DOI: https://doi.org/10.30525/2256-0742/2026-12-1-89-99

DIRECTIONS OF TRANSFORMATION OF THE MANAGEMENT SYSTEM OF ECONOMIC SECURITY OF THE AGRICULTURAL SECTOR IN THE SYSTEM OF SUSTAINABLE DEVELOPMENT

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Abstract. This article was prepared as part of the Verkhovna Rada of Ukraine's scholarship programme. It focuses on the study of the transformation of management systems for economic security in the agricultural sector in the context of sustainable development. The study is relevant due to modern challenges, particularly geopolitical threats and economic instability, as well as the need to integrate innovations and risk management in Ukrainian agriculture. It has been determined that sustainable development in the agricultural sector is only possible through the implementation of adaptive management systems that consider financial, technological, social and risk aspects of economic security. This study aims to develop and substantiate a conceptual model for transforming the management system for economic security in the agrarian sector. This model takes into account the principles of sustainable development and provides dynamic monitoring, effective risk management, financial stability, and the industry's innovative development. Such a model should focus on increasing the agrarian sector's flexibility, efficiency and stability in the face of internal and external challenges. This study employed a thorough methodological approach that included a theoretical analysis of scientific sources, the construction of a structural-logical model, the development of a system of indicators to assess management effectiveness, a comparative analysis of the best global practices and expert consultations, as well as a SWOT analysis. The study focuses on the theoretical, methodological and applied aspects of forming, developing and improving the economic security management system for the agricultural sector. This system includes the mechanisms, approaches, tools and methods that increase the efficiency of risk management and the financial stability and innovative activities of agricultural enterprises. The study's novelty lies in its comprehensive, integrated approach to transforming the economic security management system in the agricultural sector, taking into account the peculiarities of Ukraine's modern economic, geopolitical and social environment. For the first time, a two-level management model has been proposed which includes subsystems for identifying dangerous situations and implementing strategies to eliminate threats. This ensures a systematic and targeted response to various challenges. A more comprehensive and accurate assessment of the state of economic security and the effectiveness of its management is now possible thanks to an expanded system of complex indicators. For the first time, the integration of innovative technologies and human resources into the security management system is recognised as a key factor in increasing the competitiveness of the agricultural sector. Furthermore, the features of the market and geopolitical environment, which are inherently unstable, have been taken into account. This necessitates the need for flexible adaptive mechanisms for risk management and financial stability. The proposed model incorporates not only the stability of financial indicators, but also the assessment of the effectiveness of technological innovations and social factors. This provides a more comprehensive and adaptive approach to risk management. The implementation of a monitoring system and flexible strategic management enables the agricultural sector to respond in a timely manner to internal and external challenges, increase competitiveness and ensure the country's food security.

Keywords: agricultural sector, economic security, sustainable development, management, methodology.

JEL Classification: Q10, G38, O13, A11, B41

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1. Introduction

In the context of contemporary global turbulence, military challenges and mounting internal and external risks, the economic security of Ukraine's agricultural sector is of paramount importance. The agricultural sector plays a pivotal role in ensuring food security, driving the development of the national economy, and maintaining stability in rural areas. In light of the prevailing geopolitical challenges, the volatility of global markets and the pressing issue of climate change, there is an imperative to transform the economic security management system with a view to enhancing its adaptability, sustainability and innovation (Cabinet of Ministers of Ukraine, 2025).

For the global community, the issue of sustainable development of the agricultural sector is a priority, because agriculture requires the integration of technological innovations, protection from risks and balanced use of natural resources (OECD, 2024). Consequently, the transformation of economic security management systems in the agricultural sector is of both domestic and global significance for Ukraine.

The objective of the present study is to develop and substantiate a conceptual model of the transformation of the economic security management system of the agricultural sector. This model is intended to take into account the principles of sustainable development, provide dynamic monitoring, effective risk management, financial stability and innovative development of the industry. The study employs a comprehensive methodological approach, encompassing a theoretical analysis of scientific sources, construction of a structural-logical model, development of a system of indicators for assessing management effectiveness, comparative analysis with the most effective world practices, as well as expert consultations and SWOT analysis.

To achieve the goal, the following tasks are set in the work:

1. To analyse the role of the state in the formation of the economic security management system of the agricultural sector, to determine the key functions and influence of state institutions on ensuring the sustainable development of the agricultural sector of the national economy.
2. To study the current state and features of innovation and investment support for the economic security of the agricultural sector, to investigate the mechanisms for attracting investments and introducing innovations to increase the competitiveness of the agricultural sector.
3. To develop a conceptual model for the formation of an effective system for managing the economic security of the agricultural sector in the context of sustainable development, which ensures the integration of modern approaches to risk management, financial stability and innovative development.

The material is presented in a logical manner, with a consistent disclosure of research objectives that takes into account the relationship between the theoretical, methodological, and applied aspects of managing the economic security of the agricultural sector. Firstly, the role of the state in establishing a system for managing the economic security of the agricultural sector within the national economy is examined. This section analyses the functions and instruments of state influence that establish the strategic principles of agricultural sector security, create a regulatory framework and provide resources to support the stability and development of the industry. The next section is devoted to the innovative investment provisions for the economic security of the agricultural sector. It highlights modern approaches to attracting investment and the role of innovative technologies in increasing the efficiency of agricultural production. It also covers the management of financial resources as a basis for strengthening the stability of the economic system. The third section presents a conceptual model for forming an effective management system for the economic security of the agricultural sector within a sustainable development framework. Taking into account a comprehensive system of indicators for risk assessment and management, the structure of the model, its key components, interaction processes and mechanisms of adaptation to external and internal challenges are revealed.

The novelty of the work lies in its comprehensive approach to transforming the economic security management system. This approach integrates sustainable development, risk management, financial stability, and innovative solutions into a single model. Unlike traditional static models, the proposed approach focuses on providing a flexible response to internal and external challenges. It combines social, technological, risk and financial aspects, while also taking into account the specifics of the Ukrainian agricultural sector in the context of modern globalisation and conflicts. This is key to enhancing the sustainability and competitiveness of Ukraine's agricultural sector.

2. The Role of the State in Shaping the Economic Security Management System for the Agricultural Sector of the National Economy

Given the strategic importance of the industry for the country's economy, food security and social stability, the role of the state in forming the management system for the economic security of the agricultural sector of the national economy is key. The state acts as the main regulator and coordinator in this area, establishing the regulatory framework, policies and strategies that determine the principles, objectives and mechanisms

for ensuring the economic security of the agricultural sector.

The functions of the state in this process include establishing rules and standards for the activities of agricultural enterprises, monitoring their compliance, providing financial and investment support, as well as creating conditions for the development of innovative technologies and increasing human resources. State regulation of market relations in agriculture plays a significant role in stabilising prices, supporting export-oriented production and protecting the domestic market from adverse external influences.

The pressing necessity to guarantee the viability of the agricultural sector is particularly pertinent in the context of contemporary challenges, namely the intensification of geopolitical tensions, climate change, global economic turbulence and the repercussions of pandemics. It is incumbent upon the state to implement mechanisms that ensure effective monitoring and prompt response to risks, as well as to promote long-term strategic planning. In addition, the state formulates policies to manage risk, protect against external and internal threats, including economic imbalances, corruption, climate challenges and market instability. The system of economic security for the agricultural sector incorporates a multifaceted management approach, encompassing the financial and economic, legal, social, environmental, investment and innovation, and information spheres (Koshkalda et al., 2022).

A pivotal element in this regard is the establishment of an institutional framework encompassing specialised management entities that facilitate analytical support and the coordination of security policies across various levels. Furthermore, the state has established financial and legal incentive mechanisms to motivate agricultural enterprises to pursue sustainable development and innovative activities. In particular, the monitoring of investment activity, the improvement of legislation, the support of innovative activities and environmental protection are of importance.

It is imperative for the state to facilitate the enhancement of the qualification potential of personnel within the agricultural sector. In order to achieve this objective, the establishment of a system of public-private partnership is necessary for the implementation of effective investment projects. These efforts contribute not only to the stabilisation of the agricultural sector, but also to the strengthening of its role in the national economy and the guaranteeing of the country's food security (Mykhnovetskyi, 2024).

Thus, the state's role is to coordinate and integrate the various components of the economic security management system for the agricultural sector. This is achieved through the establishment of legislative norms, the stimulation of innovation, the provision of resource support, and the formation of a monitoring system. Together, these factors create the conditions necessary for the sustainable development of the agricultural sector and an increase in the population's standard of living.

The role of the state in establishing the management system for the economic security of the agricultural sector is confirmed by international sources, which provide theoretical foundations and practical examples. According to the Organisation for Economic Co-operation and Development (OECD), effective agricultural governance involves an iterative process of defining, developing, adopting and implementing policies based on evidence and taking into account the interests of all stakeholders. For instance, under the European Union's Common Agricultural Policy, national governments develop strategic plans that consider environmental, economic, and social factors. This helps to maintain competitiveness and food security (OECD, 2024).

The World Bank emphasises that "investments in research and development, extension services, infrastructure and quality control measures are fundamental to increasing the economic security of the agricultural sector" (World Bank, 2024). Such initiatives pave the way for innovation and bolster the resilience of agricultural systems in the face of climate change and globalised markets. The International Monetary Fund (IMF) emphasises that the role of the state encompasses counteracting market imbalances and economic threats by employing macroeconomic regulations and instruments that support agricultural producers. "Systemic policies should not only protect the domestic market, but also integrate it into global value chains to strengthen its global position" (IMF, 2023). For example, the German government has introduced a comprehensive programme to promote the sustainable development of agriculture, combining innovation grants with strict environmental requirements to strike a balance between productivity and environmental protection (OECD, 2024).

Thus, as evidenced by international research and policy documents, the state plays a central role in shaping the agricultural sector's economic security management system. This involves developing and implementing innovative, adaptive and sustainable agricultural policies that balance economic development with social needs.

In the context of Ukraine, the role of the state in establishing an effective system for managing economic security in the agricultural sector is of paramount importance in order to ensure food security, the stability of the national economy, and the restoration of the country's agricultural potential, particularly in the war and post-war periods. The implementation of martial law has given rise to a number of challenges that are distinct from those posed by other circumstances. These include the

destruction of infrastructure, restrictions on access to resources, logistics and financing problems, which hinder the development of the agricultural sector and threaten its sustainability (Sysolina et al., 2024). In response to these challenges, the state is implementing comprehensive measures, particularly legislative ones, with the aim of supporting agricultural enterprises, protecting land ownership, creating mechanisms for state support and investing in the modernisation of the technical park. Furthermore, the development of co-operation and production diversification programmes is underway, with the objective of mitigating risk and enhancing competitiveness in both domestic and international markets (Sydorov, 2025).

The present study explores the role of the state in establishing the economic security management system for Ukraine's agricultural sector during wartime. The analysis examines the implementation of specific measures aimed at ensuring food security, supporting agricultural production, and restoring infrastructure. In particular, during the war, the state demonstrated its capacity for prompt response to the blockade of ports, the destruction of the logistics network, and damage to agricultural infrastructure. In particular, with the assistance of the Food and Agriculture Organization (FAO) and international partners, the implementation of temporary mobile warehouses and innovative grain storage methods was initiated. This initiative was successful in preventing significant losses to the harvest (TNI, 2023). Furthermore, the Verkhovna Rada of Ukraine passed legislation that automatically extends land lease agreements for the duration of the war, a crucial measure to support agricultural enterprises (The Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine Regarding the Creation of Conditions for Ensuring Food Security under Martial Law", 2022). Concurrently, the primary focus of state support was reoriented towards export-oriented agribusinesses. Consequently, smaller producers experienced a reduction in available resources and support (TNI, 2023). The Ukrainian government has adopted the Strategy for the Development of Agriculture and Rural Areas until 2030, which includes measures to modernise production, develop infrastructure, stimulate agricultural innovation, and improve mechanisms for financial support for farmers and co-operatives (Cabinet of Ministers of Ukraine, 2024). Furthermore, the operational plan for the implementation of the strategy for the period 2025-2027 has been updated, which provides for the active use of digital technologies and green practices in the agricultural sector (AgroTimes, 2025). Drawing upon international experience, particularly in EU countries, it is evident that key successful practices include comprehensive integration of state support with market mechanisms, support for small farmers through co-operation, and a focus on sustainable development and environmental responsibility (OECD, 2024). In the future, Ukraine plans to strengthen support for farms, optimise the subsidy system, and develop the infrastructure for the supply and marketing of products. It is evident that the state will continue to prioritise the development of a flexible, innovative, and inclusive system for managing the economic security of the agricultural sector in the post-war period.

Analytical reviews demonstrate that Ukraine has established a system for monitoring the economic security of the agricultural sector, encompassing financial and economic, legislative, investment and social components. Nevertheless, the efficacy of these measures is still partly impeded by the low level of investment, insufficient integration of innovations and the need to improve comprehensive risk management (Ghladkyi, 2024). Drawing upon international experience, notably that of the European Union countries, Ukraine should deepen the implementation of adaptive models of agricultural policy with a focus on sustainable development. This should involve combining state support with market mechanisms and more actively introducing digital technologies and innovations into production and logistics. This will increase the flexibility and sustainability of the sector (OECD, 2024; World Bank, 2024). Implementing world-class best practices such as strategic planning for agricultural sector development, actively involving private investors, developing an infrastructure network, and strengthening product quality control will create conditions for long-term security and efficiency in Ukraine's agricultural sector in the post-war period.

3. Innovative and Investment Support for the Economic Security of the Agricultural Sector

Mechanisms for attracting investment and implementing innovation are essential for enhancing the competitiveness of the agricultural sector. Analysis of scientific research and practice shows that effective investment attraction relies on a number of factors, including reducing bureaucratic barriers, creating favourable legal and financial conditions, developing investment platforms and infrastructure, and stimulating innovation through public–private partnerships, preferential lending, guarantee funds and tax incentives. The following priority areas have been identified: firstly, the diversification of financing sources; secondly, the development of logistics and certification infrastructure; thirdly, the improvement of the legislative and administrative framework; and fourthly, the implementation of budget and non-state investment projects aimed at modernising the technological base and increasing the added value of production.

With regard to innovation support, this encompasses the promotion of new technologies, the development of digital platforms, the utilisation of biotechnology, and the automation of production processes. The effective implementation of innovations is achieved through the modernisation of production and management potential, the creation of conditions for scientific research and the commercialisation of results, and the establishment of a system of training and advanced training of personnel.

It is evident that the primary contemporary mechanisms employed for the purpose of attracting investments and implementing innovations within the agricultural sector are the establishment of a conducive investment climate, the provision of state incentives and guarantees, the development of innovation infrastructure, and the promotion of active collaboration between the state, business and research institutions. This contributes to enhancing the global competitiveness of the national agricultural sector.

Concurrently, innovation and investment support for the economic security of the agricultural sector constitutes a complex process, encompassing the updating of the material and technical base, the introduction of modern technologies, and the attraction of effective investment resources.

As K. Zhadko and T. Nosova (2020) note, innovations and new technologies are derivatives of investments, and the synergy between them plays a key role in strengthening the economic security of agricultural enterprises in Ukraine. Generalised indicators such as the volume of capital and direct foreign investment, agricultural product indices, and enterprise profitability serve as key indicators for assessing the state of investment and innovation support.

The present state of innovation and investment support for Ukraine's agricultural sector evinces some progress, yet necessitates further enhancement. The analysis indicates insufficient investment activity on the part of small and medium-sized farms, which hinders overall development. The implementation of innovative technologies is predominantly observed in large agricultural enterprises, while the majority of small-scale producers remain without access to the latest solutions (Pivtorak, 2024). This has a detrimental effect on the volume of investments in new technologies, infrastructure modernisation and production development (Tetyu, 2025). Moreover, structural issues, inadequate funding, and a paucity of personnel competence within the innovation sector persist as impediments. It is therefore vital to emphasise the importance of human resource support for innovative activities. This should include advanced training of specialists, as well as the organisation of consultations and training programmes for agricultural producers. These measures will lead to better adaptation of modern technologies to the specifics of the Ukrainian agricultural sector (Pivtorak, 2024).

Concurrently, challenges pertaining to inadequate financial assistance, absence of infrastructure facilities, bureaucratic impediments, and the volatility of the investment climate due to military operations persist (Sysolina et al., 2024). However, the introduction of a number of programmes to support co-operatives, modernise the sector's production and develop digital solutions to increase efficiency has been made possible by public-private partnerships and international assistance (Sysolina et al., 2024). However, the implementation of support programmes at both the state and international levels, incorporating digital technologies and co-operation, has only partially compensated for the negative factors identified.

In the course of conducting a thorough analysis of the innovation and investment support provided to Ukraine's agricultural sector, it is imperative to consider the following key aspects. Firstly, the level of investment in the agricultural sector is contingent on macroeconomic stability and the regulatory environment. Despite a modest uptick in foreign and domestic investment, investment activity is constrained by a pervasive climate of political instability, the intricacies of financing attraction procedures, and an inadequate level of state support. Concurrently, state concession programmes, credit guarantees, preferential taxation and targeted subsidies establish the prerequisites for activating investments; however, their implementation requires enhancement.

Secondly, with regard to the innovative development of the agricultural sector, there has been an increase in the use of digital technologies (AgTech), precision agriculture, biotechnology, the use of drones and farm management systems. However, the level of innovation implementation remains uneven, and the obsolescence of the production base of some agricultural enterprises limits the potential for technological renewal. A significant step is the establishment of scientific and research agricultural hubs, state financing of innovative projects, and the involvement of international support programs (Nehoda, Novak, 2023; Andreev, 2025).

To improve the situation, it is necessary, first of all, to promote:

– Acceleration of reforms in the field of improving the investment climate through simplification of administrative procedures, reduction of the tax burden on agricultural business, introduction of transparent mechanisms of public-private partnership;

– development of an innovation ecosystem that will unite agricultural production, scientific institutions and start-ups, with a focus on technology transfer and modernisation of production processes;

– ensuring systematic state support for innovations, including grant programmes, soft loans, subsidies,

as well as mechanisms for stimulating investments in sustainable development;
– expanding educational and training programmes to improve the skills of agricultural specialists in the field of modern technologies and innovation management;
– active participation in international scientific, technical and investment projects to integrate global developments and standards.

The introduction of these measures is expected to engender favourable conditions for stable investment growth and the more flexible technological development of the national agricultural sector, which will increase its competitiveness in both domestic and global markets.

The policies of the European Union, the United States and China in the agricultural sector demonstrate a variety of approaches to ensuring innovative and investment development, which can serve as examples for Ukraine. The EU's policy in the field of agriculture is focused on supporting sustainable development and digitalisation of the agricultural sector. For example, EU countries adhere to the principles of the Agritech "green course", which includes digitalisation, renewable energy, and modern land management methods (OECD, 2024). The aim of implementing the comprehensive Green Deal strategy and the Farm to Fork initiative is to reduce the negative environmental impact and improve product quality by introducing innovative environmental technologies and digitally equipping farms (OECD, 2024). This policy includes substantial financial grants and subsidies, particularly for small and medium-sized producers, to encourage balanced regional development. Additionally, the EU is developing knowledge exchange platforms between member states to share best practices.

In the United States, agricultural development policy focuses on actively using innovation and precision agriculture. The USDA programme provides support for research projects and the introduction of new technologies in the form of grants and tax breaks. The 2018 Farm Bill focused more attention on introducing biotechnology, using data and integrating digital systems in agriculture. A key element of this is the fostering of public-private partnerships to stimulate private investment in agritech start-ups and innovative solutions. China is taking a strategic, state-led approach, investing heavily in agricultural infrastructure and technological development. The government has set ambitious plans to increase yields and food security, including the goal of increasing grain production to 700 million tonnes by 2025 (CNBC, 2025). The country is also actively developing digital technologies, including smart farming, the genetic modification of crops and process automation. At the same time, the country is expanding its supply chain and creating strategic reserves to minimise its dependence on external suppliers. In other words, the EU focuses on eco-innovation and social justice; the USA, on scientific progress and partnerships with the private sector; and China, on investment scale and technological modernisation. Ukraine could adopt these approaches by combining regulatory initiatives, financial incentives, and the development of innovation infrastructure.

Based on the above, the following recommendations can be offered for the formation of an effective system for managing the economic security of the agricultural sector of Ukraine in the context of innovation and investment support:
– To develop a national strategy that meets international best practices, with an emphasis on innovation, sustainable development and digital transformation;
– to increase financial incentives aimed at small and medium-sized farms to encourage the introduction of advanced technologies;
– to create a reliable system of public-private partnerships to promote the development of innovation ecosystems;
– to implement policy frameworks that support research and development, including grants and subsidies;
– to strengthen training and capacity building for farmers and agribusiness entrepreneurs;
– to establish regional centres of excellence to facilitate knowledge transfer and technology dissemination;
– to introduce digital farming technologies and promote climate-resilient practices;
– to develop strategic stockpiling policies and diversify import sources to strengthen food security.

4. Conceptual Model for the Formation of an Effective System for Managing the Economic Security of the Agricultural Sector in the System of Sustainable Development

The conceptual model for the formation of an effective system for managing the economic security of the agricultural sector in the system of sustainable development should be based on a comprehensive and integrated approach that ensures maximum adaptability, stability and prompt response to external and internal threats. The following section provides a comprehensive overview of the primary components of the aforementioned model (see Figure 1).

The model is predicated on the following principles: systemicity, which provides a comprehensive analysis and interconnection of the elements of the system; evolutionaryness, which provides for the gradual improvement of the system in accordance with changes in the external and internal environment; co-operation between participants in agrarian relations to achieve synergy; transparency of management decisions and

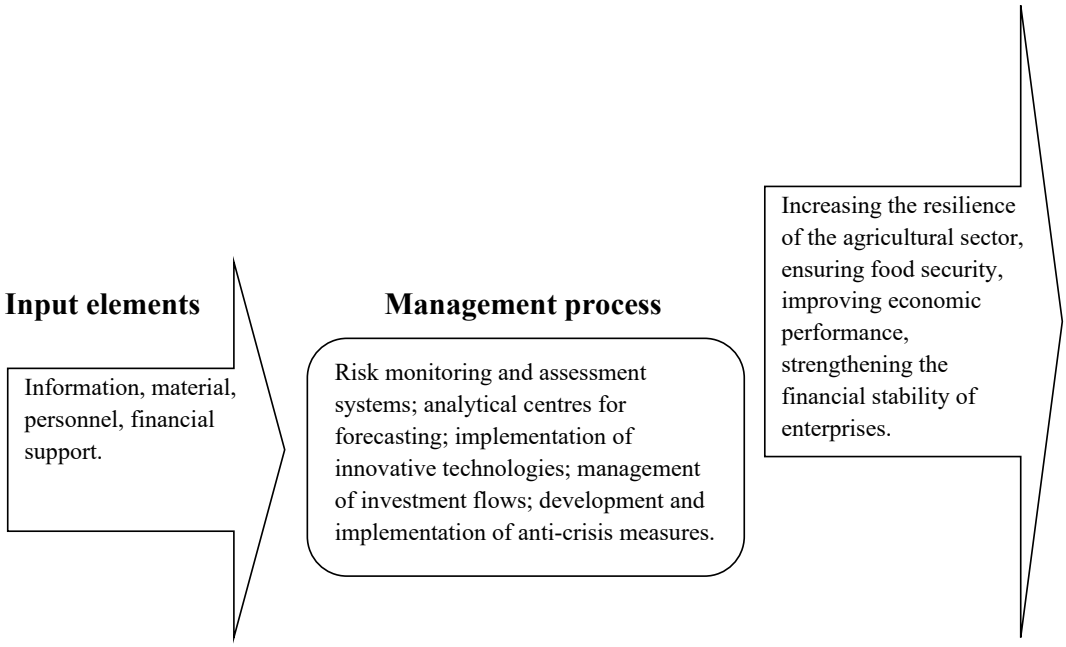

Figure 1. Structural and logical model of the economic security management system of the agricultural sector

processes; predictability, which orients the system to predict risks and threats; taking into account the interests and value orientations of the rural population, taking into account the social tolerance of the transformations carried out. The implementation of this model involves the utilisation of administrative, economic and legal influence mechanisms, which are operationalised through various instruments such as the permitting system, regulatory frameworks, targeted financing mechanisms, pricing strategies, tax mechanisms, the social responsibility of enterprises, and selective foreign economic openness. The subject composition of agrarian relations is comprised of the following entities: landowners, entrepreneurs-tenants, hired agricultural workers, the state, amalgamated hromadas, peasant farms, family farms, large agricultural enterprises (non-family corporations), agricultural service co-operatives, intermediary structures, etc. This conceptual model facilitates the systematisation of management processes whilst ensuring a balance between economic efficiency and social responsibility, thereby creating conditions for the sustainable development of the agricultural sector. It has been demonstrated that this approach contributes to the elimination of contradictions between different interest groups, thereby increasing the competitiveness of enterprises and the sustainability of their functioning in the long term.

The proposed two-level model of economic security management of the agricultural sector is a complex system consisting of two interconnected subsystems: a subsystem for identifying dangerous conditions and a subsystem for implementing strategies for eliminating threats. This management paradigm enables a methodical and targeted response to a broad spectrum of internal and external challenges that jeopardise the stability and advancement of the agricultural sector. This proposal is attributable to the fact that the conventional single-level management model is generally oriented towards reactive measures that are executed at a uniform level, without differentiating between the function of early risk detection. Furthermore, it does not invariably ensure the timeliness of response. The system's capacity for systemic analysis is limited, resulting in diminished flexibility and an elevated risk of critical hazards being overlooked. In contrast, the two-tier model, by distributing responsibility among specialised subsystems, creates a clear management logic, increases efficiency and coordination of actions, and ensures comprehensive coverage of the entire risk management life cycle – from identification to elimination. This structure significantly increases the resilience of the agricultural sector to external and internal challenges, contributing to its stable and sustainable development. It is evident that the two-level model of managing the economic security of the agricultural sector constitutes an innovative, systemic and more effective means of ensuring high-quality management in comparison with traditional approaches. A more detailed consideration of these subsystems and the transition mechanisms between them is warranted. The subsystem responsible for identifying dangerous states performs the functions of monitoring, collecting and analysing information about potential risks. The assessment is based on key indicators of economic, environmental, financial and

social stability, including market fluctuations, climatic anomalies, changes in the legislative field, as well as risks associated with logistics and lending. The subsystem's capacity for early detection of threats facilitates the initiation of response measures in a timely manner, thereby preventing negative consequences.

The subsystem responsible for the implementation of threat elimination strategies is tasked with the development and implementation of measures that are intended to neutralise or minimise the risks that have been identified. This includes the coordination of relevant authorities, agricultural enterprises and other stakeholders, and the implementation of regulatory, financial, technological and organisational solutions. The strategy may include both operational response measures and long-term programmes to strengthen the economic sustainability of the agricultural sector, depending on the level of threat.

The model's algorithm commences with the continuous collection and analysis of information by the identification subsystem, which generates alarm signals in the presence of negative trends. Subsequent to this, the threat level is to be assessed in accordance with established criteria, incorporating such factors as the degree of impact on the economy, the velocity of risk development and the probability of consequences. Subsequently, the information is transferred to the implementation subsystem, which activates the appropriate action plan, selects adequate measures, allocates resources and coordinates their implementation. Constant monitoring of the effectiveness of measures provides feedback and, if necessary, adjusts strategies.

To assess the effectiveness of the two-level model of economic security management in the agricultural sector, the following criteria are proposed. These include productivity, understood as the system's ability to identify threats effectively and in a timely manner; the quality of response, which reflects the correspondence between the measures taken and the nature and level of the threat; flexibility and adaptability, referring to the model's capacity to adjust to dynamic changes in both the external and internal environment; interaction of subsystems, defined as the consistency and coordination between the threat identification subsystem and the implementation subsystem; the level of stakeholder satisfaction, based on assessments provided by users and participants regarding the system's effectiveness; and the impact on sustainable development, which indicates the extent to which the model contributes to the long-term economic and environmental development of the agricultural sector.

In order to achieve a comprehensive evaluation of the efficacy of the economic security management system, it is recommended that a system of indicators be implemented to encompass the following:

– Financial indicators (level of profitability, investment activity, total volume of capital investments);
– risk indicators (level of external and internal threats, impact of crisis situations);
– technological and innovative indicators (level of implementation of IT solutions, updating of the technical base);
– social parameters (employment support, level of personnel qualification).

The provision of such system indicators facilitates the monitoring and timely adjustment of management strategies. The system of indicators employed for the assessment of the effectiveness of economic security management in the agricultural sector is distinguished from the systems delineated in Ukrainian and foreign literature by several significant aspects. Firstly, the proposed system comprehensively covers financial, risk, technological and social parameters, providing multidimensional and comprehensive monitoring of economic security. Foreign sources frequently concentrate on financial or environmental aspects. Numerous studies (Stepanov, 2019) address innovative and technical components; however, social and personnel indicators are not invariably incorporated. An approach of this nature, as is proposed in the system under discussion, provides a more complete understanding of the state of the agricultural sector. Secondly, this system employs a dynamic approach to risk assessment and strategy adjustment in response to both internal and external challenges. In numerous classical models, risks are regarded as a static factor that hinders the capacity for expeditious adaptation to changes in the global market environment or geopolitical events. Thirdly, indicators of technical and innovative development in the system take into account not only the availability of technologies, but also the level of their adaptation and integration into production and management processes, which increases the practical value of the assessment. Fourthly, social parameters, such as the level of employment and qualifications of personnel, are recognised as key in maintaining the sustainable development of the agricultural sector. In other systems, however, they are often given secondary attention (Prystemsky, 2020).

The proposed system is distinguished by its enhanced complexity, adaptability and consideration of technical, economic and social factors. This contributes to an increased effectiveness in monitoring and managing the economic security of the agricultural sector.

In this study, it is proposed that the following algorithm be followed for the formation of directions and the implementation of measures to enhance the effectiveness of the economic security management system of the agricultural sector (Kudelya, 2016): comprehensive analysis of the state of economic security of the agricultural sector using a system of

indicators; determination of priority areas for in creasing security (innovation, investment, human resource development, protection from risks); development of a plan for implementing measures with the definition of deadlines, responsible persons and resource provision; the ability to respond flexibly to external changes, adjusting measures depending on market conditions and geopolitical threats.

This system of forming directions and implementing measures differs from the systems presented in the scientific literature in several key aspects:

1. Integrative approach with a focus on flexibility and adaptability. Conventional models of managing the economic security of the agricultural sector (Kukhar, 2024) frequently emphasise a rigid structure of processes. However, the proposed system focuses on the system's ability to quickly respond and adjust measures in accordance with changes in the market and geopolitical situation. This has been demonstrated to enhance the stability of the system in conditions of instability, a factor that is particularly pertinent in the context of Ukraine.

2. Comprehensive analysis with a wide set of indicators. In contradistinction to narrower schemes, this system employs an expanded set of indicators that encompass not only financial and risk parameters, but also innovation, personnel and social aspects. Multi-aspect monitoring has been demonstrated to enhance the accuracy of evaluating management effectiveness (Utenkova, 2021).

3. Clear definition of priorities, taking into account innovations and human resource development. It is evident that a significant proportion of established models concentrate on risk management or financial stability. In contrast, the considered system introduces a simultaneous priority of innovations, investments and human resource development, which is designed to meet the modern challenges of sustainable development (Kudelya, 2016).

4. Planning with the definition of deadlines, responsible persons and resource provision. The formalisation of these aspects provides a clear system of responsibility and control, which is essential for the effective implementation of measures, which is sometimes lacking in other approaches (Marmul, 2019).

5. Emphasis on the external environment as a factor in adjusting the strategy. It is imperative to acknowledge the role of geopolitical threats and market fluctuations as the primary catalysts for the refinement of management strategies, thereby enhancing the system's realism and adaptability to the unique circumstances of Ukraine, a nation grappling with ongoing instability.

In addition, in order to improve risk management and financial sustainability strategies, it is necessary that risk management be based on:

– Identification of key types of threats (political, economic, natural);
– development of risk minimisation mechanisms, including insurance, diversification of activities, taking measures to ensure cybersecurity;
– creation of financial buffers and support programmes to increase the resilience of enterprises to crisis situations;
– active participation of public and private institutions that coordinate actions and financial flows to support the sector (Utenkova, 2021; Mandych, 2024).

5. Conclusions

To summarise the aforementioned points, it can be concluded that the state plays a pivotal role in establishing a system for managing the economic security of the agricultural sector. This system involves the development and implementation of innovative, adaptive and sustainable agricultural policies, which are capable of balancing economic development and social needs. The economic security of Ukraine's agricultural sector, within the context of innovation and investment support, necessitates further systemic support, the development of public-private partnerships, and the enhancement of the regulatory framework to stimulate innovative development at all levels of agricultural production. For Ukraine, the priority areas are the development and implementation of a national strategy for stimulating investment in the agricultural sector, including the digitalisation of processes, the development of public-private partnerships, and the improvement of personnel skills in the field of innovation. It is also imperative to enhance the legislative framework for stimulating investment and establishing an effective system for monitoring and evaluating outcomes, which will increase competitiveness and ensure the country's food security.

A two-level model for the management of economic security in the agricultural sector is proposed. This complex system consists of two interconnected subsystems: a subsystem for the identification of dangerous conditions and a subsystem for the implementation of strategies for the elimination of threats. This model is an integrative system that combines analytics, strategic management, innovation, and risk management to ensure sustainable development and economic security of the agricultural sector.

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Received on: 04th of November, 2025
Accepted on: 21th of December, 2025
Published on: 26th of January, 2026