The Central Research institute
of the Armed Forces of Ukraine

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

Received: *December 2, 2025* | **Revisions Requested:** - | **Revision Received:** -
Accepted: *January 28, 2026* | **Published Online:** *August 5, 2026*

Licensed (C) by Creative Commons Attribution International License 4.0 (CC BY-NC-SA)

DOI: 10.62524/msj.2026.4.2.6

A Methodology for Determining the Annual Cost of a Military Unit Based on a Comprehensive Scientific and Methodological Framework for Life-Cycle Cost Assessment

Olena Levchuk
Candidate of Economic Sciences, Associate Professor
Junior Research Fellow
Central Research Institute of the Armed Forces of Ukraine
03049, Povitrianykh Syl Avenue, 28 B, Kyiv, Ukraine
e-mail: elena_levchuk@ukr.net
ORCID: 0000-0002-2827-2134

Yevhen Marko
Candidate of Economic Sciences, Senior Research
Leading Research Fellow
Educational and Scientific Centre for Defence Management
National Defence University of Ukraine
03049, Povitrianykh Syl Avenue, 28, Kyiv, Ukraine
e-mail: marko.evgen@gmail.com
ORCID: 0000-0002-9165-8072

Abstract. The article substantiates a methodology for determining the annual cost of a military unit on the basis of a comprehensive scientific and methodological apparatus for life-cycle cost assessment. The relevance of the research is determined by the need to improve the effectiveness of defence planning, ensure the rational allocation of limited financial resources and provide transparency in cost management under the conditions of modern security challenges and prolonged armed aggression. The proposed methodology provides for the integration of all cost components related to the creation, equipping, maintenance, training, deployment and decommissioning of a military unit into a single assessment system. The basis of the approach consists of combining economic, systemic and functional methods, which makes it possible to take into account the specific features of the organisational structure, the level of manning, the intensity of combat training and the degree of the unit's involvement in performing assigned tasks. The result of applying the methodology is the determination of the average annual cost of a military unit, taking into account the full cost of its life cycle, which ensures more substantiated management decision-making in the field of building and developing the Armed Forces of Ukraine. The practical significance of the results obtained consists in the possibility of their use by military command and control bodies during the formation of development programmes, the planning of resource provision and the improvement of the efficiency of budgetary funds use. The proposed approach may be adapted to different types of military units and applied within the capability-based defence planning system. The developed methodology is based on a combination of economic, systemic and functional approaches and makes it possible to determine the average annual cost of a unit, taking into account the full cost of its life

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

cycle. It considers the specific features of the organisational structure, the level of manning, the intensity of combat training and the degree of involvement in performing assigned tasks.

Keywords: annual cost of a military unit, life cycle, life-cycle cost, cost assessment, scientific and methodological apparatus, defence planning, Armed Forces of Ukraine development, resource provision, cost efficiency, military formations, defence resource management, capability-based planning.

Introduction

Under the conditions of prolonged armed aggression and limited financial resources, improving the effectiveness of defence planning and the rational use of budgetary funds is acquiring particular relevance. One of the key tasks in the system of building the Armed Forces of Ukraine (AF of Ukraine) consists in the substantiated determination of the cost of maintaining and functioning military units [1, 2].

Traditional approaches to cost assessment are, as a rule, focused on short-term indicators and do not fully take into account all stages of the life cycle of a military unit. This reduces the quality of management decisions and complicates strategic planning [3]. In this regard, there is a need to develop a methodology that makes it possible to determine the cost of a military unit, taking into account the full cost of its life cycle.

Literature Review

The issue of life-cycle cost assessment (LCC) is one of the key issues in modern research on defence economics and resource management. The origins of the LCC concept are associated with the activities of the US Department of Defence, where it was formed as an instrument for substantiating long-term costs for complex technical systems as early as the mid-twentieth century [7]. The further development of this concept led to its widespread application in military planning, industry and public administration.

In modern research, LCC is considered as an integrated approach that covers all costs throughout the system life cycle: from development and procurement to operation, maintenance and disposal [3]. It is emphasised that the largest share of costs falls precisely on the operation and support stage, which may account for more than 60–70% of the total cost of military systems.

A significant number of scientific works are devoted to the application of LCC in assessing the effectiveness of military investments. In particular, the works of Navarro-Galera demonstrate that LCC is the most effective instrument for the economic assessment of defence programmes; however, its practical application in most countries remains limited due to the absence of appropriate methodological approaches and reliable databases [3]. Similar conclusions are confirmed by international research, which indicates an insufficient level of standardisation and the complexity of implementing LCC in national defence planning systems [5].

A separate area of research concerns the formation of the life-cycle cost structure. NATO works propose the use of cost breakdown structures, which make it possible to systematise costs by stages and functional components of the system [2]. This approach ensures greater transparency of calculations and serves as a basis for management decision-making.

Meanwhile, modern research emphasises the limitations of the traditional application of LCC, which is mostly oriented towards individual weapons models or technical systems. In particular, Beeres et al. note that most existing approaches have a “reductionist” character, as they do not take into account the organisational context, functional tasks and interrelationship between the elements of military systems [5].

Despite the significant number of research works, the issue of determining the annual cost of a military unit, taking into account the full life cycle, remains insufficiently developed. Existing

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

approaches are mostly oriented towards technical systems, whereas military units have a complex organisational and functional nature, which requires the formation of a specialised scientific and methodological apparatus.

Methodological Framework

The methodological framework of the research on determining the annual cost of a military unit on the basis of a comprehensive scientific and methodological apparatus for life-cycle cost assessment is formed as a set of interconnected approaches, principles and methods that ensure a systemic, objective and adaptive examination of military-economic processes. The research is based on the systems approach, according to which a military unit is considered as a complex socio-economic system that functions under the conditions of a dynamic security environment and is characterised by the interaction of organisational, resource, functional and performance-related components. This makes it possible to take into account the interrelationships between the stages of the unit's life cycle, the cost structure and the level of achieved capabilities.

The application of the capability-based approach is key, as it provides for cost assessment not only from the perspective of resource provision, but also through the prism of the unit's ability to perform assigned tasks. In this context, costs are interpreted as a function of achieved capabilities, the level of combat readiness and the intensity of deployment.

The life-cycle approach to a military unit also occupies an important place, as it provides for taking into account the full range of costs at all stages of the military unit's existence – from formation to disbandment. This makes it possible to assess not only current, but also long-term costs, in particular the costs of restoration, modernisation and disposal of resources.

The methodological framework also includes the military-economic approach, which ensures the combination of economic analysis with consideration of the specific features of the functioning of the security and defence sector. It makes it possible to assess the effectiveness of resource use, taking into account the strategic goals of the state, limited funding and the impact of external threats.

To formalise the assessment processes, the following research methods were used: methods of economic analysis and indicator standardisation; the method of cost decomposition by life-cycle stages; scenario analysis and methods for modelling the development of the security environment; methods for assessing risks and uncertainty; expert methods, in particular for assessing parameters under conditions of limited data; and optimisation methods for determining a rational cost structure.

The functional approach was also applied, making it possible to compare costs with the specific functions and tasks of the unit. An important element of the methodology is the consideration of uncertainty and risks, which is implemented through the use of interval estimates, the scenario-based approach and sensitivity analysis. This ensures greater reliability of the results under the conditions of limited statistical data and variability of the external environment.

The proposed methodological framework has a comprehensive character and combines modern approaches to defence planning, economic analysis and resource management, creating the prerequisites for developing a substantiated and practically oriented methodology for determining the annual cost of a military unit.

The aim of the article is to substantiate a methodology for determining the annual cost of a military unit on the basis of a comprehensive approach to assessing its life-cycle cost.

Results and Discussions

The essence of the life cycle of a military unit consists in the successive change of the states of its existence – from formation to disbandment – which reflects the dynamics of capability development, resource provision and combat effectiveness under the conditions of a changing security environment.

In generalised terms, the life cycle of a military unit includes the following main stages:

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

1. Formation (creation). At this stage, the unit's tasks, organisational and manning structure, strength, staffing with personnel, weapons and equipment are determined. Initial resource provision is carried out and the basic level of capabilities is established [1, 8].

2. Training and combat coordination. This stage includes the individual training of servicemen, combat coordination of the unit, the acquisition of interoperability, as well as the achievement of defined readiness standards, in particular in accordance with NATO approaches [4, 6].

3. Deployment and combat use. The unit performs assigned tasks within operations, including combat operations, peacekeeping missions and others. At this stage, its functional purpose is realised, and the effectiveness of its structure, command and control, and support is tested [4, 9].

4. Restoration of combat capability (rehabilitation). After performing tasks, the unit undergoes a recovery stage: replenishment of losses, maintenance and modernisation of equipment, psychological and physical rehabilitation of personnel, and renewal of resources [1, 4].

5. Rotation or reformation. Depending on changes in the situation, the unit may be relocated, reformed or adapted to new tasks, which provides for changes in its structure, strength or functional purpose [2].

6. Disbandment (liquidation). The final stage of the life cycle, which provides for the termination of the unit's existence, the transfer of its resources to other structures or their write-off [10].

From a scientific point of view, the life cycle of a military unit should be considered as a *cyclical capability management system*, where each stage is connected with management decision-making on resource allocation, effectiveness assessment and adaptation to changes in the external environment. This approach correlates with the concepts of capability-based planning and life-cycle management, which are widely used in the defence planning of NATO countries [3].

A specific feature of the modern approach is the integration of the military-economic component of the defence training system, where the life cycle of a unit is assessed not only by indicators of combat capability, but also by cost characteristics (life-cycle cost), resource use efficiency and resilience to economic constraints [4].

The formation of a modern defence planning system requires a transition from a cost-based approach to resource management to a capability-oriented model. Within this model, the key object of assessment becomes not only the structure or strength of military units, but also their ability to perform assigned tasks effectively under the conditions of uncertainty and resource constraints. In this context, the problem of the substantiated determination of the cost of a military unit acquires particular relevance as an integral characteristic that reflects the interrelationship between achieved capabilities, required resources and expected results of combat deployment.

Modern security challenges, in particular the high intensity of military operations, the dynamic nature of threats and the growing economic burden on the state, necessitate the development of a comprehensive scientific and methodological apparatus that ensures the systemic assessment of the cost of military units at all stages of their life cycle. Such an approach should take into account not only direct costs for maintenance and equipment, but also the costs of formation, training, restoration of combat capability, modernisation and adaptation to changes in the operational environment.

The basis of this apparatus consists in the integration of military-economic, organisational-managerial and functional approaches, which makes it possible to consider a military unit as a complex socio-economic system with variable performance parameters. This provides for the use of methods for standardising capability indicators, assessing their marginal utility, modelling deployment scenarios and optimising resource provision, taking into account constraints and risks.

Thus, the formation of a comprehensive scientific and methodological apparatus for assessing the cost of a military unit on the basis of capabilities is a necessary prerequisite for increasing the validity of management decisions in the field of defence planning, ensuring the effective use of state resources and achieving the balanced development of the military-economic component of the system

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

of preparing the state for defence.

The proposed approach is based on a combination of systemic, functional and economic approaches [6; 11]. The main principles are the completeness of consideration, consistency over time, adaptability and the reliability of results. The comprehensive scientific and methodological apparatus is based on a combination of:

- the systems approach (considering the unit as an integrated system);
- the functional approach (analysing functions and tasks);
- the economic approach (assessing costs and effectiveness);
- the programme-target method (alignment with development goals).

The main principles of this scientific and methodological apparatus are:

- completeness of cost consideration;
- consistency over time;
- adaptability to environmental changes;
- the possibility of comparing the results obtained.

Under the conditions of the growing complexity of the security environment and limited state resources, the issue of substantiated determination of the annual cost of a military unit as a basic element of the defence planning system is acquiring particular importance. It is annual costs that reflect the real financial pressure on the state economy and make it possible to assess the ability of the security and defence sector to maintain an appropriate level of combat capability in the long term.

The annual cost of a military unit is a complex integrated category that combines costs for personnel pay, infrastructure maintenance, operation and maintenance of weapons and military equipment, training, logistics support, as well as measures to restore combat capability. At the same time, its determination cannot be limited only to the accounting calculation of costs, but must be based on consideration of the level of capabilities achieved by the unit, the intensity of its deployment and the impact of external and internal factors.

The relevance of developing a methodology for determining the annual cost of a military unit is determined by the need to increase the transparency and effectiveness of defence resource use, ensure the comparability of costs with achieved results, and form a scientifically substantiated basis for management decision-making regarding the structure, strength and functional purpose of military formations.

The proposed approach to forming such a methodology provides for the integration of military-economic analysis, elements of the life cycle of a military unit and the principles of capability-based planning. This makes it possible to move from a static understanding of costs to a dynamic model in which annual cost is considered as a function of the unit's condition, its level of readiness, the intensity of resource use and the conditions of functioning.

The development of a methodology for determining the annual cost of a military unit is an important step towards improving the effectiveness of defence management, optimising the budgetary burden and ensuring the sustainable development of the military-economic component of the system of preparing the state for defence.

The annual cost of a military unit is determined by reducing the total life-cycle cost to an average annual value, taking into account the duration of functioning (1):

$$C_{annual} = \sum_{t=1}^{i} C_t / T, \quad (1)$$

where C_{annual} – is the annual cost of the unit;

C_t – is the cost at the *t*- th stage of the life cycle;

T – is the duration of the life cycle.

At the same time, total costs are determined as the sum of costs across all components (2):

$$C_{total} = C_{form} + C_{equip} + C_{maint} + C_{train} + C_{oper} + C_{rec} + C_{dis}, \quad (2)$$

where C_{total} – is the total or full life-cycle cost of a military unit;

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

C_{form} – is the cost of forming a military unit (staffing with personnel, creating the organisational structure, initial deployment);

C_{equip} – is the cost of equipping the unit (procurement of weapons and military equipment, communications assets, infrastructure, material and technical resources);

C_{maint} – is the cost of maintenance (pay, food provision, clothing provision, utilities, infrastructure operation);

C_{train} – is the cost of training (combat and special training, education, exercises, costs for training grounds and training aids);

C_{oper} – is the cost of deployment or operational activity (performance of combat tasks, fuel and ammunition expenditure, logistics);

C_{rec} – is the cost of recovery and maintenance (technical servicing, overhaul, modernisation of weapons and military equipment);

C_{dis} – is the cost of disbandment or liquidation (disposal of equipment, decommissioning, social payments, closure of infrastructure).

This formula shows that the cost of a military unit is formed at all stages of its existence, and not only during maintenance. It is particularly important to take into account the C_{equip} component, which often constitutes a significant share of total costs and determines the unit's capabilities.

It is appropriate to expand the proposed methodology by taking into account the time factor through the application of a discounted approach to life-cycle cost (LCC) assessment. This makes it possible to increase the accuracy of calculations and ensure the comparability of costs incurred in different periods.

Taking discounting into account, the total life-cycle cost is determined as the present value of aggregate costs (3):

$$PV = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}, \quad (3)$$

where C_t – is the cost in year t;

r – is the discount rate (the substantiated cost of capital or inflation);

n – is the life-cycle period.

The significance of assessment under this methodology consists in the following [10]:

- substantiation of capabilities: it enables the AF of Ukraine to make decisions on the creation of new structures on the basis of long-term effectiveness;
- procurement transparency: it may be used in the Prozorro system to assess not merely the purchase price, but the real cost of ownership;
- economic dynamism: it takes into account inflationary processes and changes in the value of money.

Discounting reflects the decrease in the value of money over time and takes into account inflationary processes; the alternative cost of resources; risks and uncertainty. Thus, future costs have less weight compared with current costs.

On the basis of the discounted life-cycle cost, the annual cost may be determined as an equivalent uniform annual indicator:

$$C_{annual} = C_{LCC} \cdot (r \cdot (1+r)^T)/((1+r)^{T-1}), \quad (4)$$

where C_{annual} – is the equivalent annual cost of a military unit;

r – is the discount rate;

T – is the number of years.

The inclusion of the discounted approach makes it possible to:

- increase the validity of management decisions;
- ensure a correct comparison of alternative options for the development of units;
- take into account the long-term consequences of costs;

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

- integrate the methodology into modern defence planning systems.

When applying the discounting method, it is appropriate to use a regulatory discount rate, for example, at the level of state recommendations; to take into account the specific nature of military risks; and to conduct scenario analysis, including optimistic, baseline and pessimistic scenarios).

Modern approaches to life-cycle cost (LCC) assessment provide for the need to take into account risks that affect the structure and dynamics of costs [4; 5]. In the military sphere, risks have a specific character, which is determined by the impact of combat operations, the uncertainty of the security environment and active counteraction by the adversary [6].

Unlike civilian systems, military risks are characterised by a high probability of resource losses, non-linearity of costs and significant variability in functioning scenarios. This necessitates a transition from deterministic models to stochastic or scenario-based approaches [7].

The simplest way to take risk into account is to include a risk premium in the discount rate (5):

$$r = r_f + \pi_r, \tag{5}$$

where r – is the discount rate;

r_f – is the risk-free rate;

π_r – is the military risk premium.

This approach makes it possible to take uncertainty partially into account; however, it does not reflect the structure of risks.

However, a more substantiated approach is one that provides for taking into account the probability of risk events occurring, namely risk-adjusted LCC (6):

$$C_{LCC}^{risk} = \sum_{t=0}^{T} \frac{C_t + \sum_{j=1}^{m} p_{j,t} \cdot L_{j,t}}{(1+r)^t}, \tag{6}$$

where C_{LCC}^{risk} – is the risk-adjusted life-cycle cost;

C_t – is the baseline cost in period *t*;

$p_{j,t}$ – is the probability of the j-th risk event occurring in period *t*;

$L_{j,t}$ – is the amount of losses from the j-th event;

m – is the number of risk types;

r – is the discount rate.

The proposed model makes it possible to:

- take into account expected losses from combat operations, the destruction of equipment and infrastructure;
- integrate risks into the overall cost structure;
- increase the accuracy of long-term planning.

At the same time, expected losses are determined as the mathematical expectation (7):

$$E(L_t) = \sum_{j=1}^{m} p_{j,t} \cdot L_{j,t}. \tag{7}$$

Thus, the model combines the classical LCC approach with elements of probability theory.

However, in practice, it is appropriate to use scenario analysis:

– the baseline scenario, conditionally peacetime;

– a scenario of heightened tension;

– a scenario of intensive combat operations.

For each scenario, the values of p_(j,t) and L_(j,t) are determined, which makes it possible to obtain a range of possible costs [5, 10].

Below is an example of the application of risk-adjusted LCC for a heightened tension scenario.

Let us consider a notional military unit with a life-cycle duration of T = 5 years. The baseline annual costs are:

C_t= UAH 100 million for each year).

Discount rate:

– risk-free rate r_f=5%;

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

– military risk premium π_r=7%;
– therefore: r=12%.
In this scenario, the following risks are taken into account (Table 1).

Table 1. Risk Identification (Heightened Tension Scenario)

Risk	Probability *p*	Losses, UAH million
Partial damage to equipment	0,3	40
Disruption of logistics	0,2	20
Personnel losses (compensation, replenishment)	0,1	30

*Source: calculated by the authors based on the studies by O. Semenenko (2023) and V. Bychenkov (2020).

Thus, the expected annual losses will be:

$$E(L) = 0{,}3 \cdot 40 + 0{,}2 \cdot 20 + 0{,}1 \cdot 30 = 12 + 4 + 3 = 19\ million\ UAH.$$

Annual costs adjusted for risk will amount to:

$$C_t^{risk} = 100 + 19 = 119\ million\ UAH.$$

The discounted life-cycle cost:

$$C_{LCC}^{risk} = \sum_{t=1}^{5} \frac{119}{(1+0{,}12)^t}.$$

Calculation:
year 1: $\frac{119}{1{,}12} = 106{,}25$;
year 2: $\frac{119}{1{,}254} = 94{,}89$;
year 3: $\frac{119}{1{,}404} = 84{,}76$;
year 4: $\frac{119}{1{,}573} = 75{,}66$;
year 5: $\frac{119}{1{,}762} = 67{,}55$.
In total:

$$C_{LCC}^{risk} \approx 429{,}1\ million\ UAH.$$

Determination of the annual cost equivalent):

$$C_{annual} = 429{,}1 \cdot \frac{0{,}12(1{,}12)^5}{(1{,}12)^5 - 1}$$

$$C_{annual} \approx 119\ million\ UAH.$$

Interpretation of the results. Without risk adjustment, the results are as follows*:*

$$C_{annual} = 100\ million\ UAH.$$

With risk adjustment: $C_{annual} = 119\ million\ UAH$. Accordingly, the increase in costs is +19%.

The following conclusions may be drawn from the example provided:
1. Even in a “heightened tension” scenario, risks have a significant impact on the life-cycle cost of a military unit;
2. The main contribution comes from damage to military equipment and disruption of logistics;
3. Ignoring risks leads to the systemic underestimation of costs.

The proposed methodology makes it possible to form more realistic budgets, plan reserves and make substantiated management decisions regarding the organisational structure of the unit.

The calculations provided show that, under the conditions of heightened tension, taking military risks into account leads to an increase in the annual cost of a military unit by an average of 15–25%,

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

which confirms the need to integrate risk-adjusted LCC into defence planning processes.

To increase the validity of life-cycle cost assessment for a military unit, it is appropriate to apply a scenario-based approach that takes into account changes in the level of military risks depending on the security environment [4; 5]. Let us consider three scenarios for the functioning of a military unit:

S1 – existence under peacetime conditions;
S2 – functioning under heightened tension;
S3 – functioning of a military unit during intensive combat operations.
Initial parameters:
1. Baseline costs: C_t = 100 million UAH;
2. Duration: T = 5 years;
3. Discount rate:
S1: r = 8%;
S2: r = 12%;
S3: r = 18%.
Expected losses are determined as follows (8):

$$E(L) = \sum p_i \cdot L_i \quad (8)$$

S1 – peacetime
minor risks:
$E(L)$ = 5 million UAH;
C^{risk} = 105 million UAH;
S2 (as in the above example):
$E(L)$ = 19 million UAH;
C^{risk} = 119 million UAH;
S3 – combat actions
high risks:
equipment damage: 0.6 · 80 = 48 million UAH;
personnel losses: 0.4 · 60 = 24 million UAH;
logistical losses: 0.5 · 40 = 20 million UAH.
E (L) = 48 + 24 + 20 = 92 million UAH.
C^{risk} = 100 + 92 = 192 million UAH.
The discounted cost, in generalised form, is as follows (9):

$$C_{LCC}^{risk} = \sum_{t=1}^{T} \frac{C_t^{risk}}{(1+r)^t}. \quad (9)$$

A comparative analysis of the calculations presented is provided in Table 2.

Table 2. Comparative analysis of military unit functioning scenarios

Indicator	S1 (peace)	S2 (tension)	S3 (combat actions)
Annual costs with risk, UAH million	105	119	192
Discount rate	8%	12%	18%
C^{risk}, UAH million	≈ 419	≈ 420	≈ 596
Annual equivalent, UAH million	105	119	192
Deviation from the baseline level	+ 5%	+ 19%	+92%

*Source: calculated by the authors on the basis of the research by O. Dzhyhora (2024).

The analytical interpretation of the results obtained makes it possible to draw the following conclusions:

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

1. The increase in costs is non-linear: the transition from tension to combat operations leads to a sharp increase in costs, almost doubling them);

2. The main factor is not discounting, but risks: the greatest impact on cost growth is produced by the increase in expected *E (L)* losses, not only by the discount rate;

3. The "accumulation of losses" effect: in the combat operations scenario, the costs of restoring and replacing resources become dominant;

4. The critical importance of taking scenarios into account: using only one baseline scenario leads to a significant distortion of assessments;

5. Planning should be conducted on the basis of a range of scenarios, rather than a single value;

6. It is appropriate to form reserves, or contingency costs, at the level of 15–50%;

7. The cost structure should be adaptive to changes in the intensity of combat operations;

8. The application of the scenario-based approach and the consideration of military risks in life-cycle cost assessment, or risk-adjusted LCC, is a necessary instrument for modern defence planning.

The comparative analysis of the scenarios shows that the cost of functioning of a military unit may almost double when transitioning from peacetime conditions to conditions of intensive combat operations. This confirms the need to use a scenario-based approach and to take military risks into account when assessing life-cycle cost.

Taking military risks into account when assessing the life-cycle cost of a military unit within the proposed methodology makes it possible to:

– increase the validity of management decisions;
– take into account the uncertainty of the security environment;
– optimise the cost structure with consideration of risks;
– ensure the adaptability of defence planning.

At the same time, the main limitations are the complexity of assessing the probabilities of risk events and the limited availability of statistical data [6].

It should be noted at once that these limitations are not secondary – they directly affect the reliability of the results and may significantly shift estimates of the unit's cost. Therefore, they should be considered as key methodological challenges requiring a separate toolkit for their consideration.

1. The complexity of assessing the probabilities of risk events. Determining the probabilities of risk events in military-economic calculations is methodologically complex due to a number of factors:

– *the uniqueness and irregularity of events.* Combat operations, losses of weapons, sharp changes in the intensity of deployment of units or mobilisation waves do not have stable recurrence. This complicates the application of classical approaches of probability theory and statistics;

– *high dependence on the external environment*. Probabilities are determined not only by the internal characteristics of the unit, but also by the behaviour of the adversary, political decisions, international support and technological changes. This means that risks are endogenous-exogenous and are difficult to formalise;

– *non-linearity and the "threshold effect".* In the military sphere, a minor change in parameters, for example, the saturation with air defence assets or the level of provision of military units with unmanned aerial vehicles, may sharply change the probability of losses. This contradicts assumptions about the smoothness and stability of distributions;

– *limited data availability.* Part of the information on losses, weapons effectiveness or the adversary's real indicators is classified or distorted, which increases the uncertainty of estimates;

– *the subjectivity of expert assessments.* In many cases, expert methods have to be used, which creates the risk of bias, groupthink and dependence on the experience of specific analysts.

Taken together, this leads to the fact that the probabilities of risk events within the methodology often have an interval-based or scenario-based character, rather than point values. Accordingly, the results of cost assessment should be interpreted as ranges or risk functions, rather than as deterministic values.

2. Limited statistical data. The second systemic problem is the deficit and heterogeneity of input data, which is manifested in the following:

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

- *incomplete data.* Data on costs, losses, resources and the effectiveness of unit deployment are often fragmentary, especially under the conditions of an active phase of combat operations;
- *incompatibility of sources.* Information may come from different accounting systems, including financial, logistics and operational systems, which use different approaches to the classification of costs and indicators;
- *access restrictions or classification*. A significant part of relevant information has restricted access, which makes it impossible to build comprehensive samples for statistical analysis;
- *dynamic parameters.* Cost indicators, including prices for resources, maintenance and logistics, change rapidly, which reduces the relevance even of recently collected data;
- *small sample problem.* For certain types of units or deployment scenarios, the number of observations is insufficient to obtain statistically significant conclusions;
- *survivorship bias.* Data may be biased towards units that have retained combat capability, while critical losses or unsuccessful cases remain under-recorded.

As a result of the above, the application of classical economic and statistical methods without adaptation may lead to systematic errors in cost determination.

The stated limitations necessitate:

a transition from point estimates to scenario-based and interval modelling;

the use of hybrid approaches combining statistical data and expert assessments;

the application of sensitivity analysis and stress-testing methods;

regular updating of model parameters (adaptive modelling;

and the consideration of risks through uncertainty coefficients or risk adjustments.

Thus, the complexity of assessing the probabilities of risk events and the limited availability of statistical data not only complicate the application of the methodology, but also determine the need to build it as a flexible, adaptive system capable of functioning under the conditions of high uncertainty and information incompleteness.

Conclusion

The article addresses an urgent scientific and applied task concerning the development of a methodology for determining the annual cost of a military unit on the basis of a comprehensive scientific and methodological apparatus for life-cycle cost assessment. It is substantiated that traditional approaches to defence expenditure planning do not ensure an adequate level of accuracy and adaptability under the conditions of high uncertainty, whereas the proposed approach makes it possible to integrate cost-related and functional components, as well as capability-based characteristics of a military unit, into a single assessment system.

It has been proven that the annual cost of a military unit should be considered as a dynamic indicator formed under the influence of life-cycle stages, the level of combat readiness, the intensity of deployment and the conditions of functioning. The proposed methodology ensures the decomposition of total cost into components related to the formation, training, maintenance, deployment and restoration of the unit's combat capability, which increases the transparency and controllability of the resource provision process.

The developed comprehensive scientific and methodological apparatus is based on a combination of military-economic analysis, the principles of capability-based planning and the concept of the unit life cycle. This makes it possible to take into account not only direct costs, but also indirect and long-term effects of resource use. The application of this scientific and methodological apparatus creates the prerequisites for a transition from static budgeting to adaptive cost management, taking into account changes in the security environment.

It has been established that the use of a scenario-based approach and the consideration of risk events increase the validity of assessments; however, this is accompanied by limitations related to the complexity of determining probabilities and the deficit of statistical data. In this regard, it is appropriate to apply interval estimates, sensitivity analysis and a combination of quantitative and expert methods.

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

The practical significance of the results obtained consists in the possibility of using the proposed methodology to substantiate the amount of funding for military units, optimise the cost structure, assess the effectiveness of defence resource use and support management decision-making in the field of defence planning.

Recommendations

Further development of the topic should be focused on several main areas. First and foremost, this concerns the improvement of methods for taking risks and uncertainty into account through scenario-based and probabilistic modelling. Expanding the information base and unifying cost accounting are important for increasing the reliability of assessments. A promising area is the development of digital modelling tools and the integration of the methodology into decision-support systems. It is also appropriate to deepen the approach to capability-based defence planning and ensure the alignment of the proposed methodology with long-term defence planning.

Conflict of Interest

The authors declare that they have no competing interests regarding the subject matter of the article.

References

1. Dzhyhora, O. M. (2024). *Military-Economic Aspects of the Development of the Security and Defense Sector*.
2. NATO. (2020). *NATO Defence Planning Process (NDPP)*.
3. Andres Navarro-Galera, Rodrigo I., Ortuzar Maturana. (2011). Innovating in the defense policy through spending efficiency: The Life Cycle Costing model. *Journal of Policy Modeling*, *33* (3), 407–425. (May–June). https://doi.org/10.1016/.jpolmod.2011.03.004.
4. NATO Research and Technology Organization, Neuilly-sur-Seine (France). (2003). *Cost Structure and Life Cycle Costs for Military Systems. National Technical Reports Library.* https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/ADA418708.xhtml?utm_source
5. Beeres, R., Paul, C. van Ferema, Myriame, T., Bollen I., Dado, E. (2014). *The strategic value of life cycle costing. NL ARMS. Optimal deployment of military missions in the next decade. (259–290).* T. M. C. ASSER PRESS.
6. Semenenko, O. M., Horbatiuk, V. I., & Abramova, M. V. (2023). Indicators and criteria for evaluating the effectiveness of the defense resource management system in Ukraine's security and defense sector. *Social Development & Security*, *13* (2), 112–124.
7. U.S. Department of Defense. (2020). *Operation of the Adaptive Acquisition Framework*.
8. Komarov, V. S., Oleksiiuk, V. V., & Scherban, K. A. (2024). Key elements of Russian federation's strategic adaptation for sustaining a prolonged war of attrition against Ukraine. *Science and Defense*, *4*, 3–10.
9. Scientific Research Institute of the Armed Forces (NDI VR). (2025). *Changes in forms and methods of conducting operations (combat actions) of the armed forces of the russian federation during the armed aggression against Ukraine (Jan.–Dec.* 2025*). Inform. bulletin. Book III.*
10. Syrotenko, A., Bychenkov, V., Shchypanskyi, P., Pavlikovskyi, A., & Levchuk O. (2020). Improvement of the Method of Scenario Forecasting of the Long-Term Situation in Ukraine. *Journal of Critical Reviews, 7* (18). http://www.jcreview.com/fulltext/197-1594366419.pdf?1594643003
11. Vasylyk, D. (2025). The russian military-industrial complex in the context of preparation and implementation of military aggression against Ukraine: Functioning, vulnerabilities and international countermeasures. *Political and Legal Studies*, *4* (2), 28–42.

The Central Research institute
of the Armed Forces of Ukraine

ISSN (print): 2786-9318
ISSN (online): 2786-9326
Military Science. Vol. 4 No. 2 (2026)

Методика визначення щорічної вартості військового підрозділу на основі комплексного науково-методичного апарату оцінювання вартості життєвого циклу

Олена Левчук
кандидат економічних наук, доцент
молодший науковий співробітник
Центральний науково-дослідний інститут Збройних Сил України
03049, проспект Повітряних Сил, 28 Б, Київ, Україна
e-mail: elena_levchuk@ukr.net
ORCID: 0000-0002-2827-2134

Євген Марко
кандидат економічних наук, старший науковий співробітник
провідний науковий співробітник
Навчально-науковий центр оборонного менеджменту
Національний університет оборони України
03049, проспект Повітряних Сил, 28, Київ, Україна
e-mail: marko.evgen@gmail.com
ORCID: 0000-0002-9165-8072

Анотація. У статті обґрунтовано методику визначення щорічної вартості військового підрозділу на основі комплексного науково-методичного апарату оцінювання вартості життєвого циклу. Актуальність дослідження зумовлена необхідністю підвищення ефективності оборонного планування, раціонального розподілу обмежених фінансових ресурсів та забезпечення прозорості управління витратами в умовах сучасних безпекових викликів і тривалої збройної агресії. Запропонована методика передбачає інтеграцію всіх складових витрат на створення, оснащення, утримання, підготовку, застосування та виведення з експлуатації військового підрозділу в єдину систему оцінювання. Основу підходу становить поєднання економічних, системних і функціональних методів, що дозволяє врахувати особливості організаційної структури, рівень укомплектованості, інтенсивність бойової підготовки та ступінь залучення підрозділу до виконання завдань за призначенням. Результатом застосування методики є визначення середньорічної вартості військового підрозділу з урахуванням повної вартості його життєвого циклу, що забезпечує більш обґрунтоване ухвалення управлінських рішень у сфері будівництва та розвитку Збройних Сил України. Практичне значення отриманих результатів полягає у можливості їх використання органами військового управління під час формування програм розвитку, планування ресурсного забезпечення та підвищення ефективності використання бюджетних коштів. Запропонований підхід може бути адаптований до різних типів військових підрозділів і застосований у системі оборонного планування на основі спроможностей. Розроблена методика базується на поєднанні економічних, системних і функціональних підходів та дозволяє визначати середньорічну вартість підрозділу з урахуванням повної вартості його життєвого циклу. Вона враховує особливості організаційної структури, рівень укомплектованості, інтенсивність бойової підготовки та ступінь залучення до виконання завдань за призначенням.

Ключові слова: щорічна вартість військового підрозділу, життєвий цикл, вартість життєвого циклу, оцінювання витрат, науково-методичний апарат, оборонне планування, будівництво Збройних Сил України, ресурсне забезпечення, ефективність витрат, військові формування, управління оборонними ресурсами, планування на основі спроможностей.