

STRENGTHENING THE RESILIENCE OF UKRAINE'S FOOD INDUSTRY IN THE CONTEXT OF WAR, GLOBAL RISKS AND EUROPEAN INTEGRATION

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Abstract: *The article examines the resilience of Ukraine's food industry under the combined influence of full-scale war, global risks and European integration challenges. The purpose of the study is to identify the key factors that affect the stability of the national food industry and to substantiate strategic directions for strengthening its adaptive capacity in wartime and post-war recovery. The research is based on a systemic and analytical approach, combining the assessment of institutional, logistical, economic, environmental and regulatory challenges with the analysis of long-term development priorities for the food sector. Special attention is paid to disruptions in supply chains, loss of production capacities, rising production costs, labour shortages, export constraints, environmental risks and the need to harmonize Ukrainian food policy with European standards. The findings indicate that the resilience of the food industry depends on the development of local food systems, diversification of logistics, support for processing capacities, implementation of food safety and quality standards, digital transformation and stronger institutional coordination. The article argues that European integration should be considered not only as a regulatory obligation, but also as a framework for modernization, innovation and long-term competitiveness of Ukraine's food industry. The practical value of the research lies in outlining policy-oriented measures that may support recovery planning and enterprise-level adaptation.*

Keywords: food industry; resilience; food security; war risks; European integration; Ukraine.

JEL: L66, Q18, O13, F15, H56.

Introduction

The food industry occupies a strategic place in the national economy of Ukraine. It ensures the processing of agricultural raw materials, creates added value, supports employment, forms a significant part of regional economic activity and directly affects the level of food security. In normal economic conditions, the development of the food industry is associated with technological modernization, investment activity, expansion of domestic and foreign markets, improvement of product quality and strengthening of competitiveness. However, in the conditions of full-scale war, the role of the food industry becomes much broader. It turns into one of the critical elements of national resilience, because the stable functioning of food production, processing, storage and distribution is directly connected with the ability of the state and communities to provide the population with safe, affordable and sufficient food.

The full-scale military aggression of the Russian Federation against Ukraine has significantly changed the conditions for the functioning of the national food system. Enterprises of the food industry faced destruction of production facilities, disruption of logistics, loss of access to raw materials, energy instability, shortage of labour resources, growth of production costs, environmental damage and uncertainty in export markets. These challenges affected both large enterprises integrated into national and global supply chains and small and medium-sized producers that are important for local food systems. At the same time, the war demonstrated the importance of flexibility, territorial diversification and the ability of the food sector to adapt to crisis conditions (FAO, 2021; World Bank, 2024).

The relevance of this research is also determined by the global context. Food systems around the world are increasingly affected by climate change, energy instability, volatility of international markets, changes in consumer behaviour, pandemic consequences, geopolitical conflicts and increasing requirements for food safety and environmental sustainability. For Ukraine, these global risks are combined with the direct consequences of war and the need to deepen European integration. Therefore, the issue of strengthening the resilience of the food industry should be considered not only as a short-term anti-crisis task, but also as a strategic direction of national economic development.

European integration creates both new opportunities and new requirements for Ukraine's food industry. Approximation to European Union standards opens access to broader markets, improves the quality and safety of food products and stimulates institutional modernization. At the same time, compliance with European requirements requires significant investments, organizational changes, improvement of regulatory mechanisms and adaptation of enterprises to stricter standards. For many Ukrainian producers, especially small and medium-sized enterprises, this process may be difficult without targeted state support and international technical assistance.

The purpose of this article is to identify the main wartime and global risks affecting Ukraine's food industry and to substantiate strategic directions for strengthening its resilience in the context of European integration. The research objectives are to clarify the role of resilience in the development of food systems, analyse the main groups of risks for Ukraine's food industry, determine the importance of European integration as a modernization framework and propose priority directions for strengthening the adaptive capacity of the sector.

The methodological basis of the study is a systemic approach to the analysis of the food industry as a complex socio-economic and institutional system. The research also uses methods of generalization, comparative analysis, logical analysis and synthesis of scientific, analytical and regulatory materials related to food security, industrial development, wartime recovery and European integration.

Theoretical background: resilience of food systems and food industry. The concept of resilience has become increasingly important in the analysis of economic systems, food security and industrial development. In general terms, resilience means the ability of a system to withstand shocks, adapt to changing conditions and continue to perform its basic functions. For food systems, resilience is primarily associated with the ability to ensure stable access to food, maintain production and distribution chains, preserve the quality and safety of products and adapt to economic, environmental, political and social changes.

The food industry is an important component of food system resilience because it connects agricultural production with final consumption. It transforms raw materials into food products, provides storage and processing, forms added value and supports the stability of food supply. If the food industry is weak, fragmented or excessively dependent on vulnerable logistics and energy systems, the entire food system becomes more sensitive to shocks. Conversely, a technologically developed, regionally balanced and institutionally supported food industry can increase the resilience of the national economy and reduce the risks of food insecurity. The conceptual framework for optimizing the development of the food industry highlights this role in the broader context of implementing the national economic strategy (Sychevskyi et al., 2025).

In the context of Ukraine, the resilience of the food industry should be considered at several levels. At the national level, it concerns the ability of the country to ensure food security, maintain processing capacities, support exports and prevent excessive dependence on imports. At the regional level, resilience is associated with the ability of territorial communities and regions to provide basic food needs, preserve local production chains and support employment. At the enterprise level, resilience means the ability of producers to adapt to interruptions in raw material supply, energy shortages, changes in demand, labour shortages, price volatility and regulatory changes.

An important element of resilience is adaptability. The food industry must not only return to its previous state after a shock, but also transform in accordance with new conditions. In this sense,

resilience is closely related to modernization. The goal should not be the mechanical restoration of pre-war production models, but the creation of a more flexible, innovative and competitive food industry. This includes technological renewal, digitalization, energy efficiency, development of local food systems, strengthening of quality and safety standards, improvement of logistics and expansion of cooperation between the state, business, science and international partners.

The resilience of food systems is also connected with sustainability. A food industry that ignores environmental limits, resource efficiency and social responsibility cannot be considered resilient in the long term. Therefore, resilience should include economic, social, environmental and institutional dimensions. Economically, the food industry must remain competitive and financially viable. Socially, it must contribute to employment, food availability and regional development. Environmentally, it must reduce waste, use resources efficiently and respond to climate-related challenges. Institutionally, it must operate within a clear regulatory framework and be supported by effective public policy.

For Ukraine, this multidimensional understanding is especially important because the country is simultaneously solving several strategic tasks: maintaining food security during the war, restoring destroyed and damaged capacities, preserving export potential, adapting to European standards and preparing for post-war reconstruction. These tasks cannot be separated from each other. Strengthening resilience means building a food industry that is able to function under crisis conditions and at the same time move towards European integration and long-term competitiveness.

Wartime and global risks for Ukraine's food industry. The full-scale war created a complex system of risks for Ukraine's food industry. These risks are not isolated. They interact with each other and often create cumulative effects. For example, damage to infrastructure increases logistics costs, logistics problems affect access to raw materials, energy instability increases production costs, and all these factors together reduce competitiveness and investment attractiveness.

One of the most important groups of risks is related to the destruction and damage of production capacities. Food enterprises located in regions affected by hostilities have faced direct physical damage, loss of equipment, interruption of production processes and difficulties in maintaining labour collectives. In some cases, enterprises were forced to suspend their activities or relocate to safer regions. Such processes changed the regional structure of food production and created additional pressure on enterprises that continued to operate (Deineko et al., 2025).

Logistical disruptions have become another critical challenge. Before the full-scale invasion, a significant part of Ukrainian exports depended on seaports and established transport corridors. The blockade and insecurity of maritime routes, destruction of transport infrastructure, congestion at border crossings and the need to reorient export flows to alternative routes significantly complicated the movement of raw materials and finished products. For the food industry, this meant higher transport costs, longer delivery times, uncertainty in export contracts and a decrease in profitability (Rybak, 2025).

The raw material base of the food industry was also affected. Agricultural production suffered from occupation of territories, mining of agricultural land, destruction of farms, shortage of fuel and fertilizers, disruption of seasonal field works and environmental damage. As the food industry depends on a stable supply of agricultural raw materials, any reduction in the volume or quality of such raw materials directly affects processing enterprises. This is especially relevant for grain processing, oil and fat production, dairy processing, meat processing, fruit and vegetable processing and other sectors. According to available data, the food industry maintained its position as one of the key manufacturing sectors despite these wartime disruptions (State Statistics Service of Ukraine, 2021–2024).

Energy risks have become particularly significant. Attacks on energy infrastructure and the general instability of energy supply increased the vulnerability of food enterprises. Many technological processes in the food industry require continuous energy supply, refrigeration, heating, water

treatment and strict sanitary conditions. Interruptions in electricity supply can lead not only to economic losses, but also to deterioration of product quality and safety risks. Therefore, energy autonomy and energy efficiency have become important components of enterprise resilience.

Another important challenge is the increase in production costs. The war led to higher prices for energy, fuel, raw materials, packaging, logistics and imported equipment. Currency fluctuations and inflationary pressure also affected the cost structure of enterprises. As a result, producers faced the difficult task of maintaining affordable prices for consumers while preserving financial viability. This is especially important because food products belong to basic goods, and excessive price growth can deepen social vulnerability.

Labour shortages also affect the food industry. Mobilization, internal displacement, migration abroad and changes in the structure of regional labour markets reduced the availability of qualified personnel. Enterprises faced difficulties in finding workers, technologists, engineers, logistics specialists and managers. The shortage of human capital may slow down modernization, reduce productivity and complicate the introduction of new quality and safety standards.

Environmental risks caused by the war have long-term consequences for the food industry. Pollution of land and water resources, destruction of irrigation systems, damage to ecosystems, mining of territories and contamination with explosive remnants of war can affect the quality of raw materials and the safety of food products. These risks require systematic monitoring, environmental restoration and integration of environmental safety into food industry development strategies.

Global risks also remain relevant. Climate change affects agricultural productivity, water availability and the stability of raw material supply. Volatility in global food markets affects prices and export opportunities. Geopolitical tensions influence trade routes and access to international markets. At the same time, consumer demand is changing in favour of safer, healthier, more sustainable and traceable food products. Therefore, Ukrainian food enterprises must adapt not only to wartime challenges, but also to global transformations of food markets.

The combination of wartime and global risks demonstrates that the resilience of Ukraine's food industry cannot be strengthened by one isolated measure. It requires a comprehensive policy that includes support for enterprises, restoration of infrastructure, development of logistics, energy security, access to finance, innovation, quality management and integration into European markets.

European integration as a framework for modernization. European integration is one of the key strategic directions for Ukraine's development. For the food industry, this process has a special meaning because access to the European market depends on compliance with strict requirements for food safety, quality, traceability, environmental standards and consumer protection. International organizations have emphasized that comprehensive reforms in agricultural and food policy are essential for Ukraine's long-term competitiveness and sustainable EU alignment (OECD, 2022). Therefore, European integration is not only a political or trade process, but also a deep institutional and technological transformation of the food sector.

The harmonization of Ukrainian legislation with European Union standards creates a framework for improving the quality and safety of food products. The implementation of HACCP principles, sanitary and phytosanitary measures, traceability systems and modern control procedures is essential for increasing consumer confidence and expanding export opportunities. In the long term, this can strengthen the competitiveness of Ukrainian producers both in domestic and foreign markets (European Commission, 2023).

However, compliance with European standards requires significant efforts from enterprises. Large companies usually have more resources to implement quality management systems, modernize equipment and meet certification requirements. Small and medium-sized enterprises often face financial, organizational and informational barriers. Therefore, state policy should include targeted support mechanisms for SMEs, advisory services, training programs, simplified access to information and financial instruments for modernization.

European integration can also stimulate technological renewal of the food industry. Modern European approaches emphasize resource efficiency, reduction of food losses and waste, circular economy, energy efficiency, environmental responsibility and digital traceability. These directions are fully consistent with the need to build a more resilient food industry in Ukraine. For example, the development of circular models can help reduce dependence on primary resources, use by-products more efficiently and create additional value.

An important aspect of European integration is the development of institutional capacity. Effective food policy requires coordination between ministries, regional authorities, regulatory bodies, business associations, scientific institutions and international partners. Weak institutional coordination can slow down reforms and create uncertainty for enterprises. Therefore, the modernization of the food industry should be supported by clear strategic documents, transparent regulatory procedures, reliable monitoring and evidence-based decision-making.

European integration also creates opportunities for expanding export potential. Ukraine has strong agricultural and food production capacities, but the structure of exports still needs improvement. The development of processing and the production of goods with higher added value should become a strategic priority. Exporting raw materials alone does not fully use the economic potential of the country. Strengthening the processing sector can increase revenues, create jobs, support regional development and reduce vulnerability to price fluctuations in raw commodity markets.

At the same time, integration into the European market increases competition. Ukrainian producers will have to compete not only by price, but also by quality, reliability, sustainability, innovation and brand reputation. This requires a shift from survival strategies to development strategies. Even under wartime conditions, it is important to prepare the food industry for post-war competition, modernization and integration into European value chains.

Therefore, European integration should be considered as a modernization framework for strengthening resilience. It helps define the direction of reforms, improves regulatory standards, opens access to markets and stimulates innovation. However, to turn these opportunities into real results, Ukraine needs a balanced policy that combines regulatory approximation with practical support for enterprises.

Strategic directions for strengthening the resilience of Ukraine's food industry. Strengthening the resilience of Ukraine's food industry requires a set of strategic measures aimed at reducing vulnerabilities and increasing adaptive capacity. These measures should combine short-term crisis response with long-term modernization priorities outlined in national strategies (Cabinet of Ministers of Ukraine, 2021; Ministry of Agrarian Policy and Food of Ukraine, 2024). The key risks and relevant resilience measures are summarized in Table 1.

Table 1. Main risks and resilience measures for Ukraine's food industry

Risk group	Main manifestations	Priority resilience measures
Logistical risks	Blocked or overloaded transport corridors; increased delivery time and costs; uncertainty of export routes.	Diversification of logistics; development of multimodal routes; modernization of storage and border infrastructure.
Production capacity risks	Damage or loss of enterprises, equipment and warehouses; forced relocation; interruption of production cycles.	Investment support; reconstruction of damaged facilities; regional diversification of processing capacities.
Raw material risks	Loss of agricultural land; mining and environmental contamination; shortages of fuel, fertilizers and inputs.	Support for agricultural producers; demining and land restoration; stable contracts between farmers and processors.
Energy risks	Power outages; higher energy prices; risks for refrigeration, heating and sanitary processes.	Energy efficiency; backup power systems; renewable energy solutions; modernization of equipment.

Risk group	Main manifestations	Priority resilience measures
Labour and skills risks	Mobilization, migration and shortage of qualified personnel; lack of technologists and engineers.	Professional training; cooperation with universities; support for displaced specialists; upskilling programs.
Regulatory and market risks	Need to comply with EU standards; limited resources for certification; growing competition.	Consulting support for SMEs; HACCP implementation; access to finance; integration into European value chains.
Environmental risks	Pollution of soils and water; destruction of irrigation systems; risks for food safety and raw material quality.	Environmental monitoring; remediation; waste management; climate-smart and resource-efficient technologies.

Source: developed by the author based on the synthesis of wartime food industry risks and resilience policy approaches.

The first direction is the development of local and regional food systems. The war demonstrated that excessive dependence on centralized supply chains can create serious risks in crisis conditions. Local food systems can provide communities with basic food products, support small producers, reduce logistics dependence and increase territorial resilience. This does not mean isolation from national and global markets. Rather, it means creating a balanced system in which national, regional and local levels complement each other.

The second direction is diversification and modernization of logistics. Food industry enterprises need reliable access to raw materials, packaging, equipment and sales markets. Therefore, the restoration and development of transport infrastructure, border capacity, storage facilities, refrigeration chains and multimodal logistics are essential. Special attention should be paid to export routes, because food industry products with higher added value require stable and predictable logistics.

The third direction is support for processing capacities. The development of deep processing of agricultural raw materials should become one of the foundations of post-war recovery. Processing increases added value, creates jobs, strengthens regional economies and reduces dependence on raw commodity exports. Support instruments may include concessional loans, grants, tax incentives, investment guarantees and public-private partnerships.

The fourth direction is energy resilience. Food enterprises need stable energy supply, especially those that depend on refrigeration, drying, heat treatment and continuous technological processes. Energy efficiency programs, renewable energy sources, backup power systems and modernization of equipment can reduce vulnerability to energy shocks. In the long term, energy resilience also contributes to environmental sustainability and lower production costs.

The fifth direction is implementation of food safety and quality standards. Compliance with HACCP and European requirements should be supported not only through control, but also through education, consulting and financial assistance. It is important to help small and medium-sized enterprises adapt to modern standards, because they play a significant role in local food systems and regional development.

The sixth direction is digital transformation. Digital tools can improve traceability, logistics planning, resource management, risk monitoring and interaction between producers, suppliers, regulators and consumers. Digitalization can also increase transparency and support integration into European value chains. However, digital transformation requires investment in skills, infrastructure and cybersecurity.

The seventh direction is strengthening human capital. The food industry needs qualified workers, engineers, technologists, managers and specialists in quality control, logistics, export operations and digital systems. Training programs, cooperation with universities and research institutions, professional education and support for displaced specialists can help solve labour market challenges. The eighth direction is institutional coordination. The resilience of the food industry cannot be ensured only by enterprises. It depends on public policy, regulation, regional development strategies,

international assistance and scientific support. Therefore, Ukraine needs a coherent system of strategic planning, monitoring of risks and coordination between stakeholders. Scientific institutions can play an important role in providing analytical support, developing methodologies, assessing risks and preparing policy recommendations.

The ninth direction is environmental restoration and sustainability. The food industry depends on the quality of land, water, ecosystems and agricultural raw materials. Therefore, post-war recovery should include environmental monitoring, remediation of polluted territories, restoration of irrigation systems, waste management and support for environmentally friendly technologies. This is also important for compliance with European sustainability requirements.

The tenth direction is international cooperation. Ukraine needs continued support from international organizations, donor institutions, European partners and research networks. Such cooperation can provide financial resources, technical assistance, access to best practices and integration into international innovation systems. However, international support should be connected with national priorities and long-term development strategies.

These strategic directions are interconnected. Support for processing capacities requires energy resilience, logistics, investment and skilled personnel. European standards require institutional capacity, training and modernization. Local food systems depend on regional infrastructure, small producers and access to finance. Therefore, resilience policy should be systemic and coordinated.

Conclusions

The resilience of Ukraine's food industry has become one of the key conditions for maintaining food security, supporting economic stability and ensuring post-war recovery. The full-scale war has exposed the vulnerabilities of the national food system, including dependence on critical infrastructure, logistics disruptions, loss of production capacities, energy instability, raw material risks, labour shortages and environmental damage. At the same time, the food industry has demonstrated significant adaptive capacity and remains one of the strategic sectors of the Ukrainian economy.

The study shows that resilience should not be understood only as the ability to survive shocks. In the context of Ukraine, resilience also means the ability to transform, modernize and integrate into the European economic and regulatory space. Therefore, strengthening the resilience of the food industry should combine crisis response measures with long-term development priorities.

European integration plays a dual role in this process. It creates additional requirements for Ukrainian producers, especially in the fields of food safety, quality, traceability and environmental standards. However, it also provides a modernization framework, opens access to markets and encourages technological renewal. For this reason, European integration should be used as an instrument for strengthening competitiveness and institutional development.

The main strategic directions for strengthening resilience include the development of local food systems, diversification of logistics, support for processing capacities, improvement of energy resilience, implementation of European food safety standards, digital transformation, development of human capital, institutional coordination, environmental restoration and international cooperation. These directions should be integrated into national and regional strategies for food industry development.

A limitation of this study is that it is mainly based on general analytical assessment and synthesis of existing materials. Further research should include more detailed quantitative analysis of regional differences, enterprise-level resilience indicators and the effectiveness of specific support instruments. Ongoing research at the Institute of Food Resources of NAAS provides an important analytical foundation for these strategic decisions (Institute of Food Resources of NAAS, 2021–2025). It would also be useful to develop a practical methodology for assessing the resilience of food industry enterprises under wartime and post-war conditions.

In general, the future of Ukraine's food industry depends on the ability to transform wartime adaptation into a long-term modernization strategy. A resilient food industry can become one of the foundations of national economic recovery, regional development, food security and Ukraine's successful integration into the European economic space.

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