MODAL EXPERIMENT IN THE PROCESS OF CREATING THE CONCEPTUAL MODEL OF SYSTEM OF SECURITY OF THE STATE

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Abstract. *The development of cybernetics resulted in the birth of modeling method as a general scientific method, and made unity of theory and practice become, by far, more qualitative than, until then, governing statistical method. In the field of social science, this method has appeared as the modal experiment. Using these fundamental experiences, in this work, the authors firstly explain the concept and structure of modeling, at the same time speaking about the concept and types of modeling, and then the concept and types of experiments, that is, its basic model in model experiment, and in the end, they elaborate the possible conceptual model of security system of the Republic of Serbia and modal experiment variables. In this model it is possible to vary and change the quality, intensity, dynamics and quantity factors. With the help of this model, it is possible to determine the power of accomplishment and tendencies. To achieve this simulation as forecasting, research technique has been applied. Conceptual model has been seen from the aspect of strategically doctrinary, legally normative and organizationally functional aspects, having been in compliance with security movements in the world, needs and objective possibilities of the Republic of Serbia.*

Keywords: *model, modeling, modal experiment, concept, security.*

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INTRODUCTION

In the process of realization of fundamental, applicable and developing research, the modeling method, experiments and modal experiments have been gaining larger significance. Also, their application is important when it comes to verifying and heuristic research when performing a scientific classification, description, explanation, forecasting and detection of phenomena, all of which requires their close study and getting the clearer picture of their application in all the spheres of human operations, especially in the sphere of security.

Modeling as a general scientific method has been the consequence of cybernetic development. Its basic characteristic is «the unity of theory and practice», which allows it to be at a higher qualitative level than statistical method, thus allowing it to be applied in certain fields where the very existence of the unity of theory and practice is of crucial importance, first of all in political science and practice of political security. It appears as a general theory of social and political relations, a system of programmed, political, lawful and other normatives, and also as a certain degree of fulfillment in practice — as a model experiment.[1]

There are two important moments, which have decisive influence on application of modeling method in all empirical research in political science, and they are: *firstly*, scientific research is based on already existing scientific knowledge or

[1] *Milosavljević, Slavomir*, Istraživanje političkih pojava, Institut za političke studije, Centar za omladinu i pionire Palilule, Beograd, 1980, str. 241 - 242.

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knowledge based on experience, and *secondly*, it is necessary that the project of empiric research contains certain theoretical model of research object as well.[2]

All of this enables a complete insight into the security system of a state by applying the modeling method, that is, the modal experiment, and based on existing scientific knowledge and knowledge based on experience it enables creation of new conceptual model of security system of that state.

1. MODELING, CONCEPT AND TYPES OF MODELS, EXPERIMENTS AND BASIC MODEL IN MODEL EXPERIMENT

Modeling does not mean only «presentation through senses and physical copying but every psychological presentation as well, even imagining an object or phenomenon».[3]

If we start from the point where modeling is a constitutional part of every process of human thinking, this concept can be seen as «rational, systematic, complex action of presenting adequately important points of the process or phenomenon that is social realty or their thoughts as particular units».[4] By doing so, the creation of new concepts is accomplished through already existing ones.

The process of modeling consists of noticing conceptual and physical presentation of important factors of the phenomenon which is being researched.

While modeling certain social phenomena it is necessary to respect the following principles: universality of the modeling object principle, which shows that each and every research object can be modeled; variety of the modeling principle, which means that every object or system can be modeled in different ways, and principle of prototype and example.[5]

Determination of the modeling concept preconditions determination of its structure, which consists of four elements: «modeling object, which is any phenomenon which can be researched by the modeling method; subjective factor — an individual or a group of researchers who work on some object model and through that object they do a research on some phenomenon or process; means which are used in creating the model and from which the model is created (physical, technical, cognitive and linguistic) and conditions under which the model is built».[6]

Based on previously said, one can conclude that the process of modeling consists of the following phases: defining needs and necessity to build the model, choosing modeling object, choosing type and kind of model, choosing modeling means, choosing assosiates in creating the model, projecting and creating the model, testing the model and finishing touches to it, if necessary, and presenting and using the model.

In contemporary methodology of social sciences, generally accepted meaning of the concept of model does not exist. Generally speaking, «model is every theoretical — conceptual or real, or practically realistic, system analogue to the research object (S_1) used to research on certain basic object or system (S_0)». Having this in mind, modeling is «S_1 system constructing that is modeling system according to original system S_0 which is researched on S_1 model».[7]

Also, model is ''a simplified and idealized picture of reality'', which ''enables us to face with the real world (system) in the simplified way, avoiding its coplexity and irreversibility, as well as all dangers (in the broadest sense) which could result from the experiment if it is done on that real system'', or model is ''imitation, prototype or projection of a subject — part of existing, past or possible future social reality''.[8]

Theoretically seen, having in mind gnoseological nature of a model, the following main types of models could be distinguished:

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2 Isto, str. 242.

3 *Šešić, Bogdan*, Opšta metodologija, Naučna knjiga, Beograd, 1974, str. 18.

4 *Milosavljević, Slavomir*, *Radosavljević, Ivan*, Osnovi metodologije političkih nauka, Službeni glasnik, Beograd, str. 265.

5 Isto, str. 21.

6 *Šešić, Bogdan*, Opšta metodologija, Naučna knjiga, Beograd, 1974, str. 18. (И Slavomir Milosavljević и Ivan Radosavljević разликују четири основна чиниоца моделовања: ситуацију, односно услове моделовања; субјект моделовања; објект (предмет) моделовања и средства моделовања - Milosavljević, Slavomir, Radosavljević, Ivan, наведено дело, стр. 271)

7 *Milosavljević, Slavomir, Radosavljević, Ivan*, наведено дело, str. 21.

8 Isto, str. 265

theoretical, practical, real, ideal, simple, complex, structural, functional, partial, global, analytical, typological, network, deterministic, stochastic and statistical. Apart from these, mixed or combined models, such as, for example, the theoretical — practical, structural — functional and complex are often used.[9]

Specificities of political science subject of research also demand slightly different typologization of models: simple — complex; static — dynamic; closed — open; rigid — flexible; retrospective — prognostic; evaluative (normative) — actual (realistic); derived — projected and internal — external.[10]

When we talk about scientific experiment, as the basic and the most important form of gaining scientific knowledge, it is seen as ''planned, organized and methodic producing and performing, or just changing the emergent process, in order to discover unknown facts, properties and relations between phenomena, and to check the hypothesis on these facts and their properties''.[11] From methodological and technical aspects, the experiment is viewed as ''planned observation of phenomena artificially induced in determined favorable conditions, in order to study the relationships between factors of the phenomena''.[12]

Also, experiment is a way of collecting data by direct sensual perception, with the use of auxiliary technical means or without them.[13]

There are different criteria for the classification of an experiment. According to the criterion of the place of executing, ther are the following types of experiments: experiment in natural conditions, experiment in laboratory conditions, natural experiment, experiment ''*ex post facto*'' and simulation experiment.[14]

Experiment, as a research method, usually is based on using two equal groups — experimental and control groups, which are, on the beginning of the experiment, made equal according to determined property for which the experimentator is interested in. In this, the experimental group is, according to the plan, exposed to the activity of the determined factor or influence, while the control group conducts its acting in accustomed conditions. After a single or repeated exposure to the activities of a determined factor, the experimentator again conducts measuring in both groups, and a possible (significant) difference in measuring values of a certain property between experimental and control group is attributed to the effect of experimental factor.

When it comes to social and political sciences, experiments are divided into two groups — real and quasi — experiments. The first group consists of laboratory experiment and experiment in natural conditions, and the other group — natural, *ex post facto* experiment and simulation, e.g. modal experiment.[15]

Laboratory experiment has the rarest use in political science and it is the hardest one for conducting. Experiments in natural conditions can be performed by using the two groups — experimental and control. The possibilities for conducting the natural experiment are far greater, but it can not be claimed that it is more economic then the previous type of experiment. *Ex post facto* experiment represents a reconstruction of a social phenomenon on the basis of available data and using statistical method. However, these researches by their probability and reliability have very limited value. Simulation method can be applied as a form of *ex post facto* experiment or prognostic experiment. This experiment is conducted by using known data or scientifically based assessments about properties of certain phenomenon often by means of computer in presumed functions of the goal for the formation of notions of possible situation and behavior.

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9 *Radenković, Božidar,* Interaktivni simulacioni sistem za diskretnu stohastičku simulaciju organizacionih sistema i njegova realizacija na mini i mikro računarima, doktorska teza, Univerzitet u Beogradu, FON, Beograd, 1989, str. 23.

10 *Milosavljević, Slavomir*, navedeno delo, str. 244–248. (Полазећи од дефиниције модела као ''имитације, прототипа или пројекције'' неког предмета, Slavomir Milosavljević и Ivan Radosavljević разликују три основне врсте модела: имитационе, прототипске и пројекционе моделе. Прву врсту модела чине они којима се углавном представљају реалитети друштвене стварности материјалне или друге природе.)

11 *Šešić, Bogdan*, Osnovi metodologije društvenih nauka, Beograd, 1984, str. 243.

12 *Kozić, Predrag*, Metodologija naučnoistraživačkog rada, Beograd, 1994, str. 36.

13 *Milosavljević, Slavomir, Radosavljević, Ivan*, наведено дело, str. 540

14 *Mihailović, Dobrivoje*, Metodologija naučnih istraživanja, Fakultet organizacionih nauka, Beograd, 1999, str. 162.

15 *Milosavljević, Slavomir, Radosavljević, Ivan*, наведено дело, str. 542 и 543.

As for the simulation experiment, it should be pointed out that its result is «a set of points, ie. values of dependent variables for certain values of independent variables (time)». Independent variables or variables of models have random character, and as a result of the experiment different values of dependent variables for the same value of independent variables are obtained.

When it comes to modal experiment, it can have double meaning, that is, it can be empirical and practical, on one hand, and theoretical and cognitive, on the other hand. The term «cognitive experiment» contains a contradiction, which is reflected in the fact that the experiment is primarily empirical method and that the important characteristics of the experiment are connected exactly to ''practical behavior in producing determined result''.[16] However, this contradiction could be explained: first, conceived and verbally presented model is checked by practical experiment; second, the model is only outlined, so the model is build and developed by using the experiment and quaziexperiment and third, there is a cognitive model which is based on theory and applicated in practice.[17]

Modal experiment is an experiment that is conducted on already built model. It is the higher form and a special type of artificial experiment, that is characterized by higher level of creativity. The main characteristics of modal experiment are as follows:

1) conducted on a model, in which, to some extent, the theory relaying on hypothesis which are being tested using modal expriment, is realized and practicaly presented;
2) enables researching of certain phenomena in strictly determined conditions, which could be, not only varyed, but also controled by the experimentator;
3) enables, not only varying of the conditions for conducting experiment, but also combining these conditions, and that enables conducting of new experiments;
4) enables practical researches of certain phenomena in so called pure form, after their separation from complex phenomena;
5) very broad area of application.[18]

The structure of modal experiment consists of the following factors:

— conditions in which the phenomenon occurs and exists,
— subjects who evaluate the conditions and who have certain characteristics and relationship with conditions,
— connection between the subject and the conditions in whose base are motives, interests, desires, intentions, aspirations because of which certain activities develop,
— activity, behavior, action of subjects in these or changed conditions, in order to achieve the objectives, relations and connections.
— methods and means which are used and which are clearly and efficiently being built into the possible system.

Therefore, starting from the constructed model, modal experiment comes to new model as a result of the process of thinking. In doing so, the complete process of thinking includes the following elements: perception, representation and knowledge. Also, each modal experiment is also the process of: a) selection; b) variation and c) evaluation. In fact, every modal experiment is a developed procedure of prooving and disprooving, which usually has the following three phases:

— The first phase includes a thesis or a basic (initial) idea;
— In the second phase, positive and negative arguments are presented, and they inlude selection, variation and evaluation.
— he third phase includes the establishment of a valid system model.

2. APPLICATION OF SIMULATION IN EXAMPLE FOR MICRO MODEL OF CONFLICT SITUATION

Bearing in mind that the system of security represents complex organizational system in which intertwine missions (roles), jurisdictions and functions of a large number of national and social institutions, as a prelude to the main modal experiment of this study, for additional clarification, an example of possible simulations on a micro model is provided. This is due to the fact that each global macro modal experiment is necessarily composed of many individual modal experiments, and these micro-experiments serve to define the factors macro modal experiment and simulation.

[16] Isto, str. 271.
[17] Isto, str. 272.
[18] *Šešić, Bogdan*, Opšta metodologija, Naučna knjiga, Beograd, 1974, str. 25.

As an example for micro model of conflict situation, a relation is taken between the possibility of realizing the task of a protection system from the attack from the air (aircraft, unmanned aerial vehicle, drone, a helicopter) and an aircraft used to perform terrorist attack (aircraft, unmanned aerial vehicle, drone helicopter). Generally, a protection system from the attack from the air and the aircraft, represents organizational systems whose tasks in terrorist activities are diametrically opposed. In fact their performance in a real situation represents a dialectical unity and struggle of opposites, but the ultimate goal is physical destruction of another. That's why this example is suitable for introduction to a serious scientific discussion about the behavior of the system of security depending on the degree of threat to the country using modal experiment.

To consider the possibility of realizing the task of one or another system using simulation, it is necessary to form the two models (model of system for protection of airspace and aircraft). Both models are an abstraction of the features of these systems necessary for evaluating implementation of their tasks. Essentially models represent the relation of quantitative indicators of combat capabilities of the system for protection of airspace and aircraft that determine their use in anti-terrorist and terrorist attacks. Combat capabilities of both systems are presented through the following services: spatial, temporal and firepower possibilities (spatial possibilities are expressed in the unit of length and derived units — meter, square meter, temporal in unit of time — second, and firepower through probability in the range between (0 and 1).

Spatial capability of system for protection of airspace are determined by values near and far, the lower and upper limits of observation, shooting and destroying targets in the airspace. Weather capabilities are defined: firing cycle (time required for shooting targets in the airspace) and the time required to re-shoot the target in case of failure. Firepower features were determined by target destruction probability in the airspace shooting with one, two or three anti-aircraft missiles, ammunition, etc.

Spatial capability of the aircraft are determined: by range of aircraft identification so that he is detected by the system for protection of airspace and by launching distance of antimissile on a missile system after he is being seen on the indicators in the aircraft. Weather capabilities are determined: capabilities of maneuver execution against the guidance (the ability of aircraft that upon learning that he was discovered by a missile system or antiaircraft guns leaves the zone in a short period of time) and the antimissile maneuver (the ability of the aircraft to change flight characteristics so that in case of launching anti-aircraft missiles not be hit). Firepower features are determined by a probability for destruction of missile system for antiaircraft attack with launched antimissile weapon.

Thus formed models of system for protection of airspace and aircraft are mathematical models (representing their quantitative tactical — technical characteristics), which form the basis for the formation of a unique simulation model by which it is possible to examine playing variations of actions of the conflicting parties. Mutual comparison of analog characteristics of both organizational systems (mutual comparison of quantitative indicators of spatial, temporal and fire power capability of missile systems and aircraft) in the simulation model, it is possible to determine a probability for task realization of system for protection of airspace, or aircraft, or which one is superior, whether they are the same or approximately the same, that is, which is weaker, and how much. Changing the relevant conditions of conflict situations (for example, weather conditions, the implementation of various measures and countermeasures for antiaircraft protection, to change the tactical procedures etc.) it is possible to influence the outcome of the combat, which means that on the simulation model can be implemented and conduct an experiment. This problem can be fully investigated using modal experiment by using computer applications 'mathematical laboratory' (matlab). By linking these macromodels into the models of medium size, or different sizes and scope, which can be subjected to a simulation, we gain the macromodels and macro simulations that we now show.

This example illustrates the formation of an micromodel on which it is possible to apply modal experiment, and an introduction to serious consideration of research how system of security is functioning by using simulation.

3. CONCEPTUAL MODEL OF THE REPUBLIC OF SERBIA SYSTEM OF SECURITY AND VARIABLES OF THE MODAL EXPERIMENT

By the analysis of the existing security system of the Republic of Serbia, an appropriate model can

be developed, in which it is possible to apply the modal experiment.

The model (security system of the Republic of Serbia) is considered from the strategic-doctrinal, legal-normative and organizational and functional aspects.

3.1 Normative-legal regulation of the security system of the Republic of Serbia

All democratic societies and countries (The Republic of Serbia has defined itself as one) include highly developed civilian control over the government and the exercise of power. In all of democratic societies and countries, civilian control of power and carrying out tasks and functions of government is a necessary method of achieving democracy. It is considered to be an essential component of a democratic culture and civilized society, providing control of social processes and behaviors aimed to further development of democracy and at the same time confining the activity of those that can be a function in violations of human and civil rights and freedoms.

It is undisputed that the control starts with the legislative foundations, standardized authorization, jurisdictions, responsibilities, various sanctions and other incentives, directional and restrictive measures. In fact, legislative activity forms a normative political and social model of the security system and control over it, as a model of power.

The real structure of government (legislative, executive and judicial) and the security system, as an important subsystem (instrumentally a subordinate system) is another model and dimensioning method of the role and power of the security system in the civil democratic society and the control over it. The mere listing of forms of power points to the fact that every form of government requires specific civilian control — and, of course, certain degrees and types of autonomy and self-control.

For the effective functioning of the security system, it is of utmost importance, in addition to strategic-doctrinal, organizational-functional, normative, and legal regulations.

Regarding the normative-legal regulation, the basis for the functioning of the subsystems of the security system in the Republic of Serbia is the Constitution of the Republic of Serbia that has been adopted since its creation as a separate state (2006), the Law on ministries, as well as laws regulating the defense, army, police, security services, etc.

It can be stated that the adopted normative-legal regulations of the system of security system of the Republic Serbia, since its formation as an independent state, which is undisputedly an important and a sensitive area, is in essence regulated by regulations.[19]

The Constitution of the Republic of Serbia entered in force by the Decision on proclamation at the Second Special Session of the National Assembly of the Republic of Serbia on 8. November 2006. This created the conditions for the adoption of laws and regulations and their implementation in practice.

[19] The Constitution of the Republic of Serbia, the Law on Defense, the Law on the Army of Serbia, the Law on the Security Services in the Republic of Serbia, the Law on emergency situations, Data secrecy Act, the Law on military, labor and material Duty, Law on the use of Serbian Army and other defense forces in multinational operations outside the borders of the Republic of Serbia, Law on organization and responsibility of state authorities in combating high tech crime, National Security Strategy of the Republic of Serbia, Defense Strategy of the Republic of Serbia, Strategy of development of information society in the Republic of Serbia by 2020, Strategy of the control of small Arms and light weapons in the Republic of Serbia, Strategy of scientific and technological development of the Republic of Serbia, Strategy for increasing participation of the domestic industry in telecommunication development in the Republic of Serbia, Electronic administration development Strategy in the Republic of Serbia for the period from 2009 to 2013, Strategy for transition from analogue to digital broadcasting to radio and television program in the Republic of Serbia, National Strategy for combating organized crime the National Strategy for the prevention and protection of children from violence, National Strategy for combating money laundering and financing of terrorism, National Strategy for youth, Strategy for the development of mental health protection, Strategy for the development of adult education in the Republic of Serbia, Strategy for development of vocational education in the Republic of Serbia, Strategy for improving the position of persons with disabilities in the Republic of Serbia, National employment Strategy, National Strategy for fighting corruption, Social protection Strategy, Integrated border management Strategy in the Republic of Serbia, Information society development Strategy in the Republic of Serbia, Telecommunication development Strategy in the Republic of Serbia for the period 2006—2010, Strategy for combating trafficking of human beings in the Republic of Serbia, Strategy to reduce poverty, the Doctrine of the Serbian Army, etc.

The largest number of laws, by-laws and regulations have been adopted in the period from 2006. to 2017, while the partial regulations of the previous state were still in effect.

In the Constitution of the Republic of Serbia from 2006, the defense is treated as a constitutional principle, in contrast to the security system, which is not at the level of a constitutional principle.

Article 98 of the Constitution provides that the National Assembly, as the highest representative body and bearer of constitutional and legislative authority, adopts the defense strategy (which it has implemented) and performs the supervision of the work of security services.

The jurisdictions of the Republic of Serbia in relation to this area are defined in the Article 97, which specifies that it regulates and provides security and defense of the Republic of Serbia and its citizens, as well as the measures in case of a state of emergency.

Article 112 of the Constitution defines that the President of the Republic, in accordance with the law, commands the Army and sets, promotes and dissolves the officers of the Army of Serbia.

Article 123 of the Constitution prescribes the jurisdictions of the Government.

It establishes and manages politics; carries out the laws and other general acts of the National Assembly; adopts regulations and other general acts for the purpose of law enforcement; proposes to the National Assembly laws and other general acts and forms an opinion about laws and general acts when submitted by another proposer; directs and harmonizes the work of the state administration body. Constitution, as the highest legal act, creates preconditions for legal regulation of the state system in question. The Law on Defense, which entered into force on December 19, 2007.[20] By doing so, the law has made it possible to adapt all the other laws, by-laws and regulations and enforce them in practice.

The Law on the Army of Serbia entered into force on January 1, 2008.[21]

The Law on Police entered into force on November 29, 2005.

The Law on the Establishment of Security Services entered into force on December 19, 2007.

The Law on Military Security and Military Intelligence entered into force on October 10, 2009. The Decree on the Determination of Security Operations being carried out by the Ministry of Internal Affairs, Security Intelligence Agency, Military Security Agency and the Military Police was issued on February 9, 2009.

The Law on Free Access to Information of Public Importance entered into force in 2004.

The Privacy Act entered into force January 1, 2009.

The Law on the Security Intelligence Agency («Official Journal of the Republic of Serbia», No. 42/02) entered into force in 2002, witch changes being made in 2009. and 2014.

The Law on Emergency Situations was adopted in 2009, and it formed the Sector for Emergency Situations, attached to the Ministry of Internal Affairs, as well as the special administration necessary for the sector.

The Law on Air Traffic and the Customs Law entered into force in 2010.

Law from 2013. regulates private security in Serbia.

It is important to note that the Law on the Establishment of the Security Services of the Republic of Serbia from 2007 envisioned the establishment of The Bureau for Coordination of Security Services. In addition, by the decision of the Government of the Republic of Serbia, the government defined the composition and jurisdiction of the National Security Council

Major Strategies have been adopted concerning the subject matter, such as:

National Security Strategy (2009) as the highest strategic document, Defense Strategy (2009). These two strategies allowed for favorable prerequisites for the preparation of other strategic documents (National Strategy

[20] On the day of commencement, the following laws and regulations ceased to be valid: Law on Defense («Official Journal of the Republic of Serbia», Nos. 43/94, 11/95, 28/96, 44/99 and 03/02), except for the provisions of Art. 26 to 30 and Article 39, the provisions of Title VI Safeguarding and protection measures (Articles 67 to 86) and the provisions of Art. 49 to 66, which remain in force until the adoption of special laws ; Act on emergency situations («Official Journal of the Republic of Serbia», No. 19/91) ; The Law on Defense («Official Journal of the Republic of Serbia», Nos. 45/91, 58/91, 53/93, 67/93 and 48/94), except for the provisions of Chapter VI Civil Protection (Articles 73 to 86), which remain in force until the adoption of the Civil Protection Act.

[21] On the day of commencement, the Law on the Yugoslav Army («Official Journal», no. 43/94, 28/96, 44/99, 74/99, 3/02, 37/02 and «Official Journal of Serbia and Montenegro», no. 7/05 and 44/05) ceased to be valid.

against money laundering and financing terrorism, corruption and crime, protection from elemental disasters in case of flood, fire, hail, etc.) whose implementation protects the national interests of the Republic of Serbia from the threat of security in various areas of social life*.

A part of the doctrine was established, and an organization was formed in accordance with our country's commitment to military neutrality.

Further elaboration of legal and political acts related to this area (by issuing appropriate documents and long-term plans) creates the conditions for a comprehensive normative-legal regulation of the subsystem of the system of security as well as the security system in whole.

The goal of legal and political acts in that sense are providing the conditions for peaceful development on all levels, be it the development of people as individuals, as a group, as a community, or as a whole — state of Serbia, as well as making sure that the security system in place efficiently and effectively fulfills its mission.

From these strategic documents, the systematic documents for the forces of security and defence systems, thus for the Army and for the rest of the system elements (documents consistent with their functions and responsibilities in security system of the Republic of Serbia), are derived.

There are at least five approaches to foreign policy development, which influence on security system structuring:

1) membership in Partnership for Peace Program,
2) military neutrality,
3) joining NATO,
4) ODKB
5) and other.

These orientations, defined by holders of legal and executive power, determine conducting of the foreign policy very much. It is important to point out the orientation for EU membership, developing cooperation with neighboring states, as well as regional cooperation strengthing.

The structure of national security system consists of governmental and executive parts. Governmental part includes: National Assembly of the Republic of Serbia, the President of the Republic of Serbia and the Government of the Republic of Serbia. The executive part includes particular ministries of the Government of the Republic of Serbia.

The security system structure in this model consists of the management subjects, through the legal, executive and judicial institutions, because of realization of the most favorable

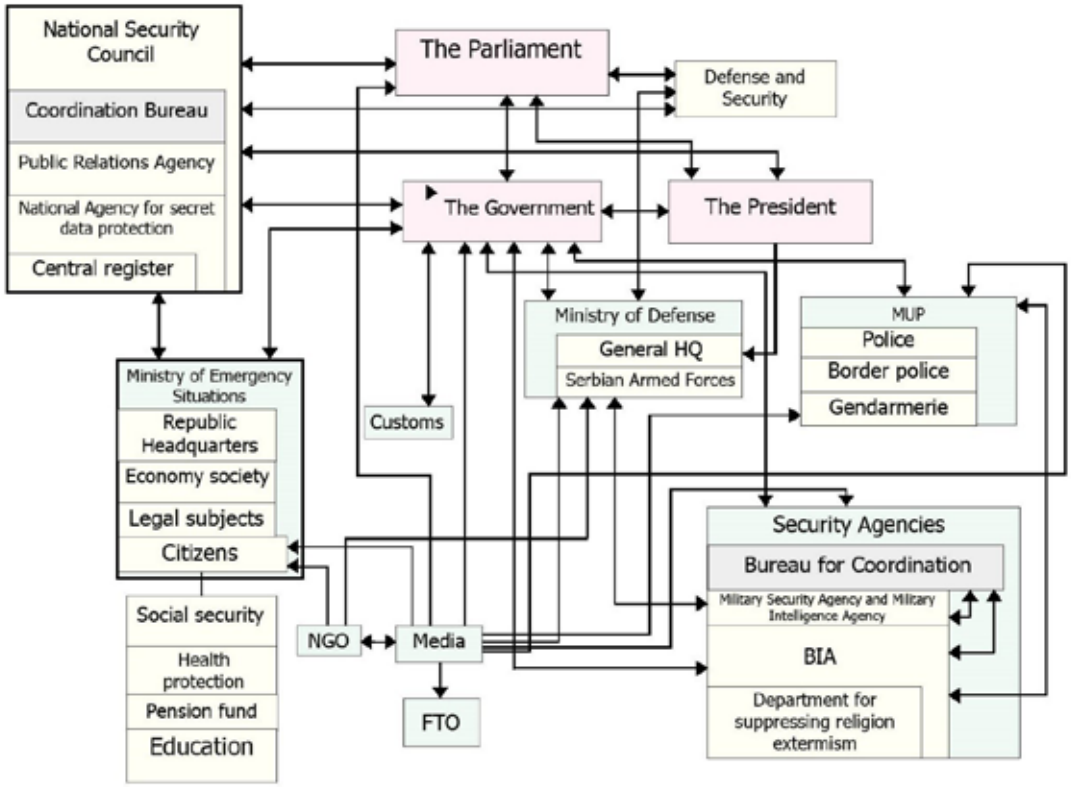


Figure 1: Conceptual model of the national security system structure

security conditions. The functions of the system management are: planning, organizing, ordering, coordination and control and they are realized consistent with the Constitution of the Republic of Serbia, law and the other regulations.[22] The National Assembly of the Republic of Serbia realizes the managing influence on all parts of security system by executing constitutional and legal activities. It decides on war and peace, conducts control over the work of the Government of the Republic of Serbia and the other subjects responsible to the National Assembly of the Republic of Serbia in accordance with the Constitution and laws of the Republic of Serbia.

The President of the Republic of Serbia manages the Army of Serbia as a commander, in accordance with the Constitution and laws of the Republic of Serbia.

The Government of the Republic of Serbia manages ministries and the institutions in the area of national security. It proposes and implements a policy of national security, directs and controls the functioning of the system, provides material resources, manages the activities of state bodies, organizations, institutions, individuals and corporations in the area of national security and ensures the implementation of international treaties and agreements in the area of national security.

Ministers of Foreign Affairs, Defense, Interior, Finance, Director of Security-Informative Agency (BIA) and Minister of Emergency Situations submit reports to the National Assembly and the Government about state of security from the scope of their responsibilities. The other ministries, at the request of the Government and the National Assembly, or when it is needed, submit reports from the scope of their responsibilities about security issues. In this mode, subjects of security are: the Army, Police, security services, private security agencies (FTO), civil security services (social and health protection, pension insurance — PIO, custom, education).

In order to implement the oversight of the security system there is Committee for Defense and Security in the National Assembly of the Republic of Serbia. The National Assembly may establish committee of inquiry on certain phenomena and events.

For guiding activities and coordination of all security issues in the Republic of Serbia, the National Security Council is established, and it is composed of the President, Prime Minister, Ministers of Foreign Affairs, Interior and Defense, as well as the directors of the security services (BIA, VOA and VBA). Within the composition of the National Security Council there is a Bureau for the Coordination of the National Security Council.

Also, in its composition, establishment of the National Agency for the Protection of Classified Information and the Central Registry is anticipated, since they are necessary preconditions for cooperation with states members of Partnership for Peace Program. By establishing of this Agency and Registry and by adopting of the Law on protection of classified information of the Republic of Serbia, the ability would be gained for protecting, storing and exchanging of classified security information. Agency for Public Relations would become a part of the Bureau for the Coordination of the National Security Council, whose main function would be internal and external relations of the whole security system with public.

The model anticipates the existence of three security services, namely: BIA, VOA, and VBA. In the model, BIA is responsible for non-military challenges and threats, and VOA, and VBA for military challenges and threats. For the coordination of the activities of these services, the Bureau for the Coordination is established.

According to the conceptual model, there is the Ministry for Emergency Situations within the Government of the Republic of Serbia, with the task of integral planning and engagement in emergency situations — protection and rescue at the national and provincial level and in local self government, with establishment of working units of volunteers in case of accidents, as well as functioning of the system in emergency situations.

Safety and security of the citizens, their rights and obligations, as well as media and NGOs, affect the overall efficiency and awareness of the security system.

The developed model of the security system is dynamic, compatible with contemporary solutions and our experience and practice and provides the opportunity for development and testing of theoretical model by experimental risk simulation, engaging the security system elements and taking other actions in the structuring of system security, for the purpose of a preventive, effective action

[22] *Gordic Miodrag*, Modalni ekperiment u istraživanju potencijalnog sistema bezbednosti države, Medija centar Odbrana, Beograd, 2011.

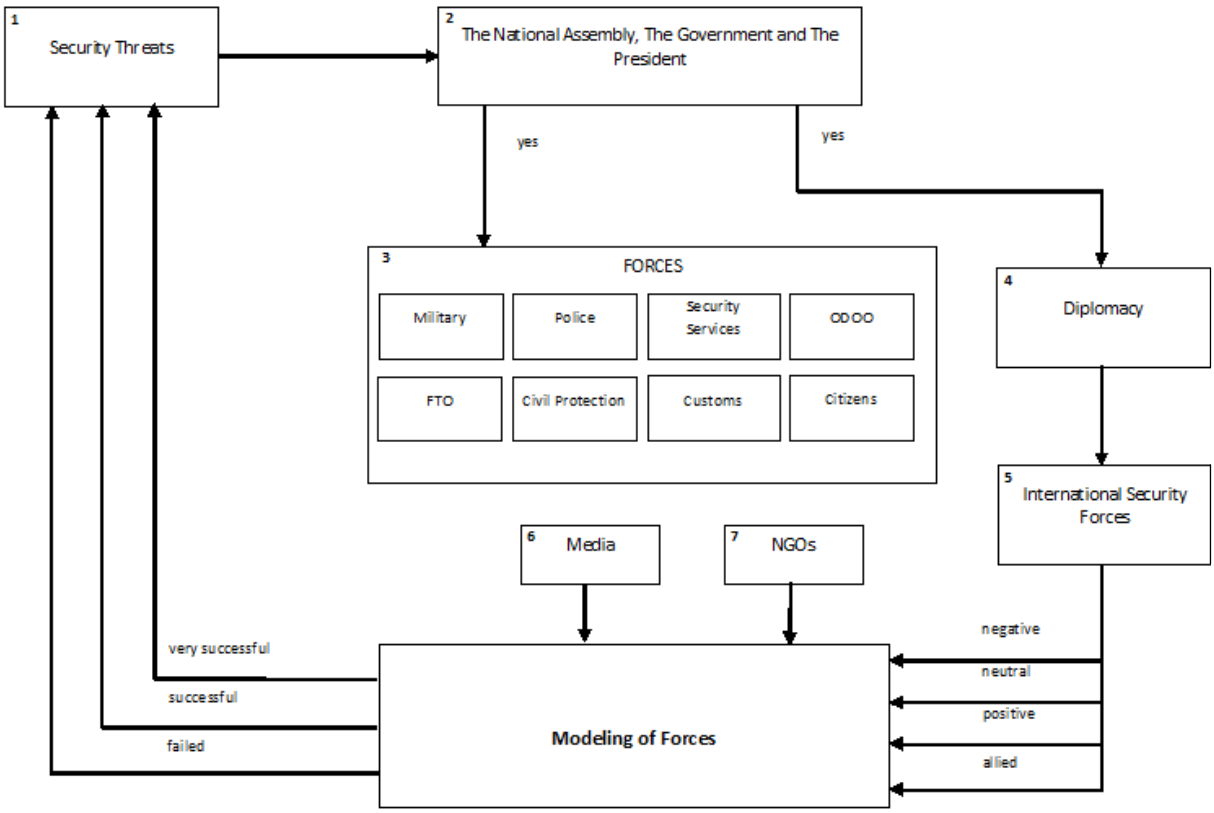


Figure 2: Algorithm of experimental variables of the security system conceptual model

directed towards the elimination of potential threats to the security of the Republic of Serbia.

The algorithm (Figure 2) shows experimental variables by blocks representing control and dependent variables, by which it is possible to experiment on the model in order to obtain appropriate results.

The algorithm assumed the existence of threat to security of the Republic of Serbia (block no.1), which causes making the decision on engagement of the forces of the Republic of Serbia security system (block no.3) by responsible state organs (National Assembly, Government, President) (block no.2), for the efficient elimination of the security threat. Simultaneously, diplomatic activitis are increased (block no.4) for the purpose of positive attitude of the international community and international security forces. International Security Forces (block no.5) can have negative, neutral, positive or allied attitude towards engaging of the security forces of the Republic of Serbia, and this significantly affects the structuring of the security forces model. Media (block no.6) and NGOs (block no.7) also have an impact on the modeling of elements of security system. Modeled forces (block no.8) respond to security threat in order to eliminate it.

Having in mind the above mentioned the central issue in resolving the algorithm is efficient structuring of the security system forces in relation to the various threats.

The algorithm was developed by blocks which include these structures, from block no.1 to block no.8. The structure of blocks represents the possible relations between variables in the model.

Block no. 1: forms of security threats to the Republic of Serbia

Block no. 2: National Assembly, Government and President

Block no. 3: forces of the security system (military, police, security services, the other armed organisations of the state, civil protection, private security agencies — FTO, the customs authorities, local self government and citizens)

Block no. 4: diplomacy

Block no. 5: international security forces

Block no. 6: media

Block no. 7: NGOs

Block no. 8: modeling of forces, reaction of forces to security threat (block no.1) and the new political decision (block no.2).

For those who make political decisions, the crucial importance is adequate modeling of efficient structure for the system of security, using

appropriate scientific methods and techniques in accordance with the assessment of security threats. Solving this problem, experimenting on a model whose experimental variables operationalized, it is possible using various mathematical disciplines and methods in decision theory by using an appropriately software support. However, to the corresponding phenomenon in reality, in order to be scientifically studied, it is necessary to establish model first, which will in the characteristics relevant to the realization of research to imitate an objective reality to which the model applies. Only in this way, the application of mathematical and software tools to model, will provide the necessary, scientifically valid results.

When implementing the research and possible answers modeled system of security on potentially different forms of endangering the security of the Republic of Serbia as a special problem manifests way of measuring how endangering, so and capabilities confronting the subsystem of security. The modeled system is structured as a organizational, which is partly determined, bearing in mind that it behaves and reacts depending on the environment (in this case a friendly, allied, and partner or enemy) and is controllable by the human factor, which determines its functioning. Modeled system of security is also a system that reflects the existence of complex social phenomena and his behavior can not be valorized by direct quantitative measured results.

In studying the problem of reaction and response measuring of the system of security on potential threats to the Republic of Serbia, it is started from the postulate, which refers to the measurement of social phenomena, which has expressed the view that the measuring is detection and finding of the quantity of a certain quality by applying certain procedures and adequate criteria. Simply put, it is always something that is being measured.

Measuring the reaction response of the system of security in this case bets in the domain of social reality that contains the past, present and future. Bearing in mind that the modeled system of security of the Republic of Serbia, is the idea — the concept of restructured organizational system, system oriented towards future security threats and that basically refers to the management of socio — enforcement interests and achieving them, it is very important to understand that these measurements have prognostic character and are based on an estimate and evaluation, as concepts important to quantify the results of operation of social phenomena. In practical terms, the basic meaning of the term assessment means assigning or has given to the value (amount value) to a current — manifested reality. So, the assessment is defined as the past and present. The assessment is also based on existing knowledge, standards and the use of instruments in which it is primarily focused on the perspective or the possible, probable quantity that can be numerically expressed (used terms conceptual definition obtain with the realization of intuitive measuring).

Subsystem of the modeled system is a man and a group of people of any size. Each person (group of people) with his instinct of self-preservation, identifies with the environment and has certain system of values. Factors of systems of security are modeled, in relation to the security risks and threats, which are usually managed by a man with his mental and physical abilities. In any case, the threat goal and system of security and are diametrically opposed, and while the threat is directed at the destruction of certain social or other value in the state, the system of security is aimed at neutralizing threats and preservation of that value. The activities of the system of security and the system that achieves the function of the constant threat are in conflict and its outcome depends on many factors, including human. In such circumstances, the work result of the system of security, as well as its interdependent subsystems can not be fully quantified. The result (in experimental — simulating conditions), is primarily a response evaluation, not his score. In fact this result represents some probability of playing, which may or may not be achieved in real terms.

Bearing in mind that the phenomena, processes and events, which represent concrete forms of existence of objective reality in the system of security are qualitative and with social character, as well as they are expressed by stance of which the cognitive value, depending on the different values of the determinant conditions, may multiple vary within the limits of between 0 and 1, it is that their measuring is matter of judgment, rather than estimates, it is clear that their real knowledge is possible by using fuzzy logic.

Fuzzy logic is created as a result of the development of polyvalent logic, which mean unlimited number of performed consequences, depending on the change in the value of its causes (including the minimum). Polyvalent logic, and thus fuzzy logic, does not exclude the results of all values between 0 and 1 that does divalent, traditional, pentavalent or nonavalent logic.

Fuzzy logic, in experimental conditions, provides roughly results of engagement of the system of security, as an organizational system, in which functioning the vital role realizes the man, but also a system that operates in hostile environment. It provides assessment of response results, which should be approximately the same in real terms. Bearing in mind all the complexity of the system of security, as well as organizational system and the complexity of the conditions of its operations, and complete defining of playing conflict situations (in which the participants are system of security and security threats and other actors in conflict situations), by the human factor, it is undoubtedly that fuzzy logic, as a scientific method, can provide quality research of system of security, from the standpoint of the need for his improvements to all parts of the organizational system in order to optimize its operation depending on all the factors that determine this system.

So Fuzzy logic as a branch of artificial intelligence, uses algorithms to simulate human thinking and decision making.Can be used in the process of assessment with undetermined all the actors, and they are given a logical meaning (converts these terms in binary form, which subsequently can be processed). Unlike the human logic, which does not permit that specific terms at the same time may be right or wrong, fuzzy logic overcomes the problem of classical logic, allowing expresses to be interpreted both as accurate as inaccurate, or fuzzy logic permits values that can simultaneously belong to several sets (more than one, unlike the conventional system). This means that the assessment depends on the angle from which the facts are observed, and at the same time it can be concluded that they can be true and false, or even both.

The essential characteristics of the fuzzy logic are: in fuzzy logic the exact reasoning is considered limited by case of approximate, ie. not exact reasoning; all is expressed by degrees of belonging; any logical system can be fuzzyficated; the fuzzy logic knowledge is interpreted as a collection of adaptive fuzzy limits within the fuzzy variables and the conclusion is seen as a process of adaptive restrictions.

For ease of understanding of characteristics of modal experiment it is necessary to determine the terms encountered when using fuzzy logic, namely: the rule base and inference mechanism.

For each expert system, a rule base is organized that contains set of all rules which are known in the system. Rule base, depending on the system in which they are used, can be organized in different ways. The rules can simply be written in plain text format. In this situation, the rules themselves before being used in the process of reasoning were transformed into a form that is most effective for use within the process.

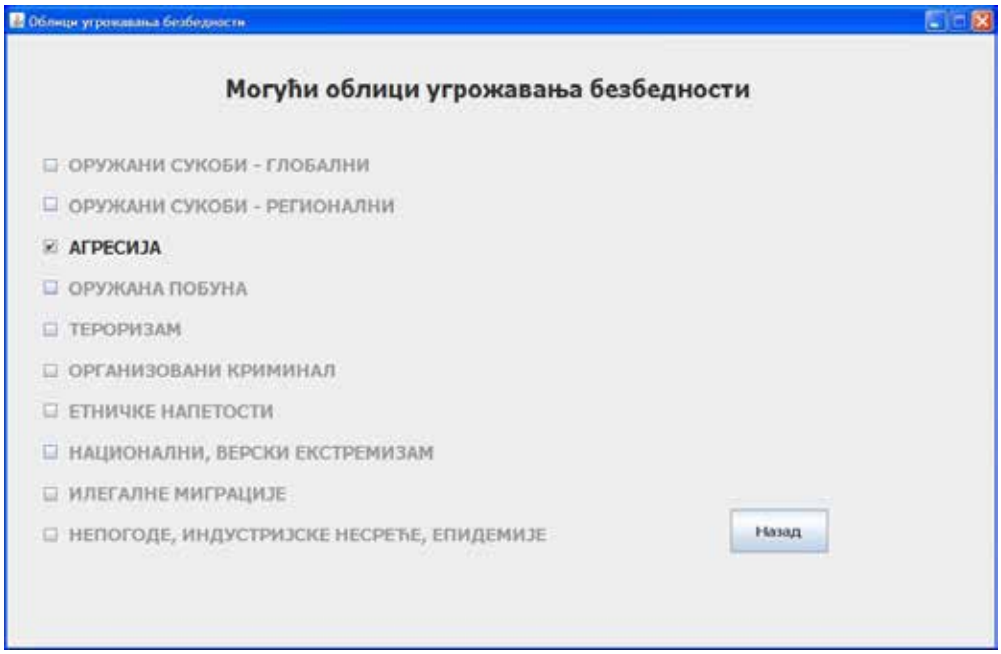
When we have rule base with the existing rules, it is necessary to explain how this specific knowledge, covered by the rules, reflects the input values, in order to calculate the value of the output variables. This process is known as inference. In fuzzy expert systems, inference process is a combination of four sub-processes: fuzzification, inference, composition and defuzzification.

When the system receives input data, in order to use them it is necessary to transform them into the form of the fuzzy value. This process is called fuzzification. Within the process of fuzzification, membership functions defined for input variables are applied to its actual value in order to determine the degree of belonging for each premise of each rule from the base. In other words, the process of fuzzification is a process of interpretation of input data by system.

Within the sub-process of inference it is being calculated the degree of belonging for the premise of each rule and they are applied in a part of the conclusion of each of the rules. These results in the form of a fuzzy subset, will be assigned to each output variable for each rule. This process is known as assessment of the rules.

In the sub-process of composition, all fuzzy subsets which are assigned to each output variable are combined together in order to form a single fuzzy subset for each output variable. There are two different rules or procedures, in sub-process of composition: MAX composition and SUM composition. In MAX composition, the combined output fuzzy sub-set is constructed by taking the maximum value from the set of all fuzzy subsets assigned to the output variable in the process of inference. In SUM composition, the combined output fuzzy sub-set is being constructed by summing the set of all fuzzy subsets assigned to the output variable in the process of inference. This method of composition is used in situations when after this sub-process, sub-process of defuzzification folows.

Defuzzification is the process of converting the fuzzy value in the real number. There are numerous methods of defuzzification, two of which are most common: method of maximum

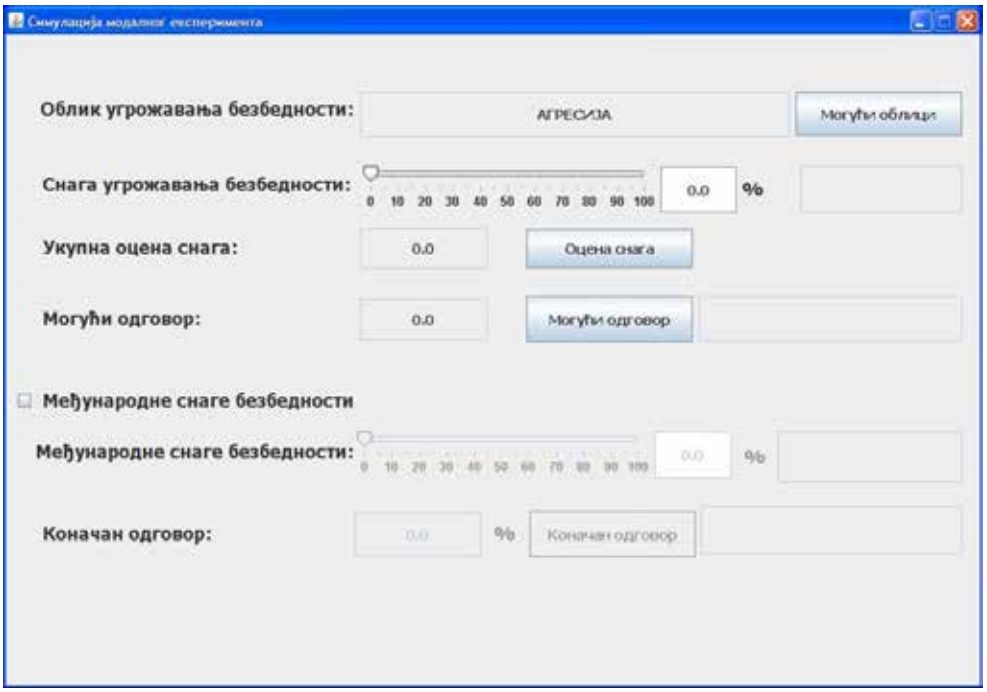


Picture 1. form of endangering security

value, known as the MAXIMUM method and the method of « center of gravity «. The method of «center of gravity» is also known as a method CENTROID.

In MAXIMUM method, as the real value of the output variable, we take one of the values at which fuzzy subset has its maximum degree of affiliation. There are several variations of MAXIMUM method, that differ only by what they do when there is more than one real value of the variable in which the degree of affiliation has a maximum value.

In the method of center of gravity (or centroid), defuzzification is done so that the whole output variable, which represents the fuzzy set, is being transformed into real value. It actually returns



Picture 2. Simulation of modal experiment on systems of security model

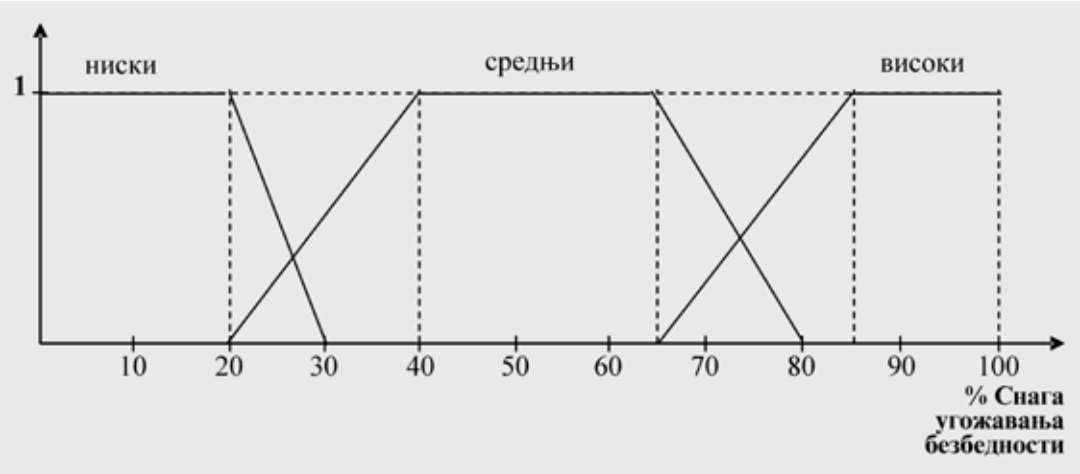


Chart 1. Forms compromising per intensity

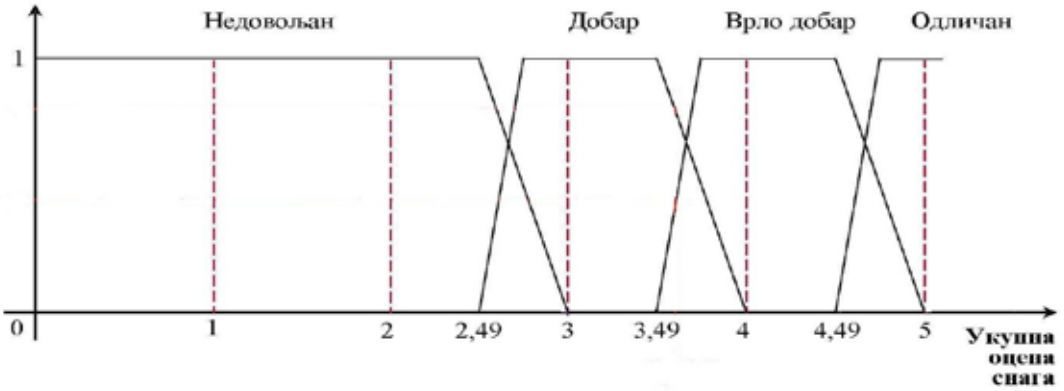


Chart 2. Readiness subsystem of security to answer

the value of focus area, which fuzzy set forms with axes. In mathematical terms, the focus of geometric figure is a point whose coordinates are equal to the middle value of the coordinates of all points that form a given geometric figure. Fuzzy sets of output variables are divided by vertical lines in every characteristic point of fuzzy set. In this way, we have various forms: rectangles, triangles or trapezes.

Combining all the above about the possibilities offered by Fuzzy logic, it will in this case be in a function of modeling the potential system of security of the country. Model provides the ability to analyze the possible forms of endangering state security, modeling structure of the elements of the system of security through an overall assessment of the forces in a function of evaluating the possible responses.

The model foresees the possibility of development for each of the forms of threats, and by strength of endangering the security, we analyze it as low, medium and high. So, the model are provided with two variables: the form of endangering security (Figure No. 1) and strength of endangering the security (Figure No. 2), in respect of modeling the forces.

As already pointed out, the forms of threats per intensity can be low, medium and high (Chart 1).

Total mark for forces can be : poor, good, very good and excellent. Bearing in mind that the Army is major carrier in the defense system, its evaluation of combat proficiency are poor from 0 to 2.49, good from 2.50 to 3.49, very good from 3.50 to 4.49 and excellent from 4.50 to 5.00 (chart 2). That criterion is dynamic and can be applied to other elements in the system of security, according to their characteristics.

Possible response in the model can be unsuccessful, successful and very successful (Chart 3).

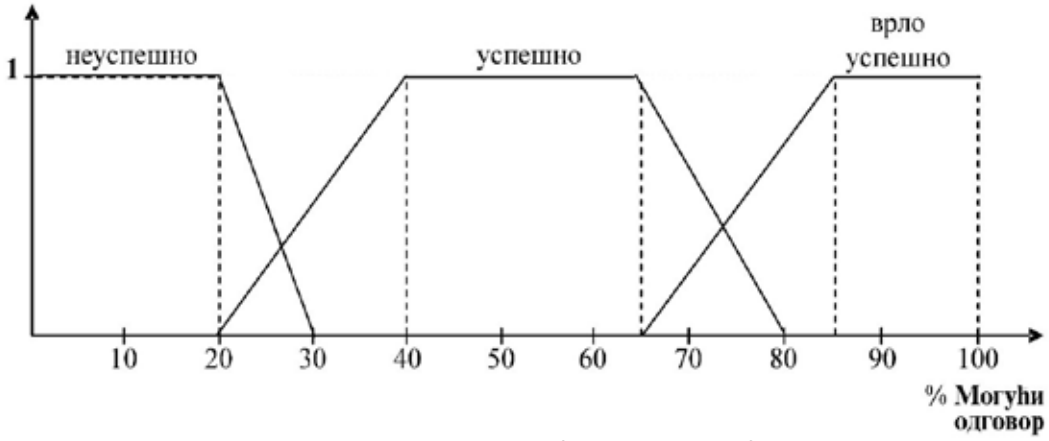


Chart 3. Possible responses for subsystem of security

For consideration of connections and relations between the variables in the structural simulation model, it is necessary to define the base of the rules relating to the strength of endangering the security and overall assessment of the forces and possible response that arises as a result, including:

1. IF strength of endangering the security **low** ^ assessment of the forces **poor** THEN possible response **unsuccessful**,
2. IF strength of endangering the security **low** ^ assessment of the forces **good** THEN possible response **successful**,
3. IF strength of endangering the security **low** ^ assessment of the forces **very good** THEN possible response **successful,**
4. IF strength of endangering the security **low** ^ assessment of the forces **very good** THEN possible response **very successful**,
5. IF strength of endangering the security **low** ^ assessment of the forces **excellent** THEN possible response **very successful**,
6. IF strength of endangering the security **medium** ^ assessment of the forces **poor** THEN possible response **unsuccessful,**
7. IF strength of endangering the security **medium** ^ assessment of the forces **good** THEN possible response **unsuccessful,**
8. IF strength of endangering the security **medium** ^ assessment of the forces **good** THEN possible response **successful**,
9. IF strength of endangering the security **medium** ^ assessment of the forces **very good** THEN possible response **successful**,
10. IF strength of endangering the security **medium** ^ assessment of the forces **very good** THEN possible response **very successful**,
11. IF strength of endangering the security **medium** ^ assessment of the forces **excellent** THEN possible response **very successful**,
12. IF strength of endangering the security **high** ^ assessment of the forces **poor** THEN possible response **unsuccessful,**
13. IF strength of endangering the security **high** ^ assessment of the forces **good** THEN possible response **unsuccessful,**
14. IF strength of endangering the security **high** ^ assessment of the forces **good** THEN possible response **successful,**
15. IF strength of endangering the security **high** ^ assessment of the forces **very good** THEN possible response **successful,**
16. IF strength of endangering the security **high** ^ assessment of the forces **very good** THEN possible response **very successful,**
17. IF strength of endangering the security **high** ^ assessment of the forces **excellent** THEN possible response **very successful,**

The process of concluding, in the above example, takes place in the following way: at the beginning, values of input variables are being fuzzificated. In the process of fuzzification, membership functions defined for input variables are applied to the actual value of the input variable, in order to determine the degree of belonging to the premise of each rule from the database.

For example, if endangering the security has the intensity of 22 % and if the total assessment of the forces is 3.618, expert system, after obtaining these values, performs the analysis in accordance with predefined graphs that represent membership functions of certain variables.

Each variable consists of more Fuzzy sets and purpose of fuzzification is that each input variable to determine which fuzzy set '' belongs '', and that the affiliation express numerical value in the domain between 0 and 1. Fuzzification value of

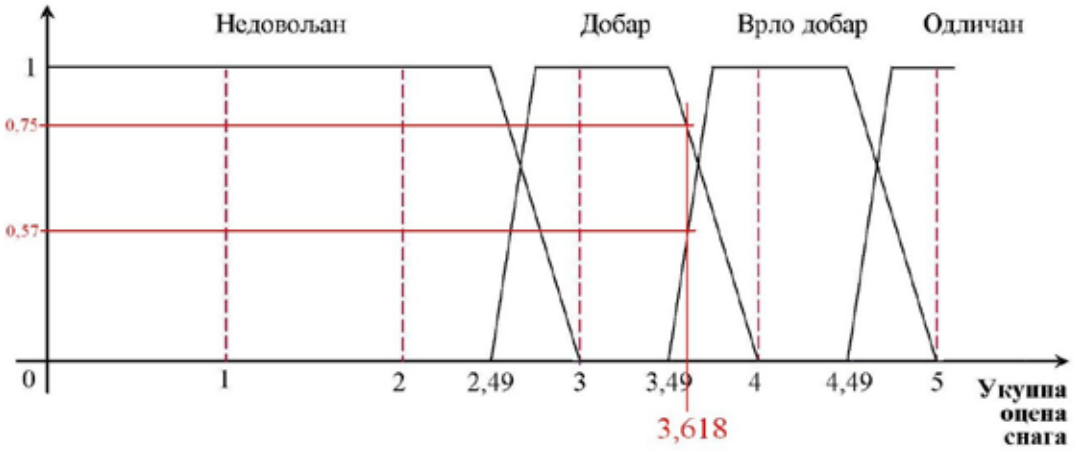


Chart 4. Fuzzification input value of strength of endangering the security

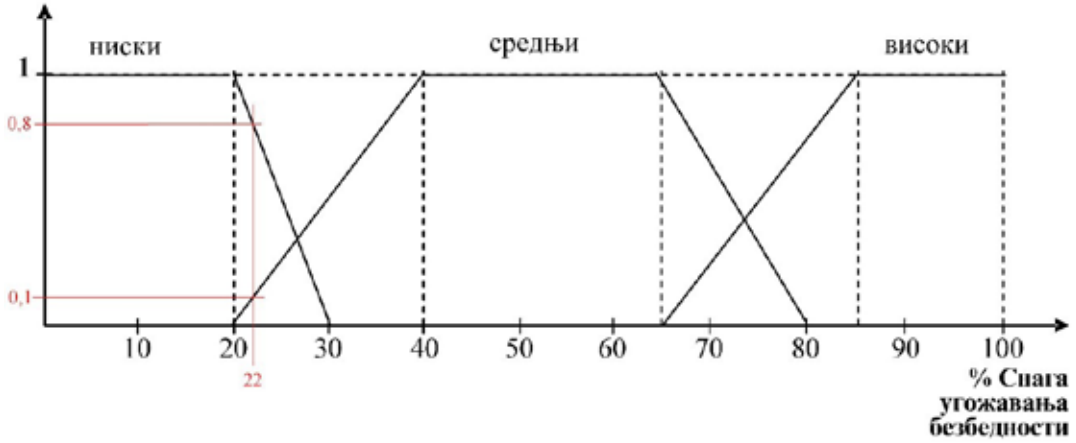


Chart 5. fuzzification of input variable total assessment of the forces

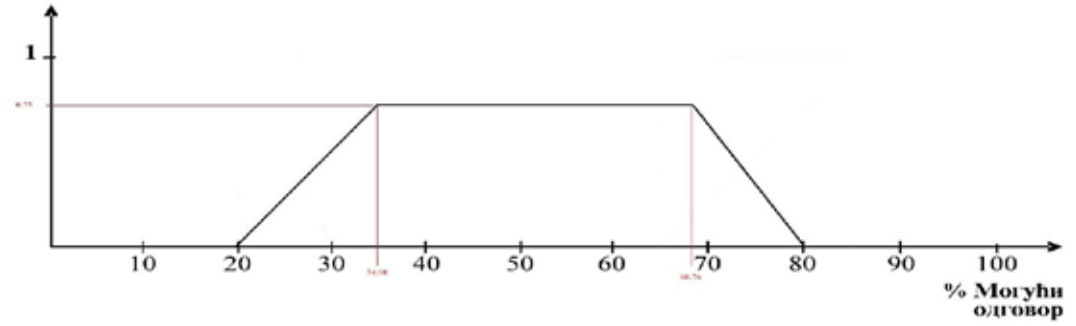


Chart 6. Intermediate result graphically shown after executing rule No.2

endangering the security obtained values of belonging variable «strength of endangering the security», which are shown in the graph 4.

The Chart 5 shows the result for fuzzification of input variable «Total assessment of the forces».

After fuzzification of input values followed by an analysis of these values in their comparison with the sets of premise values from the rule base. In the aforementioned case, the analysis showed that rules were made to numbers 2, 3, 4, 7, 8, 9 and 10. Each rule gives his subscore which can be presented by the corresponding fuzzy set. The following are graphical representations of subscores of each executed rule

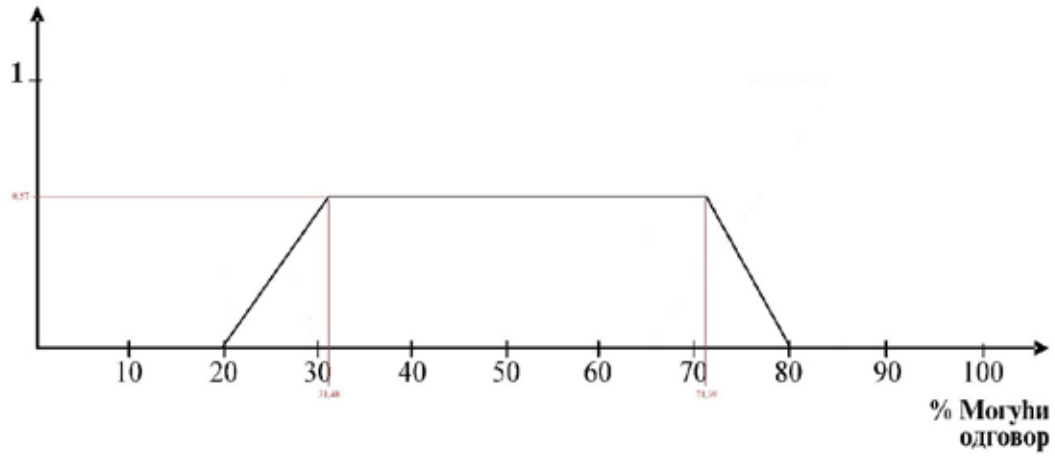


Chart 7. Intermediate result graphically shown after executing rule No.3

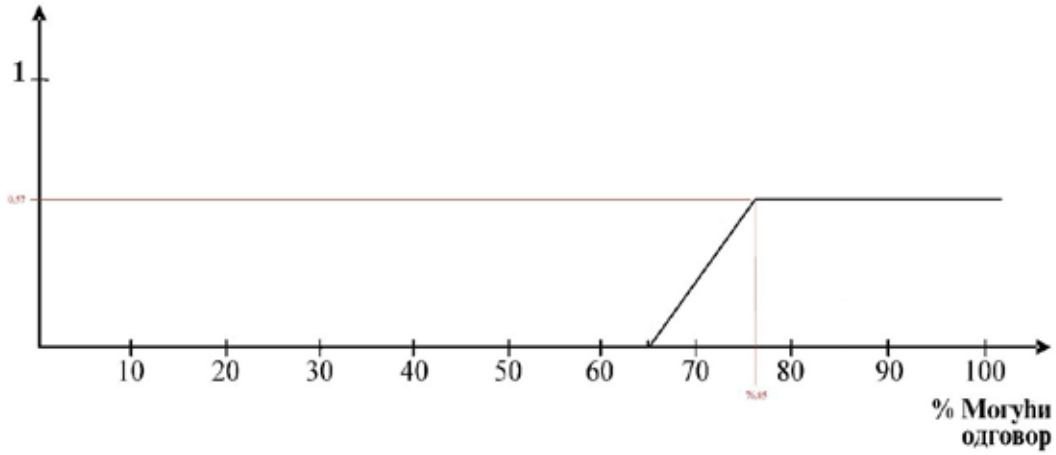


Chart 8. Intermediate result graphically shown after executing rule No.4

with a more detailed explanation of the way how the graphics are obtained only with the first rule. Other graphs are prepared in an identical manner.

Rule number 2 is the first to be executed. It reads « IF strength of endangering the security LOW ^ assessment of the forces good THEN possible response successful» If we look at chart No. 5, we observe that if the form of endangering safety in numbers represented by the input value of 22, it corresponds to the value of 0.8, which is within fuzzy set LOW form of endangering the security. Also, chart No. 6 shows that: if the total assessment of the forces is presented with the value of 3,168 it within the set of fuzzy, total assessment of the forces GOOD power corresponds to the value of 0.75. If we use between the antecedents of rules the operator «and» (^), in order to both conditions have been satisfied we take a smaller value, and it is in this case 0.75. The resulting value is transferred to the fuzzy set that represents the conclusion (antecedent). In the present case, it is possible answer SUCCESSFUL. That intermediate result is graphically shown in chart No. 6.

The second rule to be executed is rule No. 3. This rule is «IF strength of endangering the security low ^ assessment of the forces very good THEN possible response successful». Intermediate result after the execution of this rule is given on the chart No. 7.

he third rule to be executed is rule No.4. This rule is «IF strength of endangering the security low ^ assessment of the forces very good THEN possible response very successful» Intermediate result after the execution of this rule is given on the chart No. 8.

The fourth rule to be executed is rule No. 7. This rule is *«IF strength of endangering the security medium ^ assessment of the forces good THEN possible response unsuccessful»*. Intermediate result after the execution of this rule is given on the chart No. 9.

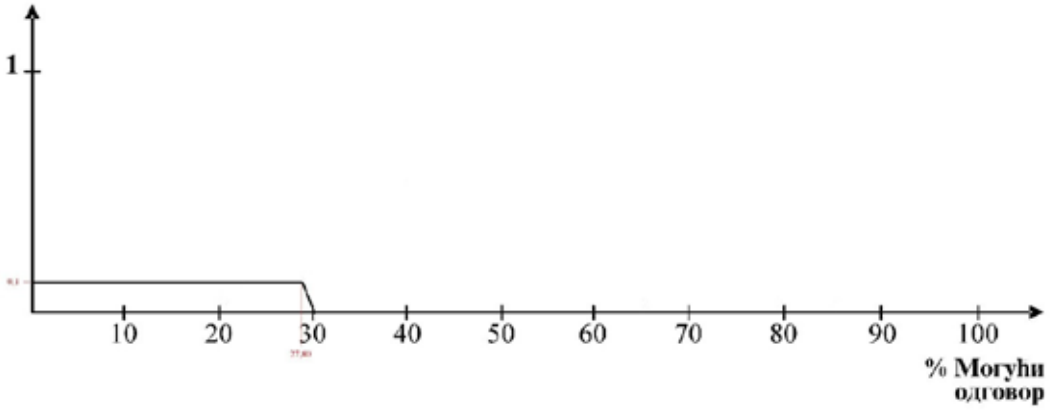


Chart 9. Intermediate result graphically shown after executing rule No. 7

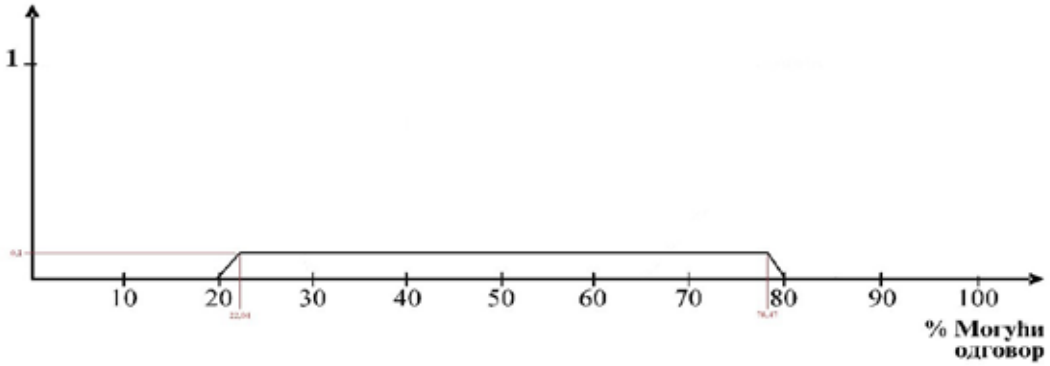


Chart 10. Intermediate result graphically shown after executing rule No.8

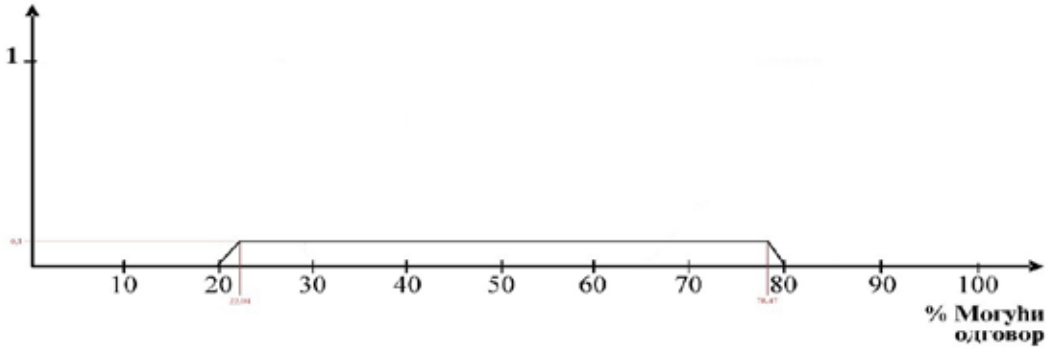


Chart 11. Intermediate result graphically shown after executing rule No. 9

The fifth rule to be executed is rule No. 8. This rule is «IF strength of endangering the security medium ^ assessment of the forces good THEN possible response successful». Intermediate result after the execution of this rule is given on the chart No. 10.

The sixth rule to be executed is rule No. 9. This rule is «IF strength of endangering the security **medium** ^ assessment of the forces **very good** THEN possible response **successful**» Intermediate result after the execution of this rule is given on the chart No. 11.

The seventh rule to be executed is rule No. 10. This rule is «IF strength of endangering the security **medium** ^ assessment of the forces **very good** THEN possible response **very successful**».

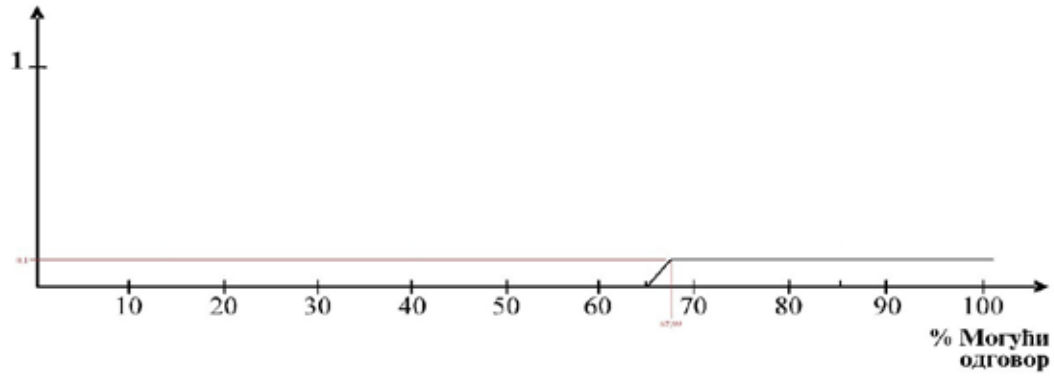


Chart 12. Intermediate result graphically shown after executing rule No. 10

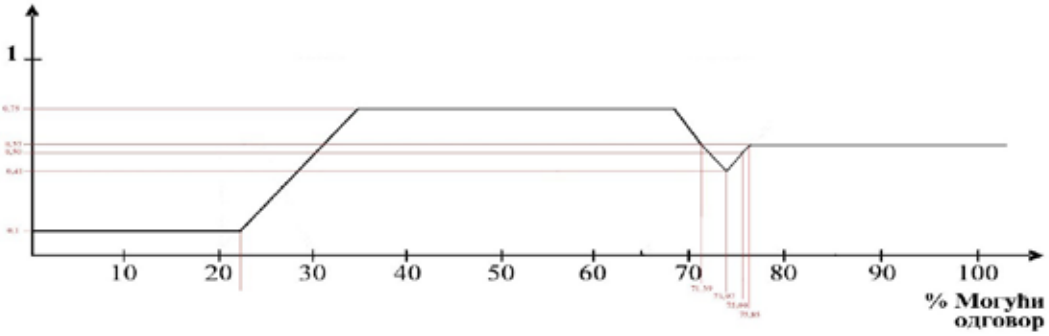


Chart 13. Graphical display of the resulting fuzy set

Intermediate result after the execution of this rule is given on the chart No. 12.

On the intermediate results of the charts 6 -12, union operation on fuzzy sets is applied and on this occasion we have the resulting fuzzy set that is also the result of reasoning in this case. If we apply the union operation on fuzzy sets with the number of chart 6-12 it will give us the resulting fuzzy set that is shown in the chart No. 13.

At the very least, for a more efficient interpretation of conclusion, defuzzification of obtained results is made which is in a form of set. Applying CENTROID defuzzification method, as described above, we get the result 58.585889 giving us that a possible answer SUCCESSFUL. A possible answer may be unsuccessful and very successful.

CONCLUSION

From a scientific point of view, the model represents a simplified picture of the real system on the basis of which the application of other scientific methods leads to scientific knowledge.

Application of modal experiment in order to study the potential system of security is constantly up to date. It is scientifically obvious that in practice, system of security, and any other social system, subsystems, contain interactive elements related to the level of general, special and individual. That differences in the context of the general, demand recognition of particularities and specifics of individual factors in the study of potential system of security of the country. This is logical — methodological and theoretical paradigm that is outlined and present in developing potential system of security of the Republic of Serbia, using modal experiment as a necessary method and research technique, which allows the unity of theory and practice at a higher level, that allows the general axiomatic theoretical steps find their practical application and verification in a natural, scientific and social dimension. Thus, the use of modal experiment as a scientific method is necessary and extremely important in making racional, economical and effective prognostic decisions.

From a scientific point of view, model represents a simplified picture of the real system in respect of which the application of other scientific method leads to scientific knowledge. In this case, the work presents the basic features of fuzzy logic as a mathematical discipline, which is the purpose of building intelligent expert systems and enabling competent national authorities to objectively model contemporary factors of system of security, and system of security in whole for preventive countering potential forms of endangering state security, people, community and the individual — citizens.

Strategic management of complex national systems, subsystems, including system of security of the state is more effective and more economical if it is based on fundamental scientific and modern knowledge. This exceeds a very represented intuitive practice and management on the strategic, but also all other government levels of decision-making.

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МОДЕЛЬНЫЙ ЭКСПЕРИМЕНТ В ПРОЦЕССЕ СОЗДАНИЯ КОНЦЕПТУАЛЬНОЙ МОДЕЛИ СИСТЕМЫ БЕЗОПАСНОСТИ ГОСУДАРСТВА

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Аннотация. *Развитие кибернетики привело к рождению метода моделирования как общего научного метода, и единство теории и практики стало, безусловно, более качественным, чем прежде господствующий статистический метод. В области социальных наук этот метод представляет собой метод моделирования. Применяя эти основополагающие методы, в этой работе сначала раскрывается концепция и структура моделирования, показываются концепции и типы моделирования, затем концепции и типы экспериментов, т.е. базовые модели в методе моделирования. В заключение, разрабатываются потенциальная концептуальная модель системы безопасности Республики Сербия и переменные модельного эксперимента. В этой модели можно варьировать и изменять коэффициенты качества, интенсивности, динамики и количества. С помощью этой модели возможно определить силу достижений и тенденций. Для достижения этой симуляции в качестве прогнозирования применялся метод исследования. Концептуальная модель была видна с точки зрения стратегически доктринальных, юридически нормативных и организационно-функциональных аспектов, которые соответствовали движениям безопасности в мире, потребностям и объективным возможностям Республики Сербии.*

Ключевые слова*: модель, моделирование, модальный эксперимент, концепция, безопасность.*