

Integration of the enterprise economic security system into the national security architecture of the state

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Purpose. The purpose of the study is to provide a scientific substantiation of a model for integrating enterprise economic security systems into the multi-level architecture of the state's economic security through the regional level, under conditions of wartime transformation and systemic risk escalation.

Methodology. The research is based on an interdisciplinary methodological framework combining economic security theory, risk management, regional economics, and systems analysis. The study applies a systemic approach, structural-functional analysis, comparative and institutional analysis, as well as economic-mathematical modeling. Methods of aggregation and weighting of indicators, scenario analysis, and forecasting are used to model cascading risks and ensure integration across the levels "enterprise – region – state."

Results. The study develops a multi-level cascade model of economic security integration that ensures vertical and horizontal synchronization of decisions, risks, and information flows across enterprise, regional, and state levels. It substantiates the role of the region as a key integrative contour where corporate risks are aggregated and transformed into national security challenges. An integral mathematical model for assessing enterprise economic security is proposed, incorporating weighted components and an existentiality criterion. Additionally, the concept of a unified information and analytical system (IAS) is introduced as a digital integrator of national economic resilience, enabling real-time monitoring, forecasting, and adaptive decision-making.

Originality. The scientific novelty lies in the development of a comprehensive multi-level integration model of economic security based on the cascade principle "enterprise – region – state," which shifts the paradigm from fragmented and sectoral approaches to a unified resilience management system. The study further advances the concept of enterprise economic security as a structural element of national resilience and introduces an integral assessment model incorporating the existentiality criterion under conditions of military and hybrid threats.

Practical implications. The results can be applied in the formation of state and regional economic security policies, development of regional monitoring and situational centers, assessment of critical infrastructure resilience, and implementation of digital risk management tools. The proposed models provide a methodological basis for creating a unified national information and analytical system for economic security management and for improving coordination between enterprises and public authorities within the national security framework.

Keywords: economic security, national security, regional economy, resilience, risk management, critical infrastructure.

Introduction

The full-scale war, digitalization, the digital transformation of the economy, and the growth of systemic risks caused by the war have led to a transformation of approaches to ensuring the state's economic security. At the same time, the contemporary transformational processes of Ukraine's economic development under conditions of military threats, spatial unevenness of socio-economic development, and increasing systemic risks necessitate a rethinking of the role of enterprises in ensuring not only corporate stability, but also regional and national security.

Under these conditions, enterprise economic security ceases to be exclusively an internal economic category and acquires the features of a component within a multi-level system of ensuring national resilience. Modern threats are characterized by a networked and cascading nature, which leads to the rapid propagation of local economic disruptions to regional and national levels.

The traditional model of economic security, within which enterprises, regions, and the state function relatively autonomously, is losing its effectiveness. The

practice of the wartime period has demonstrated that the resilience of enterprises determines the viability of regional economies, while the aggregate of regional resilience shapes the national resilience of the state.

At the same time, the current security management system is characterized by institutional fragmentation of information flows and the absence of a unified mechanism for integrating enterprise economic security systems into the state architecture of risk management.

Thus, a scientific problem emerges, consisting in the mismatch between the existing regulatory and institutional model for ensuring economic and national security in Ukraine and the contemporary configuration of military and hybrid threats. This mismatch manifests itself in the fragmentation of regulatory requirements, the absence of a unified data contour and measurable resilience criteria, as well as in the incomplete development of the three-tier integration architecture “state–regions–enterprises,” resulting in corporate risks not being aggregated into manageable parameters of regional and national resilience.

Accordingly, there is an objective need to develop a scientifically grounded model for integrating enterprise economic security systems into the multi-level architecture of the state’s economic security, with the region identified as the key integrative level for ensuring its economic resilience.

Literature review. The issue of enterprise economic security has traditionally been studied within microeconomic and corporate approaches, where it is primarily interpreted as a state of protection of resource potential, the ability to counter internal and external threats, and a condition for ensuring sustainable development of business entities. However, these approaches are largely focused on internal risk management processes and correspond to relatively stable economic environments, which limits their applicability under conditions of systemic instability and wartime economic transformation.

At the macro level, contemporary studies emphasize the growing role of state policy in ensuring enterprise resilience and national economic stability. In particular, (Laptiev, & Zakharov, 2025) argue that state economic policy under wartime conditions becomes a key determinant of enterprise stability, while (Reznikova, 2025) highlights the need for integrating economic, legal, and institutional mechanisms of public governance. (Yehorova, et al., 2022) demonstrate that the macroeconomic resilience of the state depends directly on enterprise functioning, preservation of production capacity, and integration into global economic systems. These studies indicate a gradual shift from perceiving enterprises as objects of regulation toward recognizing them as active subjects of national security formation.

Modern studies of regional economic security demonstrate a shift from centralized models toward territorially oriented and resilience-based approaches. Boschma (2015) emphasizes the evolutionary nature of regional resilience, highlighting the role of structural adaptability and innovation in responding to external shocks. (Martin & Sanley, 2015) further develop this perspective, arguing that regional resilience is determined by the ability of economic systems to absorb, adapt, and transform under crisis conditions. Empirical studies (Mulska, et al., 2025) also confirm that regional resilience directly affects national economic stability, particularly under conditions of geopolitical instability and wartime economic disruption.

Contemporary research in risk management demonstrates a transition from static control models to adaptive and dynamic systems capable of functioning under conditions of high uncertainty. International standards such as ISO 31000 (2018) and OECD recommendations (2014) emphasize the importance of continuous monitoring, scenario analysis, and proactive risk governance. Scientific contributions by (Linkov & Trump, 2021), Renn (2022), and (Aven & Thekdi, 2024) highlight that effective risk management is based on the integration of resilience principles, adaptive decision-making, and system-level coordination.

At the same time, despite the significant development of these approaches, a methodological gap remains between corporate risk management systems, regional economic resilience frameworks, and national security architectures. Existing studies consider these levels either separately or within limited interaction models, without forming a unified multi-level integration mechanism.

Thus, the current scientific discourse lacks a comprehensive model that integrates enterprise economic security systems into the broader architecture of national economic security through the regional level as a key integrative contour. This gap determines the need for developing a multi-level cascade model of economic security integration, which forms the basis of this study.

The aim of this article – scientific substantiation of a model for integrating enterprise economic security systems into the state economic security architecture through the regional level of governance, based on a unified information and analytical risk management system.

Methodology. The methodological framework of the study is based on an interdisciplinary approach that integrates the principles of economic security theory, risk management, regional economics, and systems analysis. The research is grounded in the concept of multi-level interaction of socio-economic systems, within which enterprise economic security is considered as a structural element of national resilience.

To achieve the research objective, a combination of general scientific and special methods was applied.

The systemic approach was used as the fundamental methodological basis, which made it possible to consider economic security as a multi-level integrated system consisting of interrelated elements at the enterprise, regional, and state levels. This approach ensured the identification of functional interdependencies between levels of economic security and substantiated the role of the region as an integrative contour of national resilience.

The structural-functional analysis method was employed to determine the roles and functions of each level within the proposed integration model. This made it possible to define the distribution of responsibilities between enterprises, regional authorities, and state institutions in the process of ensuring economic security and managing systemic risks.

The comparative analysis method was used to assess existing theoretical approaches to economic security and risk management, as well as to identify their limitations under conditions of military and hybrid threats. This enabled the substantiation of the need to transition from fragmented and sectoral models to an integrated multi-level architecture.

The institutional analysis method was applied to examine the regulatory and legal framework of economic and national security in Ukraine. This made it possible to identify institutional fragmentation, the lack of a unified data contour, and inconsistencies between regulatory provisions and the current configuration of security threats.

The economic and mathematical modeling method was used to develop an integral model for assessing enterprise economic security and to construct an aggregated model of national economic resilience. The proposed model is based on the aggregation of enterprise-level indicators through regional weighting coefficients and integration parameters, which reflect the contribution of each level to the overall system resilience.

The method of aggregation and weighting of indicators was applied to form integral indices of economic security at the enterprise, regional, and national levels. This method ensured the transformation of heterogeneous security indicators into a unified system of measurable parameters.

The scenario analysis and forecasting methods were used to model the propagation of risks and to assess cascading effects within the “enterprise – region – state” system under conditions of high uncertainty and wartime shocks.

In addition, elements of the digital systems approach were applied to substantiate the concept of a unified information and analytical system (IAS), which provides continuous data exchange, real-time monitoring, and adaptive decision-making within the national economic security framework.

Thus, the applied methodological toolkit ensured the development of a scientifically grounded model of integration of enterprise economic security systems into the multi-level architecture of the state’s economic security, taking into account the regional dimension and the conditions of systemic instability.

Results and discussion. The contemporary conditions of Ukraine’s economic functioning are characterized by the transformation of the security environment under the influence of military, economic, energy, cyber, and socio-demographic threats, which have acquired a systemic and existential nature (Mulska, et al., 2025). Under these conditions, ensuring national security increasingly depends not only on the capacity of central state authorities, but also on the resilience of regional economic systems and the functional reliability of enterprises that provide essential services, production processes, and economic activity within territories (Linkov & Trump, 2021).

Military aggression has demonstrated that most threats are spatially realized, i.e., through specific regions where infrastructure destruction occurs, logistical connections are disrupted, production is relocated, labor potential is lost, and investment activity declines. It is precisely at the regional level that corporate risks of enterprises are transformed into risks affecting the functioning of territorial economies, and subsequently into systemic threats to the economic and national security of the state as a whole.

At the same time, the current system of regulatory and legal support for national and economic security in Ukraine has been formed predominantly according to sectoral or centralized principles, which do not fully take into account the regional nature of contemporary threats. Legislation defines the strategic foundations of national security, the functioning of critical infrastructure, and economic resilience; however, it does not establish a comprehensive mechanism for integrating enterprise economic security systems into regional security management frameworks and their subsequent synchronization with the national security architecture.

An in-depth analysis of legislation has shown that Ukraine has already developed a multi-level regulatory framework that objectively presupposes the integration of enterprises into the national security system; however, this integration remains latent and unsystematic.

At the constitutional and legal level, economic security is defined as one of the highest functions of the state, which implies the legitimacy of state influence on economic processes under threat conditions. At the same time, the legislation does not specify the mechanism for incorporating enterprises into the security architecture as structural elements of national resilience.

The regulatory environment of integration is characterized by institutional multi-channel governance and consists of several subsystems in the absence of a unified architectural center for their synchronization, in particular:

- the national security system (strategic planning);
- the critical infrastructure protection system;
- the cybersecurity system;
- the financial and banking system of risk monitoring;
- sanction and anti-corruption compliance mechanisms;
- martial law and mobilization management mechanisms.

At the same time, the analysis of state security policy has shown that enterprises have effectively become subjects of national security implementation through:
the functioning of critical infrastructure;
the maintenance of employment;
the provision of logistics and production chains;
the stability of regional economies.

However, information on risks remains fragmented across various institutions, which prevents the timely forecasting of systemic threats. Therefore, a key prerequisite for integration is the creation of a unified information (digital) risk management framework (Aven & Thekdi, 2024).

Thus, the institutional problem lies not in the absence of norms, but in the lack of their systemic integration into a unified multi-level architecture for managing economic security.

At the same time, the regional level – which should perform the function of the operational environment for implementing the state’s economic security policy – remains insufficiently institutionalized within the state’s security architecture. This leads to a situation in which local economic crises, enterprise shutdowns, or infrastructure disruptions rapidly scale into interregional imbalances and macroeconomic risks.

Moreover, the region acts as the central link in the system of the state’s economic security. It is at the meso-level that the following processes occur: aggregation of enterprise risks; management of intersectoral dependencies; ensuring the functioning of critical infrastructure; and coordination of responses to crisis events.

Any corporate risk has a spatial dimension. Its consequences manifest through:
the shutdown of regional production clusters;
reduction in employment;
disruption of the territory’s energy balance;
breakdown of logistics routes;
reduction of the tax base of local budgets.

Thus, the regional economic system represents the first level of risk aggregation, where corporate risks are transformed according to a cascading principle: a single disruption can trigger a cascade:

$$R_{enterprise} \rightarrow R_{cluster} \rightarrow R_{regional} \rightarrow R_{national}.$$

Thus, the region simultaneously performs the functions of a buffer, a transformer, and a multiplier of threats.

At the regional level, the following are concentrated: executive authorities; territorial units of security forces; operators of critical infrastructure; regional financial institutions; and production clusters. It is precisely at this level that the operational synchronization between enterprise economic security systems and state policy becomes possible.

Therefore, the region acts as a key integrative contour between the enterprise and the state, while regional resilience acquires the characteristics of an operational component of Ukraine’s national security.

Accordingly, a conceptually grounded multi-level cascade model for integrating enterprise economic security into the state economic security system is presented in Fig. 1.

The model is constructed according to a hierarchical principle of interaction among three functionally interconnected levels: the state, regional, and corporate levels, which are unified by a single information and analytical system for data exchange between economic security systems.

At the state level, strategic management of national security is carried out, including the formation of economic resilience policy, the identification of critical

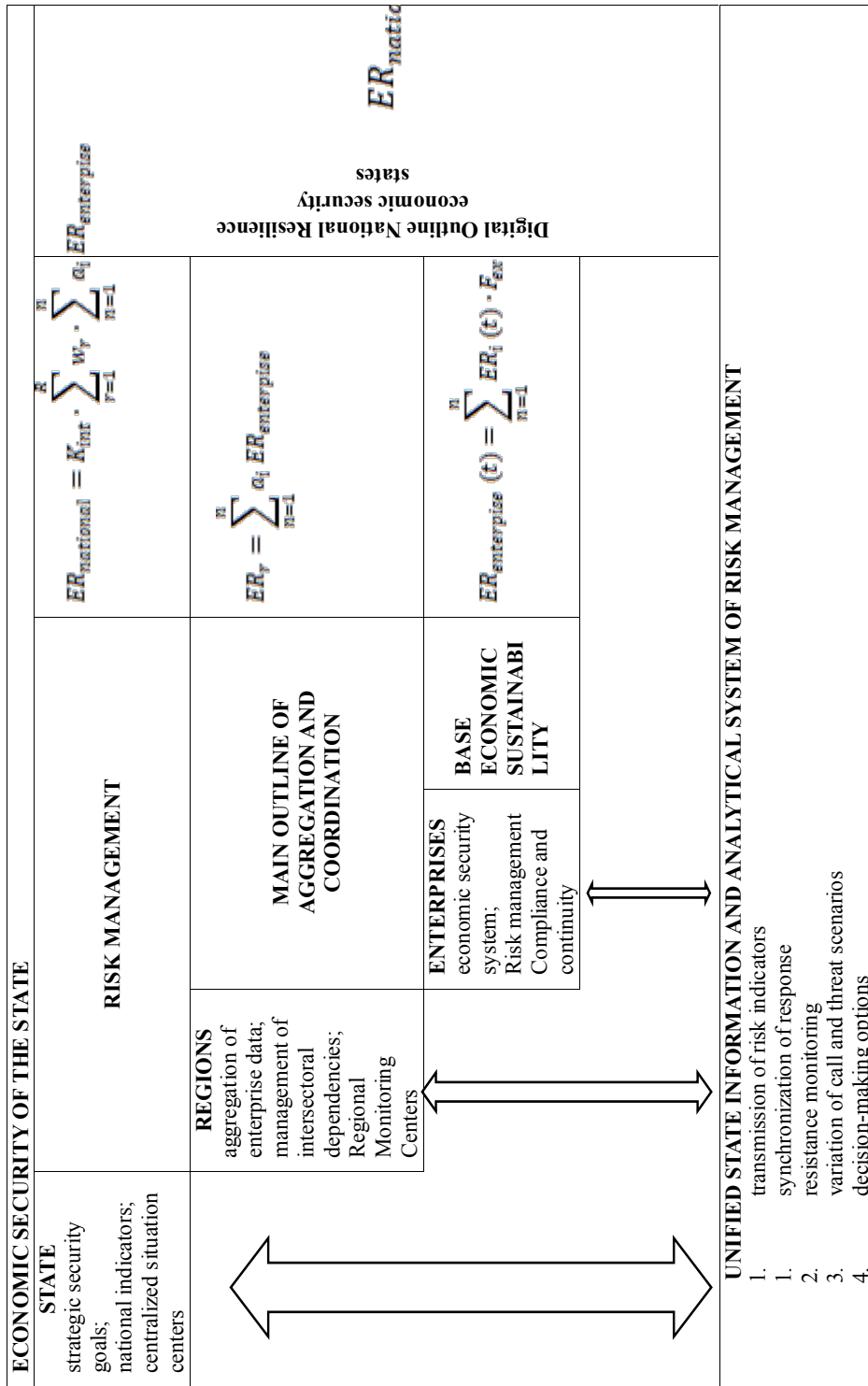


Fig. 1. Multi-level cascade model of integration of enterprises into the general structure of economic security of the state
Source: developed by the author.

risk indicators, and the coordination of activities of actors within the security and defense sector. This level performs the functions of regulatory governance, strategic forecasting, and centralized managerial decision-making.

The regional level acts as an integrative contour for aggregating information on the state of enterprise economic security, ensures monitoring of the functioning of regional economic systems, management of critical infrastructure, and coordination of responses to crisis situations. It is at this level that corporate economic risks are transformed into regional security challenges and subsequently transmitted to the national system of governance.

At the enterprise level, economic security systems operate to ensure the identification, assessment, and mitigation of internal and external risks, the maintenance of business continuity, and the formation of primary indicators of economic resilience.

Vertical information linkages between levels ensure the transmission of analytical data, risk indicators, and managerial signals, while feedback information flows form a mechanism for the adaptive response of the economic security system.

A key element of the proposed cascade model for integrating enterprise economic security systems into the national security architecture is a unified information and analytical system (IAS), which ensures continuous data exchange, aggregation of economic resilience indicators, and the formation of managerial decisions across all levels of interaction “enterprise – region – state” (UNDP, 2023).

The IAS performs the function of a digital integrator of economic resilience, transforming fragmented corporate security indicators into consolidated indicators of regional and national resilience.

The functioning of the information and analytical system is based on the following cycle: Data Collection → Aggregation → Analytics → Forecasting → Managerial Decision → Feedback, as illustrated in Fig. 2.

Thus, the model implements a closed-loop cycle of adaptive management of national resilience, within which the state’s economic resilience is formed as an aggregated result of the functioning of enterprise and regional economic security systems. This is achieved through the principle of continuous real-time monitoring of the state’s economic security and the formation of a digital contour of national economic resilience:

$$ER_{national} = F(ER_{region}, ER_{enterprise}, Data).$$

That is, national security becomes a function of the controllability of economic data.

At the corporate level, the IAS is integrated with the enterprise’s economic security system, where the enterprise acts as a primary sensor of the state’s economic risks and generates primary data on: financial stability; production continuity; workforce stability; cybersecurity; energy dependence; logistics risks; compliance risks; mobilization and critical capacity; and also forms an integral indicator of enterprise economic security:

$$ER_{enterprise}(t) = \sum_{n=1}^n ER_i(t) \cdot F_{ex} \cdot q_i,$$

where:

$ER(t)$ – the level of economic security of the first component of the subsystem of the system of economic security of the enterprise at time t ;

n – the number of components of the economic security system of the enterprise;

F_{ex} – criterion of the existence of an enterprise, reflects its ability to exist and develop in the face of complex challenges and uncertainty, in particular in wartime;

q_i – weight coefficient of the first component of the subsystem of the economic security system of the enterprise.

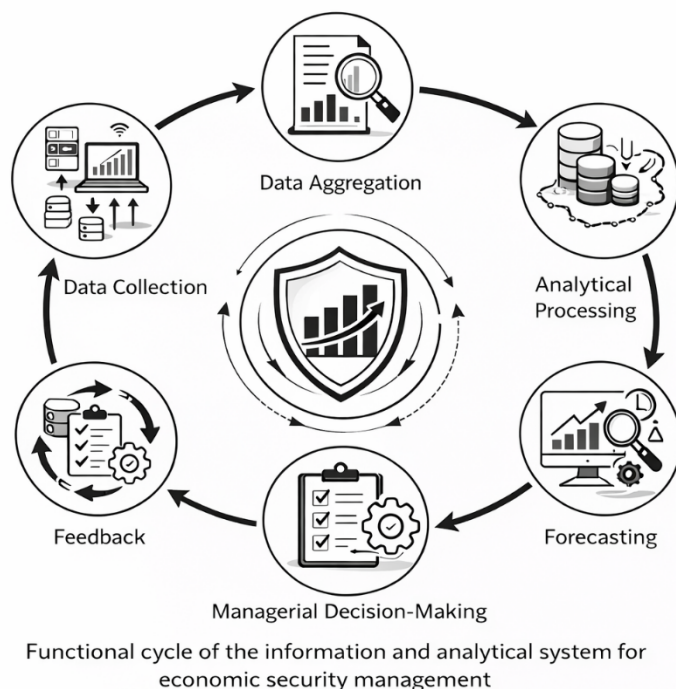


Fig. 2. Adaptive cycle of national resilience management

Source: developed by the author.

The regional subsystem of the IAS performs the following functions: aggregation of indicators of enterprises; identification of critical industry dependencies; identification of territorial imbalances; assessing the risks of critical infrastructure functioning; forecasting regional crisis scenarios. At the same time, the integral stability of the region is defined as:

$$ER_{region} = \sum_{i=1}^N a_i ER_{enterprise_i},$$

where:

a – the company’s share in the regional GRP or criticality;
 $ER_{enterprise_i}$ — level of economic security of the enterprise.

The region effectively performs the role of an operational center of national resilience, at the level of which the following processes occur: transformation of local risks into systemic ones; spatial propagation of economic threats; and formation of regional resilience indicators.

In turn, the national segment of the IAS ensures: strategic monitoring of economic security; interregional risk analysis; forecasting of systemic crises; support for the functioning of situational centers; and the formulation of state resilience policy, where the national economic resilience index is defined as:

$$ER_{national} = K_{int} \cdot \sum_{r=1}^R w_r \cdot \sum_{n=1}^n a_i ER_{enterprise_i},$$

where:

K_{int} – integration coefficient;

w_r – the weight coefficient of the contribution of the r-th region to the overall level of economic security and stability of the state;
 a – the company's share in the regional GRP or criticality;
 $ER_{enterprise}$ – level of economic security of the enterprise.

Thus, the economic security of the state is formed as an aggregate function of the stability of regions, which in turn depends on the resilience of enterprises. National economic resilience emerges as a result of the integrated interaction of enterprises, regional economic systems, and state institutions, where each level performs the functions of risk generation, transformation, and aggregation (Sheffi, Y., 2005).

Conclusion. As a result of the conducted research, it has been demonstrated that the state's economic security is not formed in a centralized manner, but rather as a result of the integrated interaction of enterprise economic security systems, regional socio-economic systems, and state governance institutions. It has been established that the region acts as a key integrative environment for the transformation of corporate economic risks into nationwide security challenges, while the enterprise serves as the fundamental carrier of economic resilience and the primary element in the formation of national resilience. The proposed cascade integration model "enterprise – region – state" ensures a transition from reactive security provision to systemic management of national economic resilience.

The theoretical significance of the obtained results lies in the development of the scientific foundations of economic security through a transition from traditional sectoral and object-based approaches to its consideration as a multi-level integrated system functioning within the architecture of national security. The study expands the theoretical provisions of regional economics regarding the role of territorial socio-economic systems in ensuring national resilience and substantiates the regional level as the key contour for the aggregation and transformation of economic risks. Furthermore, the concept of enterprise economic security as a structural element of national resilience has been further developed, which made it possible to construct an integral model for its assessment, taking into account the criterion of existentiality of socio-economic systems under conditions of military and hybrid threats.

The practical significance of the research results lies in the possibility of applying the proposed model of integration of enterprise economic security systems in the formation of regional and state policies aimed at ensuring economic resilience. The developed scientific and methodological approaches can be utilized by public authorities and regional governance bodies in the creation of systems for monitoring the economic security of territories, the functioning of regional situational centers, the assessment of critical infrastructure resilience, and the coordination of interaction between business entities and institutions of the security and defense sector. The proposed integral model of enterprise economic security provides a methodological basis for the digitalization of risk management, the formation of regional economic resilience indices, and the implementation of a unified information and analytical system for the exchange of security data across the levels "enterprise – region – state."

Further research should be directed toward the development of methodologies for the quantitative assessment of the existential economic security index of regions, the modeling of cascading interregional risks under conditions of wartime economic shocks, as well as the empirical validation of the proposed model for integrating economic security systems at critical infrastructure enterprises in Ukraine and in the processes of post-war recovery of the regional economy.

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Правдивець О. М. Інтеграція системи економічної безпеки підприємств у національну архітектуру безпеки держави

Мета. Метою дослідження є наукове обґрунтування моделі інтеграції систем економічної безпеки підприємств у багаторівневу архітектуру економічної безпеки держави через регіональний рівень в умовах воєнної трансформації та зростання системних ризиків.

Методологія. Дослідження базується на міждисциплінарному методологічному підході, що поєднує теорію економічної безпеки, ризик-менеджмент, регіональну економіку та системний аналіз. Використано системний підхід, структурно-функціональний аналіз, порівняльний та інституційний аналіз, а також економіко-математичне моделювання. Застосовано методи агрегування та зважування показників, сценарного аналізу

та прогнозування для моделювання каскадних ризиків і забезпечення інтеграції між рівнями «підприємство – регіон – держава».

Результати. Розроблено багаторівневу каскадну модель інтеграції економічної безпеки, яка забезпечує вертикальну та горизонтальну синхронізацію управлінських рішень, ризиків та інформаційних потоків між рівнями підприємства, регіону та держави. Обґрунтовано роль регіону як ключового інтеграційного контуру, де корпоративні ризики агрегуються та трансформуються в загрози національній безпеці. Запропоновано інтегральну математичну модель оцінювання економічної безпеки підприємства з огляду на зважені компоненти та критерій екзистенціальності. Також сформульовано концепцію єдиної інформаційно-аналітичної системи як цифрового інтегратора економічної стійкості, що забезпечує моніторинг у реальному часі, прогнозування та адаптивне прийняття рішень.

Наукова новизна. Наукова новизна полягає в розробленні комплексної багаторівневої моделі інтеграції економічної безпеки на основі каскадного принципу «підприємство – регіон – держава», що забезпечує перехід від фрагментарних і галузевих підходів до єдиної системи управління стійкістю. Подальшого розвитку набуло трактування економічної безпеки підприємства як структурного складника національної стійкості, а також запропоновано інтегральну модель її оцінювання з огляду на критерій екзистенціальності в умовах воєнних і гібридних загроз.

Практичне значення. Отримані результати можуть бути використані під час формування державної та регіональної політики економічної безпеки, створення регіональних систем моніторингу та ситуаційних центрів, оцінювання стійкості критичної інфраструктури та впровадження цифрових інструментів управління ризиками. Запропоновані підходи формують методологічну основу для створення єдиної національної інформаційно-аналітичної системи управління економічною безпекою та підвищення координації взаємодії між підприємствами й державними інституціями.

Ключові слова: економічна безпека, національна безпека, регіональна економіка, стійкість, управління ризиками, критична інфраструктура.

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