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THE USE OF MULTI-CRITERIA ANALYSES FOR THE SECURITY NEEDS OF REPUBLIC OF MACEDONIA

Abstract

This paper aims to support transnational cooperation for integral spatial connection of RM with its environment. By the use of the multi-criteria analyses many alternatives could be examined in accordance with many objectives and neutral criteria, analysis of their usefulness and recommendations for selection of the most realistic alternative in the decision making process of the existing and planned road infrastructure from the aspect of the spatial security organization of the territory of RM.

For the decision making process to carry out the projects for the needs of spatial organization of the RM for the security, should reduce the negative influence of the existing territorial conditions over the national and international security and improve the connections with the SEE countries.

The methods of multi-criteria decision making identify the best compromised solution to overcome the modern security threats and risks, to elevate strategic security environment and to position the Republic of Macedonia closer to the Euro-Atlantic integrative processes.

***Keywords**: transnational cooperation, spatial security organization, decision making, threats, risks, multi-criteria analyses, strategic security environment.*

Introduction

In realization of one of the missions of Perspectives in the spatial development of Europe (ESDP)[1] special role is played by those regional initiatives of the spatial development which include some EU members and some EU member

[1] ESDP - European Spatial Develoment Prespective.

candidates. Even during the preparation of ESDP, The European Commission has initiated regional initiative called INTERREG II C[1], in order to support transnational cooperation in the spatial planning of European countries and regions for security needs. In this context ESTIA[2] and OSPE[3] are the two most important regional initiatives in the area of spatial, urban development and security connection with the Southeast European countries. The need of applying multi – criteria analyses in the decision making process while analyzing the existing and planned road infrastructure has been preconditioned by the features of the infrastructure which is entitled public benefit/good (many interested subjects into it), but also to minimize the problems and risks connected with developing such projects which are important from the perspective of security and spatial connection of the Republic of Macedonia (RM) with its environment.

1. Spatial connection of the Republic of Macedonia with its environment

External connections for spatial and functional connections include all direct connections of RM with the neighboring countries, and through them the most direct relations as part of the commitment for developing good neighboring relations and enhanced exchange and cooperation with the environment are best manifested. Certain bilateral agreements with the neighboring countries still lack sufficient precise elements that could be included into the concept of future spatial organization of RM, by which they do not satisfy the substantial needs in developing future integrative elements and ties so it is realistically initial to offer all categories of developing relations instead of passively expect them.

In spite of the whole social, political, economical, geographical, security and other difference in the Western Balkan states, the efforts are more in a way of general harmonization of the own spatial-functional organization on a micro plan. It means that the western Balkan countries are seriously considering the needs and the opportunities, to express their participation in this continental constellation with greater level of harmonization referring to their macro functional structure. However, there are facts that it cannot be done by absolute autonomy in each national – spatial community, as the same has been preconditioned by the new integrative relations.

The foreseen functional regionalization of the security systems simultaneously reflects the desired level of integration within the European regions, which means participation of each country with its functional

[1] INTERREG II C - Cross-border cooperation.

[2] ESTIA - European Space and Teritorial Integration Alternatives), A strategy and policy of integration in the space development for South-East Europe. In this project, participants were Albania, Bulgaria, Greece, Macedonia, Romania and other Balkan countries.

[3] OSPE - Observatory of spatial planning and environment in South-East Europe.

structure. The category of security systems in the future period will represent the most intensive form of spatial –functional integration and realistically, it is expected that the whole Europe will be covered with significantly more harmonized net of security subsystems. Significant differences will appear in the area of capacities of certain functions in certain areas of the European space. A condition to overcome this is to see the functions which each member country can offer as a spatial-functional union to the European constellation on time.

The suggested direction of the common security systems for development of the Balkan has been carried out based on the assessment of the European macro-regional tendencies of development. Special benefit from directing the security connection in the future development of the western Balkan countries is the increased participation in sharing the European functions.

Spatial connection of RM with its environment for the security needs is necessary from many aspects, but generally, we can say that the studies for its influence are divided into two parts:

Studying the area –territory for political reasons and

Studying the space-territory for subjects which carry out politics.

The first type of studies treats the phenomena connected with it from the aspect of security politics which is carried out by certain political subjects. The goals of such studies are always defined from the aspect of wider interests which are part of political platforms of the parties and based on such studies of the territory the global and specific politics are being defined.

The second type of studies is necessary for decision making which is directly connected with the agencies which provide security. There are private agencies which provide services for others (people, buildings etc.) in order to accomplish certain interests.

In both cases there is a need for analyses of the spatial connection and finding explicative factors which can foresee the future effects of certain activities.

2. Multi-criteria analyses – tools to assist when making decisions

Methods of multi-criteria analysis are a type of a tool to make decisions developed in the beginning of 60s of the XX century. More techniques have been recommended to enable the subject that makes decisions to make *a good choice*. Certain theoreticians think that the choice exists only in the *mind* of the one who decides while the techniques to assist in decision making should enable just to confirm that in reality. For others,

such decisions should enable to make the decision that previously did not exist.

The process of decision making has been defined (Bernard, R., 2002) as a "process of confrontations regulated through different corrections which come out successively among the different participants". Such a final decision progressively elaborates to such a level that the final decision can only be a moment of ratification of the previous decisions or synthesis of grouping the decisions.

The reality in which people live is multidimensional and complex. Living, planning working and accomplishing activities in various shapes and types within the framework of such multilayered reality implies the need of the craft for facing, managing and successful resolution of *conflicting situations,* i.e. solving the resulting problems and adequate decision making.

Regardless of the shape and form of the world in which we live and regardless of the rations and changes it will prepare, the humanity is constantly facing the need for planning and making substantial decisions in connection to the realization of the plans at different levels and with different meaning. Planning is not a science, but it represents a process of normative decision making (deciding). Still, in order to carry it out successfully it is necessary in the process of decision making to base it on scientifically proven methods and techniques.

Numerous analysts and other experts as well as other involved parties whose opinion and points of view should be incorporated in the process of decision making are included. Due to the variety of opinions it is necessary to apply techniques of harmonization of the principle which refers to the considered activities or techniques which help when analyzing the negotiations of the affected sides.

"Decision making is characterized with processing information, assessing the values and optimization. It means that the inventiveness requests numerous possible answers, while the analysis actually necessitates a unique answer and the decision making is striving to choose the best possible answer "(Dixon J.R., 1996).

Decision making process (deciding) occurs, when there is a need to take an activity and then due to lack of information, lack of experience in a certain area and other reasons which impede to see the outcome, it is not completely clear what should be done and in which way. There are more options to carry out the activity and in accordance with it more outcomes with different consequences, quite often opposite and conflicting.

Different authors use different terminology for the comprising components of the decision making process (Saaty, T. L. 2006). However, generally they could be reduced to *three components* (or *conditionally five*, if

a delineation is done between attribute, basic goal and additional goal) shown in Table 1.

Table 1: Definition of attributes (goals, higher goals), criteria and alternatives (relations and differences between them)

	DEFINITION	EXAMPLE
1	2	3
Attributes (features)	Description of reality: Could be subjective or objective distinguishing of the external world	height, weight, intellects, beauty etc.
Basic goals	Directions for improvement based on attributes	Maximization or minimization of some of the attributes
Higher additional goals	Recognizable in accordance with the needs and desire of the decision makers	Reaching superior goal composed as a combination of reaching attributes
Criteria	Measures, rules, standards which represent guidelines in the decision making process	Can be attributes, goals, higher goals classified as relevant for certain situation by the decision makers
Alternatives	Set of possible solutions among which to look for the optimal one in relation to previously defined criteria.	Solutions which include all or more of the previously defined attributes and are compatible with all previously defined attributes and correspond to all defined criteria

Source: adapted from Parkan, C. and Wu, M.L., (2000): "Comparison of three modern multi criteria decision making tools", International Journal of Systems Science, 31(4), 497-517.

Attributes or the features are defined as features which describe the state of a product or a system. In principle, philosophers make distinction between attributes and features. Feature is a quality of certain objects and individual posses although we are not aware of the fact. Attribute is a quality which we consciously give to a certain object or individual. Attributes/qualities could be observed as goals which give certain direction or as superior or additional goals which define desired or targeted level,

expressed through exact defined condition in time and space which should be reached. Selected attributes should simultaneously reflect the measureable (objective and / or subjective) components of alternatives and criteria (objective and / or subjective) coming out of the preferences and analyses of the decisions makers.

Criteria define standards of assessment or rules to treat acceptability of another alternative or as a rule they are indicators of the goals and /or the attributes. Actually, through an adequate function, the attributes transform into relevant criteria for the certain problem of interest.

Alternatives are set of possible solutions among which the optimal one is looked for in relation to the previously defined criteria selected as relevant for the specific problem.

Since the projection of problem and the process of final decision making (solution to the problem) depend a lot on the used criteria, adequately the different preferences could cause significantly different projections and accordingly different outcome (decision).

3. Multi criteria analyses – Multi criteria decision making

According to (Bell, M. L., Hobbs, B.F., Elliott, E. M., Ellis, H. and Robinson, Z., 2002), and (Ortega, J. F., 2002) during the development of an area of the science known as *multi-criteria analysis* different terms were used and they are actually a subset of the multi criteria analysis i.e.:

Multi criteria decision making (MCDM);

Multi attributive function of usability (MAFU) and

Multi targeted (multi objective) programming (MOP).

In order to understand and differentiate among multi criteria decision making, multi attributive function of usability and multi targeted programming, it is important to consider the different alternatives and relations among the components into the decision making process.

Multi criteria decision making (Tille, M., 2001) is defined as a process of searching for a solution of problems involving more attributes, goals and higher goals. For that purpose, multi criteria decision making applies numerical mathematical techniques which help the decision makers to choose between discrete set of alternatives.

Multi attributive function of usability (Knoepfel, P., Larrue, C., Varone, F. and Hill, M., 2007) refers to a procedure: how, from attributes to define goals or in other words how to find and define goal for the maximization.

Multi targeted (multi objective) programming (Knoepfel, P., Larrue, C., et Varone, F. 2006) investigates problems with different goals but does not look for targeted function at higher level.

Simultaneously, different authors in function to facilitate the decision making process i.e. to find a solution of the problem of coming to a right decision when it includes multi criteria and numerous decision makers, different methods have been developed, as well as processes, techniques and analyses which incorporate complex mathematical models and/or theories when talking about decision making which refer to the **security–spatial environment.** (Krakutovski, Z., 2005)

The Method of sum up of the assessment represents comparison of the alternatives with sum up of the values of weight according to the method of global sum.

Method ELECTRE 1 is (Elimination Et Choix Traduisant la RÉalité), method which enables to lead the subject which makes a decision in selection of a possible activity (a) in the set A of activities knowing that it should consider numerous criteria of preferences of non aggregated features of possible activities and uses the technique of comparing of such activity or alternative.

The Monte Carlo method, are numerical algorithms which serve to simulate systems in different regimes of work and survival based on the theory of probability.

SWOT Analysis (SWOT analysis), assists to assess the decision maker in four classes of evaluations: Strengths, Weaknesses, Opportunities and Threats, seen from the perspective of reaching the desired condition or goal.

Trees of decisions can apply: technique of program assessment and review, analysis of the critical path, analysis of the critical chain.

Analytical hierarchical process is a procedure which enables solving hierarchically established problem with more levels (Glavinov, A., 2010).

Linear programming includes problems of optimization in which the targeted function and limitations have a linear character (Simplex Method).

Pareto Analysis, selection of an option between certain numbers of tasks which generate (general) activity.

Grid analysis is carried out through comparisons of average weight values of ranked criteria in relation to previously selected alternatives.

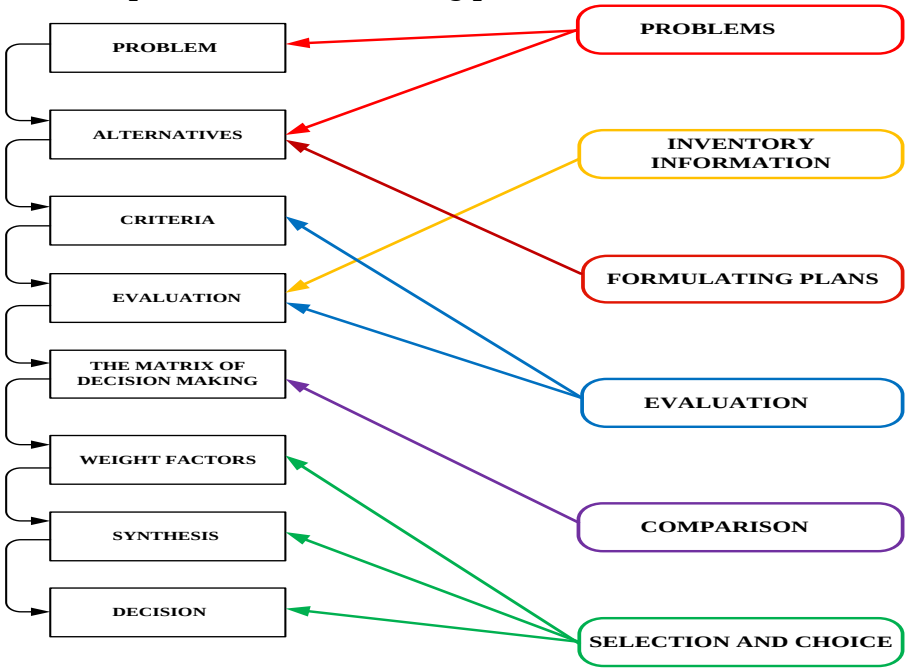
In accordance with the general theory of decision making, the main components of the process of multi criteria decision making are: *resources*, process of transformation (mapping – subjective) and / or (mapping – objective) and final desired condition which will result or would result from the decisions being made.

Decision making process can be complete when the level of knowing the problem is high enough and is called function of usability which well

describes the projected problem. In such a case, the decision making process shown on picture 1, consists of:

- ⇨ Identification of problem and its definition as a main goal;
- ⇨ Identification and construction of alternatives;
- ⇨ Identification and construction of criteria according to which there will be evaluation, assessment of the alternatives in function to carry out the main goal which includes:
  - ⇘ Understanding and clarification such as the preferences of the decision maker through defining of objective and subjective mapping of the space to attributes in the space of criteria and alternatives;
  - ⇘ Extending the sets of alternatives and in that way enabling the decision maker completely to figure out the problem and preferences through an interactive process of evaluation/assessment of alternatives;
- ⇨ Constructing the matrix of decision making. Since the multi criteria decision making encompass solving wider range of problems, including those which use compromise, we can mention that the experts who are dealing with the process of planning will see the matrix of decisions from multi criteria decision making; it is actually compatible, identical with the concept of performing substantial influences and impacts in the process of planning;
- ⇨ Defining and allocating the weight factors, coefficients of pondering, if there is a finding that those criteria are not with the same meaning and weight;
- ⇨ Synthesis: defining the function of utility;
- ⇨ Identification and choice of the optimal alternative (the final decision);

Picture 1: Steps in the decision making process



Source: Lazarevska, A., 2007:"Definition of a MCDM Model for Improving the Public Transportation Concept in the City of Skopje", Proc. 26th IASTED International Conference on Modelling, Identification, and Control (MIC 2007), pp. 375-380.

Since the alternative which satisfies previously identified and defined criteria has been recognized, application of the selected alternative can start, as well as the evaluation of the gained results and defining whether the solution is satisfactory.

Conclusion

The influence of the spatial connection of RM with its environment for the security needs, is a subject of interdisciplinary research in different areas. One of the basic functions of the spatial connection is to provide access to every micro location of the area of a given state which is of special interest for the security of each country of the Western Balkan, due to which the contemporary world is facing asymmetric threats and risks (contemporary threats and risks, contemporary security challenges) and is characterized with quick, complex and dynamic changes.

Also, challenges such as the energetic dependence and climate change have negative influence over the national and international security. During the last few years, the strategic security environment of the Republic of Macedonia significantly changed and improved during the last few years.

Democratic changes in the SEE Countries and the EU and NATO support have increased the impact over the Euro - Atlantic integrative processes. These positive changes are creating the current political and security scene in the Western Balkan where the peace, cooperation, economic and democratic development among the states are significantly improving and are contributing to the development of the whole region and the Republic of Macedonia

In the multi criteria decision making process, the spatial arrangements and spatial development of RM are included from the aspect of the security needs. Analysis of the spatial connection of RM with the environment has been made and different methodologies have been recommended to apply multi criteria analysis in the decision making process in the security area.

Specific contributions from these analyses for facilitating the decision making process are:

- ⇨ steps in the decision making process when multi criteria analyses and spatial-security connections are integrated;
- ⇨ a great number of subjects - decision makers from the western Balkan can be included in the security –spatial environment..

From the offered methods, processes, techniques and analyses as well as from the proposed steps in the decision making process from the aspect of the security needs, the category infrastructural systems will represent most intensive form of spatial–functional integration and it is realistically to expect that the whole Europe will be covered with more harmonized net of subsystems of roads, railroads, canals, oil pipelines, transmission lines, gas pipelines etc. Specific example of implementation of multi criteria analysis has been made on the existing and planned road infrastructure for defense - security needs as the most intensive form of spatial and security connection of the SEE countries through the corridors VIII and X.

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УПОТРЕБАТА НА МУЛТИКРИТЕРНАТА АНАЛИЗА ВО УРЕДУВАЊЕТО НА ТЕРИТОРИЈАТА НА РЕПУБЛИКА МАКЕДОНИЈА ЗА ПОТРЕБИТЕ НА БЕЗБЕДНОСТА

Резиме

Трудот има за цел да ја поддржи транснационалната соработка за интегрирано просторно поврзување на РМ со нејзиното опкружување. Со помош на мултикритерните анализи (МКА) може да се испитаат разни варијанти според најмногу објективни и неутрални критериуми, анализа на нивната корисност и давање препораки за избор на оптимална варијанта во процесот на носење одлуки за постојната и предвидената патната инфраструктура, од аспект на просторното безбедносно уредување на територијата на РМ.

Носењето одлуки за реализација на проектите за потребите од уредување на територијата на РМ за потребите на безбедноста треба да го намалат негативното влијание на постоечката сосотојба врз националната и меѓународна безбедност и да го подобрат поврзувањето со земјите од југоисточна Европа (ЈИЕ).

Методите на мултикритериумското донесување одлуки го идентификуваат најдоброто компромисно решение за надминување на современите безбедносни закани и ризици, заради подигање на стратегиското безбедносно опкружување и доближување до евроатланските интегративни процеси.

Клучни зборови: *транснационална соработка, просторно безбедносно уредување, носење одлуки, закани, ризици, мултикритерни анализи и стратегиско безбедносно опкружување.*