UDC 338.2:355.02
JEL Classification: G32; H56; L38

STRATEGIC MANAGEMENT OF FINANCIAL AND MATERIAL RESOURCES IN SECURITY AND DEFENSE PROJECTS

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Strategic Management of Financial and Material Resources in Security and Defense Projects

The article surveys the introduction of rational allocation of financial and material resources in the sphere of security and defense as a factor that significantly enhances the resilience of the State against modern challenges. The conditions of dynamic changes in the security environment that necessitate the use of the latest methods for assessing economic feasibility and optimizing strategic planning in the sphere of security and defense capability are considered. Special attention is given to the development of scientifically grounded approaches and econometric models to enhance the resilience and adaptability of the new defense economy. In the study, statistical data from 20 security and defense projects implemented in Ukraine, which encompass the development of new weaponry prototypes and the modernization of existing defense and security systems, were analyzed. The multiple regression method was used to assess the impact of key factors on current costs, as well as the least squares method to build a mathematical model for forecasting expenditure levels and optimizing the material and financial resources involved. It is determined that the largest impact on costs comes from management and operational items, main supply resources, and long-term investment needs. A level model of strategic management has been developed, taking into account innovative, risk, and inflation components, which confirms that high-tech projects with significant innovative potential ensure long-term economic efficiency. Prospects for further research include expanding the database to analyze a larger number of projects, implementing digital cost monitoring tools, and adapting the constructed econometric model to the conditions of other countries and defense systems. A priority direction is the development of integrated methods for assessing risks and effectiveness in the context of global transformational challenges.

Keywords: *financial and material resources, strategic management, security and defense projects, investment efficiency, cost optimization, defense economy.*

DOI: *https://doi.org/10.32983/2222-0712-2025-1-81-89*

Fig.: *4.* ***Tabl.:*** *1.* ***Formulae:*** *2.* ***Bibl.:*** *24.*

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УДК 338.2:355.02
JEL Classification: G32; H56; L38

Петруха Н. М., Петруха С. В., Тюрменко Я. М., Кононенко І. М. Стратегічне управління фінансово-матеріальними ресурсами в безпеково-оборонних проєктах

У статті досліджено впровадження раціональної алокації фінансово-матеріальних ресурсів у сфері безпеки й оборони як чинника, що суттєво посилює стійкість держави перед сучасними викликами. Розглянуто умови динамічних змін у безпековому середовищі, що зумовлюють необхідність використання новітніх методів оцінки економічної доцільності та оптимізації стратегічного планування в галузі безпеки й обороноздатності. Особливу увагу приділено розробці науково обґрунтованих підходів і економетричних моделей для підвищення стійкості та адаптивності оборонної нової економіки. У межах дослідження проаналізовано статистичні дані 20 безпеково-оборонних проєктів України, що охоплюють розробку новітніх зразків озброєння та модернізацію існуючих систем обороноздатності і безпеки. Використано метод множинної регресії для оцінки впливу

ключових факторів на поточні витрати, а також метод найменших квадратів для побудови математичної моделі прогнозування рівня витрат та оптимізації залучених матеріальних і фінансових ресурсів. Встановлено, що найбільший вплив на витрати мають управлінські та операційні статті, ресурси основного забезпечення та довгострокові інвестиційні потреби. Розроблено рівневу модель стратегічного управління з урахуванням інноваційної, ризикової та інфляційної складових, яка підтверджує, що високотехнологічні проєкти з великим інноваційним потенціалом забезпечують довгострокову економічну ефективність. Перспективи подальших досліджень полягають у розширенні бази даних для аналізу більшої кількості проєктів, впровадженні цифрових інструментів моніторингу витрат і адаптації побудованої економетричної моделі до умов інших країн та оборонних систем. Пріоритетним напрямом є розробка інтегрованих методів оцінки ризиків і результативності в умовах глобальних трансформаційних викликів.

Ключові слова: *фінансово-матеріальні ресурси, стратегічне управління, безпеково-оборонні проєкти, інвестиційна ефективність, оптимізація витрат, оборонна економіка.*

Рис.: *4.* ***Табл.:*** *1.* ***Формул:*** *2.* ***Бібл.:*** *24.*

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Introduction. Effective strategic management of financial and material resources in security and defense projects is critically important for ensuring the stable development of national security and defense capabilities. Since the implementation of suchlike projects requires significant investments, optimizing financial flows, rational distribution of material resources, and risk reduction are top priorities. A financial management system that is well-structured according to quality in the defense sector enhances the efficiency of budget expenditure, minimizes corruption risks, and ensures the stable functioning of the country's security and defense system.

In the context of dynamic changes in the security environment, investment activities in the military-industrial complex assume particular importance. The introduction of advanced methods for assessing the economic feasibility of defense projects and the optimization of strategic planning make it possible to achieve maximum efficiency in the use of financial and material resources [8]. An important aspect is the adaptation of financial management mechanisms to digitalization and the integration of innovative technologies into budgeting and control processes. Therefore, the relevance of the research is due to the need to develop scientifically grounded approaches to strategic resource management in security and defense projects, in order to strengthen the resilience and adaptability of the economic model of State security.

The study of strategic management of financial resources in defense projects is based on the theoretical foundations of financial planning and economic forecasting. In the literature, scientists such as A. Vasyliuk, T. Basiuk [2], E. Kosaretskyi, R. Boiko, A. Loishyn, and N. Zakharchenko [6] addressed issues of investment planning and evaluation of the efficiency of defense projects. Particular attention was paid to methods for assessing financial risks and mechanisms for financing and strategic support of the country's defense sector. The studies of researchers such as I. Biletskyi, N. Kondratenko, O. Rudachenko [1], Y. Petlenko, L. Tarnu, B. Shchehliuk, S. Nate [21] reveal methodological approaches to assessing the economic feasibility and financial efficiency of defense investments. In global practice, significant importance is attributed to approaches for evaluating risks and financial stability of defense projects, as proposed by M. Shashyna, A. Nedzelskiy [13], M. Pariyatman, A. Madjid, P. Santoso, P. Widodo, and H. Saragih [20].

The analysis of strategic models of distribution of financial and material resources in the military-industrial complex, as discussed in the work of W. Caballero, D. Banks, K. Wu [16], is also relevant. The examination of scientific and practical experience in financing defense projects leads to the conclusion about the necessity of developing more efficient budgeting mechanisms, implementing digital technologies for cost control, and strategic resource planning in the context of the modern paradigm of military security and defense capability of contemporary Ukraine.

Despite the availability of scientific developments, a considerable part of the issues related to efficient strategic management of financial and material resources in security and defense projects remains insufficiently addressed. In particular,

a unified approach to quantifying the strategic significance of projects from the standpoint of resource provision in conditions of uncertainty and military-economic pressure has yet to be formed. The issue of integrating innovative factors into the system for assessing the effectiveness of expenditures on defense initiatives remains unresolved, which makes it impossible to fully forecast the long-term effect. The lack of a detailed analysis of the relationship between operational costs, management costs, and the final economic outcomes of projects limits the ability to make reasoned managerial decisions.

The aim of this article is to explore the peculiarities of managing the flows of financial and material resources during the implementation of security and defense projects and to develop an econometric model for making strategic decisions regarding the efficient combination of their resource components.

A comprehensive approach was applied in the research, combining elements of econometric analysis, comparative assessment methods, and systemic modeling. The main tool became the construction of a multiple linear regression model, which allows for the assessment of the impact of key factors (X_1 – X_7) on the current costs of projects (Y). The empirical basis of the study is formed on the backing of statistical data concerning 20 security and defense projects implemented in Ukraine, which differ in scale, purpose, and funding structure. Data processing was carried out using the method of least squares to ensure the reliability of the calculations. Alongside this, the level of correlation relationships among the variables was analyzed, allowing for the identification of the most influential factors. The results of the modeling became the basis for identifying the relationship between the volume of funding and the level of expected economic efficiency, as well as formulating practical recommendations for optimizing resource provision.

Presentation of the main material. The management of financial and material resources in the context of the implementation and bringing to operational readiness of strategic projects, particularly in the areas of national security and defense, is a complex process involving cost analysis, structure, and impact on overall efficiency. To implement such initiatives, optimal allocation of resources, consideration of economic feasibility, and accurate forecasting of potential revenues are necessary.

In order to enhance the quality and the multi-factorial assessment of the efficiency of managing financial and material resources in security and defense projects, it is advisable to use integrated methodologies for assessing the strategic impact of investment initiatives. One of the promising approaches is the use of the Resource Efficiency Index, which helps eliminate the shortcomings of traditional factor analysis and takes into account the strategic importance of projects for national security. Considering the importance of innovative development in the defense sector, it is advisable to assess the efficiency of the use of financial and material resources not only from the perspective of expenditures but also through the lens of technological renewal, adaptability to a changing environment, and the ability to generate a long-term security effect. The strategic efficiency of resource management in security and defense projects is understood as the ability to ensure the optimal use of material, financial, and human resources to achieve maximum protection of national interests and sustainable development of defense infrastructure (Fig. 1) [19, p. 805].

Investment decisions in the plane of defense and security policy require an assessment of the reliability and efficiency of investments. It is important that funding is directed towards technologically progressive and strategically significant projects that not only enhance the level of security but also contribute to the development of the national military-industrial complex [13]. Since the influence of all possible factors on the efficiency of investments is difficult to evaluate, a key task is to identify the most important factors that determine the success of the implementation of defense projects and their contribution to the stability of the security system.

The research is based on real statistical data that encompasses a wide range of defense developments, from the production of missiles and unmanned aerial vehicles to the modernization of armored vehicles, and is aimed at improving financial strategies and adjusting strategic behavior [11]. For a more detailed understanding of the cost structure and its relationship with other financial and material factors, the data from 20 security and defense projects implemented in the defense sector of Ukraine were analyzed [5, p. 136]. All the projects mentioned involve both the development of new weapon models and the modernization of existing systems, and also differ in their scale, technological complexity, and purpose, which makes them an ideal basis for conducting a comprehensive analysis (Tab. 1).

Based on the collected data, a multiple regression equation is built, allowing for a quantitative assessment of the impact of each factor (X_1 – X_7) on current costs (Y). Mathematically, the equation can be expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \\ + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon. \quad (1)$$

where:

β_0 – constant,

β_1 – β_7 – regression coefficients for the respective variables,

ε – model error.

Each coefficient within the regression model reflects the degree of influence of the respective factor on current costs, specifically, how they change with an increase or decrease in the value of a certain factor by 1 unit, provided that other variables remain constant. To obtain the equation, the method of least squares was used to analyze financial indicators from 20 various defense projects, which created the conditions not only to assess the level of influence of individual factors on costs but also to use the obtained results for predicting costs in future projects [3, p. 48]. Furthermore, the regression equation can be used to identify potential ways for optimizing financial and material resources for security and defense.

$$Y = -1059{,}72 + 0{,}387 X_1 + 0{,}805 X_2 + 1{,}6397 X_3 + \\ + 0{,}9068 X_4 + 0{,}6739 X_5 + 0{,}1973 X_6 + 0{,}0714 X_7. \quad (2)$$

Therefore, we state that management costs (X_1) play an important role, with a positive coefficient of 0.3870, indicating that an increase in management costs by UAH 1 million leads to an increase in total costs for the implementation of security and defense projects by UAH 0.387 million. The obtained effect is explained by the consideration that successful management in this area requires significant efforts for coordination, administration, and control of resources, which inevitably af-

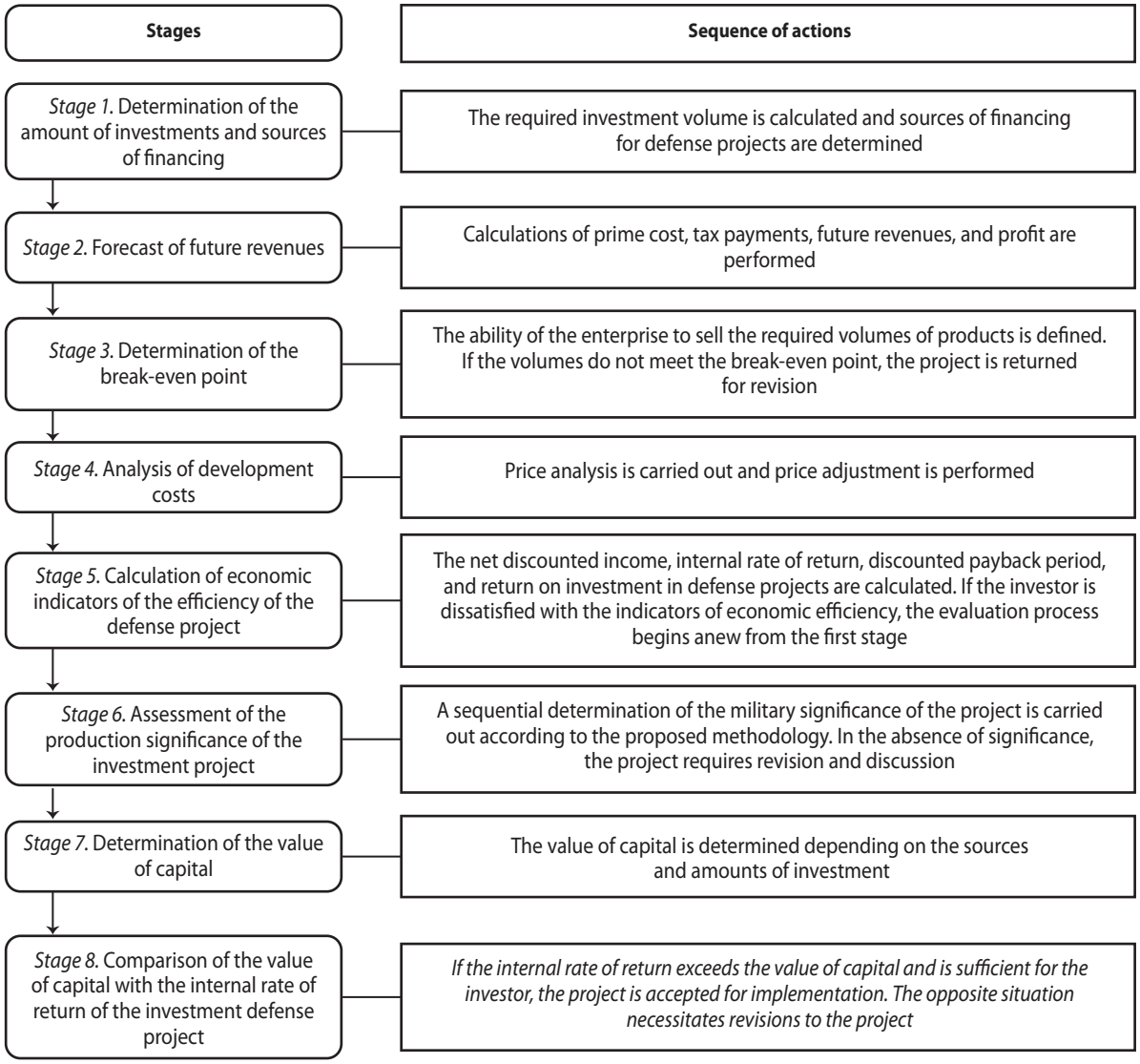

Fig. 1. Level model of the formation of strategic management of financial and material resources in security and defense projects

Source: developed by the authors

fects the budget of individual projects. Additional operational costs (X_2) demonstrate an opposite trend with a negative coefficient of -0.8050. If these costs increase by UAH 1 million, current costs for implementation will decrease by UAH 0.805 million. Changes of this kind may be related to the reason that additional resources are directed towards the improvement of operational processes, such as optimizing supply chains or automating activities, which allows for a reduction in overall costs for defense projects [15, p. 25].

The main supply resources (X_3), such as materials, equipment, and personnel, have the strongest positive impact with a coefficient of 1.6397. An increase in their volume by UAH 1 million leads to a rise in current costs by UAH 1.6397 million. This series of events reflects the specifics of security and defense projects, which often require substantial material and human resources that significantly affect the overall budget. The expected revenues from implementation (X_4) also have a significant positive impact with a coefficient of 0.9068. If projected revenues increase by UAH 1 million, the current costs for implementation increase by UAH 0.9068 million. In the security and defense sector, this indicates that projects with high potential return, such as innovative developments or large-scale defense initiatives, require considerable initial investments [4, p. 72].

The available financial reserves (X_5) cause a positive influence with a coefficient of 0.6739, when their increase by UAH 1 million raises current costs by UAH 0.6739 million. This indicates that reserves can serve as a source of sustainable financing for project implementation; however, their use is often accompanied by additional costs, for instance, for the purchase of equipment or business expansion.

The overall economic efficiency (X_6) has a negative coefficient of -0.1973, which means that an increase in efficiency by UAH 1 million reduces current costs by UAH 0.1973 million. In security and defense projects, this emphasizes the importance of rational resource utilization, increasing productivity,

Table 1

Financial and material indicators from the current security and defense projects

No.	Security and defense project	Current implementation costs (UAH million)	Management costs (UAH million)	Additional operational costs (UAH million)	Main supply resources (UAH million)	Expected income from implementation (UAH million)	Available reserves (UAH million)	Total economic efficiency (UAH million)	Long-term investment needs (UAH million)
		Y	X1	X2	X3	X4	X5	X6	X7
1	2S22 Bohdana Howitzer	10142,4	2761,5	6454,5	6878,7	7020,7	251,4	12494,7	2526
2	R-360 Neptune Cruise Missiles	456,9	22,5	14	225,5	95	7	245,7	14,5
3	Palianiysia Drone-Missile	17676	7325,6	23276,2	14596,8	196387	1005	32135,7	35580,7
4	Trembita Drone-Missile	5203,6	260,8	75,9	457,1	1844,5	8,5	338,8	889,7
5	Peklo Drone-Missile	3175,4	412	769,3	1056	2253,5	743,9	854,7	1887,9
6	Hrim-2 Ballistic Missile System	14897,9	981,2	1468,6	1571,8	7810,7	326	3971,2	60,3
7	PT-17 Main Battle Tank	1229	420,4	3786,1	1776,2	1694,9	80,9	2926,2	2737,8
8	ZRN-01 Stokrotka Multiple Launch Rocket System	4540,3	990,2	5348,9	1881,8	5039,7	201,7	3374,6	3096,9
9	Gorlytsia Combat Drone	2542,8	6025,2	9665,4	39756,1	1121,34	3073,3	10643,9	1597,9
10	Vilkha Missile Complex	488,7	55,6	334,6	1420,7	134,5	12	1582	186,1
11	T-84 tank production	1197,3	257,1	468,4	207,2	1147,9	9,8	1282,4	8,76
12	BTR-4 APC production	3289,6	2459,9	11211,5	7244	6425,3	445,4	1346,4	13939,1
13	Shrike drone by Skyfall	864,2	808,8	11258,4	889	3884	187,5	1904,4	3601,8
14	Scalpel drone by One Way Aerospace	2587	628,3	9044,1	2244,3	3838,5	141,4	4637,1	4691,9
15	Stugna-P anti-tank missile system	4828	1425,2	2261,9	3982,3	1279,9	92,9	8817	1123,7
16	Sea Baby sea drone	2644,1	316,9	3170,9	5468,2	1378,4	311,7	8173,6	0
17	Magura V5 sea drone	2528,6	1179,8	2339,8	3355,5	1646,2	140,7	1569,5	2326
18	An-2-100 upgrade version	9011,9	660,8	686,7	3168,1	3508,6	151,5	2087,3	568
19	BREN 2 assault rifles production	201,7	156,9	14,9	663	248,2	414,6	1166,2	4567,2
20	Korshun cruise missile	6267,2	1025,4	4365,2	1588,4	6476,4	453,6	4783,5	1539,5

Source: composed on the basis of [14; 24]

and improving financial mechanisms to reduce costs. Long-term investment needs (X_7) show a weak negative impact with a coefficient of -0.0714; when they increase by UAH 1 million, current costs decrease by UAH 0.0714 million. The result itself is the follow-up of investments in modernization or new technologies that provide savings in the short term [17].

Therefore, in the strategic management of financial and material resources of security and defense projects, the key positive impact on current costs is made by the main supply resources (X_3), expected revenues (X_4), and management costs (X_1). Conversely, additional operational costs (X_2), economic efficiency (X_6), and long-term investments (X_7) contribute to cost reduction, creating opportunities for optimization. Projects with high potential profitability (X_4) require significant initial investments, which must be considered when developing financial strategies in this area. The correlation matrix reveals the relationships between variables that form the basis of the multiple regression model, and its detailed analysis formulates the following conclusions as to the observations (Fig. 2.).

Current implementation costs (Y) are closely related to several key factors. In particular, management costs (X_1) have a correlation coefficient of 0.87, indicating a significant dependence: an increase in management costs is accompanied by a proportional rise in total project costs in the security and defense sector of Ukraine. Additional operational costs (X_2) demonstrate an even higher correlation of 0.91, emphasizing that their increase significantly impacts current costs. Overall economic efficiency (X_6) with an indicator of 0.93 shows that

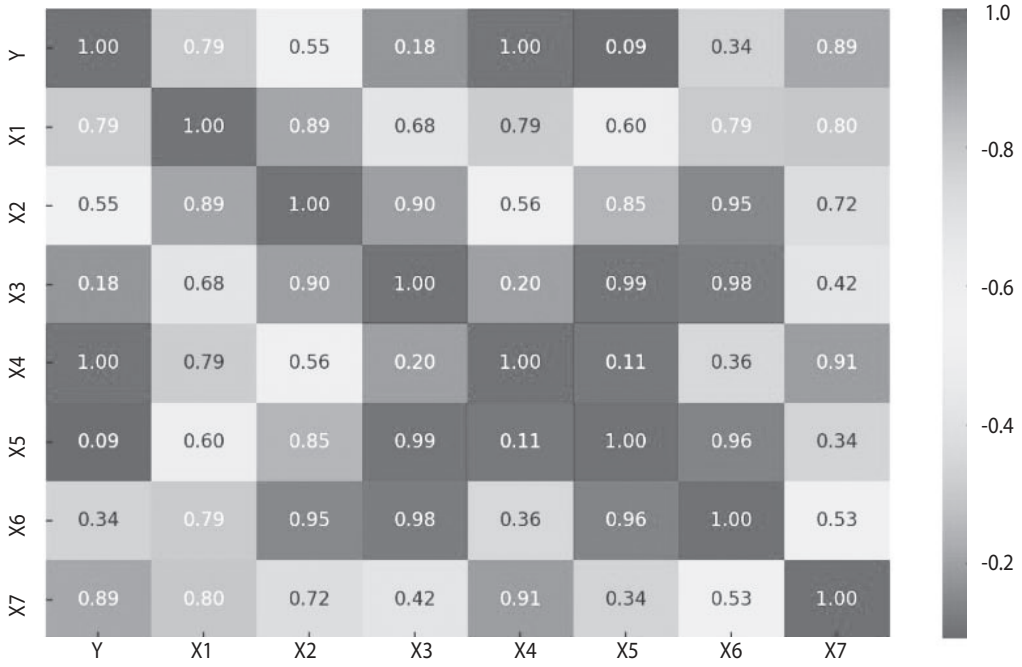

Fig. 2. Matrix of multiple linear regression for the selected series of 20 national security and defense projects

Source: developed by the authors

projects with higher efficiency often require larger financial investments at the implementation stage.

The long-term investment needs (X_7) also have a significant correlation at the level of 0.76, reflecting the relationship between the large-scale investments and the increase in current costs. Expected revenues from implementation (X_4) show a moderate correlation with current costs (Y): 0.65. Therefore, while the potential profitability of projects has some impact on costs, this relationship is less pronounced compared to other factors. In contrast, available reserves (X_5) with an indicator of 0.30 show a weak correlation, indicating their minor role in forming current costs in security and defense projects.

There is also a high interdependence among the factors themselves. Management costs (X_1), additional operational costs (X_2), and basic supply resources (X_3) show nearly maximum correlation coefficients: X_1 and X_2 – 0.98, X_1 and X_3 – 0.99, X_2 and X_3 – 1.00. This indicates that these elements are closely intertwined, and the growth of one of them inevitably leads to an increase in the others. The overall economic efficiency (X_6) is also strongly correlated with other variables: X_1 – 0.97, X_2 – 0.99, and X_3 – 0.98. The demonstrated interaction emphasizes the central role in the cost structure, dependent on key financial and material flows. The main focus of the research is set on analyzing the relationship between current costs for project implementation and their economic efficiency. The complex of the interrelationship is presented in the scatter chart (Fig. 3), which illustrates the dependence between the volume of costs (Y) and the indicator of overall economic efficiency (X_6) for the analyzed projects.

The graph of the dependence relationship between current costs and economic efficiency with a determination coefficient R^2 = 0.4632 indicates a moderate connection between these variables, confirming that economic efficiency is an important but not the only factor determining costs. Therefore, to increase the level of performance for the group of security and defense projects, it is advisable to focus on optimizing management and operational costs, as well as to introduce technologies that foster economic efficiency, which in the long term will ensure stability and financial benefit [18].

Similar modeling is conducted for the pair of current costs for project implementation and long-term investment needs (X_7), as shown in Fig. 4.

We ascertain that the relationship between current costs and long-term investment needs (X_7), as shown in Fig. 4 (R^2 = 0.2898), demonstrates a weaker connection. However, this indicator confirms that strategic investments in modernization have the potential to reduce financial costs in the future. In conclusion, it should be noted that for the rational use of financial resources allocated for the implementation of security and defense projects, a critical component is the formation of a balance between increasing the efficiency of current costs and the level of implementation of long-term investment strategies.

Thus, in the strategic management of financial and material resources for individual security and defense projects, current costs are largely determined by management costs (X_1), operational costs (X_2), economic efficiency (X_6), and long-term investment needs (X_7). Available reserves (X_5) have a minimal influence, while expected revenues (X_4) occupy a medium position. Therefore, to enhance the efficiency of the financial strategy in this area, it is advisable to focus on rationalizing management and operational costs, which will contribute to the overall economic benefit of the projects.

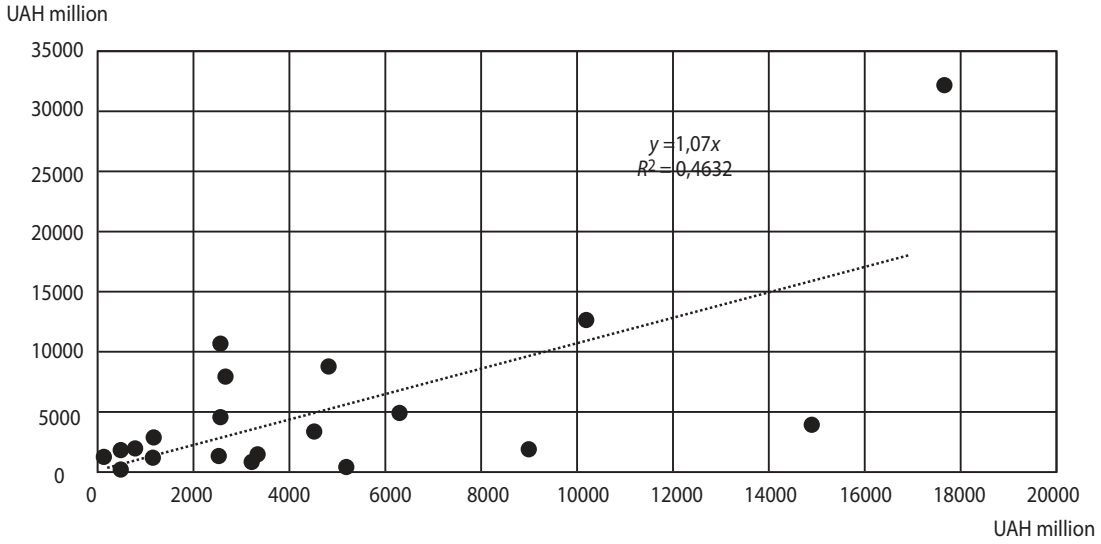

Fig. 3. The scattering and the linear regression curve, which reflects the relationship between current implementation costs (*Y*) and overall economic efficiency (X_6) in security and defense projects

Source: developed by the authors

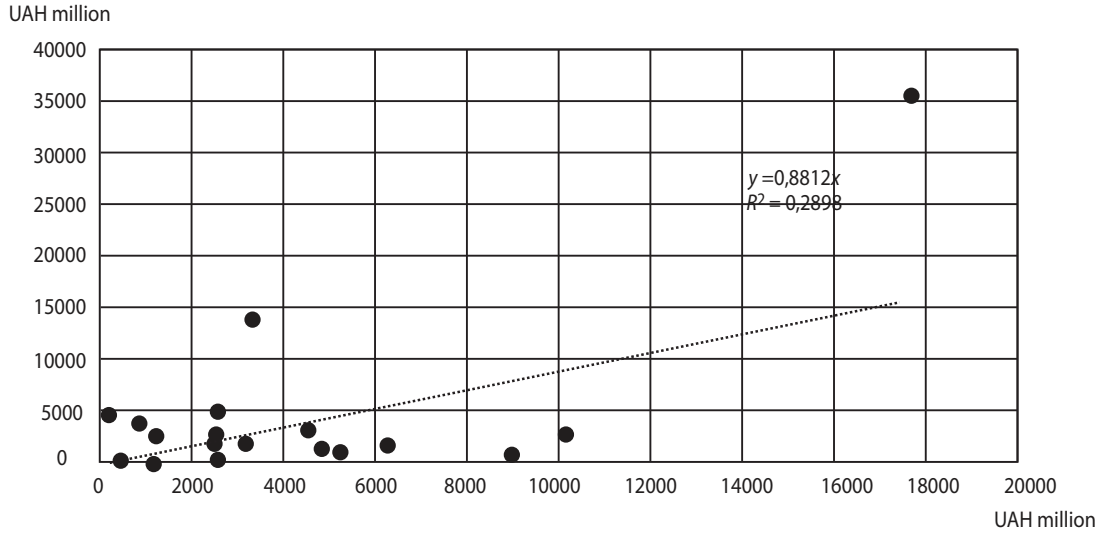

Fig. 4. The scattering and the linear regression curve, which reflects the relationship between current implementation costs (*Y*) and long-term investment needs (X_7) for security and defense projects

Source: developed by the authors

Conclusion. The research covered the main approaches to assessing the financial efficiency of investments in the military-industrial complex, including the analysis of economic feasibility, the use of risk-oriented management methods, and the application of strategic budgeting tools. Based on the collected statistical data, the financial and material indicators from 20 security and defense projects were analyzed, which allowed for the identification of key factors influencing the efficiency of resource use in the sphere of national security. In particular, it is found that the largest impact on costs comes from management and operational costs, main supply resources, as well as long-term investment needs.

The study included an assessment of the relationship between current costs and the level of strategic efficiency of defense projects, which formed the basis for determining priorities for optimizing funding and reducing unjustified project costs. It is determined that high-tech projects with significant innovative potential require substantial initial investments; however, their implementation ensures long-term economic efficiency and contributes to the resilience of the defense sector. The appropriateness of applying a level model of strategic management of financial and material resources, which includes three main components: innovative, risk, and inflationary ones, has been substantiated.

The developed model can become a basis for conducting a multi-factorial assessment of the efficiency level of resource distribution and will help ensure the economic resilience of security and defense projects in conditions of instability. A mathematical model of multiple regression is developed, which allows for forecasting costs and assessing the impact of individual

financial factors on the overall efficiency of implementing security and defense initiatives. The use of the model enables not only the identification of weaknesses in financial planning but also the development of strategies for cost optimization and increasing the economic efficiency of projects in the sphere of national defense and security.

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Стаття надійшла до редакції 25.02.2025 р.
Статтю прийнято до публікації 12.03.2025 р.