FEATURES OF STRUCTURAL CHANGES ON THE EFFECTIVENESS OF THE SYSTEM OF MATERIAL SUPPORT OF TROOPS (FORCES) IN MODERN CONDITIONS

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Summary

The article considers significant differences in the criteria and indicators for evaluating the effectiveness of planning based on the capabilities of the Armed Forces of Ukraine in comparison with the leading countries of the world. Functional features of material support as a complex system are given, taking into account trends in changes in the forms and methods of using troops (forces), and attention is focused on the use of defensive actions by the Armed Forces of Ukraine. A model of functioning of material support is proposed, which allows choosing a rational version of the composition and structure of forces and means, ensuring maximum efficiency of combat units 'actions with minimal resource costs. The main features of material support of the Armed Forces of Ukraine are identified and approaches to improving the functioning of the material support system are proposed. Creation of an effective system of material support as functions of logistics support in the conditions of combat operations to repel the attack of Russian troops on the territory of Ukraine, which plays a key role and is a priority task for improving efficiency in providing and managing the necessary resources of the Armed Forces of Ukraine. The introduction of the principles of compliance and mutual compatibility, existing structural divisions of the department and the peacetime and wartime support forces will allow performing tasks in a special period. These principles are implemented through measures related to the optimization of the support system for the Armed Forces of Ukraine. The maximum degree of autonomy at all levels of government allows implementing standards and procedures adopted in NATO member states in the Armed Forces of Ukraine in order to maintain the necessary level of defense capability, effectively respond to threats and challenges to national security. The need to avoid distorted wording or other concepts in defining criteria and indicators for evaluating the effectiveness of planning based on the existing potential of the Armed Forces of Ukraine and their correlation with NATO and EU member states allows us to modernize the system of providing material resources

Key words: logistics, material resource provision system, Armed Forces of Ukraine, management system, defense resources, NATO standards.

DOI https://doi.org/10.23856/5723

1. Introduction

The current stage of reforming the Armed Forces of Ukraine, taking into account changes in the armed struggle, forms and methods of Use, focus on defensive actions, a characteristic feature of modern combat operations is the use of the latest highly effective means of destruction which requires an increase in the technical equipment of combat units and leads to significant changes in the quantitative and qualitative characteristics of losses of weapons and military equipment, an increase in the intensity of their use, resource costs.

As part of the development, problematic issues are gradually taken into account, the system of material and technical support of the Armed Forces of Ukraine, which have switched to the logistics system, taking into account the experience of the Armed Forces of NATO member countries. Studying the experience of foreign countries, there is an urgent need to pay attention to the definition, concept and functioning of logistics that exists in the advanced countries of the world and create a logistics support system as a management system, which in the advanced countries of the world is listed as the management of material resources, technologies and the organization of ensuring the life of troops (forces).

The characteristic conditions of conducting modern operations (combat operations) pose new challenges to the organization of material support for troops. The expected result of structural changes in the logistics of the Armed Forces of Ukraine is the effective use of the material and technical base, optimal organization of material support for troops in peacetime and wartime, ensuring high survivability of the support system, as well as approximation of the standards of the organization of material and technical and medical support to the standards that exist in the Armed Forces of other countries and NATO member countries.

The need to implement a set of measures aimed at maintaining the necessary level of combat capability, which is determined by the availability of serviceable samples of weapons and military equipment (hereinafter referred to as weapons and military equipment) and their proper provision with material resources, remains one of the priorities of the Ministry of defense of Ukraine *(Decree of the President of Ukraine No. 473/2021, 2021)*.

The solution of such tasks is assigned to the logistics system of the military-industrial complex, which is created and operates depending on the forms and methods of use of the relevant units of the Defense Forces.

The large-scale invasion of Russian troops on the territory of Ukraine has changed the nature of the development of armed struggle, the conditions and conduct of modern operations (combat operations). This has led to an increase in their spatial and temporal indicators, which require a significant increase in the expenditure of appropriate resources and changes in the organization of providing them to troops (forces), which causes the need for an in-depth analysis of the processes that took place during the radical change in the organizational and staff structures of the Armed Forces of Ukraine and other components of the security and defense sector of Ukraine and a rational option for the functioning of the material support system.

In the scientific works of V. Kivlyuka *(Kivlyuk, 2006)*, O. Khazanovich, And. Romanchenko, V. Shuenkin *(Romanchenko & Shuenkin, 2007; Khazanovich, 2007)* presents views on retrospective development and directions for improving material and technical support, which are considered from the point of view of their organization and determine gradation indicators. It is noted that further research should form the basis for the search for a rational construction of a modern unified, integral system of material support. At the same time, not a single option has been proposed regarding a promising model of comprehensive logistics support for troops (forces) in modern conditions of conducting operations (combat operations).

The problematic issue of modeling the process of functioning of the material support system of the group of troops, as one of the subsystems of logistics support, was considered by M. Shishanov, A. Gulyaev, M. Shevtsov *(Shishanov et al., 2017)*, methods of modeling on the basis of an integrated approach, which are based on the construction and research of a model of the system for ensuring the combat capability of the OVT park of the grouping of troops, methodological approaches, modeling the process of rational placement and application of individual elements of the technical support system are described in the works of O. The Reveller, B. Demyanchuk, V. Kosareva, O. Maslia *(Hulyak et al., 2016; Hulyak et al., 2019)*, which have not yet been implemented in the practical activities of the troops (forces).

Modeling of the processes of technical support for the combat use of weapons samples is devoted to the work of Fr. Sukhina, A. Kosenko *(Sukhin et al., 2019)*, in which the mathematical apparatus of discrete Markov Processes is applied, but the assessment of the regularity of changes in the probability of being in the state of samples "damaged – not restored" (in the process of their intended use) showed that in typical conditions, due to combat damage, this probability, despite the measures taken, reaches the level of only 0.5-0.7.

Thus, taking into account evolutionary structural and functional changes in the system of material support will allow modeling the distribution of available resources to ensure the completeness and quality of performance by troops (forces) of the tasks assigned to them and the fastest achievement of the criteria and indicators necessary for integration into NATO, and most importantly to increase the capabilities of the logistics system.

2. Materials and Methods

Experts say solving problems that can quickly change during defensive actions.

The essential characteristics of material support consist in mathematical models related to the justification of planned measures to provide troops (forces) necessary for further assessment of the combat capability of troops (forces) in terms of achieving their level of combat readiness, first of all, these are various types of material resources implemented through functioning in the transport system with a certain efficiency of the corresponding subsystems.

Recent years are characterized by the overwhelming number of cargo transported for the needs of the Armed Forces of Ukraine, other military formations and law enforcement agencies. There is a steady trend towards an increase in the transportation of personnel, weapons, equipment, food, etc. The current stage of development of military formations and law enforcement agencies is characterized by an increase in the quality of performing security and defense tasks. Projects of material support for military formations and law enforcement agencies are non-commercial in nature, which in most cases does not allow us to assess their profitability. This highlights the relevance of this study.

The analysis shows that the implementation of projects and programs for the material support of the Armed Forces of Ukraine includes the management of human, material, Energy, Information and other resources throughout the project. The most promising area is the development of information technology logistics and cargo transportation. Analysis of existing approaches to material security management in other subject areas, emerging risks. It is the risk that allows you to track deviations in project indicators that reduce its effectiveness.

Improving the efficiency of the logistics system of the Armed Forces of Ukraine is an urgent scientific and applied task, which uses System Analysis and the method of analogies. It is these methods that make it possible to better study the logistics system and analyze its mechanisms of interaction with other structures.

Systematization of the definition of the concept of material support Project, made it possible to generalize and give your vision of this concept: as a unique set of coordinated works of a given content with certain initial and final dates, limited cost and time of implementation, aimed at achieving the planned goals of material support in the characteristics of duration, cost and satisfaction of project participants. The research is aimed at improving the efficiency of managing material support projects of the Armed Forces of Ukraine by developing new models and methods for managing such projects.

An increase in the number of input variables leads to an increase in complexity (an increase in the number of rules) for constructing a fuzzy logical output system. Building a hierarchical system of fuzzy logical inference and knowledge bases reduces complexity (the number of rules). The development of a software module based on the algorithm of the method as part of automated information systems of the Armed Forces of Ukraine will reduce the time for risk assessment of Logistics Information Systems of motor transport units.

The developed models and methods are the basis of the created algorithms and programs of automated information systems that ensure high-quality implementation of the management processes of these projects in conditions of uncertainty. The prospect of further research is to substantiate the composition of automated information systems for managing the material support system of the Armed Forces of Ukraine (military formations and law enforcement agencies).

3. Results and Discussion

Modern trends in armed struggle provide for the globalization of intelligence, control, navigation systems while simultaneously integrating weapons into the most powerful systems, increasing asymmetry in the nature of the struggle and led to significant changes in the spatial and temporal indicators of operations, forms and methods of using troops (forces), which requires an increase in resource requirements for combat operations and requires improvement of approaches to defense planning and their comprehensive support.

The world's leading countries use capability-based defense planning, which is adjusted in a timely manner depending on changes in global trends in armed struggle. At the same time, the dotmlpf doctrine is applied, which is based on seven criteria using the unified defense resource management system (DRMIS), which uses a system for evaluating the effectiveness of achieving results, quantified as a percentage, based on the main indicators that reflect the effectiveness of using resources for logistics processes *(Defense Acquisition University Glossary & US Defense Department, 2011)*.

The ability-based planning technique primarily focuses on how the enemy will conduct combat operations, rather than on who the enemy might be or in which part of the world the next war will start. It also takes into account that it is not enough to plan conventional wars in remote theaters of war. On the contrary, the United States must determine the capabilities necessary to deter and defeat opponents who rely on surprise, deception, and asymmetric action to achieve their goal" *(Nakaz Heneral'noho shtabu Zbroynykh Syl Ukrayiny No. 246, 2020)*.

"Recommendations for defense planning based on capabilities in the Ministry of defense of Ukraine and the Armed Forces of Ukraine" (hereinafter referred to as recommendations) *(Minister of defense of Ukraine, 2017; Order of the Ministry of Defense of Ukraine No. 484, 2020)* define a new approach to the organization of Defense Planning. This methodology was developed on the basis of a similar process of strategic planning of the US armed forces and has long been used not only by Defense Departments of the world, but also by business

representatives. The implementation of the recommendations was a significant step in bringing this element of strategic planning to the standards of the world's leading countries.

Also, the proposed mechanisms have a significant potential for developing existing capabilities, especially in conditions of insufficient funding for the needs of the Armed Forces. In the Armed Forces of Ukraine, the assessment of capabilities is considered to be the level of combat readiness, that is, the state of troops (forces), which ensures the realization of their combat potential in the interests of solving tasks in a certain period of time with a given effectiveness in specific conditions of the situation. The effectiveness assessment is carried out according to various criteria and indicators: the combat readiness coefficient, quantitatively reflected as a functional dependence on the staffing of personnel, the level of provision of weapons and military equipment, materials; the technical readiness coefficient as the ratio of the number of serviceable samples to the list composition; a complex combat readiness indicator, as a multiplication of seven different coefficients in essence.

Thus, the criteria and indicators for evaluating the effectiveness of planning based on capabilities in the Armed Forces of Ukraine and the leading countries of the world differ significantly, which is explained by the peculiarities (evolution) of the structure and functional properties of the corresponding support systems (table 1).

As can be seen from the Table 1, changes in the structure of technical and logistics support systems have led to their significant functional features. At the stage of creation and construction of the Armed Forces of Ukraine, a characteristic feature was the presence of autonomous forces and means of both technical and logistics support from the unit to the center, with their location on the ground determined by law.

During the integration of technical and logistics support into logistics support, the presence of logistics support bodies is traced with the mandatory creation of Joint Support Centers. The next restructuring of the logistics support structure into a logistics system took place with the creation of a new management body of the Support Force Command.

Further reform of the management bodies, the availability of separate weapons and the rear of the Armed Forces of Ukraine led to the subsequent redistribution of the functional capabilities of the corresponding support forces.

The development of the organizational and staff structure of the Armed Forces of Ukraine, taking into account NATO standards, is characterized by the emergence of a specialized management body of the logistics Forces Command and the corresponding *J*- structures in technical and logistics support systems with maximum use of the capabilities of the modern military-industrial complex.

The implementation of logistics support tasks for the use of the Defense Forces in strategic actions and operations of the Defense Forces is carried out in a single logistics support system, which includes a set of interrelated management bodies, forces and Means and logistics support infrastructure.

Based on the common functions of logistics support, as well as in order to ensure compatibility, coordination and management, available logistics assets are combined into a common logistics support system, which is a hierarchically distributed logistics support management bodies (strategic, operational and tactical levels) with subordinate forces and Means.

The system of logistics support of the Defense Forces is divided into strategic, operational and tactical levels, between which there is a clear distribution of functions and powers for organizing logistics support of the armed forces of Ukraine and other components of the Defense Forces.

The distribution of logistics support tasks is carried out in accordance with the levels of military administration:

Table 1

Evolution of the structure and functional properties of technical and logistics support systems into the function of material support of a unified logistics system

Stages	System structure, main types	Main functions	Notes
Creating, building	Technical support: tank-technical; auto technical; rocket and artillery engineering; Metrological Logistics support: clothing; food; provision of fuel and lubricants; apartment maintenance service	provision and creation stocks; training of personnel; technical exploration, evacuation and repair of damaged (defective) military equipment; management.	availability auton- omous forces and Means; normative defined location on the ground
Reformation	Logistics (logistics): material support; technical support separate management body of the support Force Command	accumulation to the established standards of inventory of material and technical means and timely delivery software their troops	integration tech- nical and logistics support in the material and tech- nical support; creation United States support centers
Development	Unified logistics system of the Defense Forces: material support; technical support; transport support specialized management body Logistics Force Command based on J-structures; Armed forces of Ukraine; Rear of the Armed Forces of Ukraine; Elements of the military-industrial complex	integrated of all systems with partial replacement	adapted to work in accordance with NATO standards

Source: compiled by the author based on data from enterprise financial statements (Postanova Kabinetu Ministriv Ukrayiny No. 1225, 2000; European Commission, 2019; Law of Ukraine No. 9015, 2018)

Strategic level: structural divisions of the Ministry of defense of Ukraine, other central bodies that are subordinate to military formations – Organization of design, development (modernization, modification), procurement and supply, liquidation (disposal) and sale of unusable military equipment and material and technical means, performance of works, provision of services and their financing in the amounts necessary for the effective performance of the armed forces, other components of the defense forces assigned to them tasks.

General Directorate of logistics (hereinafter-Gul) (J-4) of the General Staff of the armed forces of Ukraine – planning logistics support for strategic deployment and use of Defense Forces, implementation of short-and medium-term defense planning activities in the direction of logistics support, determining the need for military equipment and MTZ, monitoring their receipt.

Command of logistics forces (hereinafter – CSL) of the armed forces of Ukraine with subordinate forces and means of logistics support – implementation of logistics support measures of the Armed Forces of Ukraine in their daily activities, during training activities, during strategic deployment, preparation and conduct of operations (combat operations), restoration of combat capability of troops (forces), planning the use and management of subordinate military units and institutions.

Kos logistics center with subordinated Logistics Support forces and facilities with the tasks of planning and organizing logistics support for groups of troops (forces) in joint forces operations.

Logistics support management bodies of central bodies of other components of the defense forces with subordinate forces and Means – implementation of measures to organize logistics support for daily activities, training measures, from mobilization and rapid deployment of subordinate forces, preparation and execution (conduct) of Special Tasks (actions) in accordance with the purpose and specifics of activities, restoration of combat capability of forces and management of subordinate forces and means of logistics support.

Operational level: logistics units of Headquarters, Command (management, divisions) of logistics, regional (territorial) management bodies of logistics support of other components of the defense forces with subordinate forces and means of logistics support – planning and organization of logistics support for subordinate troops (forces) in their daily activities, during training, mobilization and operational deployment, training and participation in operations (combat, special actions), restoration of combat capability of troops (forces).

Tactical level: logistics units of Headquarters, Logistics units (officials) of military units, management bodies and support units of military units (subunits) of other components of the defense forces with subordinate forces and means of logistics support – planning and organization of logistics support for military units (subunits) in their daily activities, during training, mobilizing and bringing into combat readiness, training and conducting combat (special) actions, restoring the combat capability of military units (subunits) *(Doctrine of unified logistics VKP 4-00(01).01, 2020)*.

If consider material support as a complex system, it should be structured properly and ensure maximum efficiency of combat units 'actions with minimal resource costs.

In the existing models of the functioning of the material support system, the criterion for evaluating the effectiveness is determined by the combat readiness coefficient of each type of military equipment, which requires significant time spent on appropriate calculations and does not take into account the dynamics of changes in their characteristics due to the use of modern innovative technologies that are implemented in the process of re-equipment of units.

At the same time, it is particularly important to determine the appropriate, rational structure of the grouping and the corresponding forces and means of providing it for solving problems that can change rapidly during defensive actions.

The input data will be the state of available resource capabilities R, controlled space parameters area of the combat area x, operational-tactical and military-geographical factors, the exciting parameter is a change in the situation over time $x_1(t)$. The initial parameter of the system selects the level of combat capability of units based on the availability of serviceable samples of weapons and military equipment N, capable of performing tasks for their intended purpose (fig. 2).

The determining parameter in this case will be the value of spending the resource used to maintain the required level of combat capability of units and their own forces and Means, which

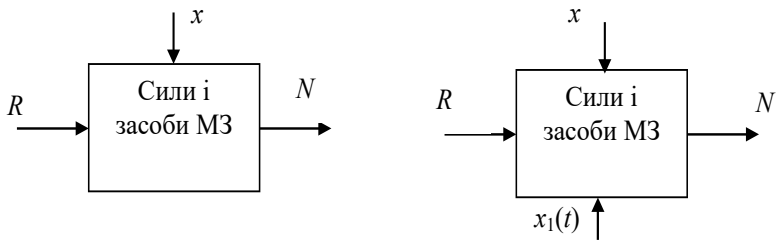

Figure 2. Scheme of functioning of the material support system for various conditions of organization and conduct of Defense actions

Source: Nakaz Heneral′noho shtabu Zbroynykh Syl Ukrayiny No. 246 (2020), Postanova Kabinetu Ministriv Ukrayiny No. 1225 (2000)

maximally corresponds to the system of evaluating the effectiveness of achieving results used in the leading countries of the world and NATO.

Based on Fig. 2, the system of material support in the conditions of early preparation for defensive actions (without the influence of the enemy), operates in a stationary mode without the presence of exciting parameters. During the organization of the material support system in conditions of direct contact with the enemy, the system begins to function in a different mode of excited state caused by a change in the situation over time.

So, the model of functioning of the system the system of material support without the influence of exciting parameters takes the form:

$$N = f(R, t) \text{ when } X = const, \quad (1)$$

where N – the level of combat capability of units by the availability of weapons and military equipment samples capable of performing their intended purpose;
R – resource accumulated by the system, material support system;
t – time of task completion by the system, material support system;
x – controlled parameters of the defensive area space.

With the appearance of influence on the system, the system of material support of exciting parameters (the influence of enemy weapons), the model of its functioning takes on a new look

$$N = f(R, x_1, t). \quad (2)$$

An essential feature of the functioning of the material support system, specifically for the conditions of defensive actions, is the possibility of using a well-tested scientific and methodological apparatus for assessing its effectiveness (for example, modeling using discrete Markov Processes, or building a decision support system), which allows you to choose a rational version of the composition and structure of forces and Means for the purpose of their further positioning on the ground.

Despite the global trends of increasing the space – time scope of modern operations (combat operations), changing the forms and methods of using troops (forces), the main type remains defensive actions, and the issue of their provision is the system of material support.

4. Conclusions

As a result of a complex theoretical study, there was an attempt to solve the scientific task of establishing the dependence of the material support system on the levels and system of the logistics mechanism of the military-industrial complex. Thus, significant changes in the forms and methods of the use of troops (forces), spatio-temporal indicators of operations (combats), the process of reforming and development of the Armed Forces of Ukraine, the features of the creation, construction, functioning of the relevant support systems, the system of material support, as one of functions of logistics support – allows you to perform tasks as assigned with maximum efficiency and minimal resource costs. The possibility of using a proven scientific and methodological apparatus for evaluating its effective management makes it possible to choose a rational version of the composition and structure of forces and means for the performance of assigned tasks. Reforming the management of the support system of the Armed Forces of Ukraine – will increase the timeliness and efficiency of the support system, reduce costs and optimize the process of managing material, information and human flows.

Prospects for further research can be seen in the examination of the logistics system of the defense forces of Ukraine.

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