International Journal of Safety and Security Engineering
Vol. 12, No. 4, August, 2022, pp. 421-428
Journal homepage: http://iieta.org/journals/ijsse

Assessment of Spatial Challenges of the Economic Security System of Industrial Enterprises

Oksana Zybareva[1], Iryna Shevchenko[2], Svitlana Tulchynska[3*], Oleksandr Popov[4], Elvin Yangulov[5]

[1] Department of Entrepreneurship, Trade and Stock Market Operations, Yuriy Fedkovych Chernivtsi National University, Chernivtsi 58012, Ukraine
[2] Department of Accounting and Business Consulting, Simon Kuznets Kharkiv National University of Economics, Kharkiv 61166, Ukraine
[3] National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Kyiv 03056, Ukraine
[4] First Deputy Chairman of the Board, Joint Stock Company «FED», Kharkiv 61023, Ukraine
[5] Department of International Management and Innovation, Odessa Polytechnic National University, Odessa 65044, Ukraine

Corresponding Author Email: tuha@ukr.net

https://doi.org/10.18280/ijsse.120402

Received: 31 May 2022
Accepted: 26 July 2022

Keywords:
economic security, industrial enterprises, evaluation, methodical approach, threats

ABSTRACT

Within the study, methodological support for assessing economic security of industrial enterprises of Ukraine is provided. The purpose of this study is to substantiate the method of assessing spatial challenges and trends in the development of the system of economic security of industrial enterprises. The methodological basis of the study is a systematic approach, which made it possible to assess the spatial challenges of the economic security system of industrial enterprises on the example of leading enterprises of Ukraine. The methodological toolkit for ensuring the assessment of the level of economic security of the enterprise included such stages as: collection, processing, selection of indicators and methods for assessing the factors of enterprise activity. Using the proposed methodology for assessing spatial challenges of the economic security system, the level of economic security of the studied enterprises was determined and the factors that are destructive and stimulating for the development of enterprises were singled out. According to the results of the analysis of the enterprises' activities, the factors that reduce and increase the level of their economic security were singled out. The conducted analysis made it possible to propose a conceptual scheme for modeling the economic security of an industrial enterprise.

1. INTRODUCTION

Current trends in the development of economic systems at various levels are characterized by the high dynamism of changes in the economic space, the presence of crisis deformations, high uncertainty in the business environment, the impact of unpredictable impulses on the development of economic entities, which cause fluctuations in business processes and violate the target orientations of the economic development of economic entities.

It should be noted that today's trends of instability and the unconditional impact of spatial challenges are reflected in the development of business entities in Ukraine. Ukraine's armed conflict with the Russian Federation has exacerbated the financial, economic, and investment crisis in all spheres of public life. Such negative consequences led to a decline in production, reduced sales of goods and services, which dealt a severe blow to the economic sector of the country, thereby threatening economic security of industrial enterprises. In this regard, the areas of assessing spatial challenges and threats to the stability of economic security are becoming increasingly important. One of the effective tools in ensuring economic security is the development of appropriate scenarios for the development of enterprises that take into account the threats to the internal and external environment, which avoids or reduces the negative impact of relevant factors. In the post-war period, the issue of employment of the population who lost their jobs will be acute. Enterprises will face the problem of finding highly qualified personnel due to high migration flows that took place during the war.

2. LITERATURE REVIEW

Many scientific works are devoted to the study of modern innovation and investment issues of the industrial enterprise's development and ensuring their economic security.

Mishchuk et al. [1] propose to form an information base for the development and implementation of a comprehensive set of management actions aimed at achieving and maintaining economic security of the desired level in the long run based on strategic compliance of processes and resources with future business environments. Scientists say that the implementation of the developed proposals will be an important basis for increasing the investment attractiveness of enterprises.

Within the scope of the Grigoraș-Ichim et al. [2] investigate the processes of forming the perception and vision of business entities in the border zone Romania - Ukraine - Moldova regarding interim financial reporting.

Alpysbayev et al. [3] aimed to identify destabilizing factors of economic security and develop recommendations for improving the efficiency of the enterprise development. The

authors identified the following destabilizing factors that limit the work of industrial enterprises: insufficient demand for manufactured products, shortage of own financial resources, intensification of market competition and macroeconomic uncertainty.

Marhasova et al. [4] prove that the greening of production is one of the priority directions for ensuring the sustainability of production activities of enterprises and increasing their economic security.

Mishchuk et al. [5] proposed a methodology for assessing the economic security of employees of an industrial enterprise, and considered the experience of Ukraine.

Zlotenko et al. [6] is based on determining the optimal structure of financing the investment activities of industrial enterprises in the context of ensuring economic security of such activities. Scientists have developed a model for optimizing economic security, which is based on minimizing losses in the formation of sources of financing investment activities allows the company's management to make informed strategic decisions and provides sufficient justification for measures in the field of economic security.

Pushak et al. [7] investigated the process of forming a system for assessing the economic security of an enterprise in the agrarian sector deserves attention.

A methodological approach to assessing the level of economic security is proposed by Shatokhin [8]. The authors proved the expediency of using the Harrington desirability function as a tool for comprehensive assessment of the level of economic security of an industrial enterprise on the basis of its functional components.

Boiarynova et al. [9] and Popelo et al. [10] devoted their scientific works to the conceptual principles of assessment and forecasting of innovative development, to the development of a methodical approach to forecasting and intensification of innovative development.

Tulchynska et al. [11] and Vovk et al. [12] proposed innovation-investment strategies for the modernization of microeconomic systems in the conditions of digitalization and modeled the choice of an innovation-investment strategy for realizing the modernization potential.

Mishchuk et al. [13] argue that in a society of 5.0 intellectual capital is a key factor in shaping economic security of enterprises. The priority of structural components of intellectual capital as a factor in the economic security formation of the enterprise is determined. Scientists have substantiated that the organic connection of the structural elements of intellectual capital will form economic security of the enterprise and ensure the parameters of economic security in the long run.

Sotskova and Kalashnikova [14] argue that the economy digitalization leads to changes in the content and priorities of certain components of economic security, increases the requirements for the organization of appropriate work in enterprises, necessitates monitoring to reduce risks and threats. To assess the level of economic security, the authors propose a comprehensive approach, based on the combination of a number of indicators into a single integrated indicator. Scientists believe that the use of private indicators that determine the effective integrated indicator will identify factors and reserves to strengthen economic security.

The analysis of the theoretical and methodological foundations of the accounting and analytical support for the management of economic security conducted by a team of authors, namely Vasylishyn et al. [15] showed a variety of approaches to the selection of indicators characterizing the level of economic security. Researchers propose to implement a model of analytical support for economic security management in the conditions of uncertainty and growing risks and threats to enterprises, which should be based on the use of general economic, statistical, and integrated and econometric approaches. Practical significance of the proposed approaches is the possibility of positioning enterprises in optimal, satisfactory, volatile and crisis zones of economic security, as well as in the analysis of the dynamics of the integrated level of economic security, considering causation.

Snishchenko and Krot [16] devoted to the peculiarities of managing the economic security of cooperative enterprises.

Balatskyi et al. [17] analyze the features of the organizational and economic mechanism of the economic security management of the enterprise. The authors propose an integrated structure of the mechanism of the economic security management in the foreign economic activity. According to the authors, the economic security management is based on the development of alternative management solutions, their detailed analysis and implementation of the most optimal of them.

Viknianska et al. [18] was the development of a methodological approach to the economic analysis and management of enterprises in the conditions of the transformation of economic systems.

According to the authors Shtangret et al. [19], in unstable market economy, companies can succeed in business by creating an economic security system, focused on forecasting possible changes in the internal and external environment through some measures. Researchers note that early detection of possible changes in the level of economic security of the enterprise increases the response time to this. In the article, the authors consider the essence of weak signals, describe the process of detecting weak signals, identify differences between anticipatory management and adaptive crisis management in relation to the process of economic security of the enterprise.

Blakyta et al. [20] focus on creating a mathematical model for assessing, and analyzing and forecasting economic security of the enterprise in a crisis. The authors are invited to conduct a constant rapid analysis and forecast of the impact of the crisis on the economic security of the enterprise using a standardized integrated index of economic security. An algorithm for gradually increasing the relevance of the analysis of the economic security level is introduced. Sharma et al. [21] devoted their research to examining the role of safety training in original equipment manufacturing companies on employee perceptions of safety knowledge, safety behaviors, and a safe work environment.

The purpose of this study is to substantiate the methods of assessing spatial challenges and trends in the economic security of industrial enterprises. To achieve the goal, the following tasks were solved: a methodical approach to assessing the level of economic security of enterprises was formed; methodological developments proposed in the work were tested on the example of industrial enterprises of Ukraine; a conceptual scheme for modeling economic security at industrial enterprises was formed, taking into account spatial challenges.

Despite the sufficient number of thorough scientific developments, the issue of ensuring the economic security of industrial enterprises is extremely relevant and requires further research.

3. METHODOLOGY

Modern processes of globalization and military conflict in Ukraine have caused crises characterized by increasing competition, instability and limited financial system, reduced resource potential, changing social and political orientations of the country and business. The main mechanism for ensuring economic security of industrial enterprises is considered as a set of financial, managerial, economic, legal ways of the interaction between business and the environment, which provides a profit to the extent necessary for the company to be in the economic security zone. Methodological support for the analysis of the economic security level of the enterprise includes the following stages: collection, processing, selection of indicators and methods of assessing the factors of the enterprise activity (Table 1).

The set of indicators for the assessment of economic security factors was identified according to the relevant criteria, which reflect the main business processes in enterprises. The analysis of the state of economic security of the enterprise by the authors was conducted based on the data of industrial enterprises of Ukraine for the period 2017-2020.

Based on the selected indicators, you can simplify the procedure for assessing economic security of the enterprise by analyzing the most important indicators of each factor, and not all that are part of it. Indicators and their number can be changed depending on the needs and specifics of the enterprise.

The authors propose the calculation of an integrated indicator of economic security of an industrial enterprise, which consists of a set of indicators for selected groups. The calculation of the integrated index is carried out according to the formula:

$$I_{es} = \sqrt[4]{I_{fs} \cdot I_{iid} \cdot I_{pa} \cdot I_{si}} \quad (1)$$

where, I_{es} - integrated index of economic security; I_{fs} - index of financial stability of an industrial enterprise; I_{iid} - index of innovation and investment development; I_{pa} - index of production activity; I_{si} - staffing index.

It should be noted that for relevant calculations it is necessary to consider the use of different definitions and quantitative measurements of economic security levels. Different scientists in their methods of assessing economic security of the enterprise use different scales and evaluation criteria. In this study, such diverse scales were grouped and generalized, which allowed to form the appropriate levels of economic security of industrial enterprises (Table 2).

Since four integral indices were used for evaluation, namely the index of financial stability of the industrial enterprise; index of innovation and investment development; the index of production activity and the index of personnel support, we assume that each of the indices has the same weighting factor of influence on the index of economic security of the industrial enterprise.

Thus, for market conditions with a high level of competition using quantitative methods to assess the economic security level, it is necessary to consider the global interests of the enterprise and its market position.

This division of levels of economic security of industrial enterprises should be used only in a competitive environment, because for monopoly enterprises that have greater protection from the state, the impact of environmental factors is different. Therefore, when using the assessment of the level of economic security for monopoly enterprises, it is advisable to use a different scale. It should be noted that the calculations of the state of economic security of the enterprise operate with different scales of its measurement.

Also, it should be noted that it is not desirable to determine the reference value of the integral index or its components, since constant changes in the environment, which cause fluctuations in economic systems, including such systems as industrial enterprises, can change greatly. So, for example, the military conflict that is currently ongoing in Ukraine significantly affects the state of economic security of enterprises, and the introduction of which standard in such a case will not be a legitimate decision.

Table 1. A set of indicators for assessing economic security of industrial enterprises

Criteria for the distribution of indicators by groups	Indexes
Financial stability	Coefficients: autonomy, maneuverability of equity, total coverage, absolute and critical liquidity, solvency, turnover of receivables and payables; fixed asset index; Return on assets, equity, sales, production assets; Growth ratios: sales volumes, assets, net profit, share of production assets
Investment and innovation development	Growth rates: gross fixed capital formation, share of investment in capital construction, investment in the acquisition of fixed assets, the cost of technological innovation, the cost of informatization, the cost of software
Efficiency of production activities	Growth rates: shares of fixed assets in production potential, shares of inventories in production potential, shares of work in progress in production potential, shares of fixed assets in assets, depreciation of fixed assets, inflows and outflows of fixed assets, labor productivity, capital adequacy and return on assets
Staffing	Coefficients: turnover of staff on admission, turnover on disposal of staff; preparation for new professions; retraining of employees, staff training, growth rate of staff

Table 2. Levels of economic security of the enterprise

The level of economic security	Characteristics of the state of the enterprise at the time of economic security assessment
0-0,382	The level of economic security of the enterprise is critical. In the absence of appropriate measures, the level of economic security of the enterprise may fall to a critical level.
0,383-0,618	An acceptable level of economic security, but there are negative trends in the enterprise that are the result of threats
0,619-0,854	Sufficient level of economic security to be maintained
0,855-1	High level of economic security of the enterprise, which allows the enterprise to have significant competitive advantages in the market or industry

Source: generated by the authors.

The minimum level is distinguished, which characterizes the unstable state of economic security, which indicates the unsatisfactory development of the enterprise and the existing threats to the external and internal environment. The longer the company is in this state, the greater the likelihood of loss of profits. An average, normal or sufficient level of economic security characterizes the development of the enterprise in which it is sufficient to use the resource base, which allows to maintain its competitive position in the market in the current and medium term. High, very high level of economic security characterizes the development of the enterprise which effectively uses the resource base in compliance with all market requirements, which provides competitive advantages in the medium and long term. Usually at this level of economic security the company is the market leader and occupies a competitive position.

4. RESULTS

The calculation of trends in the development of the economic security system of industrial enterprises was carried out according to the above indicators with the separation of the levels of economic security (Table 1 and 2). Approbation of the proposed algorithm for calculating economic security of industrial enterprises was carried out based on the use of data from such enterprises as Private Joint Stock Company (PJSC) Central Mining and Processing Plant, Public Joint Stock Company (PJSC) ArcelorMittal Kryvyi Rih, Joint Stock Company PJSC Mining and Processing Plant" for the period of 2017-2020 [22-24]. The selected enterprises belong to the enterprises of the mining and metallurgical complex and are the leaders of their industry in Ukraine. In general, the industrial complex of Ukraine for the period 2017-2021 was characterized by an increase in sales of industrial products (Figure 1). These data indicate that in 2021 there was an increase in sales of industrial products by 66.71% compared to 2017, and by 44.67% compared to 2020.

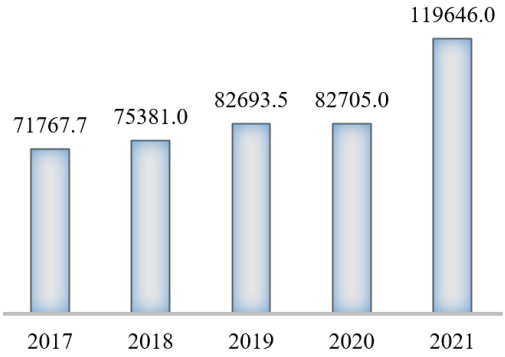

Figure 1. Volume of sold industrial products for 2017-2021 (USD million)
Source: generated by authors based on [25]

For the analyzed period of 2017-2021 in the regional distribution of the leader among the regions in terms of sales of industrial products are Dnipropetrovsk, Donetsk, Zaporizhzhia, Kharkiv and Poltava regions (Figure 2 and 3).

Therefore, to assess the economic security of industrial enterprises, it was selected enterprises from these regions, as the largest enterprises of the industrial complex are located in these regions. Due to the hostilities taking place on the territory of Ukraine today, some large industrial enterprises have unfortunately been destroyed and their reconstruction is not possible due to the peculiarities of the technological processes of their activities. Therefore, the industrial potential of Ukraine has lost its position for a long time.

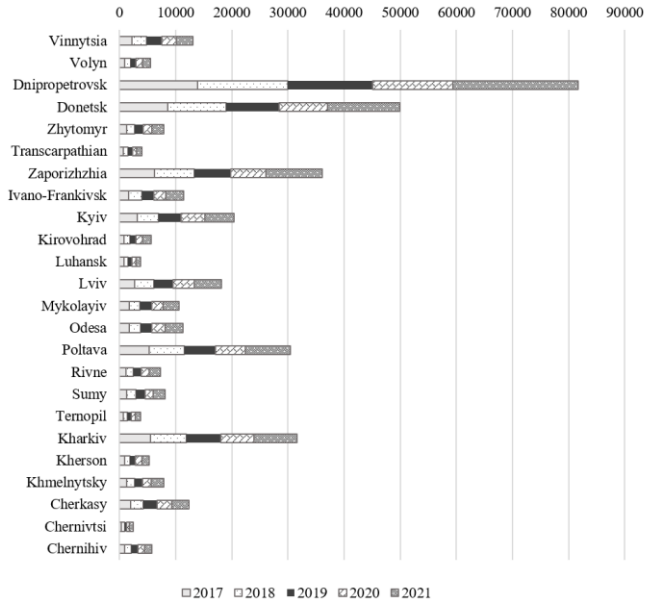

Figure 2. Volumes of sold industrial products by regions of Ukraine for the period 2017-2021 (USD million)
Source: generated by authors based on [25]

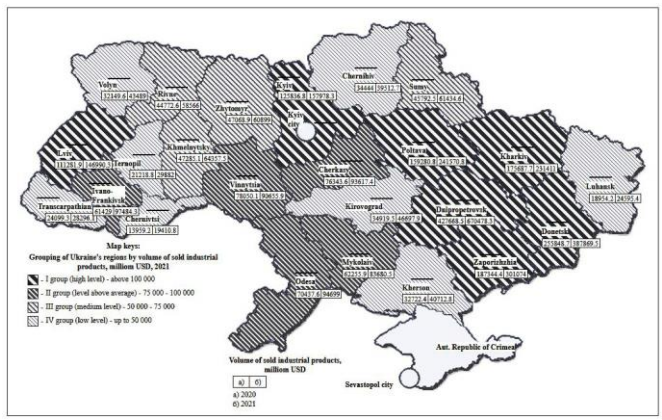

Figure 3. Grouping of Ukraine's regions by volume of sold industrial products, milliom USD, 2021
Source: generated by authors

Table 3. The results of calculations of the index of economic security (I_{es}) selected for analysis of enterprises

Enterprises	Year			
	2017	2018	2019	2020
PJSC "Central Mining and Processing Plant"	0.62	0.71	0.65	0.74
PJSC ArcelorMittal Kryvyi Rih	0.54	0.61	0.58	0.60
JSC "Southern Mining and Processing Plant"	0.83	0.81	0.79	0.83

Source: calculated by the authors

In the process of calculating the integral index of economic security of industrial enterprises, including PJSC "Central Mining and Processing Plant", PJSC "ArcelorMittal Kryvyi Rih" and JSC "Southern Mining and Processing Plant", the main indicators of financial and economic activity presented

in the table were used. 1. On the basis of which the component indices are determined, including the index of financial stability of the industrial enterprise; index of innovation and investment development; production activity index and staffing index. Calculation data are given in Table 3.

Thus, in 2020 the integrated index of economic security for PJSC "Central Mining and Processing Plant" was:

$$I_{es20} = \sqrt{0.68 \cdot 0.98 \cdot 0.74 \cdot 0.63} = 0.74 \quad (2)$$

For PJSC ArcelorMittal Kryvyi Rih in 2020, I_{es} was equal to:

$$I_{es20} = \sqrt{0.68 \cdot 0.55 \cdot 0.69 \cdot 0.51} = 0.60 \quad (3)$$

For JSC "Southern Mining and Processing Plant" the integrated index of economic security was calculated by the formula:

$$I_{es\ 20} = \sqrt{0.72 \cdot 0.91 \cdot 0.81 \cdot 0.91} = 0.83 \quad (4)$$

Similar calculations were performed for the surveyed enterprises for the relevant analyzed periods on the basis of official data on the activities of enterprises [23-25].

The analyzed enterprises in the period 2019-2020 had a lower level of economic security precisely because of the pandemic, which spread to the whole world and negatively affected all markets and international logistics. But in the period 2021-2022, most companies were able to resume full operation or adapt to new operating conditions, which had a positive impact on their activities and led to increased profits.

Criteria of financial stability by 19% characterize the variability of the system of economic security indicators, which indicates its fundamental impact on its level. This criterion characterizes the availability of enterprises to ensure their effective operation and development.

The group of indicators of innovation and investment development at the surveyed enterprises was estimated on the basis of calculations of the growth rate of gross fixed capital formation, growth of costs for technological innovations, growth of accounts payable turnover. These characteristics indicate the effectiveness and efficiency of industrial enterprises. Depending on how appropriate the company introduces innovations in its activities depends on the effectiveness of their work. Efficiency in this case is characterized by the achievement of planned results in comparison with certain criteria.

Criteria for the efficiency of production activities are characterized by the company's profit, renewal of its production assets and the efficiency of their use. The personnel component plays an important role in the company's activity. The number of staff, their qualification level, motivation can be both intensive and extensive.

The assessment of the structure of the above criteria indicates the lack of financial support for enterprises to ensure their economic security. Low financial capacity reduces the level of innovation and investment processes in enterprises, which lead to lower efficiency of technological processes, reduced competitive advantage in the market and maintaining a stable position in it.

The problem of providing highly qualified personnel is acute for the leaders of almost all enterprises, as the introduction of innovative products and technologies requires appropriate skills and abilities among staff.

According to the calculations for the analyzed period, the company JSC "Southern Mining and Processing Plant" has a sufficient level of economic security. The company has implemented a number of measures for capital construction, expansion or improvement of fixed assets. Investment projects in 2020 by USD 25.41 million, enterprise development support programs by USD 52.04 million. These measures contributed to improving the financial and economic condition of the enterprise, production development, strengthening financial capacity and, as a consequence, increasing the level of economic security.

PJSC "Central Mining and Processing Plant" also has a sufficient level of economic security. A sufficient level of economic security is provided by the enterprise due to effective foreign economic activity at the enterprise, timely evaluation and revaluation of fixed assets. However, the pandemic and the resulting restrictions had a negative impact on the world market for ore prices and exports.

An acceptable level of economic security is typical for PJSC ArcelorMittal Kryvyi Rih. This level of economic security for the company characterizes the negative trends in its activities that are the result of threats posed by the pandemic and lack of funding. The development and implementation of appropriate programs and areas for minimizing threats to the external and internal environment requires modeling the level of threats and probable behavior of the enterprise to eliminate or minimize them.

The main problem faced by enterprises is the insufficient level of funding for its activities. The financial capacity of enterprises affects its adaptability to external changes. In a market and changing environment, adaptability is one of the key features of enterprise development and ensuring its economic security. There are structural and functional adaptation, depending on the object of change and impact.

Structural adaptation characterizes the change in the processes of organizational change of the enterprise that affect its structure. Structural adaptation is inherent in enterprises that can quickly with minimal costs for their activities to begin restructuring processes to work more efficiently in the long run.

Functional adaptation is characterized by changes in the functions of the enterprise that occur due to the improvement of business processes. Today, the adaptability and flexibility of enterprises is an important tool to ensure their economic security and increase the level of competitiveness.

Based on the calculations of trends in the development of economic security of industrial enterprises, a conceptual scheme of its modeling was proposed (Figure 4).

The development of a conceptual scheme for modeling economic security of enterprises is an urgent task, as currently public administration of enterprises is not carried out directly but based on regulating their activities based on legal, socio-economic measures based on direct or indirect regulation. Development of relevant regulations, provisions that have a direct impact on the activities of the enterprise limit its activities in a particular area.

The tax and financial policy of the state is aimed at managing their activities. Regulation of inflation at the state level helps to reduce exchange rate fluctuations and thus allows to regulate the pricing policy of export-import operations. High inflation has a negative impact on the industrial potential of the state and enterprises in this industry.

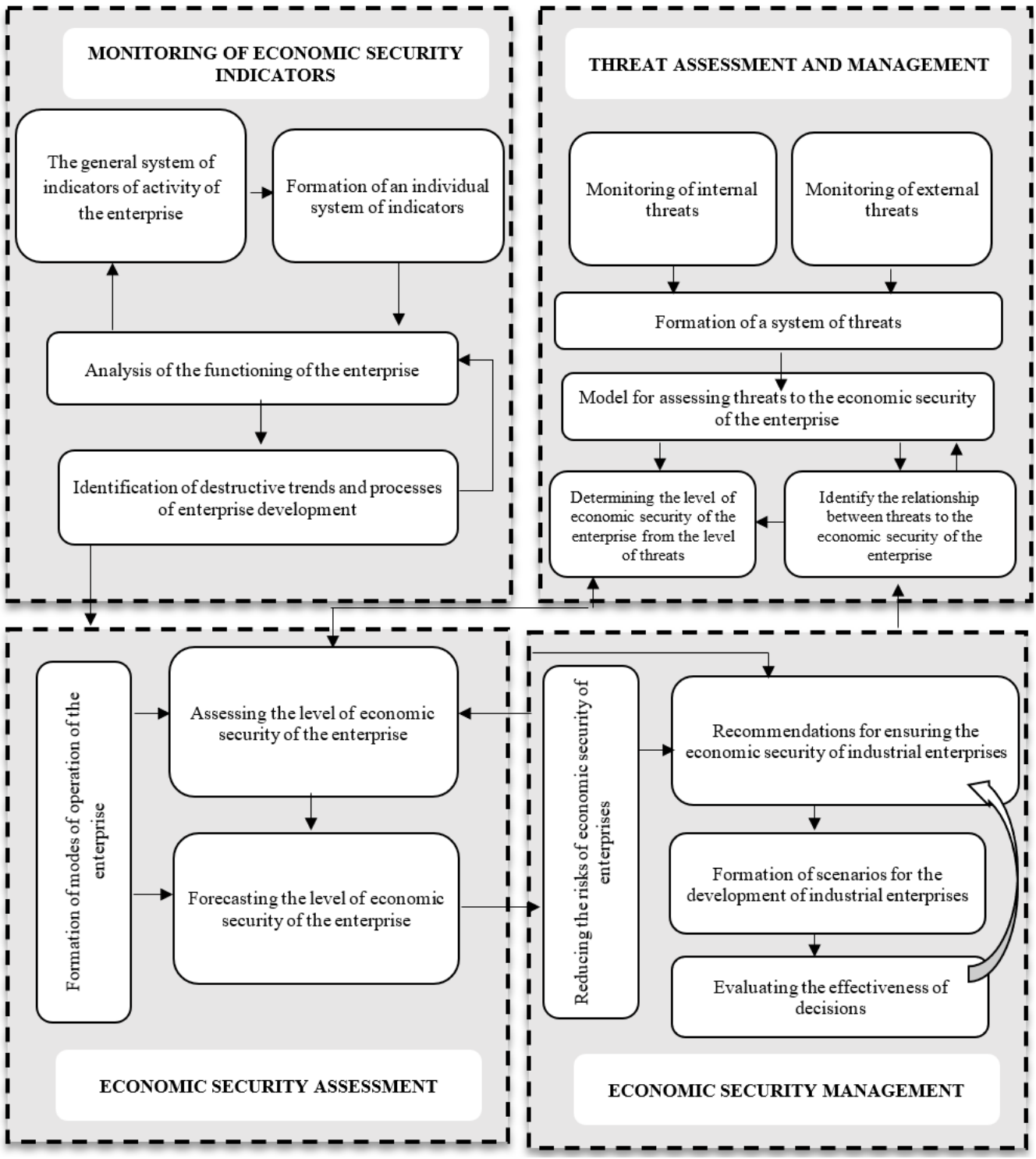

Figure 4. Conceptual scheme of modeling economic security of an industrial enterprise
Source: generated by the authors

The proposed conceptual scheme for modeling the economic security of industrial enterprises includes four blocks: monitoring of economic security indicators, threat assessment and management, economic security assessment and economic security management.

Each of the outlined blocks is connected with other blocks and together forms a system of economic security of the enterprise. The given system includes an estimation of the general activity of the enterprise, influence of threats of external and internal environment, with modeling of their influence and development of the corresponding measures for minimization of their negative consequences or avoidance.

5. CONCLUSIONS

Based on a study to assess the level of economic security of industrial enterprises, it was found that the greatest impact on the development of industrial enterprises has the growth of public debt in Ukraine; slow pace and slowing down the development of appropriate regulatory and legal support to create conditions, guarantees for business development; unfavorable investment climate in the country, low level of innovation activity, non-compliance with the terms and conditions of supply of materials and resources with suppliers; digitization and computerization of production processes;

introduction of a policy of staff training and motivation.

Methodological support for the assessment of economic security of industrial enterprises was formed, which includes stages and methods, modeling and determination of factors of the external and internal environment that have an impact on it. Four groups of criteria that form the economic security of the enterprise were singled out as component indices, including the index of financial stability of the industrial enterprise; index of innovation and investment development; production activity index and staffing index.

The selection of appropriate indicators and criteria for assessing the economic security of industrial enterprises with the interpretation of their results was based on the assumption that all indicators should be within the relevant reference values, non-compliance with which violates normal development and has negative trends in its development potential. The analysis was conducted at industrial enterprises that are leaders in their field and have a competitive position.

Approbation of the proposed methodological approach was carried out for such industrial enterprises of Ukraine as: PJSC "Central Mining and Processing Plant", PJSC ArcelorMittal Kryvyi Rih and JSC "Southern Mining and Processing Plant".

The analysis showed that companies that implement innovations in their activities, through their own or borrowed funds to expand their production and technical potential, introduce methods of motivation and training of their staff have the highest level of economic security.

The conducted research made it possible to substantiate the general conceptual scheme of modeling the economic security of industrial enterprises, which includes four blocks: monitoring of economic security indicators, threat assessment and management, economic security assessment and economic security management. The conceptual scheme for modeling the economic security of industrial enterprises has an applied value for ensuring the economic security of industrial enterprises in the conditions of rapidly changing spatial challenges.

Further research is needed to assess and develop measures to ensure economic security of industrial enterprises in the postwar period. Because the crisis is high at the state, regional and enterprise levels, which requires new approaches to financing, innovation, logistics to restore production and competitive position in the market.

REFERENCES

[1] Mishchuk, Y., Nusinov, V., Kashubina, Y., Polishchuk, I., Pasichnyk, N. (2021). Security of strategic economic interests of mining and metallurgical enterprises in post-industrial conditions as factor of their investment attractiveness. Academy of Strategic Management Journal, 20(1): 1-9. http://ds.knu.edu.ua/jspui/handle/123456789/3150.

[2] Grigoraș-Ichim, C.E., Cosmulese, C.G., Savchuk, D., Zhavoronok. A. (2018). Shaping the perception and vision of economic operators from the Romania – Ukraine – Moldova border area on interim financial reporting. Economic Annals-XXI, 173(9-10): 60-67. https://doi.org/10.21003/ea.V173-10

[3] Alpysbayev, K.S., Gridneva, Y.E., Kaliakparova, G.S., Saparbayev, A.D., Assanova, S.S. (2020). Economic security management at industrial enterprises: A case study. Journal of Security and Sustainability Issues, 9(4): 1165-1176. https://doi.org/10.9770/JSSI.2020.9.4(4)

[4] Marhasova, V., Garafonova, O., Popelo, O., Tulchynska, S., Pohrebniak, A., Tkachenko, T. (2022). Environmentalization of production as a direction of ensuring the sustainability of production activities of enterprises and increasing their economic security. International Journal of Safety and Security Engineering, 12(2): 159-166. https://doi.org/10.18280/ijsse.120203

[5] Mishchuk, Y., Hrechko, A., Skliar, N., Yastremska, N., Kamynskyi, P. (2021). Development of a methodology for assessing economic security of industrial enterprise employees: Experience of Ukraine. Academy of Strategic Management Journal, 20(2): 1-10. http://ds.knu.edu.ua/jspui/handle/123456789/3293

[6] Zlotenko, O., Rudnichenko, Ye., Illiashenko, O., Voynarenko, M., Havlovska, N. (2019). Optimization of the sources structure of financing the implementation of strategic guidelines for ensuring the economic security of investment activities of an industrial enterprise. TEM Journal, 8(2): 498-506. https://doi.org/10.18421/TEM82-25

[7] Pushak, Y., Lagodiienko, V., Basiurkina, N., Nemchenko, V., Lagodiienko, N. (2021). Formation the system for assessing the economic security of enterprise in the agricultural sector. Business: Theory and Practice, 22(1): 80-90. https://doi.org/10.3846/btp.2021.13013

[8] Shatokhin, A.L. (2015). Method of assessing the level of economic security of industrial enterprises applying Harrington desirability function. Actual Problems of Economics, 173(11): 463-470. http://nbuv.gov.ua/UJRN/ape_2015_11_56

[9] Boiarynova, K., Popelo, O., Tulchynska, S., Gritsenko, S., Prikhno, I. (2022). Conceptual foundations of evaluation and forecasting of innovative development of regions. Periodica Polytechnica Social and Management Sciences. https://doi.org/10.3311/PPso.18530

[10] Popelo, O., Tulchynska, S., Lagodiienko, N., Radin, A. M., Moskalenko, A. (2021). Methodical approach to forecasting the intensification of innovative development of regions using the Mathcad program. International Journal of Circuits, Systems and Signal Processing, 15: 1591-1601. https://doi.org/10.46300/9106.2021.15.171

[11] Tulchynska, S., Popelo, O., Vovk, O., Dergaliuk, B., Kreidych, I., Tkachenko, T. (2021). The resource supply of innovation and investment strategies of the microeconomic systems modernization in the conditions of digitalization. Wseas Transactions on Environment and Development, 17: 819-828. https://doi.org/10.37394/232015.2021.17.77

[12] Vovk, O., Kravchenko, M., Popelo, O., Tulchynska, S., Derhaliuk, M. (2021). Modeling the choice of the innovation and investment strategy for the implementation of modernization potential. Wseas Transactions on Systems and Control, 16: 430-438. https://doi.org/10.37394/23203.2021.16.38

[13] Mishchuk, I., Riabykina, Y., Ushenko, N., Hamova, O., Tkachenko, S., Yastremska, N. (2022). Intellectual capital as a factor forming economic security of enterprises in society 5.0. Wseas Transactions on Business and Economics, 19: 269-277. https://doi.org/10.37394/23207.2022.19.25

[14] Sotskova, S.I., Kalashnikova, I.V. (2021). Comprehensive assessment of enterprise's economic security system in the digital economy conditions.

Lecture Notes in Networks and Systems, 304: 513-520. https://doi.org/10.1007/978-3-030-83175-2_64
[15] Vasylishyn, S., Ulyanchenko, O., Bochulia, T., Herasymenko, Y., Gorokh, O. (2021). Improvement of analytical support of economic security management of the agricultural enterprises. Agricultural and Resource Economics, 7(3): 123-141. https://doi.org/10.51599/are.2021.07.03.08
[16] Snishchenko, R.H., Krot, L.M. (2021). Managing the economic security of enterprises in coopetition. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 6: 165-169. https://doi.org/10.33271/NVNGU/2021-6/165
[17] Balatskyi, I., Onishchenko, M., Dutchenko, O., Dutchenko, O. (2021). Organizational and economic mechanism of the economic security management in foreign economic activity of the enterprise. Quality - Access to Success, 22(180): 10-13.
[18] Viknianska, A., Kharynovych-Yavorska, D., Sahaidak, M., Zhavoronok, A., Filippov, V. (2021). Methodological approach to economic analysis and control of enterprises under conditions of economic systems transformation. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 4: 150-157. https://doi.org/10.33271/nvngu/2021-4/150
[19] Shtangret, A., Topalova, E., Polovcev, O., Chornenka, O., Musiyovskyi, A. (2021). Practical aspects of the use of antisipative management in the process of ensuring the economic security of an enterprise. Business: Theory and Practice, 22(1): 202-210. https://doi.org/10.3846/btp.2021.13556
[20] Blakyta, H., Bogma, O., Bolduieva, O., Lukyanov, V., Shtuler, I. (2021). Modeling enterprises' economic security in crisis conditions. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 4: 116-121. https://doi.org/10.33271/nvngu/2021-4/116
[21] Sharma, R., Mishra, D.K. (2020). The role of safety training in original equipment manufacturing companies on employee perception of knowledge, behavior towards safety and safe work environment. International Journal of Safety and Security Engineering, 10(5): 689-698. https://doi.org/10.18280/ijsse.100514
[22] Official site of the enterprise PJSC "Central Mining and Processing Plant". https://cgok.metinvestholding.com/ru, accessed on 10 May 2022.
[23] Official site of the enterprise PJSC ArcelorMittal Kryvyi Rih. https://ukraine.arcelormittal.com, accessed on 10 May 2022.
[24] Official site of the enterprise «YUZHNIY GOK» MINING AND PROCESSING PLANT. https://www.ugok.com.ua/ua, accessed on 10 May 2022.
[25] Official website of the State Statistics Service of Ukraine. http://www.ukrstat.gov.ua, accessed on 10 May 2022.