Methodological approach to evaluation of logistics system efficiency

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Abstract

The Armed Forces of Ukraine is currently undergoing reforms to maximize compatibility with the Armed Forces of NATO member countries. One of the components of the armed forces of any developed country is the logistics system. The logistics system is a complex and multilevel structure. Given the above, it is necessary to take into account differences in origin, units of measurement indicators for assessing the effectiveness of its operation. The logistics system is a complex, multilevel structure. In the course of the research, a methodical approach to the evaluation of the efficiency of the logistics system was developed, which is based on the integrated indicator of the evaluation of the efficiency of the logistics system. The proposed indicator allows assessing the effectiveness of the logistics system, with both the system as a whole and its individual elements (individual logistics subsystems). The development of an integrated indicator for assessing the efficiency of the logistics system. The essence of the integrated indicator is that it allows you to take into account the main indicators that affect the efficiency of the logistics system, which are different in origin, units, and content. It also allows you to take into account the indicators that arise in the operation of the logistics system. The formation of an integrated indicator for assessing the effectiveness of the logistics system is based on generalized indicators, which in turn are a set of partial indicators for assessing the effectiveness of the logistics system of the state defense forces. Based on the results of the analysis, the author identified the main imperfections of the logistics system of the Armed Forces of Ukraine and substantiated the ways to improve the logistics system of the Armed Forces of Ukraine.

Key words: logistics system, state defense forces, efficiency, forms, methods.

Introduction

The Armed Forces of Ukraine is currently undergoing reforms to maximize compatibility with the Armed Forces of NATO member countries. One of the components of the armed forces of any developed country is the logistics system. The logistics system is a complex and multilevel structure. Given the above, it is necessary to take into account different in origin, units of measurement indicators for assessing the effectiveness of its operation. Given the above, the urgent scientific task is to take into account the maximum number of indicators that characterize the efficiency of the logistics system.

Material and methods

Existing approaches to assessing the efficiency of the logistics system are not adapted to a comprehensive assessment of the effectiveness of the logistics system [1-3]. This is due to the assessment of only the first component of the logistics system, without taking into account other components of the logistics system, as well as the mutual influence

of indicators on each other.

Given the above, the purpose of this study is to develop an integrated indicator for assessing the effectiveness of the logistics system, which:

will take into account all components of the logistics system;

takes into account the impact of indicators for assessing the effectiveness of the logistics system on each other with different units of measurement.

Results and discussion

The integrated indicator for evaluating the efficiency of the logistics system is hierarchical, consisting of generalized indicators for evaluating efficiency, which in turn consist of partial indicators. The generalized indicators are structured for each of the components of the evaluation of the efficiency of the logistics system. The generalized indicator of an estimation of efficiency of system of logistics can be calculated by convolution of the partial indicators reflecting (Vlasov I., Vorobyov, O., Nakonechnyi O., Sereda Yu., 2020; Nakonechnyi O., 2019):

quantitative and qualitative composition of forces and means of the logistics system;

structure of forces and means of logistics system;

tactical and technical characteristics of samples of armaments and military equipment that are part of the forces and means of the logistics system;

opportunities for the restoration of samples of weapons and military equipment, etc.

The logistics system includes a set of functional components (organizational and staffing units) united by a common purpose and can be described by a vector of indicators that characterize the contribution of the latter to the level of functioning:

$$\mathrm{E}^{\mathrm{FS}} = (\mathrm{E}^{\mathrm{FS}_1}, \mathrm{E}^{\mathrm{FS}_2}, \ldots, \mathrm{E}^{\mathrm{FS}_n}, \ldots, \mathrm{E}^{\mathrm{FS}_N}), \quad (1)$$

where $\mathrm{E}_n^{\mathrm{FS}}$ – the level of the *n*-th organizational and staffing structure that is part of the logistics system;

N – the number of functional components of the logistics system.

The logistics system includes subsystems: planning subsystem, management subsystem with the executive component – the forces and means of providing: the logistics system includes subsystems: planning subsystem, management subsystem with the executive component – the forces and means of providing:

$$\mathrm{E}^{\mathrm{FS}} = (\mathrm{E}^{\mathrm{FS}_1}, \mathrm{E}^{\mathrm{FS}_2}, \ldots, \mathrm{E}^{\mathrm{FS}_k}, \ldots, \mathrm{E}^{\mathrm{FS}_K}), \quad (2)$$

$\mathrm{E}_k^{\mathrm{FS}}$ – the level of belonging of the *k*-th element of the functional subsystem of the logistics system;

K – the number of elements in the functional subsystem of the logistics system.

In formalized form, the integrated indicator of the efficiency of the logistics system can be described as follows:

$$E^{\mathrm{LS}} = F[R(t), U(t), Q(t), Y(t)], \quad (3)$$

where E^{LS} – components of the functioning of the logistics system at the time t (on ℓ-thstage) periods T, $t \in T$;

$R(t), U(t), Q(t)$ – generalized indicators of components of the logistics system;

$Y(t)$ – conditions for changing the operational situation.

The level of functioning of organizational and staffing structures of the logistics system in the conditions $Y(t)$ determined by the formula [1-5]:

$$R(t) = f_1\left(r^{\mathrm{base}}, r^{\mathrm{sup}}, Y(t)\right),$$

where $r^{\mathrm{base}}, r^{\mathrm{sup}}$ – levels of functioning of organizational and staffing structures that perform the basic functions of the logistics system and providing the functions of the logistics system. In turn:

$$r^{\mathrm{base}}(t) = f_2\left(\{r_1^{\mathrm{des}}\}, \{r_1^{\mathrm{qu}}\}, \{r_1^{\mathrm{staf}}\}, \{r_1^{\mathrm{meth}}\}\right),$$

where $\{r_1^{\mathrm{des}}\}$ – partial indicators characterizing the share of forces and means that perform the basic functions of the logistics system that will be destroyed;

$\{r_1^{\mathrm{qu}}\}$ – partial indicators that characterize the quality of units that perform the basic functions of the logistics system;

$\{r_1^{staf}\}$ – partial indicators of staffing;

$\{r_1^{meth}\}$ – partial indicators that characterize the method of application of units that perform the basic functions of the logistics system.

Depending on the value of the indicator $r^{sup}(t)$it can be described as follows:

$$r^{sup}(t) = f_3(\{r_m^{ef}\}, \{r_m^{qu}\}, \{r_m^{staf}\}, \{r_m^{meth}\}).$$

The level of functioning of the control subsystem of the logistics system in the conditions $Y(t)$is defined by the expression:

$$U(t) = f_4\big(u^{cs}(t), u^{se}(t), u^{cu}(t)Y(t)\big),$$

where $u^{cs}(t), u^{se}(t), u^{cu}(t)$ – levels of functioning of logistics control elements, systems and means of automation and communication. In turn:

$$u^{cs}(t) = f_5(\{u^{org}\}, \{u^{inf}\}),$$

where $\{u^{org}\}$ – partial indicators that characterize the quality of management of the components of the logistics system;

$\{u^{inf}\}$ – partial indicators characterizing the level of information support of logistics system units.

To partial indicators $\{u^{org}\}$belong:

u^{nf} – the level of compliance of logistics system units, new forms and methods of their application;

u^{staf} – the level of staffing of logistics management bodies with relevant specialists;

u^{dev} – level of implementation of modern algorithms of support and decision-making;

u^{adap} – the level of adaptation to changes in the operational environment;

u^{cont} – the level of compliance of the organizational structure of the management system with the management requirements.

Partial indicators $\{u^{inf}\}$ include:

$\{u^{plan}\}$ – the level of compliance of information support when planning the use of units of the logistics system to the required;

$\{u^{infsup}\}$ – the level of compliance of information support in the direct management of units of the logistics system to the required;

$\{u^{con}\}$ – the duration of the cycle of extraction, collection and delivery of data on collateral from all sources in relation to the required;

$\{u^{upd}\}$ – period of complete updating of data on the situation.

Level of functioning of control points:

$$u^{ce}(t) = f_6(\{u^{tech}\}, \{u^{func}\}),$$

$\{u^{tech}\}$ – partial indicators that reflect the technical equipment of control points of the logistics system;

$\{u^{func}\}$ – partial indicators characterizing the process of functioning of control points of the logistics system.

$$u^{cs}(t) = f_7(u^{integ}, u^{comp}, u^{tim}, u^{ss}, u^{imc}),$$

where u^{integ} – the level of integration of the automated logistics management system into the network-centric-oriented technical basis of the logistics system;

u^{comp} – levels of compatibility of existing (those coming into service) means of automation of control points at different levels of control;

u^{tim} – the level of timeliness of reception, processing, display and transmission of policy documents, commands and signals;

u^{ss} – the level of special protection of means of transmission and processing of information;

u^{imc} – the level of equipment of management bodies of information-modeling complexes.

Taking into account (3) the integrated indicator has the form:

$$\mathrm{E} = F\big[R(t), U(t), Q(t), Y(t), f_{12}(\{z_j(t)\}, \{n_{ij}(t)\}, \{c_j(t)\})\big], \quad (4)$$

$\{z_j(t)\}$ – a set of tasks assigned to the logistics system in the *j*-th version of its actions, $z \in Z$;

$\{n_{ij}(t)\}$ – system of changing the organizational and staffing structure of the logistics system, aimed at changing it *i*-th$\big(i \in l\big)$ indicators in *j*-th action option, $n \in N$;

$\{c_j(t)\}$ – resources allocated for implementation *j*-th variant of action of the logistics system $j \in J$;

I, N, Z, J – a set of indicators, development measures, options for the list of tasks assigned to the system of logistics and options for its development.

Conclusions

The development of an integrated indicator for assessing the efficiency of the logistics system. The essence of the integrated indicator is that it allows you to take into account the main indicators that affect the efficiency of the logistics system, which are different in origin, units and content.

It also allows you to take into account the indicators that arise in the operation of the logistics system. The formation of an integrated indicator for assessing the effectiveness of the logistics system is based on generalized indicators, which in turn are a set of partial indicators for assessing the effectiveness of the logistics system of the state defense forces.

The direction of further research should be considered the development of methods for assessing the effectiveness of the logistics system.

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