The aim of knowledge map is storage, sharing and development of knowledge for decision-making among decision group members.

The mathematical model and its solution also support information and knowledge formalization and sharing. A geographic information system (GIS) allows us to create the complex package of data, information and knowledge and together with function tools, WEB services and the ability to produce and encapsulate knowledge; we can find relationships, analyze trends and patterns and apply multi-criteria decision-making.

Very elastic database in cooperation with access to requested models and localized problem description, interpretation and presentation; it is the good background for successful decision support system. Our aim is to formalize correspondence between these items.

II. GROUP DECISION-MAKING

Group decision-making means decision process in groups consisting of multiple members with the aim to decide what action a group should take. The decision-makers are typically households and firms or organizations which often represent groups of decision-makers rather than an individual decision-maker [20], [1]. Economic, social, political or military decisions are often done by groups of decision-makers which must decide and choose the best solution of decision problems [28], [29].

Process of group decision-making has the following three perspectives:

- Psychological perspective - it's necessary to examine individual decisions in the context of a set of needs, preferences and values he/she seeks.
- Cognitive perspective - the decision-making process is a continuous process of problem solving based on interaction with the environment.
- Normative perspective - the selection of decisions is based on the logic of decision-making, on rationality and it has to lead to the best decision.

The problems of group decision-making is that group often spends its time discussing the information shared by members rather than discussing information known only by some of members. Those groups that know how to share unique information make better decisions.

Groups benefited particularly from sharing unique information when they employed a highly structured, more focused method of discussion [23] or they used Decision Support Systems (DSS), especially group decision support system or communication-driven decision support system.

DSS represent specific computerized information systems that support various decision-making activities [27]. A properly designed DSS is an interactive software-based system intended to help decision-makers and group decision-makers compile useful information from raw data, documents, personal knowledge, and use various types of models with the aim to identify and solve problems and make decisions.

Group decision-making as a cooperation of more than one decision-maker generally with more than one criterion has multiple criteria decision-making character. When implementing multi-criteria decision methods, a significant role is played by a quantitative preference of each evaluation criterion, by weights. These weights of criteria significantly influence the quality of decision.

Determining the correct and responsible weights of each partial evaluation is important task when multi-criteria problems are being solved. It is indisputable that this task requires very good knowledge of a certain topic and a significance and effect of each criterion. A range of methods is available for making the weights more accurate, determined by an expert, or a group of experts from the specialized field, at the beginning.

There exist many methods, which are able to determine object preferences based on object utility values according to evaluation criterion and its weight. All methods usually request additional information to be able to set up weights and preference functions.

A special approach to information and knowledge sharing and preferences setting useful for group decision-making is based on the Analytical Hierarchical Process (AHP) and the Analytical Network Process (ANP), which are often in a root of DSS [31], [32], [33], [34].

The AHP method [31], [32] is based on mathematics and psychology and serves as a mathematical method for individual or group decision-making with multiple criteria. It provides a comprehensive and rational framework for structuring a decision problem into a hierarchy, for relating its elements, and for choosing solutions. The ANP method generalizes the AHP. ANP derives global preferences from relative measurements of the network dependences of all decision elements [33], [34].

Decision-making situations are often based on geospatial data and information. Spatial decision-making, targeting market segments, planning distribution networks, responding to emergencies, and many others – all these problems involve questions of geography. These problems are often solved by group of decision-makers. GIS allows visualizing, understanding, and interpreting geographical data in many ways that shows relationships, patterns, and trends in the form of maps, globes, reports, and charts.

GIS helps to solve problems by data, which are quickly looked up and easily shared. GIS offers a large number of information layers, previous analysis and additional data from many sources to solve this problem. The access to the additional selected information (even in the form of model) in proper time, verified and coming from the credible source is the main aim of DSS based on GIS.

III. KNOWLEDGE AND KNOWLEDGE MAPS

The central term knowledge is generally defined as a dynamic human process of justifying personal beliefs as part of an aspiration for truth. Knowledge means the problem understanding, the ability to solve a problem. Knowledge cannot be defined without its context, experience, interpretation, and reflection.

Knowledge has the following aspects [11]:

- It represents solution of problem.
- It has a normative function.
- It is internally and externally networked.
- It is dynamic and contextual.
- It is or is not personal bounded.

Decision-makers need to share data, information and knowledge to make better decisions. Proper tools for storage, sharing and development necessary data, information and knowledge for decision-making are knowledge maps.

This means that a knowledge map must regard a progression of ideas, general conceptual relationships and a problem solving process.

A knowledge map is a special form of description of knowledge. There are various definitions of the terms knowledge map and knowledge mapping. Stanford [38], [39] defines it as follows: "Knowledge mapping quite simply is any visualization of knowledge beyond textual for the purpose of eliciting, codifying, sharing, using and expanding knowledge." Gordon [10] also shows that knowledge maps may be referred to as the maps of acquiring knowledge. The knowledge maps are important as building knowledge tools as well as thinking tools [30], [22].

Different kinds of knowledge maps according to their content or application in thinking processes can be defined, for instance:

- A mind map is a diagram used to represent words, ideas, tasks or other items linked to and arranged around a central key word or idea. It is used to generate, visualize, structure and classify ideas, and as an aid in study, organization, problem solving, decision-making, and writing. Mind maps help people to think and learn [6].
- A concept map is a graph showing the relationships among concepts. This scheme can use a word description of map elements, symbolic description and colors [6], [25], [5]. Concepts in nodes are connected with labeled branches.
- Strategy maps and goal maps were introduced by Forsberg and Olsson. These kinds of maps are a way of providing a macro view of an organization's strategy, and provide it with a language in which they can describe their strategy prior to constructing metrics to evaluate the performance against their strategy [14].

According to the knowledge creation and modeling process the following types and classification of knowledge maps can be set [41]:

- Descriptive maps describe the real situation as precisely as possible.
    - The mutual positions of elements in weak descriptive maps are unimportant, only the symbols themselves and the quality of their relationships are relevant.
    - In strong descriptive knowledge maps the item must use spatial relationships to elicit, share and codify knowledge [39]. Geographical maps are typical representatives of strong descriptive maps.
- Normative maps contain a typical standard or norm, an optimal solution or the best decision. Their aim is to describe the best solution or the norm.
- Prescriptive maps [3] help to find ways how to reach solutions selected according to the normative map. They are mainly oriented on the process.

IV. GEOGRAPHIC INFORMATION SYSTEMS

The geospatial data, information and knowledge play very important role in many decision-making situations. Geospatial decision-making needs the tools to analyze the relationships of proximity, connectivity, neighborhood, overlay, to investigate the spread and seek of phenomenon and their combination in dependence on selected set of attributes and information layers. GIS and its functions are a kind of this tool.

Geographic information system (GIS) provides essential marketing and customer intelligence solutions that lead to better business decisions [13]. Geography is a framework for organizing our global knowledge and GIS are a technology for being able to create, manage, publish and disseminate this knowledge for whole society.

GIS can be interpreted and used also as knowledge maps, because a knowledge maps can be regard as a progression of ideas, general conceptual relationships and a problem solving process. GIS a knowledge maps allows to store, visualize, analyze and interpret the data from many sources in many ways that are not possible in the rows and columns of spreadsheets. Many spatial problems are complex and require the use of analysis and models. GIS can help your business saving time and money, while improving access to information and realizing a tangible return on your GIS investment.

With GIS, it is possible to analyze:

- Site selection and location analysis
- Number of potential customers within market area
- Accessibility of the site
- Customer segmentation, profiling, and prospecting
- Demographics and customer spending trends
- Potential new markets
- Scenarios and strategy and so on.

On the other hand there are a lot of difficulties asking for more context information. Some of factors are difficult to evaluate or predict, new features have to be introduced, theirs relative importance can be changed to reflect differences of opinion, it can be necessary to generate a new set of alternatives with more precise structure [17], [19].

The large ability of GIS is aided to implement knowledge models from different branches of scientific investigation for wide context of evident as well as less evident connections, models of trends, objectives and expected or predicted relations. From this point of view the context and knowledge are the two sides of the coin (Fig. 1). To follow the context we obtain knowledge and often this way is more than the result [4].

GIS shows data, information and knowledge and their relationships, patterns and trends in the form of maps, scenarios, reports and charts, and helps to solve problems using data which are quickly looked up, easily shared and internally and externally networked. Moreover, the selection of information layers can follow the local, temporal, thematic, spatial, and other types of context [15], [16].

The top level of GIS usage is the modeling where the information layers from a real, artificial and virtual world are composed together to select optimal scenarios or verify given hypotheses or assumptions. To solve the problem, GIS works with selected number of information layers (geometry and attributes) from the contextual space (real, artificial or virtual) and analyzes relationships, evaluates scenarios, creates partial results and verifies assumptions to prepare detailed task specification.

The set of problem-oriented layers (geometry and attributes) can be viewed as a weak descriptive map while the GIS layers themselves are a strong descriptive map. In GIS layers there is possible investigate not only dependencies but also the location and distances among map elements, their scale and so on.

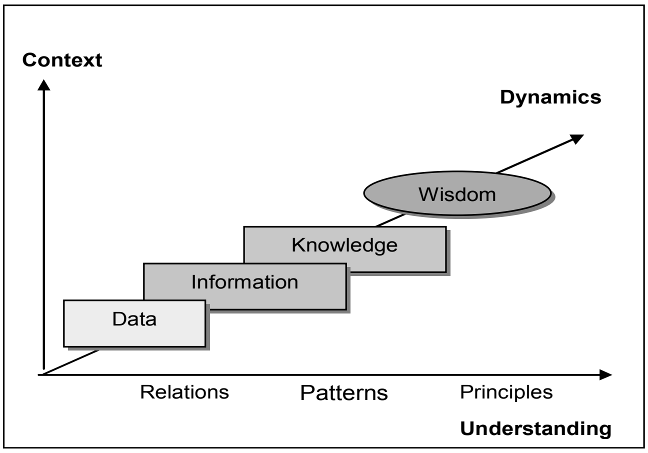

Fig. 1 Data, information and knowledge in GIS approach [17]

A. Geo-information Modeling

Current GIS technology primarily approaches the problem from the top-down perspective by modeling the structure of context. It is so called cartographic modeling which supports decision-making and knowledge creation. The basic GIS functions are used in a logical sequence to solve complex spatial problems using integrated analysis of multiple geographically distributed factors by a logical sequence with GIS modeling functions.

- **Connectivity function**

Contiguity measures evaluate characteristics of spatial units that are connected. These units share one or more characteristics with adjacent units and form a group. The term unbroken is the key concept.

- **Proximity function**

Four parameters are used to measure proximity: target locations, unit of measurement, function to calculate proximity and the analyzed area. A common type of proximity analysis is the buffer zone.

- **Network function**

A network is a set of interconnected linear features that form a pattern or framework. They are commonly used for moving resources from one location to another. Networks analysis entails four components: set of resources, one or more locations where the resources are located, an objective to deliver the resources to a set of destinations, and the set of constraints that places limits on how the objective can be met.

- **Spread function**

The spread function is simply the best way to get from point A to point B.

- **Seek function**

Seek function refers to a function that is directed outward in a step-by-step manner using a specified decision rule.

- **Inter-visibility function**

This function can be described by the phrase line of sight. It is a graphic depiction of the area that can be seen from the specified target areas. Inter-visibility functions rely on digital elevation data to define the surrounding topography. Together with overlay function that creates composite maps by combining diverse data sets it is a powerful tool.

B. Context Representation

Context is very important in recognition and multi-criteria decision at multiple levels. Achieving the highest possible levels of decision performance means the efficient use of all contextual information. Sources of contextual data can be user and event models, environmental states and parameters acquired by various sensing methods, logical relationship between objects in physical spaces and in images, consistency between different instances of observation in time and views, and previously interpreted observations [16].

C. Representation of dynamics

Since the knowledge is specified independently from the application domain, reuse of the knowledge is enabled for different domains and applications. The knowledge modeling connected with knowledge based systems is influenced everyday by new research results.

The model is only an approximation of reality and the modeling process is a cyclic process and new observations may lead to a refinement, modification, or completion of the already constructed model.

GIS architecture is open to incorporate new requirements of knowledge-based analysis and modeling, namely in connection with web designed spatial databases and temporal oriented approaches. Further development consists of information accessibility improving, knowledge-based decision-making and application of temporal objects [12].

The imagination of a temporal object model is very exciting and it will bring quite a new quality of evaluation processes. The knowledge is dynamic.

In decision-making we often need to know the history to be able to understand the trends and model the future. The management of anything, including the acceptation of important decisions is not possible to do having the inventory information. To be successful in the management of things means to account the changes, understand the trends and effectively plan the future changes.

The availability of different sensing modalities and the efforts in multi-modal information fusion, the importance of dynamic algorithms by employing prior information as context for better inference opens new space for the decision-making.

The recent interest in adaptive applications based on user context oriented on activity and history, improved robustness, efficient use of information sources as well as adaptation to event and user behavior models can be gained through the utilization of contextual information [21].

D. Integrated Analysis

The use of GIS modeling approach enables to interconnect the possibilities of the IF THAN rule with the WHAT IF analysis, accounting all advantages of spatial data analysis. The evaluation procedure consists of the two steps: firstly to set up parameters and to determine their importance and secondly to provide the sensitivity analysis to demonstrate the effect of selected parameters and to define weighting measures eventually.

A knowledge map can be applied in GIS as a description of selected set of information layers with additional information, models and virtual aspects for a deep analysis of relationships with accounting of different factors. Knowledge is a multifaceted concept with multilayered meaning. The functional and modeling tools are able to proceed and precise measures and estimation and set up objective weights and preferences for further sophisticated analyses.

Despite rapid progress in this area, there is still a significant number of challenges that need to be addressed to enable automatic contextual decision-making. The aim is to find the methodology to define relevant sources of context and spatial-temporal relationships of objects and events, to incorporate contextual information into algorithm design and to be able to use in full range behavior models and internet resources as a knowledge-base for context extraction.

V. KNOWLEDGE MAPS IN GIS

Geospatial decision-making needs the tools to analyze the relationships of proximity, connectivity, neighborhood, overlay, to investigate the spread and seek of phenomenon and their combination in dependence on selected set of attributes and information layers. GIS and its functions are the kind of this tool. Moreover, the selection of information layers can follow the local, temporal, thematic, spatial, and other types of context [15].

To solve the problem, GIS works with selected number of information layers (geometry and attributes) from the contextual space (real, artificial or virtual) and analyzes relationships, evaluates scenarios, creates partial results and verifies assumptions to prepare detailed task specification.

The set of problem oriented layers can be viewed as a weak descriptive map while the GIS layers themselves are a strong descriptive map. In GIS layers there is possible to investigate not only dependencies but also the location and distances among map elements, select the optimal path that fulfils given conditions including elevation, to solve the problem of scale and resolution of data from many sources and so on.

Context is very important in recognition and multi-criteria decision at multiple levels. Achieving the highest possible level of decision performance means the efficient use of all contextual information. Sources of contextual data can be also user and event models, environmental states and parameters acquired by various sensing methods, logical relationship between objects in physical spaces and in images, consistency between different instances of observation in time and views, and previously interpreted observations [16].

The three essential information structures are sequences, hierarchies and webs, which can be explained, described, and used as a special form of knowledge maps. The simplest way to organize information is to place it in a sequence. Sequential ordering may be chronological, a logical series of topics progressing from the general to the specific, or alphabetical, as in indexes and encyclopedias.

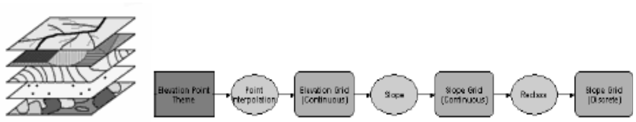

Fig. 2 Sequence of layers in GIS approach (according to the [17])

As an example of simple task see Fig. 2 that shows model where input information layer are sequentially pre-processed using operations like selective search, creation of new spatial entities, reclassification, neighborhood operations and buffering to obtain final overlay dataset that contains useful information for decision making.

The hierarchies are the best way to organize and simplify most complex packages of information (Fig. 3). Hierarchies are a very suitable structure to incorporate a particular point of view (multiple criteria decision-making) into the system arrangement.

Web organizational structures contain only few restrictions on the pattern of information use (Fig. 4). The goal is to follow associative thought and free flow of ideas, allowing users to keep their interests in a unique, heuristic pattern investigation.

This model contrary of the sequential is very sophisticated and complex. It makes possible to communicate between additional information sources and task models, can take into consideration partial evaluations and integrate accessible information layers to process and evaluate different scenarios.

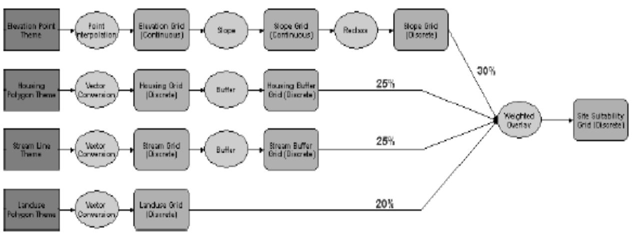

Fig. 3 Hierarchy of layers in GIS approach-according to the [17]

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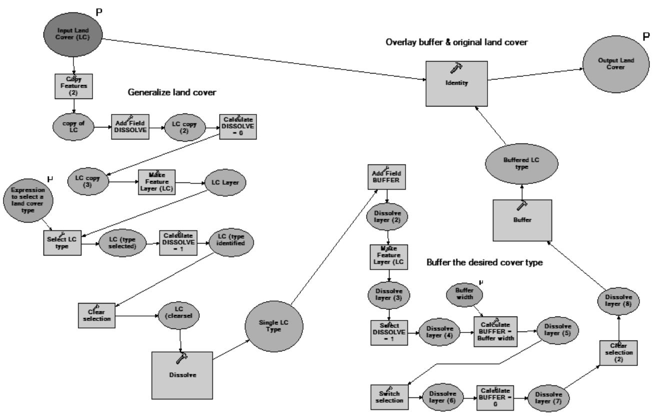

Fig. 4 Web of layers in GIS approach [17]

VI. GROUP DECISION-MAKING USING GIS

Decision-making process consists of several phases. Simon [37] defines three general phases – Intelligent, Design, and Choice phase. Implementation phase can be the fourth one or sometimes it represents a new decision problem. Schwartz [35] defines nine phases for the group decision-making.

Table 1 shows relations among decision-making phases, GIS support and knowledge maps. Nine phases according to Schwartz [35] are grouped into four phases according to Simon [37] in the first column; their goals are in the second column. The third and fourth columns contain examples of proper types of GIS layers and tools and knowledge maps.

In the following text we will demonstrate group decision-making in geospatial problems based on GIS. Actual steps in a group decision-making process according to Schwartz [35] using knowledge maps in GIS will be explained using typical examples.

Systems approach helps to solve complex decision problems because all necessary points of view can be included into solving process. Knowledge maps are very useful tools for describing and sharing date, information and knowledge around the members of the decision group. And more, GIS applications represent models for optimization of all steps of decision-making process.

This tools were used for instance in the problem of the transport environmental impacts assessment of transport projects and of the best one selection [7].

A. Identify the Problem

First of all the decision-makers need to identify the problem and the goal of its solving [21].

For this purpose a mind map of a problem is more than suitable. A decision group must compound for the answers of at least the following questions:

- What is the problem?
- What is it not?
- Where the problem is located?
- What types of consequences are there?

Mind maps are used to generate, visualize, structure, and classify ideas in this step.

Answers the questions above in geospatial decision-making processes need to select proper and necessary layers. As we discuss group decision-making, we can suppose that each decision-maker and each criterion is represented by one or more GIS layers (Fig. 5). For this purpose a mind map is a suitable tool because it is used to select, structure, and classify necessary layers [40], [9].

Table 1: Knowledge maps, GIS support and group decision-making [6]

Group decision-making	Goal	GIS support	Knowledge map
Intelligence phase ***Identify the Problem*** ***Clarify the Problem***	**Understanding the problem**	**Problem localization, wide context understanding**	**Mind map** **Concept map** ***Descriptive map***
Design phase ***Analyze the Cause*** ***Solicit alternative solutions***	**Quantification concepts and their relations**	**Information layers selection,** **Scenarios design**	**Cognitive map** ***Descriptive map***
Choice phase ***Selecting One or More Alternatives for Action***	**The best solution searching,** **model experiments,** **model solution**	**Scenarios testing, parameters estimation, integral analysis**	**Knowledge map** ***Descriptive or normative map***
Implementation phase ***Plan for Implementation*** ***Clarify the Contract*** ***The Action Plan*** ***Provide for Evaluation and Accountability***	**Realization of chosen solution**	**Result interpretation, consequences and future impact modelling**	**Prescriptive map** ***Descriptive or normative map***

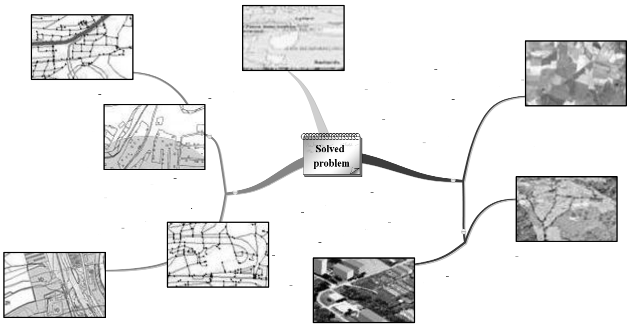

Fig. 5: GIS layers in mind map (MindMap) [6]

B. Clarify the Problem

This step is the most important when working with a group of people. Now it is the time to discuss all consequences and understand wide context of the problem.

In clarifying the geospatial problem, ask the group the following questions:

- Who or what is involved with the problem?
- Who or what is likely to be affected?
- What types of relationships will we follow?
- How many scenarios will be tested?
- Are there others who need to be consulted prior to a decision?

To represent context we use trees, structures and maps to describe organization, structuring and logical arrangement. From the data and information point of view, selection of necessary layers and the process of their working up have to be clarified. A concept map can be a useful tool for organizing, relating and representing geospatial data, information and knowledge in various layers necessary for geospatial modeling, because a concept map can show influences, consequences, and dependencies of all GIS layers and their elements.

C. Cause Analysis

Since a cognitive map helps to describe the structure of the causal assertions, and the consequences that follow from this structure, it is a proper tool for a problem analysis from internal and external relations point of view. The cognitive map is a tool for graphical description of a system of GIS layers (**Error! Reference source not found.**).

The next steps are:

- Information layers selection
- Scenarios design
- Task design using Model-Builder
- Additional data specification

This step calls for identifying as many solutions to the problem as possible before discussing the specific advantages and disadvantages of each.

Model-Builder is essential for developing different workflow diagrams showing data processing steps in the creation of the final routing priority map. Blue ovals in Model-Builder scheme (**Error! Reference source not found.**)

indicate input layers, while green ovals are intermediate layers calculated to obtain the final

weighted layer. The yellow rectangles are all operations performed on data layers in order to standardize each layer with the relative weighting scale.

The selected steps of GIS analysis and modeling formally organized in some kind of a flow chart can be interpreted as a weak descriptive map, which explains the dependencies between the following steps in GIS modeling with necessary data and information in proper GIS layers. This weak descriptive map represents a successful solving process, e. g. knowledge.

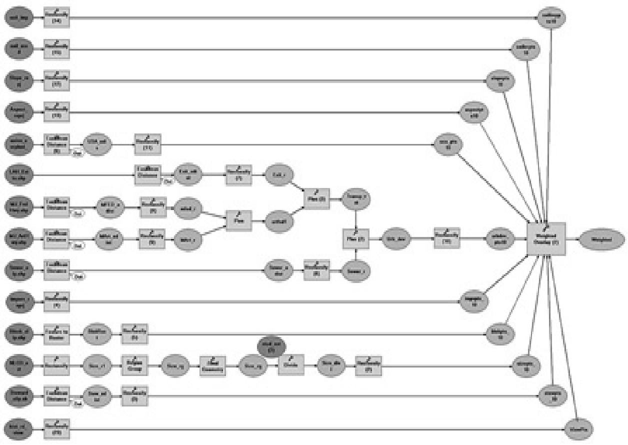

Fig. 6 Cognitive map in ModelBuilder [6]

D. Choice Phase

Before selecting specific alternatives for action, it is advisable to identify criteria the desired solution must meet. Each data layer falls under a data category, which has an assigned multiplication factor reflecting its relative importance, compared to other data categories.

Within each category, each feature is represented by one or more data layers and is assigned a relative weight in accordance with its estimated cost or routing preference within the category.

Each data layer therefore has a relative weight for each feature it contains, and a multiplication factor from its category to yield its total weight.

Than we continue with:

- Scenarios testing
- Parameters estimation
- Hypothesis verifying
- Integrated analysis of spatial and attribute data

At this point, it becomes necessary to look for and discuss the advantages and disadvantages of options that appear viable.

The result can be for example selected area for some actions, place where some social, economic or other activities are successful, missing or needed. The form of such a result is

again the GIS layer, which is a strong descriptive map in the sense of a normative map (Fig.).

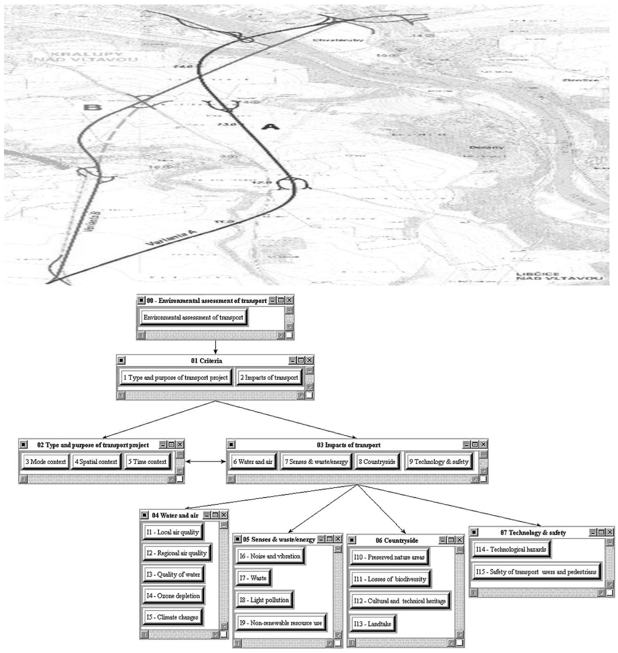

Fig. 7 Layer with possible road constructions and ANP model [7]

E. Implementation Phase

This requires looking at the details that must be performed to cover all task consequences. Strong descriptive or prescriptive maps help us to implement solution received by a normative map (**Error! Reference source not found.**). The prescriptive knowledge map includes the rules how to read model facing real conditions (environment).

The next steps are:

- Results interpretation
- Possible consequences taken into consideration
- Dynamic analysis of the problem
- Future impact modeling.

Accuracy of input data is critical: decisions based on GIS analyses depend on it, and errors can influence the validity of the entire task.

VII. CONCLUSION

Decision-making process in contemporary decision problems often uses GIS. Data, information and knowledge sharing is supported by various forms of knowledge maps and models in GIS. We analyze selected examples of knowledge maps in essential GIS structures - sequences, hierarchies and webs, which can be explained, described, and used as a special form of knowledge maps.

Group decision-making in geospatial problems analyzes the relationships of proximity, connectivity, neighborhood, overlay to investigate the spread and seek of phenomena and their combinations in dependence on selected set of attributes and information layers. The useful tools for this process are various types of knowledge maps.

A mind map and a concept map improve processes of data, information and knowledge sharing among decision group members in the intelligent decision phase.

The set of problem oriented GIS layers in a design phase can be viewed as a weak descriptive map while the GIS layers themselves are strong descriptive map. In GIS layers there is possible to investigate not only dependencies but also the location and distances among map elements, their scale and so on.

The selected steps of GIS analysis and modeling formally organized in some kind of a flow chart can be interpreted as a weak descriptive map, which explains the dependencies between the following steps in GIS modeling with necessary data and information in proper GIS layers. This weak descriptive map represents a successful solving process, a choice phase, e. g. knowledge.

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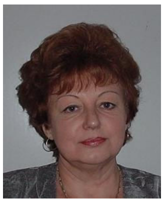

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