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BUSINESS MANAGEMENT WITHIN THE MACROECONOMIC SECURITY RISK MANAGEMENT SYSTEM: METHODOLOGICAL FOUNDATIONS IN THE CONTEXT OF INTEGRATION TRANSFORMATIONS

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Abstract. *The purpose of the study is to substantiate the methodological foundations for integrating business management into the macroeconomic security risk management system and to determine the relationship between managerial responses of business entities to macroeconomic risks and the resilience of the national economy under integration transformations. The research is based on a systemic and structural-logical approach to the analysis of macroeconomic security and business management. General scientific methods of analysis, synthesis, comparison, generalization and logical interpretation were applied. The empirical component of the study involved a dynamic analysis of gross fixed capital formation, capital investment, innovation activity of industrial enterprises, and research and development expenditures in Ukraine. These indicators were used to characterize investment, innovation and technological dimensions associated with the adaptation of the business sector to changes in the macroeconomic environment. The study substantiates the role of business management as an integral micro-level component of the macroeconomic security risk management system. A two-way relationship between macroeconomic conditions and managerial decisions of enterprises is identified. Macroeconomic risks affect business entities through changes in financial conditions, investment opportunities, market demand, technological requirements, supply chains and the institutional environment, while managerial responses influence investment, innovation, production, employment and technological development. The relationship between key macroeconomic risk areas, their manifestations at the enterprise level, relevant business management dimensions and managerial responses is systematized. It is shown that strategic, financial, investment, innovation, operational and crisis management instruments contribute to business adaptability and, consequently, to the resilience of the national economy. A multilevel methodological approach to macroeconomic security risk management is developed by integrating macro-level regulatory instruments with micro-level business management mechanisms. The methodological logic of interaction is formalized as a sequence: macroeconomic risks; changes in the business environment; managerial responses of enterprises; business adaptability and resilience; aggregate economic effects; macroeconomic security. The proposed approach can be used to improve risk-oriented management, strategic planning and decision-making at both enterprise and public-policy levels. Its application makes it possible to identify the transmission of macroeconomic risks to business entities, select appropriate management instruments and strengthen the adaptive capacity of enterprises and the national economy under integration transformations and heightened uncertainty.*

Keywords: *macroeconomic security, risk management, risk-oriented management, macroeconomic stability, economic resilience, integration processes, European integration, national economic recovery, investment activity, innovation development, institutional capacity, strategic management, business management, business resilience.*

БІЗНЕС-МЕНЕДЖМЕНТ У СИСТЕМІ УПРАВЛІННЯ РИЗИКАМИ МАКРОЕКОНОМІЧНОЇ БЕЗПЕКИ: МЕТОДОЛОГІЧНІ ЗАСАДИ В УМОВАХ ІНТЕГРАЦІЙНИХ ТРАНСФОРМАЦІЙ

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Анотація. *У статті обґрунтовано методологічні засади інтеграції бізнес-менеджменту в систему управління ризиками макроекономічної безпеки в умовах інтеграційних трансформацій. Використано системний, порівняльний і структурно-логічний підходи, методи аналізу, узагальнення та динамічного оцінювання макроекономічних й інвестиційно-інноваційних показників. Визначено роль бізнес-менеджменту як мікрорівневого механізму адаптації підприємств до макроекономічних шоків. Обґрунтовано взаємозв'язок макроекономічних ризиків, змін бізнес-середовища, управлінських реакцій підприємств, їх адаптивності та стійкості національної економіки. Запропонований підхід може використовуватися для вдосконалення ризик-орієнтованого управління, стратегічного планування та підвищення стійкості бізнесу й національної економіки в умовах інтеграційних змін.*

Ключові слова: *макроекономічна безпека, управління ризиками, ризик-орієнтоване управління, макроекономічна стабільність, економічна стійкість, інтеграційні процеси, європейська інтеграція, відновлення національної економіки, інвестиційна активність, інноваційний розвиток, інституційна спроможність, стратегічне управління, бізнес-менеджмент, стійкість бізнесу.*

JEL Classification: M100; D810; E600; F150; M210

Formulation of the problem. The relevance of the study of the methodology for managing macroeconomic security risks in the context of integration processes and the restoration of the national economy is due to a set of modern challenges that form a new paradigm for the functioning of economic systems. The conditions of military instability, global crisis phenomena, increased geoeconomic competition and the transformation of world markets significantly increase the level of uncertainty and riskiness of the economic environment, which directly affects the state of the state's macroeconomic security.

Of particular importance is the need to form an effective methodological basis for risk management, which ensures the identification, assessment and minimization of threats in the process of implementing state economic policy. Integration into international economic associations, in particular in the context of the European integration course, requires harmonization of approaches to ensuring economic security, adaptation of national institutions to external standards and consideration of transnational risks.

At the same time, the processes of post-war restoration of the national economy actualize the problem of increasing the resilience of the economic system to internal and external shocks, effective use of resource potential and ensuring long-term economic growth. In this context, risk management is considered as a key tool for forming an adaptive and proactive model of public administration, focused on ensuring stability, security and competitiveness of the economy.

At the same time, the effectiveness of macroeconomic security risk management largely depends on the ability of business entities to adapt their managerial decisions to changes in the external economic environment. Macroeconomic shocks are transmitted to the business level through fluctuations in demand, investment constraints, changes in the cost and availability of financial resources, disruptions in supply chains, technological challenges and regulatory transformations. Therefore, business management should be considered as an important functional component of the macroeconomic security risk management system. Strategic, financial, investment, innovation and crisis management instruments enable enterprises to respond to external threats, maintain operational continuity, preserve development potential and contribute to the overall resilience of the national economy. In this context, the interaction between macroeconomic risk management and business management forms a multilevel mechanism in which the stability of the national economy and the adaptive capacity of enterprises are mutually interdependent.

Thus, the scientific substantiation of the methodological foundations of macroeconomic security risk management, taking into account the role of business management in adapting enterprises to external shocks, is a necessary prerequisite for strengthening the resilience of both individual business entities and the national economy in the context of integration transformations.

Analysis of recent research and publications. Contemporary research on macroeconomic security, economic integration, investment processes, innovation and economic resilience is represented by the works of H. Asogwa and B. Azu [1], F. Babayev et al. [2], C. Huo et al. [7], B. Kim and I. Osgood [10], X. Lai et al. [12], E. Lannon [13], H. Omri et al. [16], A. Poltorak et al. [18, 17], and A. Silagadze et al. [20].

The available studies cover a broad range of issues related to the transformation of national and business environments under the influence of integration processes and global economic challenges. Asogwa and Azu [1] examine the relationship between trade within integrated blocs and economic growth, while Babayev et al. [2] focus on the role of investment flows in the development of emerging economies. Huo et al. [7] emphasize the importance of financial and innovative technologies for efficient resource management and economic development, whereas Lai et al. [12] analyse the impact of digital technological innovation on corporate international diversification. The institutional and integration dimensions of economic transformation are addressed by Kim and Osgood [10], Lannon [13], and Silagadze et al. [20].

Particular attention should also be paid to the managerial dimension of economic security. Omri et al. [16] identify macro-level factors influencing entrepreneurial behaviour, while Poltorak et al. [18] substantiate management approaches to restoring economic security under conditions of regional disproportions. In addition, Poltorak et al. [17] demonstrate the relationship between innovative development and financial security. These studies provide a theoretical basis for considering business management as an important micro-level component of the macroeconomic security risk management system.

Separation of previously unresolved parts of the overall problem. A distinct strand of recent research focuses on enterprise-level management mechanisms. Bobyliev and Chupryna [3], Dunda et al. [6], and Kremena and Honchar [11] examine strategic decision-making under armed conflict, logistics crises, and uncertainty; Burtnyak and Khaludilo [4], Khalatur et al. [9], Levykin et al. [14], Shevchenko [19], and Yemets et al. [21] address digital transformation, financial management, and business-process adaptation; while Cherniavska and Lan [5], Mammadova and Abdullayeva [15], and Zianko and Murha [22] focus on reputation, communication, and management effectiveness. Taken together, these studies explain how enterprises adapt their management systems to external changes, but mainly within the boundaries of the individual firm. This reveals a methodological gap between research on the macroeconomic determinants of business activity and studies of enterprise-level managerial adaptation: the feedback mechanism through which aggregate managerial responses of enterprises may mitigate or amplify macroeconomic shocks remains insufficiently conceptualized. Accordingly, the integration of business management into a multilevel system of macroeconomic security risk management requires further methodological substantiation.

The purpose of the study is to substantiate the methodological foundations for integrating business management into the macroeconomic security risk management system and to identify the relationship between managerial responses of business entities to macroeconomic risks and the resilience of the national economy under integration transformations.

Basic material. The modern world economy is characterized by an unprecedented level of interdependence, integration and transformation. Processes of regional and international economic integration, such as participation in trading blocs, global value chains and financial cooperation initiatives, have changed the foundations of macroeconomic stability and security. While integration creates opportunities for growth, innovation and competitiveness, it also generates new systemic risks that threaten the economic sustainability of national economies. In this context, macroeconomic risk management becomes a crucial element in ensuring sustainable development, national security and effective adaptation to global transformations.

In the proposed approach, business management is considered as an integral component of the macroeconomic security risk management system. This position is based on the fact that macroeconomic risks are not limited to the national level but are transmitted to enterprises through changes in the financial, investment, market, technological, logistical and institutional environment. Consequently, the ability of business entities to identify, assess and respond to such changes affects not only their individual stability but also the resilience of the national economy as a whole.

From a methodological perspective, the relationship between macroeconomic security and business management can be interpreted as a two-way process. On the one hand, macroeconomic

instability generates risks for business entities and influences their strategic priorities, investment decisions, access to financial resources, innovation activity and operational continuity. On the other hand, the aggregate managerial responses of enterprises determine the dynamics of investment, employment, production, innovation, technological development and tax revenues, thereby influencing the macroeconomic stability of the state.

Accordingly, the role of business management within the macroeconomic security risk management system should be considered through several interrelated management dimensions. Strategic management provides long-term adaptation to structural and integration transformations; financial management supports liquidity, financial sustainability and rational allocation of resources; investment management determines the ability of enterprises to maintain and renew productive capacity; innovation management facilitates technological adaptation and competitiveness; operational and supply chain management reduces vulnerability to disruptions in production and logistics; while crisis and risk management ensure timely response to shocks and preservation of business continuity.

The analytical logic of the study therefore proceeds from the micro- to the macroeconomic level. At the enterprise level, external shocks trigger strategic, financial, digital, operational and crisis-management responses, including adaptation to armed conflict and logistics disruptions [3, 6], digital and financial transformation [4, 9, 19, 21], business-process adaptation [14], and improvement of management effectiveness [22]. These managerial decisions directly affect investment, innovation, production, employment and business continuity. When aggregated across enterprises, such responses generate sectoral and economy-wide effects that may either mitigate or amplify the initial macroeconomic shock. Thus, macroeconomic security is considered not only as a result of public regulation, but also as an outcome influenced by the cumulative managerial responses of business entities.

Within this framework, the methodology of macroeconomic security risk management should combine the macro-level instruments of forecasting, monitoring, institutional regulation and economic policy with the micro-level instruments of business management. Such an approach makes it possible to consider enterprises not only as objects affected by macroeconomic risks but also as active participants in the formation of economic resilience. The adaptive capacity of business therefore becomes one of the channels through which macroeconomic risks can either be amplified or mitigated.

The methodological logic of this interaction can be represented as follows: macroeconomic risks; changes in the business environment; managerial response of enterprises; business adaptability and resilience; aggregate economic effects; macroeconomic security. The feedback nature of this relationship means that effective business management contributes to stabilizing investment activity, innovation processes and production potential, thereby strengthening the capacity of the national economy to withstand internal and external shocks.

Table 1

Relationship between macroeconomic security risks, business management instruments, risk assessment and monitoring

Macroeconomic risk area	*Manifestation at the business level*	*Risk assessment indicators at the enterprise level*	*Business management dimension*	*Managerial response*	*Monitoring indicators*
Financial and inflation risks	increasing costs, reduced purchasing power, deterioration of access to finance	cost growth rate; operating margin; liquidity ratio; interest coverage ratio	financial management	budget optimization, liquidity management, diversification of financing sources	dynamics of operating costs, liquidity, profitability and cost of financing
Investment risks	reduction in investment resources and postponement of development projects	capital investment intensity; cost of capital; share of postponed or cancelled investment projects	investment management	project prioritization, investment portfolio revision, search for alternative financing	dynamics of capital investment, financing availability and implementation of investment projects

Market risks	changes in demand, market contraction, increased uncertainty	sales dynamics; order volume; market share; demand volatility	strategic and marketing management	scenario planning, market diversification, adaptation of business models	changes in sales, orders, market share and customer demand
Technological and innovation risks	technological lag, reduced competitiveness	R&D intensity; innovation expenditure intensity; share of innovative products in sales	innovation management	technological modernization, R&D development, digital transformation	dynamics of R&D and innovation expenditures, introduction of new products and technologies
Supply chain and logistics risks	disruptions in supplies, increasing delivery costs	supplier concentration; delivery lead time; logistics costs; inventory turnover	operational and supply chain management	supplier diversification, inventory management, restructuring of logistics chains	delivery time and reliability, logistics costs, inventories and supplier dependence
Institutional and regulatory risks	changes in standards, regulations and integration requirements	compliance costs; number of identified non-compliance cases; costs of adaptation to new requirements	strategic and compliance management	adaptation to regulatory changes and international standards	changes in regulatory requirements, compliance costs and identified non-compliance cases
Crisis and military risks	loss of assets, production interruptions, relocation risks	value of asset losses; duration of operational downtime; recovery time; share of critical processes covered by continuity plans	crisis and risk management	business continuity planning, relocation, reserves, scenario-based decision-making	operational downtime, asset losses, recovery time and continuity of critical business processes

Source: developed by the authors

In accordance with ISO 31000:2018 [8], the proposed framework supplements risk identification and managerial response with risk assessment and continuous monitoring. The indicators presented in Table 1 are enterprise-level metrics intended to assess the manifestation and dynamics of macroeconomic risks at the microeconomic level. Their monitoring provides feedback for reviewing managerial responses and adjusting them when the level or consequences of risk change.

For practical application, the proposed framework can be implemented through a sequential decision-making algorithm:

1. Identification of the dominant macroeconomic risk affecting the enterprise.
2. Assessment of its manifestation using the enterprise-level indicators presented in Table 1.
3. Determination of the relevant business management dimension.
4. Selection of the corresponding managerial response.
5. Continuous monitoring of changes in the selected indicators.
6. Revision of the managerial response if the risk level or its consequences increase. The choice of management instruments should therefore be based on the type of risk, the intensity of its manifestation at the enterprise level and the dynamics of monitoring indicators. This approach transforms the proposed framework from a descriptive classification into a practical decision-support tool for risk-oriented business management.

Further validation of the proposed algorithm through enterprise-level case studies constitutes a direction for subsequent research, as the present empirical analysis is based on aggregate national statistical data rather than primary data from individual enterprises.

The presented relationships demonstrate that macroeconomic security risks acquire specific managerial manifestations at the enterprise level. Therefore, business management acts as a transmission and adaptation mechanism between changes in the macroeconomic environment and the actual economic behaviour of enterprises. The effectiveness of such adaptation is reflected in investment, innovation and production dynamics, which, in turn, influence the resilience and recovery capacity of the national economy.

Macroeconomic security refers to the state of stability and resilience of a national economy that allows it to withstand internal and external shocks while maintaining growth, employment and social well-being. Macroeconomic security includes balanced fiscal and monetary policies, stable inflation rates, sustainable debt levels and effective regulation of the financial and banking systems. However, in the era of integration, these parameters are increasingly influenced by global market dynamics, transnational capital flows and geopolitical factors. The increasing openness of national economies makes them more vulnerable to external crises, such as global recessions, supply chain disruptions or fluctuations in energy prices. Thus, traditional approaches to ensuring macroeconomic stability must evolve into more flexible, adaptive and preventive risk management systems. Managing risks in macroeconomic security in the context of integration transformations requires a comprehensive approach that combines forecasting, regulation and institutional strengthening. Governments must develop reliable mechanisms for early detection of weaknesses in the fiscal, monetary and social sectors. This includes improving the analytical capacity of national institutions and increasing financial literacy to increase the economy's ability to respond to shocks. The experience of recent global crises, including the COVID-19 pandemic and energy market turbulence, demonstrates that proactive risk management can mitigate the negative consequences of systemic disruptions and accelerate recovery.

Integration processes also require coordination between national and supranational institutions. Participation in economic unions and regional partnerships requires harmonization of monetary, fiscal and trade policies, which can both strengthen and limit national macroeconomic sovereignty. On the one hand, integrated markets provide access to larger capital pools, diversified trading partners and innovation ecosystems, which enhance macroeconomic resilience. On the other hand, they expose economies to external policy decisions. For example, the monetary policy of the central government within an economic bloc can significantly affect inflation and exchange rates in member states. Therefore, effective macroeconomic risk management in this environment depends on maintaining a balance between openness and autonomy. In addition, structural reforms play a key role in strengthening macroeconomic security. These reforms include diversifying the economic structure, developing high-value-added sectors, and improving the quality of state institutions. Integration provides an opportunity to modernize production systems, attract foreign investment, and strengthen technological capabilities. However, if not managed properly, it can deepen inequality and economic dependence. A well-designed strategy that integrates risk management into national development planning is therefore essential. Such a strategy should focus on building adaptive institutions, promoting sustainable fiscal discipline, and fostering inclusive growth that enhances overall economic resilience.

The modern global economy is characterized by deepening integration and interdependence between countries, which have significantly influenced Ukraine's economic trajectory. As the country continues its path toward European integration and economic modernization, ensuring macroeconomic security is becoming central to national development policies and strategies. For Ukraine, faced with the combined effects of war, global crises, and structural economic vulnerability, the ability to manage macroeconomic risks is not only a matter of stability, but also of sovereignty and resilience in the international arena.

Taking into account the proposed methodological framework, the empirical part of the study is used to characterize the macroeconomic environment and aggregate investment and innovation dynamics within which enterprise-level managerial responses occur. The selected indicators – gross fixed capital formation, capital investment, innovation activity of industrial enterprises and R&D expenditures – differ in their level of aggregation. In particular, gross fixed capital formation and R&D expenditures are macro-level aggregates and therefore cannot be interpreted as direct measures of business management effectiveness. They characterize the investment and technological conditions of the national economy, whereas the innovation activity of industrial enterprises more directly reflects enterprise-level adaptation. Accordingly, the empirical analysis illustrates the macroeconomic context and aggregate outcomes within which the proposed micro-to-macro transmission mechanism operates, rather than establishing a direct causal effect of individual managerial decisions on macroeconomic security.

The dynamics of the gross fixed capital formation level in Ukraine for the period from 2000 to 2024 are presented in Figure 1. This economic indicator reflects the share of the country's gross domestic product directed toward the creation, expansion, or renewal of fixed production assets. It essentially serves as an indicator of the state's investment activity, characterizing the volume of real investments in the productive potential of the economy.



Fig. 1. The dynamics of the gross fixed capital formation level in Ukraine

Source: calculated and built by the authors based on data from the State Statistics Service of Ukraine, Annual National Accounts

The analysis of the data presented in Figure 1 allows us to conclude that during the period from 2000 to 2008, Ukraine experienced steady growth in the level of gross fixed capital formation (from 19.7% of GDP in 2000 to 27.1% of GDP in 2007). This trend indicates the intensification of investment processes, the expansion of the country's production potential, favorable macroeconomic conditions, growing domestic demand, and the availability of credit resources. In 2008, the level slightly decreased to 25.9%, coinciding with the onset of the global financial crisis.

The period from 2009 to 2015 was marked by a significant decline in investment activity. As a result of the 2008-2009 financial crisis and subsequent economic shocks, including the military events of 2014, the indicator fell from 18.3% of GDP in 2009 to its minimum of 13.5% in 2015. This decline reflects a weakening of investment potential, the loss of part of industrial capacity, and a reduction in private capital investments.

Between 2016 and 2019, a gradual recovery was observed from 15.5% to 17.6% of GDP indicating partial stabilization of the macroeconomic environment and a gradual revitalization of investment activity. However, in 2020-2022, the level again declined significantly (to 11.9% of GDP in 2022) under the influence of the COVID-19 pandemic and the ongoing military actions in Ukraine, which led to infrastructure destruction, enterprise relocation, and a contraction in investment volumes.

In 2023-2024, a noticeable recovery of the indicator was recorded-up to 19.9% and 18.9% of GDP, respectively. This can be interpreted as a response to the intensification of reconstruction processes, the implementation of investment projects supported by international assistance, and the increase in capital expenditures within the public sector.

Thus, the dynamics of gross fixed capital formation in Ukraine throughout 2000-2024 demonstrate a cyclical pattern, closely correlated with the phases of economic growth, crisis, and recovery. The indicator serves as a sensitive measure of economic security, reflecting the effectiveness of state policy in the fields of investment management, integration processes, and post-crisis recovery.



Fig. 2. The dynamics of capital investment levels in Ukraine

Source: calculated and built by the authors based on data from the State Statistics Service of Ukraine, Capital Investment (annual) and Annual National Accounts

The dynamics of capital investment in Ukraine by main types of economic activity for the period 2010-2024 are presented in Figure 2 and reflect the share of the gross domestic product directed toward investment in the reproduction, modernization, and creation of fixed assets across

various sectors of the economy. This indicator characterizes the intensity of investment processes within the economic structure, allowing for an assessment of which industries serve as the key.

The analysis of the data presented in Figure 2 allows us to conclude that during 2010-2013, Ukraine experienced positive investment dynamics, reflecting a gradual recovery following the 2008-2009 global financial crisis. The level of capital investments increased from 16.7% of GDP in 2010 to 19.5% of GDP in 2012, indicating intensified investment in industry, transport, construction, and the service sector. In 2013, however, the investment level declined to 17.1% of GDP, signalling the beginning of a deterioration in the investment climate on the eve of the political and economic crisis.

The period of 2014-2016 was characterized by a sharp decline in investment activity, associated with the onset of military actions, the annexation of part of the country's territory, and the destruction of production infrastructure. The indicator decreased from 13.8% of GDP in 2014 to 13.7% in 2015, before partially recovering to 15.1% in 2016. This reflects the economy's process of adapting to new geopolitical conditions and the gradual restoration of investments in key sectors.

During 2017-2019, capital investments stabilized relatively at 15-16% of GDP, indicating a certain balance between public and private investments and the beginning of structural transformation in industry. In 2020-2022, the indicator dropped sharply from 12% of GDP in 2020 to 5.3% in 2022 due to the COVID-19 pandemic, a contraction in production activity, and large-scale destruction caused by military actions in Ukraine. This sharp decline signifies a critical reduction in investment potential, a halt of numerous projects, and the loss of opportunities to modernize fixed assets.

In 2023-2024, a gradual recovery of investment activity began: the indicator rose from 6% to 7% of GDP, reflecting increased capital allocations for infrastructure reconstruction, international aid projects, and the development of sectors oriented toward domestic demand.

Thus, the dynamics of capital investments in Ukraine during 2010-2024 demonstrate a high sensitivity of investment activity to crisis and military factors, which is a decisive aspect of the country's economic security risks. This indicator serves as a key measure of the effectiveness of state policy in economic recovery, integration processes, and strategic management of risks in the development of the national economy.

The dynamics of innovation activity of industrial enterprises in Ukraine should be considered through the prism of business management, as innovation management constitutes one of the key mechanisms through which enterprises respond to macroeconomic risks and integration-driven transformations. Industrial enterprises are the basic element of the national economy, forming a significant share of the gross domestic product, providing employment for the population and creating a material basis for economic development.

In this context, the methodology of innovation management involves the application of a set of principles, methods and tools aimed at effective planning, organization, coordination and control of innovation processes. Its implementation ensures increased production productivity, optimization of resource use, as well as increased competitiveness of enterprises in the internal and external economic environment.

At the same time, the integration of methodological approaches to innovation management contributes to the formation of an adaptive and sustainable economic system capable of effectively responding to external and internal challenges. Thus, it is the management methodology that is the key tool for ensuring the innovative development of industrial enterprises and, as a result, supporting the macroeconomic stability of the state.

Firstly, innovation drives productivity growth. When industrial enterprises adopt new technologies, improve production efficiency, or introduce advanced management systems, they are able to produce more output with the same or fewer resources. This increase in efficiency supports sustainable economic growth, which in turn strengthens macroeconomic indicators such as GDP growth, employment levels, and fiscal revenues. In Ukraine's context, where structural reforms and economic modernization are ongoing, innovative industrial activity helps reduce dependence on raw material exports and volatile markets, thereby stabilizing the national economy.

Secondly, innovation contributes to competitiveness in domestic and international markets. Ukrainian industrial enterprises that continuously innovate are better positioned to compete within European and global markets, especially under integration processes. Increased competitiveness leads to higher exports, stronger trade balances, and inflows of foreign investment. These factors reduce external vulnerabilities and enhance the economy's ability to absorb shocks, reinforcing macroeconomic security.

Moreover, innovation activity fosters structural transformation in the economy. By shifting production toward high value-added goods, digital technologies, and green energy solutions,

industrial enterprises can help diversify the Ukrainian economy. Diversification reduces dependence on a limited number of sectors or commodities, which in turn mitigates risks associated with price fluctuations, global crises, or geopolitical tensions. Such structural resilience is a cornerstone of macroeconomic stability, particularly in a context of ongoing integration into the European economic space.

Finally, the dynamics of innovation activity influence employment and social stability. Innovative enterprises often create higher-skilled jobs, promote workforce development, and support regional economic development. Stable employment and rising incomes contribute to domestic consumption, a stable tax base, and social cohesion, which are the critical factors for maintaining macroeconomic stability in times of uncertainty.

The dynamics of innovation activity among industrial enterprises in Ukraine are summarized in Figure 3. This indicator reflects the level of engagement of enterprises in introducing new technologies, products, processes, and organizational solutions. It provides insight into the capacity of the industrial sector to modernize, enhance competitiveness, and contribute to sustainable economic growth.

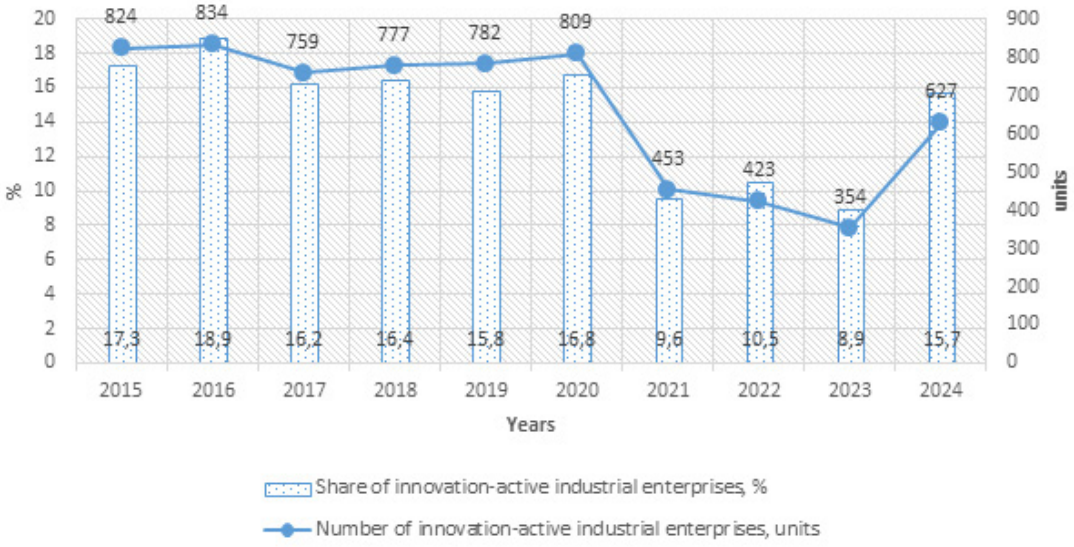

Fig. 3. The dynamics of innovation activity of industrial enterprises in Ukraine

Source: built by the authors based on data from the State Statistics Service of Ukraine, Innovation Activity of Enterprises

The analysis of the data presented in Figure 3 indicates that during 2015-2024, the dynamics of innovation activity among industrial enterprises in Ukraine exhibited pronounced fluctuations, reflecting both cycles of economic development and the impacts of crisis and military factors, which directly affect the level of technological renewal and the economy's capacity to integrate into the European innovation space.

In 2015-2016, the share of innovation-active enterprises increased from 17.3% to 18.9%, coinciding with a period of gradual macroeconomic stabilization following the 2014 crisis and the recovery of investment activity in industry. This growth reflects the restoration of enterprise potential for implementing technological innovations, modernizing production processes, and attracting investment in research and development.

The period from 2017 to 2020 was characterized by relative stabilization of innovation activity within the range of 15.8-16.8%, despite existing structural problems in the industrial sector. The number of innovation-active enterprises remained nearly constant (759-809 units), indicating a balance between the adaptive capacity of businesses and financial resource constraints. During this time, the foundations were laid for the development of collaborative innovation models with European structures, representing an important step toward integration into the unified EU scientific and technological space.

A sharp decline in 2021-2023 (the share fell from 9.6% to 8.9%, and the number of enterprises from 453 to 354) indicates a significant deterioration in innovation dynamics due to military actions, disrupted supply chains, the loss of production capacities, and the outflow of highly skilled personnel. This period was marked by heightened economic security risks, including technological degradation and decreased competitiveness of domestic production.

At the same time, 2024 saw a noticeable recovery in innovation activity: the share of innovation-active enterprises rose to 15.7%, and their number increased to 627 units. This reflects the gradual restoration of Ukraine's scientific and industrial potential. The positive dynamics in 2024 can be attributed to the activation of international financial and technical assistance programs, the expansion of integration ties with the EU, and the mobilization of resources for modernizing critical industrial sectors.

Thus, in our view, the innovation activity of industrial enterprises during 2015-2024 serves as a systemic indicator of the state's economic security. Fluctuations in this indicator reflect the impact of both internal structural risks and external shocks, while its increase in 2024 signals the adaptation of Ukrainian industry to new conditions of integration-driven development and post-war recovery.

Expenditures on research and development (R&D) in Ukraine are a fundamental factor for ensuring long-term macroeconomic stability. Investment in R&D drives innovation, technological advancement, and competitiveness, which are crucial for creating a resilient and adaptive national economy. In the context of global integration and rapidly changing economic conditions, R&D spending strengthens the country's capacity to respond to internal and external shocks, ensuring sustainable growth and stability.

Firstly, R&D investments stimulate technological innovation and productivity growth. By funding new technologies, scientific research, and experimental development, Ukraine can improve the efficiency and competitiveness of its industrial and service sectors. Higher productivity reduces production costs, increases output, and supports economic growth, which directly contributes to stable macroeconomic indicators such as GDP growth, employment, and fiscal revenues. Without sufficient R&D funding, industries may lag behind international competitors, leaving the economy more vulnerable to external market fluctuations.

Secondly, expenditures on R&D enhance the country's integration into global markets. Economies that invest in knowledge and technology-intensive sectors are better able to compete internationally. For Ukraine, this means expanding high value-added exports, attracting foreign direct investment, and participating in European and global innovation networks. Such activities generate additional capital inflows, strengthen the balance of payments, and reduce the risks associated with over-reliance on raw materials or low-tech sectors, thus supporting macroeconomic stability.

Moreover, R&D funding underpins structural economic transformation. By promoting innovation in sectors such as energy, agriculture, and manufacturing, research investments contribute to economic diversification. A diversified economy is less sensitive to shocks in individual sectors or external price fluctuations, making it more resilient. This structural resilience is a key element of macroeconomic security, especially in a country like Ukraine, which is navigating post-war reconstruction, integration processes, and global economic uncertainties.

Finally, expenditures on R&D create positive social and human capital effects. Investments in research institutions, universities, and high-tech industries foster a skilled workforce, generate high-quality jobs, and promote regional development. A well-educated and innovative workforce increases domestic productivity and competitiveness, enhances social stability, and broadens the tax base, all of which are essential for sustainable macroeconomic management.

Expenditures on research and development (R&D) in Ukraine, illustrated in Figure 4, represent a key indicator of the country's scientific and technological potential and its capacity for innovation-driven growth. This indicator reflects the volume of financial resources allocated to fundamental and applied research, experimental development, and the implementation of innovative technologies across various sectors of the economy.



Fig. 4. Expenditures on research and development in Ukraine

Source: built by the authors based on data from the State Statistics Service of Ukraine, Implementation of Scientific Research and Development

Analyzing the data in Fig. 4, it was found that in the period 2010-2024 the dynamics of expenditures on scientific research and development in Ukraine is characterized by a steady decrease in the share of these expenditures in the GDP structure - from 0.75% in 2010 to 0.37% in 2024. This trend reflects a gradual reduction in state and corporate participation in financing the scientific sphere, which increases the risks of degradation of scientific and technological potential and limits the innovative capabilities of the economy. In 2010-2013 the share of expenditures on scientific research and development was maintained at the level of 0.65-0.75% of GDP, which indicated the preservation of the basic level of scientific and research potential formed in previous decades. This was a period of relative stability, during which the scientific system functioned in conditions of limited but relatively predictable budget financing.

Since 2014, after the start of hostilities and structural shocks in the economy, there has been a sharp decline in science funding: in 2015 the figure decreased to 0.55%, and in 2016-2019 it was kept in the range of 0.43-0.48% of GDP. This means a gradual depletion of resources for the reproduction of scientific personnel, a reduction in the share of applied developments and a decrease in the number of innovative projects, which negatively affected the technological security of the state. The period 2020-2023 is marked by minimum values of the indicator (0.33-0.41% of GDP), which reflects the consequences of the COVID-19 pandemic, reduced investments in the real sector and the transfer of budget priorities to the defense and social sphere. The preservation of such a low level of funding in the conditions of martial law in 2022-2023 indicates a critical decline in the potential for innovative reproduction, which is a systemic threat to economic security. In 2024, a moderate recovery of the indicator to 0.37% of GDP was recorded, which can be considered as the first signs of stabilization of scientific funding against the background of increased international technical assistance and the implementation of post-war recovery programs. However, even this level remains significantly lower than the minimum recommended by international standards (about 1.5–2% of GDP for countries with an average level of development), which indicates a high risk of Ukraine lagging behind in the field of scientific and technological security. Thus, in our opinion, the low share of spending on scientific research and development in Ukraine's GDP during 2010-2024 is a critical indicator of the vulnerability of the national economy. It reflects the weakening of the connection between science, industry and public administration and indicates the need for systemic reforms of science financing, aimed at increasing innovation sustainability, integration into the European scientific space and ensuring strategic economic security.

To supplement the graphical analysis, a correlation and regression analysis was conducted for the common observation period of 2015-2024. The share of innovation-active industrial enterprises was used as an enterprise-level indicator of adaptive and innovation-oriented behaviour, while capital investment as a percentage of GDP was considered as an aggregate indicator of investment activity in the economy.

The Pearson correlation coefficient between the share of innovation-active industrial enterprises and capital investment amounted to $r = 0.662$, indicating a moderate positive relationship. The corresponding simple linear regression is:

$$Y = 0.370 + 0.786X,$$

where X is the share of innovation-active industrial enterprises, %, and Y is capital investment, % of GDP. The coefficient of determination is $R^2 = 0.439$, while the regression coefficient is statistically significant at the 5% level ($p = 0.037$).

The obtained results indicate that higher innovation activity of industrial enterprises is statistically associated with higher aggregate investment activity. At the same time, given the limited number of annual observations and the aggregate nature of the dependent variable, the identified relationship should not be interpreted as evidence of direct causality. Rather, it provides empirical support for the proposed micro-to-macro transmission mechanism, according to which enterprise-level adaptive and innovation-oriented behaviour is associated with aggregate economic outcomes.

Conclusions. The study substantiates a multilevel approach to macroeconomic security risk management based on the integration of enterprise-level managerial responses into the broader mechanism of economic resilience. The proposed methodological logic follows the sequence: macroeconomic risk; changes in the business environment; managerial response of enterprises; business adaptability and resilience; aggregate economic effects; macroeconomic security. This approach allows enterprises to be considered not only as recipients of macroeconomic shocks but also as economic agents whose cumulative managerial responses may contribute to their mitigation or amplification. The relationship between macroeconomic risks and business management was

systematized by distinguishing financial and inflation, investment, market, technological and innovation, supply-chain and logistics, institutional and regulatory, and crisis and military risks. For each risk area, its manifestation at the enterprise level, relevant management dimension, managerial response, risk-assessment indicators and monitoring indicators were identified. This provides a practical basis for selecting management instruments according to the type and intensity of risk and for revising managerial responses on the basis of monitoring results.

The empirical analysis confirmed the high sensitivity of Ukraine's investment and innovation environment to crisis shocks. Gross fixed capital formation declined to 11.9% of GDP in 2022 and recovered to 18.9% in 2024, while capital investment decreased to 5.3% of GDP in 2022 and increased to 7.0% in 2024. The share of innovation-active industrial enterprises declined to 8.9% in 2023 but increased to 15.7% in 2024, with the number of such enterprises rising from 354 to 627. At the same time, R&D expenditures demonstrated a long-term downward trend from 0.75% of GDP in 2010 to 0.37% in 2024, indicating the persistence of technological and innovation vulnerabilities in the national economy.

The correlation and regression analysis for 2015–2024 revealed a statistically significant positive relationship between the share of innovation-active industrial enterprises and capital investment as a percentage of GDP ($r = 0.662$; $R^2 = 0.439$; $p = 0.037$). The estimated regression equation, $Y = 0.370 + 0.786X$, indicates that higher innovation activity of industrial enterprises is associated with higher aggregate investment activity. Given the limited number of annual observations and the aggregate nature of the dependent variable, this relationship should be interpreted as an association rather than evidence of direct causality.

Thus, the results provide empirical support for the proposed micro-to-macro transmission mechanism: enterprise-level adaptive and innovation-oriented behaviour is associated with aggregate investment and innovation dynamics that form part of the broader macroeconomic security environment. At the same time, aggregate indicators such as gross fixed capital formation and R&D expenditures should not be interpreted as direct measures of business management effectiveness, but rather as characteristics of the macroeconomic environment and aggregate outcomes of interactions between business activity, public policy and other economic factors.

The practical value of the proposed approach lies in the possibility of applying a sequential decision-making algorithm that includes identification of the dominant risk, assessment of its manifestation at the enterprise level, selection of the relevant management dimension and response, monitoring of corresponding indicators and subsequent adjustment of managerial decisions. Further research should focus on validating the proposed framework using enterprise-level data and case studies, which would make it possible to assess the effectiveness of particular managerial responses and more precisely identify the mechanisms through which they influence aggregate economic resilience.

References

1. Asogwa H., Azu, B. Agriculture trade exports tracing and economic growth among integrated blocs. *International Journal of Sustainable Development and Planning*. 2024. №19(12). pp. 4735-4742. DOI: https://doi.org/10.18280/ijsdp.191220.
2. Babayev F., Goncharenko I., Mazur H., Abdullae U., Chernyaha L. Investment Flows and country development in Emerging Markets: Analysing the impact of Foreign investment on Economic growth. *Theoretical and Practical Research in Economic Fields*. 2024. №15(4), 894 p. DOI: https://doi.org/10.14505/tpref.v15.4(32).09.
3. Bobyliev I. O., Chupryna N. M. Models and methods of strategic business management during armed conflict. *Economic Bulletin of the State Higher Educational Institution "Ukrainian State University of Chemical Technology"*. 2025. № 1. pp. 51-59. DOI: https://doi.org/10.32434/2415-3974-2025-21-1-51-59.
4. Burtnyak I. V., Khaludilo T. V. Digital transformation of business management: innovative models, forecast scenarios and current challenges of economy modernization. *The actual problems of regional economy development.* 2025. №21(1). pp. 34-40. DOI: https://doi.org/10.15330/apred.1.21.34-40.
5. Cherniavska I., Lan L. Theoretical aspects of business reputation management. *International scientific journal «Internauka»*. 2025. № 5. pp. 17-20. DOI: https://doi.org/10.25313/2520-2057-2025-5-11051.
6. Dunda S., Piankova O., Tur O., Turchyna M., Tyukha I., Ingram K. L. Strategic management of international business projects in the context of a logistics crisis. *Naukovyi visnyk Natsionalnoho Hirnychoho Universytetu.* 2026. № 1. pp. 218-226. DOI: https://doi.org/10.33271/nvngu/2026-1/218.

7. Huo C., Leng W., Xiang Y. Efficient natural resources management through financial and innovative technologies in developing nations from the lens of economic development. *Resources Policy.* 2024. №99. 105401. DOI: https://doi.org/10.1016/j.resourpol.2024.105401.
8. International Organization for Standardization. ISO 31000:2018 Risk management – Guidelines. 2nd ed. Geneva: ISO, 2018. 16 p. https://www.iso.org/standard/65694.html
9. Khalatur S., Masiuk I., Kravchenko M., Kurbatska L., Sirko A. Digitalisation as a modern trend in the development of financial management in small business. *Financial and credit activity: problems of theory and practice.* 2025. № 3. pp. 370-382. DOI: https://doi.org/10.55643/fcaptp.3.62.2025.4758.
10. Kim B., Osgood I. Democracy and clustered models of global economic engagement. *International Studies Quarterly.* 2024. №68(4). DOI: https://doi.org/10.1093/isq/sqae130.
11. Kremena R., Honchar L. Overcoming cognitive biases in strategic business management. *Economic Bulletin of the State Higher Educational Institution "Ukrainian State University of Chemical Technology"*. 2025. № 1. pp. 133-140. DOI: https://doi.org/10.32434/2415-3974-2025-21-1-133-140.
12. Lai X., Yue S., Guo C., Gao P. Unleashing global potential: The impact of digital technology innovation on corporate international diversification. *Technological Forecasting and Social Change.* 2024. №208, 123727. DOI: https://doi.org/10.1016/j.techfore.2024.123727.
13. Lannon E. The European Political Community in the EU's wider neighbourhood: A new element of the differentiated pan Euro-Mediterranean integration framework. *European Law Journal.* №30(4), pp. 595-613. DOI: https://doi.org/10.1111/eulj.12535.
14. Levykin V., Levykin I., Ievlanov M., Petrychenko O. Improvement in the method of case-based management of end-to-end business processes. *Technology audit and production reserves.* 2025. № 5(2). pp. 56–64. DOI: 10.15587/2706-5448.2025.340267.
15. Mammadova F., Abdullayeva N. The role of communication and collaboration in business management. *Economics of the Transport Sector.* 2025. №45. pp. 196-210. DOI: https://doi.org/10.30977/ETK.2225-2304.2025.45.196.
16. Omri H., Omri A., Abbassi A. Macro-level determinants of entrepreneurial behavior and motivation. *International Entrepreneurship and Management Journal.* 2024. №4(20). pp. 2629-2667. DOI: https://doi.org/10.1007/s11365-024-00990-6.
17. Poltorak A., Khrystenko O., Sukhorukova A., Moroz T. and Sharin O. Development of an integrated approach to assessing the impact of innovative development on the level of financial security of households. *Eastern-European Journal of Enterprise Technologies.* 2022. №1/13(115). pp. 103-112. DOI: https://doi.org/10.15587/1729-4061.2022.253062.
18. Poltorak A., Stamat V., Sukhorukova A., Dovgal I., Onyshchenko D. Strategies for regional disproportion management to restore economic security in the Ukrainian agricultural sector. *Ekonomika APK.* 2024. Vol. 31(6). pp. 48-58. DOI: https://doi.org/10.32317/ekon.apk/6.2024.48.
19. Shevchenko S. Digital transformation as a tool for efficient management: a case study in business process management. *Customs scientific journal.* 2025. № 1. pp. 74-86. DOI: https://doi.org/10.32782/2308-6971/2025.1.8
20. Silagadze A., Mekvabishvili E., Gaganidze G., Atanelishvili T., & Chikviladze M. Adaptation of the economic policies of the US, EU and post-Soviet countries to new realities of the global economy: A comparative analysis. *Scientific Bulletin of Mukachevo State University Series "Economics"*. 2024. №11(4). pp.106–119. DOI: https://doi.org/10.52566/msu-econ4.2024.106.
21. Yemets O., Shpak A., Romaniuk T. AI drivers of business transformation: strategic management, data security, marketing. *Efficient economy.* 2025. № 6. DOI: https://doi.org/10.32702/2307-2105.2025.6.48%20.
22. Zianko V., Murha S. Conceptual principles for assessing effective business management. *Innovation and Sustainability.* 2025. Vol. 5, no. 3. pp. 30-41. DOI: https://doi.org/10.31649/vis/3.2025.30.

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