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NEW PERSPECTIVES OF SIMULATION MODELING IN THE OPERATIONAL ART OF MILITARY ACTION PLANNING THROUGH SOFT SYSTEMS METHODOLOGY

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Abstract: *The contemporary operational environment is mainly determined by the dynamics of the phenomena occurring within the connections of the societal fields. Decoding the reality and designing military actions have shifted to new coordinates of the operational art, in terms of the way the factors of influence that change the status of each societal field are jointly approached. The term societal has acquired new meanings in the context of the overconnectivity of the fundamental domains of the society which are the following: political/diplomatic, military, economic, social, medical – pandemic, infrastructural, informational, environmental and geo-strategic. The operational art of military action planning is based on decoding the operational environment and includes analyses with different level of detail depending on the approached societal field. The analyses result in different models of action of the opponent that involve organizing and reorganizing the friendly formations that will be planned to take part in operations. Deciding for or against certain options for resolving a (military) crisis situation takes place following repeated simulations until favorable results are obtained. In this article, we aimed to bring to the attention of the specialists in the field of military action planning the integrative methodology of "design thinking" the main aspects related to the impact of the dynamics of the societal domains network in the perspective of the simulated modeling in military action planning.*

Keywords: *military action; operational art; societal fields; simulation modeling; soft systems methodology.*

Introduction

Finding a solution to a crisis situation or countering the consequences of a negative event with a major societal impact requires the existence of specific intervention plans and planning the effort to come up with a remedy to the situation[1]. Due to the multidimensional nature of the military actions, the military societal field can be considered a reference factor in managing a crisis situation. Applying operational art in planning the military operations concentrates the effort of the actions towards the opponent's center of gravity by determining the decisive operations[2]. Because of the implications of the support and modeling operations, focusing primarily on the decisive operations involves identifying systematic errors in the planning process. Based on the modern concepts of developing the action plans in the economic societal field, according to the integrative methodology of "design thinking" new research directions have emerged on the possibilities of implementing new methods of planning military operations. Depending on the expected result, we aim to highlight *the self-adaptive models* valid in critical situations, and throughout the present article we shall tackle the issue of the joint realization of the principles of the operational art through the simulated modeling method and the "soft systems methodology".

The Extent of the Military Operations within the Simulated Modeling Method

The changes of state at the level of each societal field imposed by the recent economic transformations have led to the appearance of some complex phenomena in the wide joint spectrum: political/diplomatic, military, economic, social, medical - pandemic, infrastructural, informational, environmental and geo-strategic. Thus, future military operations are likely to

[1] Iulian Chifu, *Decizia în criză*, RAO Publishing House, Bucharest, 2019, p.16.
[2] S.M.G./P.F.-5 Doctrina planificării operaţiilor în Armata României, p. 9.

be complex, highly technologized and having a strong multidimensional character, designed to respond to new crisis situations. This requires designing certain response options for possible crisis situations, dosing the efforts and conducting joint action of those responsible for developing a timely response and having a strong capacity to adapt to change. Military action planning involves the development of options for action, the coordination of efforts and the implementation of the operational plans on employing the forces both in peacetime, in crisis situations and in war.

Depending on the nature and intensity of the occurrence of the influencing factors, the societal domains may have a different behavior which, based on the network connections between the domains, determines the appearance of imbalances and the creation of the conditions appropriate for the initiation of crisis situations[3]. The analysis of this context led to the following hypothesis: "if the nominal values of the state descriptive factors for a societal field can be determined, then, based on permanent monitoring of the state values, predictions can be made regarding the possibility of the occurrence of unbalanced or crisis situations". The hypothesis is based on the formula for decoding the behavior of the entities that make up the monitored societal field and the actors with whom they interact. Decoding the behavior of an entity specific to a societal field can be done following the process of *simulation modeling*[4]. In relation to the transformations in the proximity operational environment, the simulation modeling method is the way in which a different degree of functional optimization of the entire organization can be obtained, as opposed to technological modeling which refers only to artificial (engineering) systems.[5]

The operational art underlies military action planning and involves the coherent use of an algorithm for solving problems specific to a crisis situation. *Mission command* allows expressing the problem at the operational level and identifying the solutions at the tactical level. In other words, "mission command" achieves the autonomy to solve a problem based on the statement formulated at a higher level of command. This involves activating the *self-adaptive models* which apply to critical situations. The main self-adaptive component of any organization, in terms of management or command and control, is the personnel component, made up of all the positions occupied. The incumbents are "those who adapt their behavior to the changes of the decision-making and/or internal or interconnection variables"[6]. A self-adaptive process implies the existence of two dimensions of systemic models: the cybernetic model and the realistic model. As for the parallel strategic, operational and tactical planning of military operations, we shall refer to the realistic model suggested by Jay W. Forrester[7]. The self-adaptability of the realistic model in Jay W. Forrester's opinion, applicable to the systems in interactional dynamics, is not based on formal mathematical models, but on the study of identifiable inter-conditions with the real social systems and their mirroring in appropriate evaluative models. By extrapolation, the behavior of the network connected societal domains can be explained by the realistic model suggested by Jay W. Forrester[8] and translated into capitalization within the "soft systems methodology", a concept initiated by Peter Checkland in 1981 at Lancaster University[9].

Creating the concept of a military operation implies the completion of the coherent stages according to the process of military action planning:

- making and accessing the resource database (data and information entries, first estimates);

[3] A. L. Barabasi, *Linked: noua ştiinţă a reţelelor*, Timişoara, Brumar Publishing House, 2017, ISBN 978-606-726-088-5, pp. 7-1.
[4] Doruleț Grădinaru, et al, *Simulări și proiecte de management*, Sitech Publishing House, Craiova, 2007, p. 1.
[5] https://sgg.gov.ro/new/wp-content/uploads/2020/10/CARTA-ALBA-A-APARARII.pdf, accessed on 19.02.2021.
[6] Doruleț Grădinaru, et al, *Simulări și proiecte de management*, Sitech Publishing House, Craiova, 2007, p. 1.
[7] https://web.mit.edu/sysdyn/sd-intro/D-4165-1.pdf, accessed on 15.02.2021.
[8] https://web.mit.edu/sysdyn/sd-intro/D-4165-1.pdf, accessed on 21.02.2021.
[9] https://www.lancaster.ac.uk/lums/people/peter-checkland, accessed on 15.02.2021.

- setting up work teams on modules and combat functions;
- developing planning products to express the level of threat (composition, location and capabilities) and the form of aggression (courses of action - COAs) of the enemy;
- designing the operation based on which the concept of the operation will be developed and the planning documents which contain the objectives, the estimte indicators and deadlines;
- conducting repeated exercises and simulations to review the plan and implement the necessary corrections by activating the control-management system.

A first observation is given by the existence of the mechanism for designing and regulating the planning of a military operation according to the feedback model. This involves obtaining solutions based on algorithms for solving the tactical or crisis situation and verifying their viability depending on the value of the result. Following the application of the "soft systems methodology" concept, the operation planning process is structured on 7 stages, as shown in figure 1.

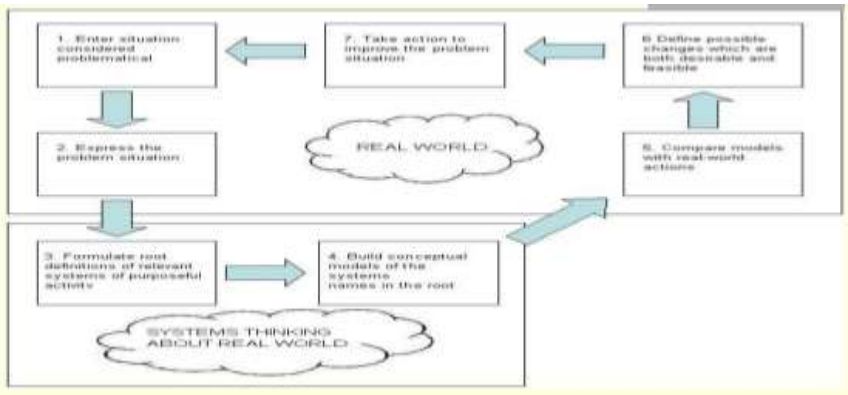

Figure 1. Algorithm for decoding the reality of the operational environment with the simulation modeling method by applying the "soft systems methodology" concept.[10]

Corresponding to stage 4 in figure 1, we identify designing the enemy's course of action as a direct result of the intelligence preparation of the battlefield (IPB/JPOE). The analysis of the factors of influence, terrain, weather and possible actions of the friendly forces leads to the development of the courses of action (of the friendly forces), corresponding to stage 5 in figure 1 (namely – the development of war games as a method of identifying solutions). Reshaping the military action planning process, by applying the simulation modeling method, takes place under a new perspective of moving from the "feedback" approach to the "feed-forward" approach as a strategic tool for managing changes. The advantage of such a transition is to replace the expectation of a positive or negative result of a crisis situation with the provision of future-oriented options or solutions by the simulation modeling method by going through the loop of stages 3 and 4 in Figure 1.

The Operational Art in Military Action Planning from the Perspective of Soft Systems Methodology

The application of the operational art in the planning of military operations is based on decoding the operational environment by activating the reference base and includes analyses differently detailed depending on the approached societal field. Decoding the reality of the operational environment is the starting point in formulating the correct "diagnosis" for a crisis situation and implicitly gives the possibility to identify in due time one or more variants of solving the unfavorable or unacceptable situation. The complexity of the contemporary operational environment is given by the multitude of network connections between the societal

[10] https://slulibrary.saintleo.edu/c.php?g=449435&p=3067618 accessed on16.02.2021.

domains, which in the first stage is decoded by formulating situation estimates on branch or services. This contributes to stating the problem or identifying the first signs of a crisis, corresponding to stages 1 and 2 in figure 1. Selecting the situation estimates and identifying the actions of the factors and actors involved in the events, generate a characterization of the status relevant to the behavior of the components of different societal domains. The components of the military societal field are asked to develop military response options and to create action plans that would solve the unfavorable or unacceptable situation (corresponding to the initial situation). The key to the operational art, applied in this case, consists in the timely identification of the decisive actions which would have the desired effects that would contribute to the achievement of the objectives. The multitude of societal fields corroborated with the multidimensionality of the action environments generates an increase of the number of options for the design of the solutions for solving the situation and also of the number of objectives to be achieved. The operational art identifies the cause-effect connections, respectively cause-consequence ones, which occur as a result of the actions or inactions of the actors involved in the development of an event.

The notion of event has emerged within the operational art and opens new horizons for the achievement of the established objectives and involves dosing the efforts for the creation of the appropriate conditions for transiting from one stage or sequence to another within a military operation. An event can be constructed to accomplish a purpose or can be decoded in order to avoid surprise or to reach the climax of an operation. The integration of the military actions in space and time involves the distribution or the expression of explicit tasks, so that a force can intervene to solve that part of the problem according to its action capabilities.[11] Planning military operations within the "soft systems methodology" involves developing several models to solve the crisis, to design the dynamics of the system (the network of societal fields) through which the *equations of the hypothetical state of things* are obtained. Based on these equations, by repetitive simulation, the dynamic behavior of the actors that contribute to the realization of the events is understood, fact by which the assessment of the alternative policies is obtained and finally, a high-performance solution is chosen. Each model designed in the "soft systems methodology" concept assumes the existence of several status parameters for each societal field through which situation descriptions are obtained, respectively the situation estimates are formulated which lead to identifying the values and nature of the network relations. The relation between the elements of the societal fields develops a certain network architecture with variable geometry depending on the available resources and on the pursued objectives or purpose. A military conflict between the friendly and the enemy forces according to the "soft systems methodology" is understood under the new coordinates of the operational art. The diagrams of causal loops between the actors can be viewed based on the variables and their relations over time. These allow us not only to analyze their current status but also to design the relational models and to make assumptions about their behavior in the dynamics. This fact is far superior to courses of action formulated for the enemy or for the friendly forces. This is similar to developing courses of action simultaneously with or during the war games. The action models designed in this way allow us to look beyond the individual events and to understand at a much deeper level the nature of the relationships between the actors/elements of the societal fields - in a dynamic system manner. By mapping the network structure based on the relationships developed between the actors or elements of the societal fields, it is possible to achieve recurring models as a coherent sequence of events over time or the model of future crisis situations.[12] *The equations of the hypothetical state of things* are the determinations of the

[11] Cristian Dincovici et al, *Manualul privind pregătirea întrunită de informaţii a mediului operational*, MoD Publiching House, Bucharest, 2014, p. 89.

[12] P. Pederson, D. Dudenhoeffer, S. Hartley, M. Permann, *Critical Infrastructure Interdependency Modeling: A Survey of U.S. and International Research*, The INL is a U.S. Department of Energy National Laboratory operated by Battelle Energy Alliance, Idaho National Laboratory, 2006, p. 3.

efforts made to counteract the enemy actions such as in the defensive operation or the concentration of efforts to obtain a higher combat potential than the one planned in order to prevent a defensive response from the enemy in the offensive operation.

Designing the dynamics of the systems, as in a network of interconnected elements, by quantifying the system descriptive factors leads to the development of a new approach necessary for understanding the dynamic behavior of the elements of interconnected societal fields. In this sense, corresponding to the military societal field, it must be emphasized that these identified behaviors defy the intuitive solutions and the attempt to formulate common processes of description and analysis that deductively lead to inconsistencies and contradictions. Since these systems are made up of multiple non-linear feedback loops, the military analyst or the one operating in the field of societal security is not able to interpret how a certain influencing factor will behave. Consequently, the actual behavior of an actor involved in the development of an event or crisis situation differs substantially from his expected behavior in certain known circumstances. By applying the simulation modeling method "soft systems methodology", a new "content substance" of the situation estimates is obtained through which the causal links of the situation transformations are determined in a dynamic way. This is possible due to constructive simulation systems with different resolution depending on the complexity of the network and the number of the participating actors. Another aspect is related to understanding the situations that, depending on the resolution of the simulation system, offer a variety of techniques for quantifying the variables in the equations of the hypothetical state of things by visualizing and simulating the relationships in order to analyze the behavior of the actors involved in the event.

The algorithm for obtaining a simulation model underlies the social relations between different subjects in terms of their social position but having common interests, which develop atypical behaviors in their actions, similar to a military confrontation. Mapping the results by recording the values of the relationships between the social subjects is an approach to planning, monitoring and assessing the social change initiatives.[13]

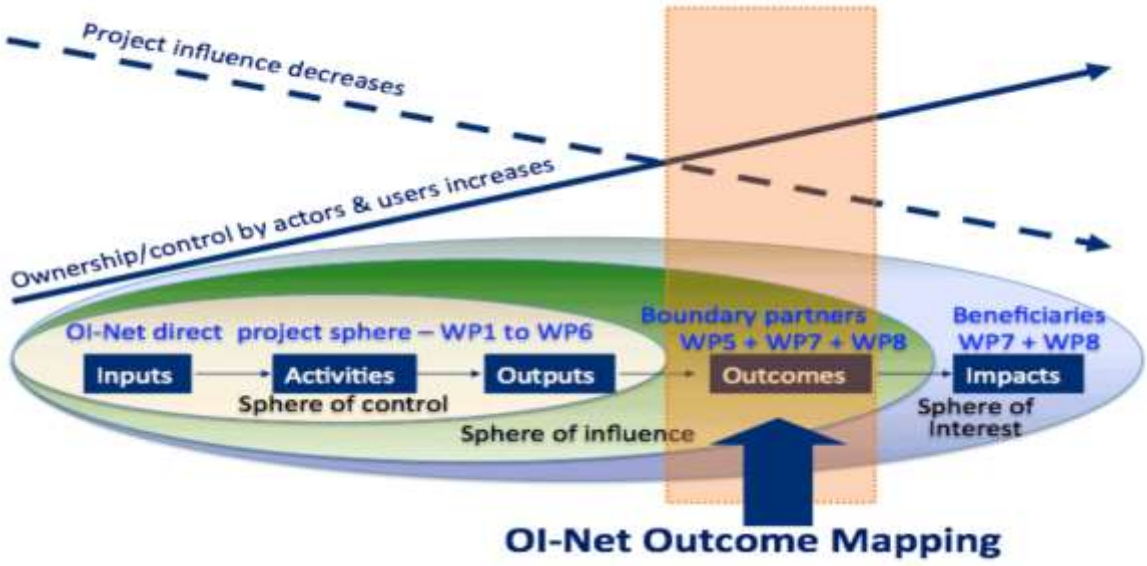

Figure 2. Variant of algorithm for mapping the results for a social system after applying the simulation modeling method (OI - Net = open innovation network)[14].

[13] https://slulibrary.saintleo.edu/c.php?g=449435&p=3067599 accessed on 17.02.2021.
[14] *Idem.*

The delimitation of several fields of action depending on the number of war parties/actors involved (WP) in the development or conduct of an event (be it desired or undesired) results in a progression as a variant of solving a problem or a crisis situation according to the model in figure 2. Simulation modeling develops a set of tools and guidelines that prompt working groups of different societal fields to work together and through an iterative process to identify and achieve the desired change in the conditions of the system status parameters. The originality of the solutions obtained through the simulation modeling method consists in moving from assessing the impact of adopting a certain course of action in the military action planning process, to achieving the desired changes in the behaviors, relationships, actions or activities of the elements of the societal fields, of the groups and organizations, of the actors, generally speaking, involved in the development of an event. Monitoring the values of the situation descriptive factors and the processes that occur or may occur at a given time is a method of identifying the direction of propagation of a negative event by the cascading effect with variable geometry depending on the nature of the network elements.

From the point of view of planning military operations, we observe a shift of the planning attention from obtaining effects during the decisive operation to obtaining cascading effects during the modeling operations. In this way, we witness a polarization of the operational art towards the scope of support operations and mainly of modeling operations, so that the decisive operation falls into the background. It all sums up essentially to identifying those events within the operational design, associated with the objectives to be met by modeling operations as being the most relevant for obtaining the results or the impact, which subsequently, by monitoring the status values related to the action or the inaction of the actors involved in carrying out an event, lead to the success of the operations. The direct result of applying the operational design is to influence the behavior of the actors involved, so that they follow the desired course of action, according to the concept of the operation. The fulfillment of the established objectives takes place simultaneously with the gradual modification of the contextual conditions, which allows the direction of the strategy to achieve the course of the future events through modeling operations.

This way of thinking and designing a military operation develops the operational art in the concept of "soft systems methodology" and allows an improvement of the performance of the components of a system through joint work. The gradual fulfillment of the set objectives within a planned course of action can be achieved through restructuring the organization or reorganizing it for combat, whenever there is a change in its status descriptive parameters.

In the case of planning a military operation in the concept of the "soft systems methodology", we observe that the application of the operational art is based on the substantiated integration of the situation estimates. A situation estimate involves the simultaneous existence of certain data as well as uncertain data or assumptions. Assumption-Based Planning (ABP) helps an organization prepare for the changes occurring in its environment that could disrupt its plans[15]. This training is systemic in nature, as it explores the relationships between the involved parties and the influencing factors, as well as because it determines the time perspectives and constraints of a developed plan, as shown in Figure 3.

[15] https://slulibrary.saintleo.edu/c.php?g=449435&p=3067613, accessed on 19.02.2021.

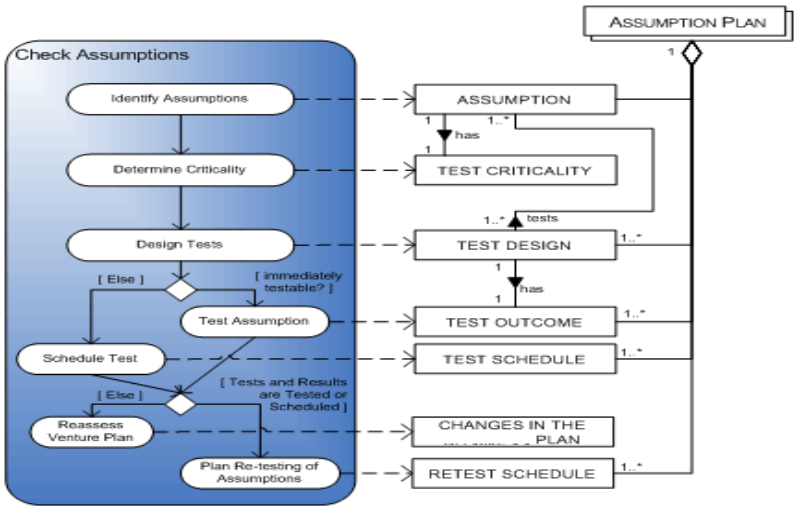

Figure 3. The logical diagram of the assumption-based planning process[16].

Identifying the time perspectives and the constraints of a developed plan, following a logical diagram of the assumption-based planning process, as in Figure 3, can be one of the best solutions in planning the actions required for countering a crisis situation or in dealing with the consequences of a negative event having a major societal impact.

Conclusions and Recommendations

Understanding the functioning of the "societal network" obtained by connecting the fundamental areas of the society which are: political/diplomatic, military, economic, social, medical-pandemic, infrastructural, informational, environmental and geo-strategic, we open new directions of scientific research in the field of military operation planning. Estimates of the situations based on which the possible courses of action of the opponent's forces or of the friendly forces are developed represent the "raw material" necessary for the process of transforming an unacceptable situation into the desired end state. Following the situation analyses for each societal field and by the manner of integrating the situation estimates, there are different models of action of the opponent involving the structuring and restructuring of their own formations and designing their actions which will be planned in operations.

Using in the relation the simulation modeling method in the "soft systems methodology" concept brings a new vision on the operational art and implicitly of the military action planning process in relation to the need to identify the optimal solutions for solving a crisis situation. The over-connection of the fundamental fields of a society requires sufficient theoretical and practical knowledge to cover at least two societal fields. This is possible by setting up interdisciplinary working groups on two or more societal fields.

Decoding the reality of the complex operational environment generated by the multitude of network connections established between the societal fields implies developing and managing the situation estimates for each over-connected societal field. This fact falls under the umbrella of knowledge management where the security specialists have distinct responsibilities depending on the specifics of the societal field. Certain options for solving a (military) crisis situation are selected or rejected after repeated simulations until favorable results are obtained. Due to the complexity of this approach, the mechanism for identifying a solution in a crisis situation may be the subject of further research.

[16] *Idem.*

Another aspect of applying the simulation modeling method in the operational art of military action planning through the concept of "soft systems methodology" is to open new perspectives under the integrated approach to a crisis situation or to produce a negative event with major societal impact. The first recommendation in this context is that in an actual crisis situation to shift attention from identifying the underlying causes of a problem to identifying the possible solutions (through simulation modeling) which is fundamentally different from the conventional approaches to solving the security problems.

Another proposal concerns the adoption of new working methods in planning military operations, in the sense that it is necessary to create a database of models for solving security problems occurring in the societal fields. This will allow all organizations that at some point may go through a crisis situation, to be prepared so as to reach their optimum performance capacity both in normal times and in a hypothetical crisis situation.

Although the simulation modeling method applied within the concept of "soft systems methodology" has been defined as a tool for solving problems in the security area of a "system of systems", it tends to work better when more series of participants attend, from several societal fields. As in the strategic management, the technique of the scenario is applied to design at least two "situations of future dynamics", such as: "the most likely course of action" and "the most dangerous course of action". The main purpose of the simulation modeling is to obtain sufficient models for a wide range of future risks and opportunities in support of forward planning and precautionary action, respectively, adopting a proactive behavior.

At the end of this approach meant to highlight the importance of the new perspectives in the military action planning, we express our belief that the future of the operational art will be directed towards the creation of the resource database of models of plausible situations. Following the establishment of such models of dynamic situations that a certain organization can go through, by conducting repeated simulations, it is possible to obtain optimal variants for solving a crisis situation in time, i.e. fulfilling the specific requirement of applying the operational art, regardless of the affected societal field or fields.

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