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Operational Research and Organizational System

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Abstract: Organizational systems, as well as specific integration of social and technical systems are extremely important for the development of human society. The most part, the problems of managing these systems are reduced to operations research - a generic term for activities that define the processes involved in the functions of organizational systems, and hence the term operations research.
Field of study operations research as a scientific discipline, the organizational processes and activities that are being carried out and an important determinant of the intention to find the best decisions in managing the operations undertaken to achieve the set goals of the system. The generality of operations research is reflected in the fact that apply to all types of organizational systems - commercial, industrial, agricultural, military, medical, educational, government, and the like. Users of operations research decision makers - managers, whose task is to efficiently and effectively manage organizational systems.
In this paper we consider operational research and conceptual foundations that enable its effective use in solving the problem of organizational systems.
Key words : operational research, organizational system, hard OR, soft OR, critical OR.

I. Introduction

Field of operations research – OR as a scientific discipline, the organizational processes and activities that are being carried out and an important determinant of the intention to find the best decisions in managing the operations undertaken to achieve the set goals of the system. As with research operations in organizational systems, hence the name – Operational Research. The generality of operations research is reflected in the fact that apply to all types of organizational systems - commercial, industrial, agricultural, military, medical, educational, government, and the like. Users of operations research decision makers - managers, whose task is to efficiently and effectively manage organizational systems. Operations research is very close and can tell synonymous, the concept of management science, so that in Anglo-Saxon literature frequently encountered acronym OR / MS (Operations Research / Management Science) and the American Association of Operational Research called the Institute for Operations Research and Management Science (INFORMS - Institute For Operations Research and Management Science) [Krcevinac et al, 2011].

The scientific method consists of operations research mechanisms of reasoning which is based on the holdings of the methods of mathematics, statistics, information systems, computer science, and economic phenomena and mechanisms of observation in organizational systems that are mainly based on statistical and economic methods. The essential characteristics of scientific methods of operational research is to build and solve mathematical and statistical models of abstract structures that describe the properties of objects and relationships of organizational systems.

Operations research as a scientific discipline, have an instrumental character of all scientific research: abreast in order to learn how to solve problems (as it is anything, anything works). Math, on the other hand, the basic science in the development of operational research, a purely cognitive character: abreast for the sake of knowledge, without any implications for the possible use in other sciences instrumental nature.

Therefore, the scientific research in the field of OR can not be identified as a mathematical research, because of their nature, these differences. So, by their nature, operational research are identical technical and social sciences.

In short, operational research, the scientific discipline that uses sophisticated quantitative methods to arrive at better decisions. Using mathematical modeling (optimization, simulation, probabilistic) to analyze complex situations, operations research allow managers making more effective decisions and build more productive systems, based on:

- modern information technology and databases,
- the possibility of fast and cheap considering the various available alternatives decision- making,
- predictors of making and risk assessment,
- a number of methods of solving model-making and appropriate software tools.

Modern managers, managing organizational systems, facing the following five situations that require the application of operations research:

1- Decision problems are complex and there is a large number of decision-making factors; existing information system provides insufficient analytical support, and operational research are becoming a real way to increase business intelligence information system.
2- Inefficient business processes, some processes have a bottleneck and are inconsistent with other processes so that their productivity is low, a large number of day, operational decisions is not aligned, leading to inefficiencies overall business; operational research, as shown in many cases, can to significantly improve the decision making in these situations.
3- Business risks that may jeopardize the success of a business, determining the risk of new projects and contracts with partners can be very difficult; Operations Research provides a powerful method for the quantification of risk and can balance the risk of danger.
4- Organization insufficient use of available databases; operations research with his methods are specialized to extract the most valuable information from available databases, and also indicate the missing data and information that the system needs to collect in order to further increase the value of information necessary for decision- making .
5- Competition in today, the global market has become more pronounced; many competing organizations use operations research in decision-making and thus to gain a comparative advantage, that is why it is necessary, in order to survive in a very tough competition to each organization applying operations research to their business.

Reviewing the literature, and especially browsing the Internet resources in the network, we can find thousands of examples that illustrate the significant benefits realized by managers - from the strategic to the tactical level - by applying the methods of operations research in decision-making. Let us mention a few of them [INFORMS ScienceofBetter.org, 2006]:

1- A large department store chain Sears has an annual savings of $ 42 million, using the routing system and schedule their fleet vehicles for the distribution of goods from warehouse to point of sale.
2- Pentagon, Department of Defense uses the methods of operations research in solving the massive logistical operations supplying troops.
3- Ford car factory uses operations research to optimize the design and testing of new prototypes of cars achieving annual savings of $ 250 million.
4- Great DIRECTV satellite television provider using methods of operations research to forecast demand satellite television.
5- Great television network NBC used methods of operations research to improve their television advertising sales plans resulting in more than 200 million in revenue.

Traditionally, the focus of operations research is focused on quantitative and technical issues of managing organizational systems, the focus of which has been the most researched and significant results in practice. The above examples closely follow this approach of operational research, the so-called "hard" operations research (hard OR) and the term operations research involves a hard approach.

II. Conceptual issues of Operations Research

In recent decades, formed the focus of other so-called 'soft' operational research, focused on the management problems that are not well structured and elude precise quantification. The third focus, the so-called "critical" operational research focuses on the ethical and ideological issues of election management objectives. The hard and soft operational research almost always, at least implicitly, assume the value system of the capitalist social order. For the purposes of taking, say, profit maximization as one of the primary goals of organizational functioning production systems and research operations that lead to this goal. In other words, the primary user of these two types of operations research is management. Critical Operations Research considered a wider range of users, participants in the functioning of organizational systems and deal with what is now known as participative management, i.e. workers' participation in management organization system.

These three paradigms of operational research suggests that the operations research discipline par excellence of organizational sciences, which are specific synergy of social and technical sciences using mathematics as their language, at least in its "hard" version. In this sense, operational research, following the scientific method, to construct an idealized model of the real world, using scientific theories and try that, based on empirical knowledge, explain and predict phenomena in the real system. Consider what is today understood by the term paradigm.

As defined in [Kuhn, 1970], the paradigm is defined as a universally acceptable scientific achievement, at least for a time, served as a model for the community of researchers in modeling and solving problems. Paradigm can be understood as a research framework defining research methods and the method of

interpretation of the results. In this way, a paradigm defines the common ground shared by the researchers of a research direction.

Traditional, hard operations research paradigm relies on the mathematical formalism of the full extent and to a limited extent adopted by the achievements of social, political, and behavioral sciences. In this way, operational research is limited to solving problems well enough to be described by a mathematical model, ignoring the class of problems for their resolution, other than a quantitative approach, demand and quality.

Still in [Morse et al, 1970] required to be addressed by operations research and no quantitative aspects of the problem we are dealing with the decision-maker. Also, [Boland et al, 1996] states that the analysis of the problem need to be considered "subjective preferences, ethical attitudes and aesthetic judgments" of decision making. In [Checkland, 1983] argues that there is a definite divergence between theoretical research and education in the field of operations research, on the one hand, in relation to the requirements of decision makers who expect a high usability of operations research in practical applications. Furthermore, in [Dando et al, 1981] points to the fact that operational research relatively little use in addressing broader social issues that do not have active cooperation with the social sciences.

Obviously, there is a need of redefinition of operations research in the light of the above observations with regard to their usefulness for important social issues. The current practice of defining operational research through mathematical modeling and appropriate technological support, certainly sacrificing relevance and scope of its possible applications. The way to overcome these substantial objections related to the practical application of operations research should be directed towards the integration of complementary no quantitative and quantitative methods. This integration is now called "soft" operations research (soft OR) that allow structuring complex issues of organizational systems, taking into account the different and often conflicting interests of decision makers.

Critical paradigm of operational research [Rosenhead et al, 1982] reveals an ideological bias and the hard and soft paradigms of operational research and points out the need to overcome them. This paradigm requires that one must consider a system of values prevailing in the organizational system and its environment and, because the capitalist social system, development of operational research under strong ideological influence, must be reviewed and the methodology used structurally derived priorities and criteria based on the capitalist system values. Furthermore, [Mingers, 1992], the critical paradigm must avoid partiality and distortion resulting from the use of traditional reasoning approaches that provide the emancipatory interest of all those who suffer the consequences of decisions made.

The main weakness of soft operational research lies in the fact that the powerful and the weak, rarely able to express their opinions and interests on an equal footing, [Habermas, 1974]. Those who are powerful have a definite advantage in deciding the advantage, of course, want to keep. In addition to their political power, they have better access to information and the capacity to effectively communicate and thus have the power of ideological activity. All this is not present among the weaker side. This is a consequence of the structural inequalities of the participants in the organizational system and critical operational research they want to avoid this and install the methodological approach to the application of operations research.

III. Traditional - Hard Operational Research (Hard OR)

The term hard refers to the exclusive use of mathematical - logical methods, as opposed to the term soft, "which means the dominant use qualitative methods. More specifically, the subject matter of [Krcevinac et al, 2011] is completely hard Operational Research. Also, Hard Operational Research is a characteristic that is their primary focus problem and its solution and the beneficiaries of a secondary. Hard operational research trying to acquiesce all the problems in mathematics - the logical framework, although it is a priori clear that this is often not possible. As already mentioned, the hard operations research help managers, using mathematical - logical methods in the analysis of complex problems of organizational systems in order to find the best ways of achieving the goals or objectives.

In fact, the process of hard operations research consists of the following sequence of steps, [Carter, 2001]:

1- **The formulation of the problem**. Operating researcher collects sufficient information, through special surveys and interviews with decision-makers who are beneficiaries of the results. He tries to understand the state of the organizational system (or part of it), the desired goals and expectations. Thus, the problem can be properly formulated. This is a vitally important step on whose quality depends on the entire process.

2- **Modeling**. In this step, formulate a mathematical model that describes the system, processes using mathematical equations, relations and formulas. The adequacy of the mathematical model of the real system being described is a necessary condition for a valid application of the above problem and solution in step 1.

3- **Selection and data collection**. In this step, the collected input data for the model defined in step 2 to test the desired particular solution of the model. In modern applications of this step is solved using an information system of the organization as well as external databases.

4- **Solving the model**. In this step, you choose the method of solving the model formulated in step 2 This step and step 2 in the strictest sense are considered operational research, which is evident from the contents of the [Krcevinac and others, 2004].
5- **Validation of the model**. In this step it is checked whether the model and its solution satisfactorily predict the future behavior of the organizational system.
6- **Implementation**. This is the last step in it operational research, using the authority of management, the owner of the solution, the solution obtained is introduced in organizational system.

The benefits that can be achieved by the systematic execution of the above procedure are: better management, better decision making, better coordination and better results in achieving organizational functioning system.

IV. Methods of modeling

The concept model is crucial in the general system theory and the perception of the world around us. Modeling is a powerful and often unique method of research and includes the replacement of the real property to somebody else - material or abstract.

The most important feature of any model is an adequate representation of the object of the study in accordance with the specific task and the means used. Model building is a physical or abstract system used to solve specific tasks in order to gain new knowledge about the real object - the original of which is the right model. Model must be closer to the original point of the investigated features of the real object but simpler than the original, as for other non-essential characteristics.

Classification of basic modeling methods and types, so obtained, the model is shown in Fig. 1. Operations Research and Information Systems is the most interesting class of symbolic (semiotically, character) models. They are based on a system of symbols (characters), hence the name - symbolic models. Any language, artificial or natural, is actually a system of signs. Artificial languages are programming languages, mathematical notation, logical statements and different graphical notation.

Semiotic systems are characterized by three areas:

- syntax,
- semantics and
- pragmatics.

Syntax deals with the rules of formation of the sentences (strings) in the appropriate language without considering what they mean. Semantics considers the interpretation of sentences and determine their importance in the communication process from the standpoint of object modeling is a crucial significance. Pragmatics explores the relationships semiotic system to the real system and achieving the goals of communication.

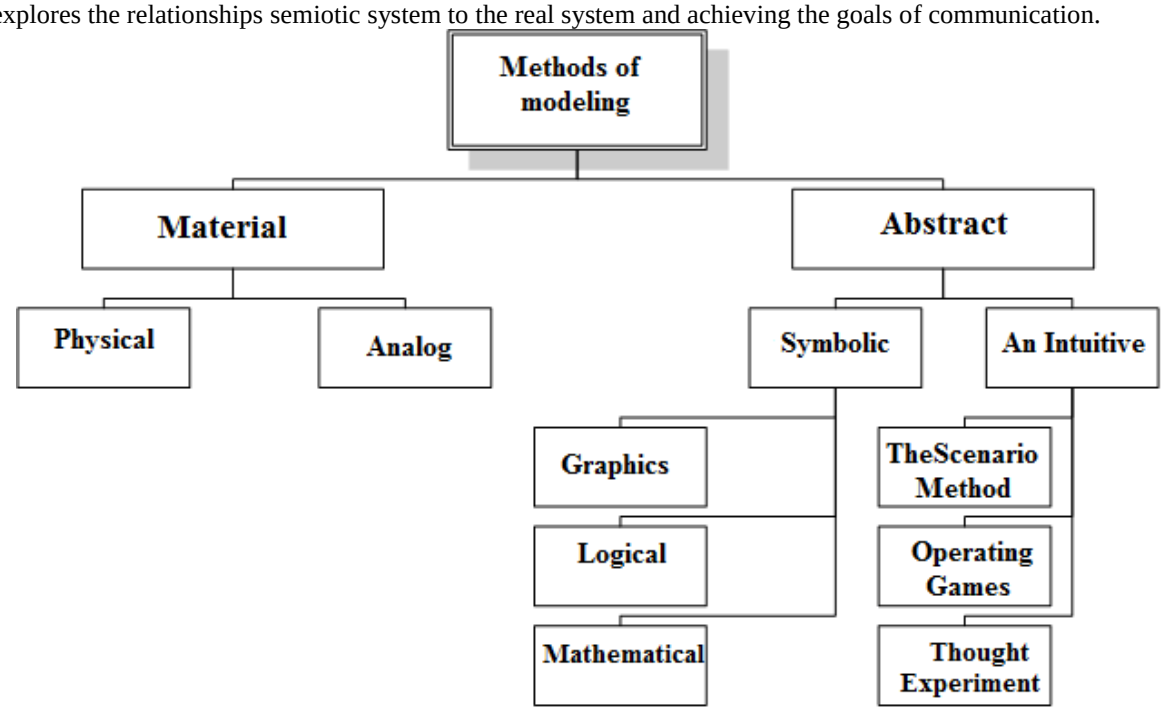

Fig. 1. Classification of methods of modeling

For us, the most interesting mathematical models that represent real systems objects using mathematical symbols, making it possible to investigate the operation of real systems using a systematic approach.

V. Mathematical model of the system

Formally, the mathematical model can be represented by the following four,

$$< A_{0,} \theta, H, \Psi >$$

Where:

A0 - the objective functioning of the system;
θ - resources necessary for the operation of the system;
N - operator modeling the operation of the system;
ψ - operator which is an indicator of the effectiveness of the operation to achieve the goal of functioning of the system.

Operator in this context, we call the law (rule) under which each element x from the set X corresponds to some element y in the set Y. In addition, the sets X and Y can be of different nature (for example, can represent real and complex numbers, respectively). In this case, the term operator coincides with the notion of function.

The operator of modeling operations H define the mapping set Λ is Dekart's product of a set of model parameters and the set U of possible strategies in the management of the system into a set Y of output response of the model:

$$H: \Lambda X U \xrightarrow{A_0, \theta_m, R_S} Y$$

Where:

θm - resources at the stage of modeling results of operations, and
Rs - set of properties (attributes) of the system being modeled.

Operator criteria system efficiency and operations that it performs - Ψ defines a mapping set Y output feature of the set of W values of criteria (indicators) the effectiveness of

$$\Psi: Y \xrightarrow{A_0, \theta_\varepsilon, R_S} W$$

Where:

θε - Resources used under estimate the efficiency of the system.

Note that the above construction operators must follow the basic principle of system approach - the principle of achieving the goal. In addition, it is also necessary range of available resources used to model operator H to obtain solutions, as well as the composition of a set of strategy management system (operations) U. The more resources available for modeling, this model is more detailed and it is possible to consider a number of management strategies. In fact, the higher the number in the initial set of available alternatives is possible to consider a number of alternative management and reduce the risk of omitting the best.

It follows that the most general form of the mathematical model formulation system (its operations) n-tuple defined by size:

$$M = < U, \Lambda, H, Y, \Psi, W >$$

Way of defining the operator Ψ and the selection criteria of efficiency W is totally dependent on the system of values, one that models the system (or those for whom the system is modeled). More detailed discussion of this is in part related to the value aspect of the application of operations research. Methods of forming a set U of possible alternatives in the management part of what we call in the narrow sense of Operations Research or hard (hard operations research).

VI. Classification of mathematical models

Classification of mathematical models, the expedient approach to the aspect of properties of operators of modeling operations and evaluation criteria of efficiency.

The operator H modeling operations can be functional, ie. given system of analytic functions, or algorithmic, ie. contain mathematical, logical and linguistic operations which can not be reduced to a sequence of application of analytical functions. In addition, it can be deterministic, where each element of U x Λ

corresponds to a set of values determined by the output characteristics of the model $\bar{Y} \subseteq Y$. It can also be stochastic when each element in the set of U x Λ corresponds to a random subset of $\bar{Y} \subseteq Y$.

Operator efficiency evaluation Ψ can be given either as an unambiguous mapping (point to point, ie. Every element of the output characteristic Y corresponds to a unique value of the efficiency W), or as a collection of jubilation set in point (where the value of a corresponding set of performance indicators values of output characteristics) .

Depending on the properties of the operator model, mathematical models can be divided into four main classes: analytical, statistical, simulation and optimization.

Analytical models are characterized by determined the functional relationship between elements of sets U, Λ, Y, and W value of the efficiency is determined by one mapping (point to point). These models are widely used and well describing quantitative character (main trends) behavior of the studied system. Due to the simplicity of their software realization on a computer and high operational value of the results, these models are often used in tasks of the synthesis system, and also optimize the strategies of management operations.

Statistical models are called mathematical models in which the relationship between the elements of the set U, Λ, Y, specifies the functional operator H and the operator Ψ is a mapping of a set of point (several points at one point) and contains statistical data processing algorithms. Such models are used in those cases where the result of the operation is random and there are no accurate functional dependencies associated statistical parameters, the random nature of the procedure. Reasons coincidence results may be external influence of random character; random nature of the processes that are external to the system, and the random nature of the implementation of control strategies. In statistical models, beginning to form a representative sample of the value of the output response of the model, and then on statistical processed to obtain a scalar or vector value of the efficiency.

Simulation models are characterized by the fact that the operator sets the modeling results of operations algorithmically. If it is stochastic, the operator reviews the performance indicators specified as a set of mapping to a point, then we have a case of classic simulation models. These models can have the operator H is deterministic nature and the operator Ψ is defined uniquely mapping. Table 1. shows the most commonly used mathematical models.

It is important to note that in the construction of analytical and statistical models widely used homomorphism properties (the ability that the same mathematical model describes the different physical nature, processes and phenomena). Also, the simulation models using a isomorphism of processes and structures, ie. unambiguous mapping of the elements of the structure and processes of the real system in the respective elements of the mathematical model.

			Type of basic operators			
			H			
			Functional		Algorithmic	
			Deterministic	Stochastic	Deterministic	Stochastic
Type mapping	*Ψ*	Mapping a collection of point	-	Statistical	-	Simulation
		The accurate mapping	Analytical	-	Simulation	-

Table 1. Classification of mathematical models

Property of isomorphism and homomorphism is illustrated in Fig. 2.

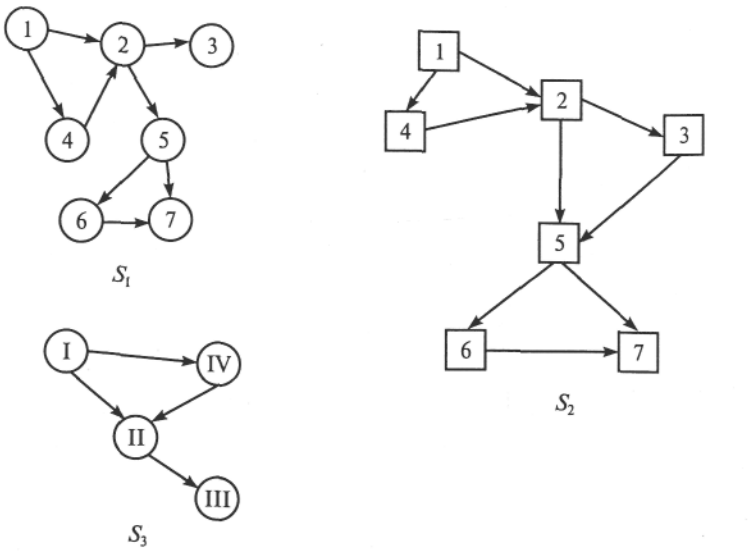

Fig. 2. Example of an isomorphic mapping and homomorfnog: S1 - original system; S2 - isomorphically copying the original; S3 - Homomorfic copying the original

Classification of mathematical models can be made on other properties. For example, a common classification of mathematical models depending on the model parameters and variables of time. Dynamic models are those in which the variable appears explicitly time and divided into stationary (in which the time depends only input and output values and non-stationary (at which time vary any of the parameters of the model, either its structure or both). Such classification is shown in Fig. 3.

Of Fig. 4. The classification of mathematical models from three properties: its character changes the values of variables; properties of the used mathematical apparatus, and methods of treatment coincidence. Displayed classification requires no further explanation, except that under the signal-stochastic model includes a model with random effects of external factors.

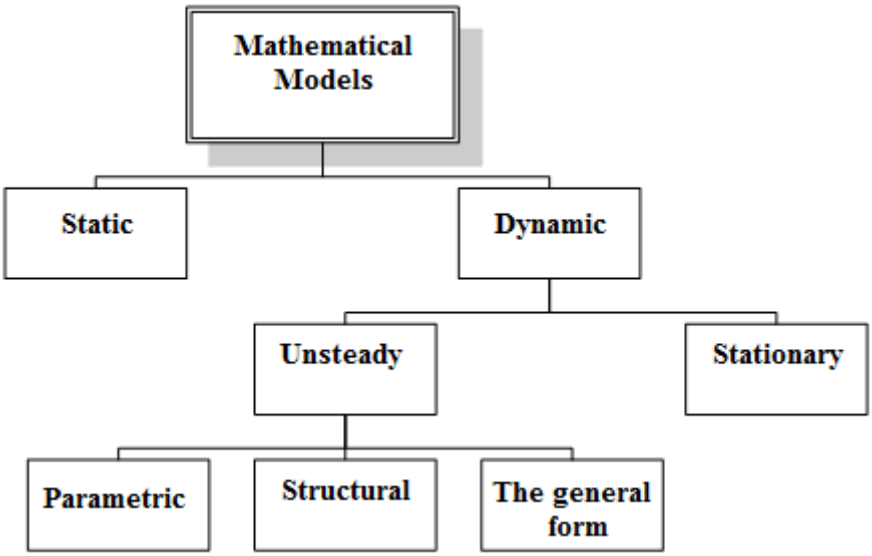

Fig. 3. Dependence of mathematical models of time

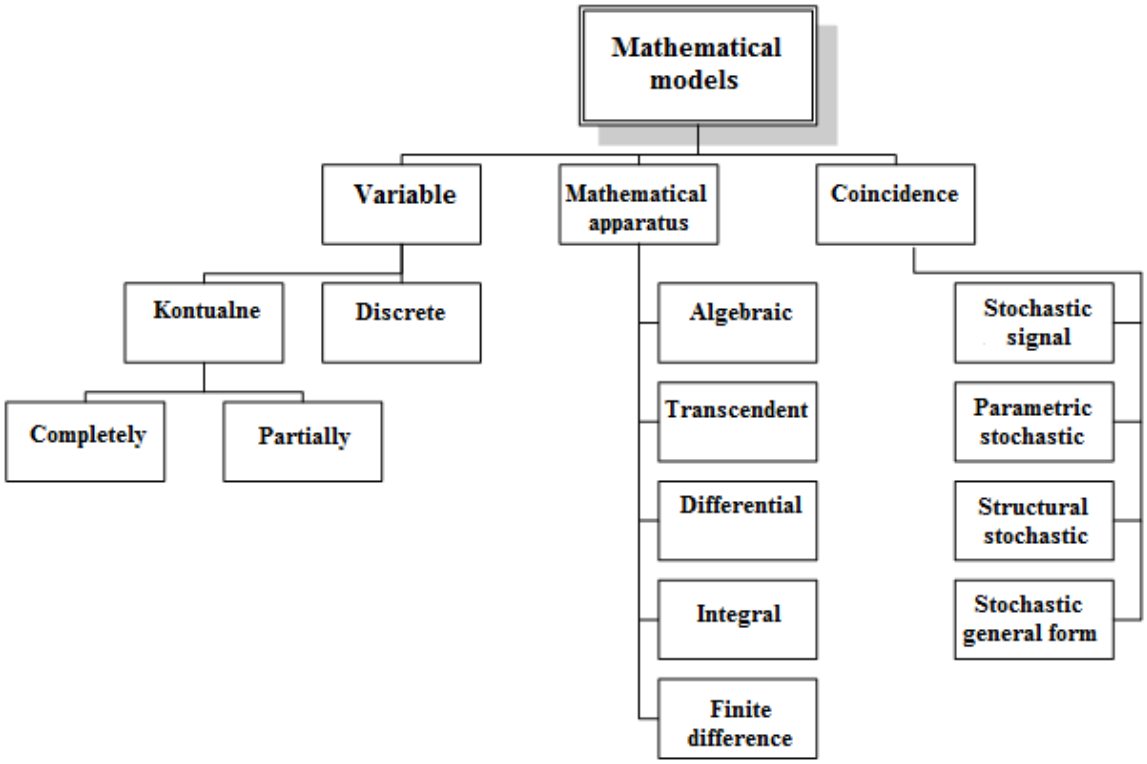

Fig.4. Classification of mathematical models for the three properties

VII. Soft Operations Research (Soft OR)

Most of the problems of organizational systems require the use of soft methods of operations research in the formulation phase problem for the purpose of structuring and better insight into its merits and propose possible directions for solutions. Using this method relies on a multidisciplinary approach, with greater involvement of the social sciences. Interdisciplinarity, by the way, is one of the important characteristics of operational research, irrespective of the paradigm.

Methods of soft operational research are the most useful in the early stages of the problem formulation step. In most of the examples of methods of soft operational research states that the most useful one of your "understanding of the problem." When the domain of the problem and its context can be defined precisely to cross the hard operations research methods. One of the most important advantages of soft OR method that can be applied in the absence of complete information, and that this fact in a transparent way to show customers.

However, the methods of soft OR have some disadvantages, such as:

- lack of replication of results obtained in one case to another;
- the ability of powerful individuals in the decision-making process substantially affect the outcome of the decision-making group;
- difficulties in understanding and modeling the individual behavior of people;
- variability in the interpretation of the results obtained by the methods of soft OR because of the qualitative nature of the results;
- High dependence on the ability of a person to communicate results, and
- the tendency of users to consider using alternatives considered in lieu of the value high score.

Soft OR should not be regarded as soft as they are rational enough and have sufficient scientific rigor. The nature of the soft OR is best understood in comparison with hard OR, which was done in the following Table 2.

Hard OR	Soft OR
▪ There is only one decision maker (or group of consensual decision-making) with a clearly defined purpose. ▪ There is an agreement what is the nature of the problem. ▪ The most important elements of the problem can be quantified on them to collect reliable	▪ There are a heterogeneous group with different dosilaca decisions and conflicting goals ▪ There is no consensus about the nature of the problem. ▪ Many important elements of the problem can not be quantified. ▪ In accordance with the previous one can not

data. ▪ The mathematical model can be used to obtain solutions. ▪ Possible uncertainties can be modeled probability theory. ▪ The methods may not be transparent to the results presented. ▪ The role of specialist hard OR in solving the problem is the same as with any other expert. ▪ Researchers dealing with hard OR, generally speaking, must have good analytical power and excellent mathematical and computer skills.	construct a mathematical model. ▪ Possible uncertainties can not be reduced to a probability. ▪ The methods should be transparent and accessible to users. ▪ The role of specialist soft OR moderated group participants discussed the problem. ▪ Researchers dealing with soft OR, in general terms, they must have the power of negotiation and persuasion, often in stressful meetings.

Table 2. Comparative characteristics of hard and soft OR

Numerous methods of soft OR is pretty big, and consider some of the most commonly used.

- Soft Systems Methodology (SSM)
- Viable Systems Model (VSM)
- Strategic options development and analysis (SODA)

In addition, confirmatory methods of soft operational research in the past, fundus soft OR method also consists of a number of other methods, such as :

* Method *Intervencije totalnih sistema* (TSI)
* Method *Pristup strateškog izbora* (SCA)
* Intervention method of complete system (TSI)
* Access Method strategic choices (SCA)
* Inspection and testing methods of strategic assumptions (SAST)
* Method of Scenario Planning (SP)

Again, the soft operations research methods are most useful in the early stages of the problem formulation step, ie. defining its structure. In most of the examples of methods of soft operational research states that the most useful one of your "understanding of the problem." When the domain of the problem and its context can be defined precisely to cross the hard operations research methods.

Probably, the most one can expect from a kind of complementary hard and soft operations research. The soft operational research are superior to rigid problems in structuring phase as has been shown, in this sense, they offer a number of methods. The main disadvantage is the lack of soft OR method by which to objectively, logically determine which of the possible solutions of the problem is most favorable. On the other hand, hard OR have what soft is missing, such as methods to finding the best solution, as they attempt to address precisely defined.

It should be expected that in the future will increasingly use a kind of fusion of hard and soft operations research, which will lead to new integrated methodology of operations research.

VIII. Critical Operations Research

Science and technology are critical factors in the development of the modern world. This fact alone raises to the forefront the issue of responsibility of science and scientists in ethical application of scientific achievements. The issue of responsibility of science and scientists is best expressed Robert Oppenheimer, one of the creators of the atomic bomb, after using it over Hiroshima "... Scientists are now committing sin. "

This, of course, for operations research, which, as its science aimed at the development and application of methods and techniques that enable more efficient and effective decision making. Analyzing the relationship between ethics and decision-making processes, in [Schneeweiss, 2000], states: "... over, operations researchers, as analysts or consultants, operational research, applied science, is part of the decision-making process, and therefore, at least partially, responsible for the preservation of moral standards. "

Ethical aspects of operations research interaction occurs as operational researchers (a professional who deals with Operations Research) with three elements: models and methods, users and society as a whole, as shown in Fig. 5, [Brans et al, 2002]. Ignoring any possible interaction can lead to abuse of operations research in unethical purposes.

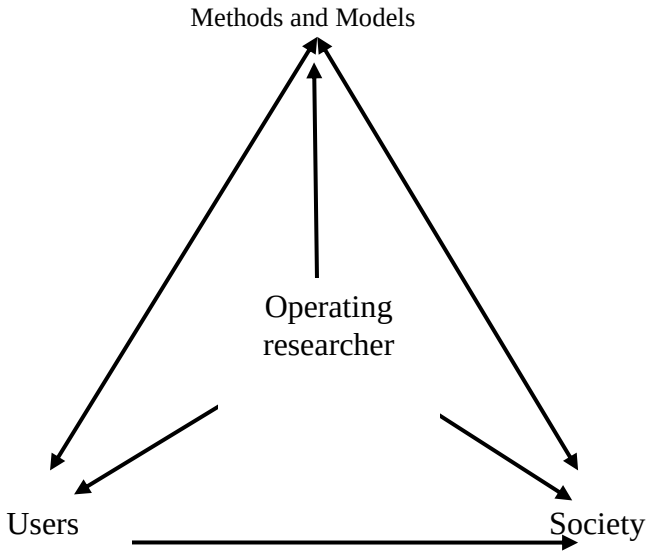

Fig. 5. Interactions operational research

As noted above, the critical paradigm of operational research [Rosenhead et al, 1982] reveals an ideological bias and the hard and soft paradigms of operational research and points out the need to overcome them. This paradigm requires that one must consider a system of values prevailing in the organizational system and its armaments and, because the capitalist social system, development of operational research under strong ideological influence, must be reviewed and the methodology used structurally derived priorities and criteria based on the capitalist system values. Furthermore, [Mingers, 1992], the critical paradigm must avoid partiality and distortion resulting from the use of traditional reasoning approaches that provide the emancipatory interest of all those who suffer the consequences of decisions made.

Based on this view, is based on the need to develop a critical paradigm of operational research. Soft OR are particularly exposed to criticism because of its regulatory and conservative nature of the analysis and synthesis of organizational systems, particularly in terms of structural inequality. In fact, many methods of soft OR is expected to be possible to reach consensus among stakeholders, competing views of the world and, using the mechanism of structural participatory debate. Basically, any method of soft OR does not take into account, or the social and political structure of the organizational system, or the surrounding area. The question is, how is it possible that the idea of disabled social groups (workers, etc.) are equally represented in the process of finding a consensual solution. In fact, the influence of these groups is minor and the solutions adopted include only cosmetic and extremely minor changes that affect this group. Existing structures of domination and reinforce the preserves and "stacking" as a result of the application of soft OR is completely bounded, structural constraints imposed by the status quo.

Furthermore, especially in cases of decision making process of soft OR exclude groups with little organizational power, often with an explanation of their incompetence. The main weakness of soft operational research lies in the fact that the powerful and the weak, rarely able to express their opinions and interests on an equal footing, [Habermas, 1974]. Those who are powerful have a definite advantage in deciding the advantage, of course, want to keep. In addition to their political power, they have better access to information and the capacity to effectively communicate and the way they have the power of ideological influence. All this is not present among the weaker side. This is a consequence of the structural inequalities of the participants in the organizational system and critical operational research they want to avoid this and install the methodological approach to the application of operations research.

Thus, in terms of structural inequalities, it is indispensable to modify the available methods to minimize the impact of structural inequality, which is the goal of critical operations research. The goal is possible realize substantial liberation and emancipation of all social groups and ideologies transparent display that is predominant in the circumstances of decision making.

The first method is the critical paradigm is the so-called *Community* OR (COR), [Jackson, 1988]. Shifting the focus from managers and their need for effective management to organizations that promote multicultural values, such as democratic participation in the management of the organization and the equality of the organization and that the COR terminology called communes, and that has been successfully applied to some of the issues of public importance , ie. in organizations without the domination of one group.

The second method, which we will explain in detail the *Critical Systems Heuristics* (CSH) , [Ulrich, 1983]. The main goal of this method is that the system promotes ideas and concepts in the context of Habermas' concept of practical reasoning, which should enable us to know - what we should do. Traditional, hard OR, operating in the context of instrumental reason, and help us to decide - as something to do.

The critical orientation of this method is embedded in its objectives. Method CSH want to reveal the normative content of the existing and newly proposed project organizational system; inevitable partiality to reveal the assumptions used and fully explain them; unmasks the true essence of the so-called "objective" approach and make transparent the true interest and motivation of planners and managers - the decision-makers, and Finally, to enable those who default are excluded from the planning process, but to suffer the consequences of adopted plans that participate in the process.

CSH core idea of the method is that the definition of the problem, the proposed solution and for its assessment of results depends on the previous judgments of the integrity of a system and exploring its limits. Thus, for example. if the optimization process is not considered an integral system may lead to suboptimal solutions. The method CSH these courts are called Boundary Judgments (BJ) - border courts, because they define the limit of the reference system in which some assumptions are valid. Thus, the meaning and validity of the assumptions used in the analysis and synthesis system, is always dependent on the border of the courts on the facts (observations) and standards (standards values) should be considered relevant and which can be omitted as irrelevant, out of consideration.

The concept of the limit of the courts is essential to systematically reviews the process boundary. Method CSH, among other concepts, provides a framework for the so-called 12. *borderline categories* shown in the following Table 3.:

1. User 2. Purpose 3. Performance criteria	***SOURCES OF MOTIVATION***	**ACTIVE**	**Reference**
4. The decision maker 5. Resources 6. Decision-making environment	***Sources of power***	**PARTICIPANTS**	**system**
7. Professionals 8. Expertise 9. Guarantor	***SOURCES OF KNOWLEDGE***		**border** **courts**
10. Witness			
11. Emancipation 12. World outlook	***source of legitimacy***	**Passive participants**	

Table 3. Reference system boundary courts

Box 12 border category in Table 3. can be used to:

- systematic identification of the boundary of the courts;
- Analysis of alternative reference system for the definition of the problem and evaluation of the proposed solution;
- Review any proposed solution to the problem that rely on hidden or limit the courts take the God-given.

CSH provides a conceptual framework for any of the three tasks, which can be described by the "eternal triangle", which is made of a reference system, fact and value, fig.6.

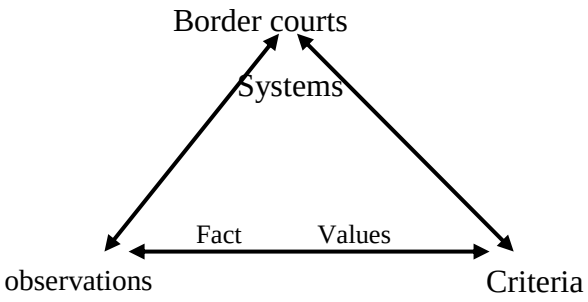

Fig. 6. "Eternal Triangle"

Use the "eternal triangle" in addressing the problem, including imposing other two vertices of a triangle in the analysis. For example. which factors are relevant if the move of the reference system or modify the adopted value system?

In summary, CSH can be defined as a critical methodology for the identification and consideration of border courts. CSH can not be viewed as a closed system model, but rather as an approach that introduces a critical practice in the application of operations research, regardless of the specific methodology used.

The following Table 4. summarizes the main conclusions and presents a comparison of the three considered operations research paradigms: hard, soft and critical.

Parameter	Hard OR	Soft OR	Critical OR
Illustrative methodology	System analysis, system dynamics, mathematical programming, mat. molding	SSM, SODA, VSM	CSH, COR
The primary task	Troubleshooting, optimization	Structuring the problem, achieving consensus, perfection of the system	Participatory problem solving, discovery of ideological power
Domain of interest	Objective entity, fact, rational system	Subjectivity, multi-criteria rationality, "ideas"	Subjectivity, multi-criteria rationality, "ideas" and their relationship to the material conditions
Techniques	Quantitative, numbers, equations, mathematical models	Qualitative, symbolic, cognitive maps, diagrams	Qualitative linguistic constructions
Base discipline	Math, Natural and Engineering Sciences	Sociology, psychology, political science	Sociology, psychology, political science, radical economics and organizational science
Models	Mathematical	Perception, "holons"	Systems and holons
The main beneficiaries	Management	Management	"Most Oppressed"
The role of analysts OR	Expert, calculator, technical	Facilitator, consultant	Educator, Emancipator, Liberator
Organizational level	Mainly operating	Mainly strategic	All levels of the organization and society
Paradigmatic basis	Functionalism, landscaped view of the company, objective onto-epistemology	Interpretavizam, landscaped view of society, subjective onto-epistemology	Radical humanism, radical structuralism, the conflict view of society, objective and subjective onto-epistemology

Table 4. Comparative paradigm OR

IX. Conclusion

As a result of the widely studied in the literature in the field of basic methodology OR the paper presented their conceptual foundations that enable effective problem solving in organizational management systems. Briefly discusses historical development and evolution of OR as a scientific discipline, explained their

methodology and discussed the areas of application. OR generality is reflected in their applicability to all types of organizational systems - commercial, industrial, agricultural, military, medical, educational, government, etc., if the fact that customers are different methods of OR decision makers whose mission is to efficiently and effectively manage organizational systems .

One of the results discussed in this paper it can be concluded that the OR paradigm suggests that the OR discipline of organizational science par excellence and the synergy of specific social and technical sciences using mathematics as their primary language, at least in its "hard" version.

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