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ROZWÓJ SEKTORA ROLNEGO GOSPODARKI UKRAINY W WARUNKACH STANU WOJENNEGO: STRATY NARODOWE I PERSPEKTYWY MIĘDZYNARODOWE

DEVELOPMENT OF THE AGRICULTURAL SECTOR OF UKRAINE'S ECONOMY UNDER MARTIAL LAW: NATIONAL LOSSES AND INTERNATIONAL PROSPECTS

ABSTRAKT: Sektor rolny Ukrainy stanowi strategiczny element gospodarki narodowej, zapewniając bezpieczeństwo żywnościowe państwa oraz kształtując znaczną część jego potencjału eksportowego, co sprzyja zatrudnieniu na obszarach wiejskich i stabilizacji społeczno-gospodarczego rozwoju terenów wiejskich. Uwagę poświęcono dyskursowi na temat zrównoważonego charakteru produkcji rolnej w warunkach wojny, adaptacji polityki do nowych zagrożeń, a także miejscu krajowego rolnictwa w międzynarodowych perspektywach strategicznych, w tym postanowieniom Europejskiego Zielonego Ładu oraz Wspólnej Polityki Rolnej UE.

Celem artykułu jest określenie specyfiki funkcjonowania sektora rolnego gospodarki Ukrainy w warunkach stanu wojennego, a na tej podstawie zaproponowanie oceny skali i struktury bezpośrednich i pośrednich strat sektora rolnego w wyniku wojny oraz wskazanie możliwości i perspektyw jego odbudowy w kontekście integracji międzynarodowej.

Główną hipotezą jest założenie, że odbudowa i zrównoważony rozwój sektora rolnego w warunkach wojny i powojennej odbudowy są możliwe pod warunkiem kompleksowej oceny strat, adaptacji międzynarodowych instrumentów zarządzania ryzykiem, integracji z rynkami europejskimi oraz aktywnego wdrażania innowacyjnych modeli biznesowych.

Główne wnioski z badania wskazują na potrzebę stworzenia zintegrowanego systemu monitorowania strat w sektorze rolnym z uwzględnieniem standardów międzynarodowych. Dodatkową wartością badania jest opracowanie koncepcyjnych podstaw adaptacji narzędzi GFDRR do kontekstu krajowego, w celu uzasadnienia decyzji dotyczących odbudowy sektora oraz zwiększenia odporności podmiotów gospodarczych na wsi, co stanowi przedmiot zainteresowania naukowców, decydentów politycznych i międzynarodowych darczyńców.

SŁOWA KLUCZOWE: rezyliencja, bezpieczeństwo żywnościowe, gospodarka wiejska, zarządzanie kryzysowe, innowacje rolnicze, zrównoważony rozwój rolnictwa

ABSTRACT: The agricultural sector of Ukraine is a strategic component of the national economy, ensuring the country's food security and forming a significant part of its export potential, which contributes to rural employment and the stabilization of the socio-economic development of rural areas. Attention is paid to the discourse on the sustainability of agricultural production in the context of war, the adaptation of policy to new risks, and the place of national agriculture in international strategic perspectives, including the provisions of the European Green Deal and the EU Common Agricultural Policy.

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The purpose of the article is to identify the features of the functioning of Ukraine's agricultural sector under martial law and, based on this, to propose an assessment of the scale and structure of direct and indirect losses of the agricultural sector as a result of the war, as well as to outline the opportunities and prospects for its recovery in the context of international integration.

The main hypothesis is the assumption that the recovery and sustainable development of the agricultural sector during the war and post-war reconstruction are possible, provided there is a comprehensive assessment of losses, adaptation of international risk management tools, integration into European markets, and active implementation of innovative business models.

The main conclusions of the study indicate the need to establish a unified damage monitoring system in the agricultural sector in accordance with international standards. An additional value of the study is the development of conceptual foundations for adapting GFDRR tools to the national context in order to substantiate decisions regarding sectoral recovery and to enhance the resilience of rural economic entities, which is of interest to scholars, policymakers, and international donors.

KEYWORDS: resilience; food security, rural economy, crisis management, agricultural innovation, agricultural sustainability

INTRODUCTION

Problematic situation

Throughout the entire period of Ukraine's state sovereignty, the agricultural sector has performed a systemic function by ensuring food security, generating foreign currency earnings through exports, and implementing a mechanism for the socio and economic stabilization of rural areas by providing employment. However, the full-scale military aggression of the Russian Federation against Ukraine has led to a profound destabilization of the sector's functioning, causing multi-faceted losses at the national level. A significant portion of agricultural infrastructure (elevators, warehouses, vehicles) has been destroyed, the area under cultivation has decreased due to the temporary occupation of territories, and both internal and external logistics chains have been disrupted. Additionally, access to financial resources, innovations, and insurance services for agricultural producers has been reduced.

The agrarian crisis caused by the war dictates new rules and priorities for agricultural policy that can ensure the resilience of production systems, the diversification of economic activity, and the preservation of human capital in rural areas. The integration of national agricultural policy into the European Green Deal and the EU's Common Agricultural Policy is one of the stages in transforming the agricultural production model towards environmental sustainability, digitalization, development of cooperation, and inclusive growth.

M. Nehrey, A. Taranenko, and I. Kostenko highlight the main issues hindering the development of the agricultural sector: a low level of transparency in land relations, the mismatch between national regulatory and technological standards and international quality and safety requirements for agricultural products, low levels of investment, the irrelevance of Ukrainian legislation to EU requirements, dependence on state funding, and underdeveloped logistics¹. Oleksandr Shpykuliak argues that the institutional adaptation of agricultural enterprises in Ukraine to the

¹ M. Nehrey, A. Taranenko, I. Kostenko, *Ukrainian agricultural sector in wartime: problems and prospects*. Economy and Society. 2022, No. 40, p. 3.

conditions of the European Green Deal is the foundation for economic growth and the creation of additional jobs².

The war in Ukraine has positioned small agribusinesses and family farms as key players in maintaining rural employment and as primary beneficiaries of state support through preferential financing and credit instruments³. The development of farming and agricultural enterprises necessitates the formation of a conceptually new agricultural policy focused on institutional recovery and the socio-economic stabilization of rural areas in the post-war period, substantiating the optimal model of its functioning in the face of transformational challenges⁴.

Based on previous research and a critical review of the scientific literature, the main approaches to analyzing the transformations of Ukraine's agricultural sector under full-scale war conditions have been presented, particularly regarding the scale of economic losses, the impact of the armed conflict on food security, regional employment, and agricultural exports. The assessment of the scale of economic losses and the impact of the armed conflict necessitates the implementation of mechanisms for compensating the damages incurred by agricultural enterprises during martial law. Compensation for damages caused to agricultural enterprises during martial law in Ukraine is carried out taking into account the actual costs of restoring damaged or destroyed assets and the absence of the possibility to involve independent appraisers, the calculation of damages may be conducted independently based on current market prices and projected financing for the restoration of a specific asset⁵. The analysis was based on an interdisciplinary approach, which allowed for a comprehensive assessment of the challenges, threats, and potential of the agricultural sector under martial law and during post-war recovery.

RESEARCH OBJECTIVES

Main research objective

The main objective of the study is to identify the specific features of the functioning of Ukraine's agricultural sector under martial law, to assess the scale and structure of direct and indirect losses of the agricultural sector resulting from the full-scale war, as well as to outline the opportunities and prospects for the recovery and development of the agricultural sector in the context of international integration and a sustainable growth strategy.

Specific research objectives

1. Conducting a comprehensive scientific analysis of the transformational processes taking place in Ukraine's agricultural sector under the impact of martial law.

² O. Shpykuliak, *Development of forms of economic organization for effective employment in rural areas based on the principles of the European Green Deal*. Digital Economy and Economic Security, 2024, 5 (14), p. 179.

³ O. Shpykuliak, M. Malik, S. Kravchenko, L. Zaboranna, *Organisational and economic support for the development of business enterprises in agriculture under martial law*. Ekonomika APK, 2024. 31(2), p. 68.

⁴ O. Shpykuliak, M. Humeniuk, D. Shelenko, D. Nemish, S. Balaniuk, *Management Of Farm Development And Their Role In The Socio-Economic Recovery Of Rural Areas*. Journal of Vasyl Stefanyk Precarpathian University, 2025, Vol. 12, No. 2, p. 101-102.

⁵ V. Zhuk, M. Pugachov, O. Shpykuliak, Yu. Bezdushna, Ye. Popko, *Application of accounting for the assessment of war losses for agribusiness enterprises of Ukraine*. Agricultural and Resource Economics. 2023. Vol. 9. No. 3, p. 206-207.

2. Determining the scale of national economic losses caused by the destruction of production infrastructure, disruption of logistics chains, and the decline in agricultural productivity.
3. Identifying the stages of implementing damage assessment tools in Ukraine's agricultural sector (based on GFDRR practices).

RESEARCH PROBLEMS

Main research problem

The protracted nature of the armed conflict, which has lasted for more than three years, highlights the need for a systematic identification and scientific-methodological justification of the directions for the development of the agricultural sector. This involves the formulation of strategic objectives, the assessment of national losses, the development of compensation instruments, and the identification of prospects for international integration into the European Green Deal and the EU Common Agricultural Policy.

Detailed research problems

Despite the gradual alignment of national agricultural policy with the requirements of the European Union, a number of systemic challenges persist in the domestic agricultural sector. The lack of a proper strategic vision, limited state support, investment shortages, and insufficient institutional capacity create additional obstacles to realizing international prospects. The issue of agricultural sector development during wartime is multifaceted and requires a systemic approach that considers not only losses but also the potential for post-conflict recovery and integration into the European economic space based on sustainable development.

RESEARCH HYPOTHESES

Main hypothesis

The war in Ukraine is critically transforming the agricultural sector, opening new prospects for international integration and structural restructuring aimed at increasing the resilience, innovation, and competitiveness of economic entities.

Specific hypotheses

The consequences of Russia's invasion of Ukraine have severely undermined the potential for gross value-added growth in the agricultural sector, thereby disrupting domestic food security and the flow of export-oriented chains.

International donor support, EU trade preferences, and the reconfiguration of logistics routes contribute to the reorientation of Ukrainian agricultural exports from the Asian to the European market.

RESEARCH METHODS

The methodological foundation of the study is based on a comprehensive, interdisciplinary approach to examining the challenges faced by Ukraine's agricultural sector under martial law. Given the complexity of the issue, the article employs a combination of general scientific,

economic-statistical, graphical, empirical, and content analysis methods, which allow for the identification of both quantitative and qualitative aspects of the phenomenon under study.

The use of comparative analysis made it possible to trace the dynamics of Ukraine's agricultural exports and imports during the period from 1991 to 2023 in order to identify changes in the structure of foreign trade and determine its sensitivity to political and security challenges. Statistical data were obtained from the World Development Indicators database.

The assessment of socio-economic trends in the sector was carried out using the method of economic-statistical analysis (analysis of employment dynamics in the agricultural sector and labor productivity in agriculture). To identify the degree of correlation between the aforementioned indicators, the Pearson correlation coefficient was applied, which enabled a quantitative assessment of the strength and direction of the relationship between employment levels and labor efficiency.

By applying the method of structural-logical generalization, the logic of the stages of implementing damage assessment tools in the agricultural sector was constructed, taking into account the practice of the Global Facility for Disaster Reduction and Recovery (GFDRR) adapted to the Ukrainian context. The use of this method contributed to the integration of international experience into national agricultural loss management practices.

AGRICULTURAL ECONOMY OF UKRAINE UNDER THE PRESSURE OF WAR: FROM LOSSES TO RECONSTRUCTION STRATEGIES

The outbreak of the full-scale aggression of the Russian Federation against Ukraine became a critical turning point in the global security environment and the functioning of the international system, triggering irreversible socio-economic processes. The war has left a significant mark on agricultural policy, altering the trajectory of the transformation of Ukrainian agriculture. With the beginning of the full-scale armed aggression against Ukraine, the strategically important agricultural sector faced previously unknown challenges related to the destruction of infrastructure, restricted access to markets, landmines on agricultural lands, increasing risks to the lives of agricultural workers, and declining investment activity.

The further development of Ukraine's agricultural sector is considered by the author of the article in a global, systemic manner and taking into account regional integration processes, as it serves as an important marker of international prospects (the provisions of the European Green Deal, Common Agricultural Policy – CAP), setting the vector for transforming the agricultural model based on the principles of greening, sustainability, and inclusiveness. The resilience of Ukraine's agricultural sector, despite numerous losses, is described in the works of Valerii Zhuk

et al.⁶, Alan Yuhas⁷, Maryna Nehrey et al.⁸, and Roman Neyter et al.⁹, where emphasis is placed on the ability of agricultural production to adapt to wartime conditions, preserve export potential, and gradually restore production infrastructure. Nataliia Kussul et al.¹⁰, Mariana Shkoda et al.¹¹, and data from the Website of the National Institute for Strategic Studies¹² demonstrate that, despite large-scale damage to agricultural land, Ukraine's agricultural sector shows a high level of resilience and adaptability. Enterprises and households are actively implementing innovative approaches to agricultural production, diversifying sales channels¹³, forming new models of cooperation, and attracting international aid. Thanks to the joint efforts of the state, international partners, and the farmers themselves, it has become possible not only to minimize the negative consequences of the war but also to lay the foundation for the post-war reconstruction of the sector based on the principles of resilience, environmental sustainability, and food security.

The war in Ukraine has led to the destruction of agricultural entrepreneurial ecosystems, eliminating production capacities and infrastructure, which has resulted in irreversible losses, exacerbated the crisis in rural communities, hindered the development of entrepreneurial structures, and increased pressure on the country's economy, food, and energy security¹⁴. This statement leads the author to conclude that the growing pressure on the economy, food, and energy security of the country will have a long-term impact on the agricultural sector.

The prolonged military conflict highlights the urgent need to create transparent and effective compensation mechanisms for losses suffered by both citizens and agricultural business entities. In January 2023, the International Marketing Group (Germany's Relief Coalition)¹⁵ conducted a survey of Ukrainian farming enterprises, which revealed insufficient attention to compensation for the losses they had incurred, especially for small and medium-sized farms, as they are the backbone of food security and exports. The existence of legally enshrined compensation

⁶ V. Zhuk, M. Pugachov, O. Shpykuliak, Yu. Bezdushna, Ye. Popko, *Application of accounting for the assessment of war losses for agribusiness enterprises of Ukraine*. Agricultural and Resource Economics. 2023. Vol. 9. No. 3, p. 198.

⁷ A. Yuhas, *Thousands of Civilian Deaths and 6.6 Million Refugees: Calculating the Costs of War*. The New York Times. 2022.

⁸ R. Neyter, S. Zorya, O. Muliar, *Agricultural War Damages, Losses, and Needs Review*. Center for Food and Land Use Research (KSE Agrocenter), 2024, p. 4.

⁹ M. Nehrey, A. Taranenko, I. Kostenko, *Ukrainian agricultural sector in wartime: problems and prospects*. Economy and Society. 2022, No. 40, p. 23.

¹⁰ N. Kussul, S. Drozd, H. Yailymova, A. Shelestov, G. Lemoine, K. Deininger, *Assessing damage to agricultural fields from military actions in Ukraine: An integrated approach using statistical indicators and machine learning*, International Journal of Applied Earth Observation and Geoinformation, 2023, Vol. 125, 103562, p. 18.

¹¹ M. Shkoda, O. Kupchyshyna, T. Kasumov, I. Bernatska, N. Burda, O. Stepanova, N. Zaritska, Y. Rusina, *Analysis of Innovative Projects of Technological Management of Cluster Partnership and Business Diversification During the Post-War Recovery and European Integration of the National Economy*. Management Theory and Studies for Rural Business and Infrastructure Development, 2024. Vol. 46. No. 4, p. 623.

¹² *The agricultural sector of Ukraine in 2023: components of sustainability, problems and future tasks*, 2024, Website of the National Institute for Strategic Studies.

¹³ M. Shkoda, O. Kupchyshyna, T. Kasumov, I. Bernatska, N. Burda, O. Stepanova, N. Zaritska, Y. Rusina, p. 629-630.

¹⁴ M.I. Puhachov, V.M. Zhuk, O.H. Shpykuliak, et al., *Organizational and Economic Principles for Assessing the Impact of Military Aggression and Compensation Policy on the Development of Agrarian Entrepreneurship in Ukraine*, Monograph, Kyiv, 2024, p. 13

¹⁵ *The impact of the war on the state of the agricultural sector in Ukraine*, Germany's Relief Coalition for Ukraine.

guarantees has become an important signal to external partners regarding Ukraine's commitment to a transparent and inclusive recovery model. The development of a separate draft law on the mechanism for compensating business losses, particularly in the agricultural sector, was a priority task that enabled improvements in economic recovery, the attraction of international technical assistance, and investment. In this regard, the adoption of the Law of Ukraine on compensation for damages to citizens, including the provision of compensation in the form of certificates, is an important step toward social justice and the restoration of trust in the state during a time of crisis¹⁶.

International experience employs various methods for damage assessment, including the Damage and Loss Assessment (DaLA)¹⁷ methodology, developed by UN-ECLAC in 1972 and improved by international organizations, which serves as a universal tool for determining the economic consequences of natural disasters.

The updated "Rapid Damage and Needs Assessment (RDNA4)"¹⁸, conducted by the Government of Ukraine in cooperation with international partners, shows that the total recovery needs amount to USD 524 billion, which is 2.8 times higher than Ukraine's projected GDP for 2024. The outlined scale of Ukraine's losses indicates a high level of destruction and the critical need for long-term international support and strategic planning for the recovery processes. The study by a group of authors led by Klaus Deininger et al.¹⁹ provides a quantitative assessment of food security losses and highlights the real consequences of the war for agricultural production.

Tetiana Kuzmin et al.²⁰ provide an example of an analytical approach to strategic planning that enables agricultural enterprises to adapt to crisis conditions and maintain productivity even during periods of instability. The scholarly work of Oleksandr Shpykuliak et al.²¹ highlights advances in the formation of a new model of local agribusiness, which ensures food security, preservation of the rural way of life, and adaptation to contemporary challenges. Oleksandr Shpykuliak et al.²², by proposing a classification of organizational and economic principles for the development of entrepreneurial entities, outlined development prospects based on size and status under martial law, and emphasized the importance of state support through preferential lending in enhancing the efficiency of agribusiness activities.

¹⁶ *The impact of the war on the state of the agricultural sector in Ukraine, Germany's Relief Coalition.*

¹⁷ *Damage, loss, and needs assessment - tools and methodology*, The World Bank.

¹⁸ *Updated assessment of Ukraine's recovery and reconstruction needs*, 2025, The Diplomatic Service of the European Union

¹⁹ K. Deininger, Ali, D. Ayalew, N. Kussul, A. Shelestov, G. Lemoine, H. Yailimova, *Quantifying war-induced crop losses in Ukraine in near real time to strengthen local and global food security*. *Food Policy*, 2023. p.

²⁰ T. Kuzmin, I. Balaniuk, D. Shelenko, O. Shpykyliak, M. Smushak, *Economic assessment of agricultural enterprises in Ivano-Frankivsk region, Ukraine – identification of factors that influence performance*, *Journal „Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development”*, 2024, Vol. 24, Issues 3, p. 507.

²¹ O. Shpykuliak, I. Balaniuk, D. Shelenko, S. Balaniuk, A. Sukhovii, *The socio-economic role of small agribusiness in the development of modern Ukraine and Poland*. *Journal of Vasyl Stefanyk Precarpathian National University*, 2024, Vol. 11, No. 2, p. 34-35.

²² O. Shpykuliak, M. Malik, S. Kravchenko, L. Zaboranna, *Organisational and economic support for the development of business enterprises in agriculture under martial law*. *Ekonomika APK*, 2024. 31(2), p. 68.

The relevance of the authors' research stems from the need for a comprehensive assessment of the impact of martial law on the agricultural sector, the identification of key losses and achievements made possible through strategic risk management, and a rethinking of the role of the agricultural sector in the current economic reality faced by Ukraine.

Economy Under Fire: The Catastrophic Consequences of War for the Agricultural Sector

The agricultural sector, as a structurally formative component of the national economy and a factor of economic influence in Ukraine, has transformed into a space of multi-level vulnerability encompassing systemic risks of an institutional, technological, and financial nature, and requires new approaches to agrosphere management under wartime conditions. In 2021, Ukraine exported a record 61.5 million tons of grain and oilseed crops, with a total value exceeding \$22.2 billion. Vasyl Roztrioha²³ emphasizes that since the beginning of the full-scale war, Ukraine has lost 25% of its agricultural land, with total losses amounting to a quarter of the pre-war area. Between February 2022 and the first quarter of 2024, 1,261²⁴ agricultural enterprises have been lost.

According to data from the "Superagronom.com" website²⁵, the highest number of liquidated enterprises is recorded in the Odesa, Zaporizhzhia, and Kyiv regions, while the Kherson, Kharkiv, and Donetsk regions show fewer closures—an indicator that these communities remain under occupation.

According to the KSE Institute research center, as of November 2024, Ukraine's agro-industrial complex has suffered losses amounting to \$10.3 billion²⁶. As a result of the war, more than 130,000 units of agricultural machinery have been lost, 4 million tons of grain storage capacity have been destroyed or damaged, and 16,000 hectares of perennial plantations have been lost. Active hostilities and the resulting fires have caused significant damage to forest areas – 298,000 hectares of forests have been damaged, with losses estimated at \$4.5 billion²⁷.

According to the main website for agronomists, the regions of Ukraine most affected by the war are in the south and east: Donetsk region – \$2.929 million USD, Kharkiv region – \$2.050 million, Zaporizhzhia region – \$1.747 million. The lowest losses were recorded in the western regions of Ukraine – Zakarpattia (less than \$0.5 million)²⁸. By damage categories, the losses are distributed into the following groups: destruction of agricultural machinery – \$5.8 billion; infrastructure and crop losses – \$2 billion; grain storage facilities – \$1.8 billion; perennial plantations – \$0.4 billion; livestock – \$0.29 billion²⁹. Total losses due to reduced grain production reached up to \$82.9 million; losses from underharvested oilseeds amounted to \$65.7 million. In vegetable farming,

²³ V. Roztrioha, *The Numbers Are Shocking: How Much Arable Land Ukraine Has Lost During the War*. Agro24 website, 2025.

²⁴ *Ukraine's agricultural sector after three years of war: losses and challenges*, 2025.

²⁵ *1,261 Agricultural Enterprises Have Closed Since the Beginning of the Full-Scale Invasion*, 2025.

²⁶ T. Antonyuk, *Direct losses of Ukraine due to the war reached \$170 billion*, KSE assessment Institute, 2025.

²⁷ T. Antonyuk, op. cit.

²⁸ *Ukraine's agricultural sector after three years of war: losses and challenges*, 2025.

²⁹ *Ukraine's agricultural sector after three years of war: losses and challenges*, 2025.

losses reached \$217.3 million, of which \$109.3 million came from tomatoes and cucumbers; direct financial losses are estimated at \$5 million³⁰.

Due to mines and other explosive remnants of war, Ukraine suffers losses estimated at \$11.2 billion annually, equivalent to 5.6% of Ukraine's GDP in 2021. In 2024 alone, deminers cleared and returned over 231,000 hectares of agricultural land to farmers. The total cost of reclamation of demined soils, according to the Kyiv School of Economics (KSE), is estimated at \$40 million³¹. According to data from the KSE Institute, the indirect losses of Ukraine's agricultural sector due to the war may reach \$83 billion by the end of 2025³².

In response to wartime challenges, the Ukrainian government introduced a range of support measures for the agricultural sector, including simplified export procedures, financial aid, and affordable loans for enterprises³³. However, these initiatives have been primarily aimed at large companies, while small farming households remain in a more vulnerable position³⁴. This outlined asymmetry in the distribution of support highlights the need for a structural rethinking of agricultural policy in the context of post-war recovery. To this end, the Ukrainian government developed the „Ukraine Recovery Plan and New Agricultural Policy” worth \$750 billion, where the agricultural sector is prioritized, providing for investments in infrastructure, logistics, and producer support³⁵. However, this document has already faced criticism from farmers for its lack of focus on small farming enterprises and its emphasis on large exporters. The imbalance in approaches is especially critical under martial law conditions, where small agricultural producers are the most vulnerable to both external and internal challenges.

From Damage Documentation to Economic Partnership: The Agrarian Front of Ukraine's Foreign Policy

Ukraine is maintaining the „Register of Damages Caused by the Aggression of the Russian Federation Against Ukraine”³⁶, which serves as the main document for international recognition of wartime losses, documenting the damage caused and forming the basis for fair compensation and future recovery of the country. Maintaining this Register of Damages is a step toward a legally justified mechanism of reparations and international recognition of the scale of losses incurred by Ukraine. According to World Bank estimates³⁷, the scale of resources needed for Ukraine's post-war recovery after three years of war has already reached \$524 billion, emphasizing the unprecedented level of destruction and the need for a systematic approach to reconstruction.

³⁰ *Ukraine's agricultural sector after three years of war: losses and challenges*, 2025.

³¹ *Ukraine's agricultural sector after three years of war: losses and challenges*, 2025.

³² R. Neyter, S. Zorya, O. Muliar, *Agricultural War Damages, Losses, and Needs Review*, Center for Food and Land Use Research (KSE Agrocenter), 2024.

³³ Yu. Lopatynskiy, O. Shpykuliak, V. Kyfyak, D. Shelenko, V. Shpykuliak, *Development of institutional structures of green business in rural areas under European integration and global challenges*, *Economics and Business Management*, 2025. 16(1), p. 117.

³⁴ *Realities of Ukrainian Agriculture During the War*, 2024.

³⁵ *Realities of Ukrainian Agriculture During the War*, 2024.

³⁶ *Register of damages caused by the aggression of the Russian Federation against Ukraine*.

³⁷ A. Shalal, *Ukraine needs \$524 billion to recover, rebuild after three years of war*, World Bank says, 2025.

In particular, according to the Ukrainian Union of Industrialists and Entrepreneurs³⁸, one-third of the country's industrial potential remains unused due to high risks associated with doing business.

As of early March 2025, the structure of Ukraine's agricultural exports remained commodity-oriented: out of the total export revenue of €12.8 billion, over €8 billion came from low-value-added products – primarily oil, grain, and meal³⁹. Despite limited added value, this trade profile is a factor in stimulating the agri-food markets of the European Union and supports intra-European economic dynamics in the areas of processing and consumption. According to Svitlana Tsybulska⁴⁰, it is more logical for Europe to stimulate imports of the most needed goods from Ukraine (corn, soybeans, meal) than to depend on North and South America. Ukraine is considered a strategically important trade partner for the EU in terms of ensuring food security and reducing logistics costs. Evidence of these opportunities is provided by the dynamics of foreign trade indicators, which make it possible to assess the scale of exports and changes in their structure (Table 1).

Table 1
Dynamics of Changes in Ukraine's Foreign Trade Indicators in Goods

Indicators	Value and Nature of Changes		
	January 2025	Jan VS Jan	January 2024
Export	88,5%		100%
Import	\$ 3179.7 million		\$ 5514.8 million
Negative trade balance	\$ 2335.1 million		\$ 1500.4 million
Export-to-import coverage ratio	0,58		0,71

Source:⁴¹

The dynamics of Ukraine's foreign trade indicators in goods for January 2025 prove a growing imbalance in trade operations. The gap between exports and imports led to an increase in the negative foreign trade balance to \$2,335.1 million, which is 55% higher than the figure for the previous year. The decline in the export-to-import coverage ratio to 0.58 (compared to 0.71 in January 2024) reflects the deterioration of the economy's trade resilience, meaning that for every dollar of imports, Ukraine was able to generate only 58 cents through exports, thereby creating additional pressure on the country's balance of payments.

A quantitative indicator of the effectiveness of the agricultural sector is the correlation between the level of employment in agriculture and labor productivity, as shown in Table 2.

During the period from 1991 to 2021, Ukraine experienced a steady decline in the share of employment in agriculture (Table 2). Alongside the decrease in employment, labor productivity

³⁸ *Ukrainian Union of Industrialists and Entrepreneurs, 2022.*

³⁹ S. Tsybulska, *Ukrainian agricultural products will relieve the EU of dependence on North and South America*, AgroPortal.ua, 2025.

⁴⁰ S. Tsybulska, *Ukrainian agricultural products will relieve the EU of dependence on North and South America*, AgroPortal.ua, 2025.

⁴¹ *Express release. Foreign trade of Ukraine in goods, 2025*, State Statistics Service.

increased, measured by gross value added per worker (in constant 2015 prices). The dynamics over 1991–2021 demonstrates that Ukraine’s agricultural sector underwent profound reforms aimed at aligning with the Sustainable Development Goals and modernizing agriculture. The presented empirical data confirm the analytical hypothesis that the consequences of military aggression against Ukraine have caused a systemic weakening of the growth potential of gross value added in the agricultural sector, destabilizing domestic food security and disrupting the functioning of export-oriented agri-food chains.

Table 2

Dynamics of Employment in the Agricultural Sector and Labor Productivity in Agriculture in Ukraine (1991–2021)

Years	Employment in Agriculture (%)	Agriculture, forestry, and fishing, value added per worker (constant \$2015 US)
1991	19.33	2128.438
1995	22.49	1573.171
2000	22.05	1505.96
2005	20.46	1890.61
2010	16.30	2659.435
2015	15.26	3618.046
2018	14.90	4205.204
2019	13.91	4544.21
2020	14.12	4164.967
2021	14.12	4889.466

Source⁴²

Based on the data in Table 2, the author calculated an estimate of the relationship between employment in agriculture and labor productivity in the sector using the Pearson correlation coefficient. To assess the relationship between the share of agricultural employment (E_{agr}) and the value added per worker, the following formula was applied:

$$r = \frac{\sum (E_{agr,i} - \bar{E}_{agr}) (VA_{worker,i} - \bar{VA}_{worker})}{\sqrt{\sum (E_{agr,i} - \bar{E}_{agr})^2} \cdot \sqrt{\sum (VA_{worker,i} - \bar{VA}_{worker})^2}}$$

де $E_{agr,i}$ – the percentage of employed in agriculture in the year ;

$VA_{worker,i}$ – the value added in agriculture per worker in the year ;

\bar{E}_{agr} та \bar{VA}_{worker} – the average values of the corresponding indicators.

During 1991–2022, a strong inverse relationship was observed between the share of employment in agriculture and the value added per worker (in constant 2015 prices), with a correlation coefficient of approximately $r \approx -0.95$. The p-value $\approx 2.71 \times 10^{-16}$ indicated an extremely high statistical significance of the relationship.

⁴² World Development Indicators, 2025.

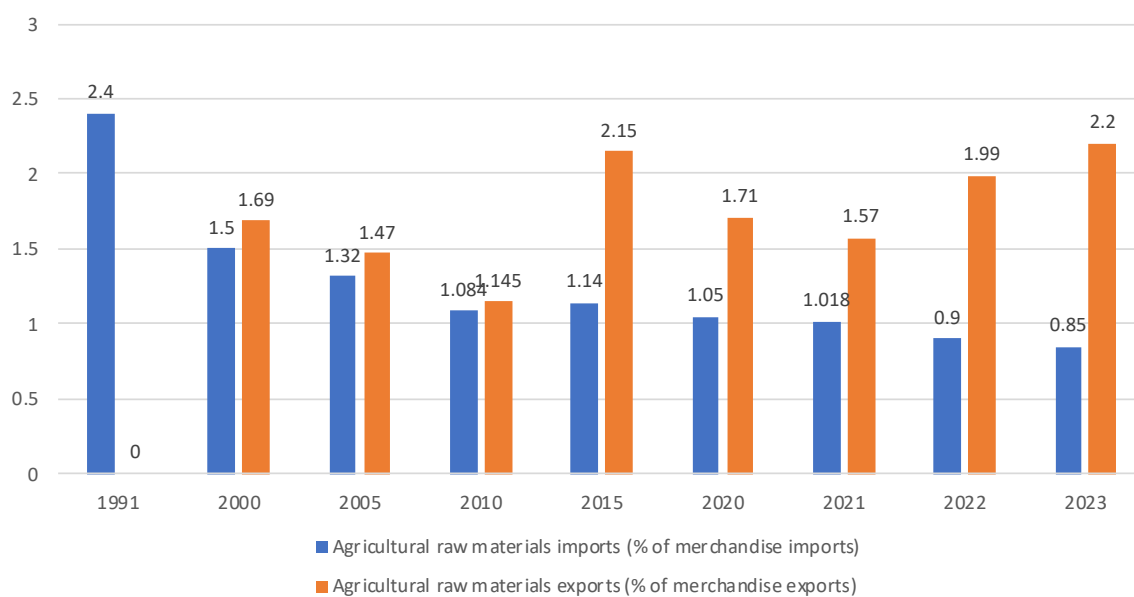
The correlation coefficient $r \approx -0.95$ indicated a strong negative relationship – as the share of employment in agriculture decreased, labor productivity increased. This was due to: migration (departure of the working-age population from rural areas); technological advancement and mechanization in agricultural enterprises⁴³; changes in the structure and organization of production⁴⁴; reduction of cultivated land (due to temporary occupation and military actions, a significant portion of land has been withdrawn from use); government support and international assistance. These factors confirm that the reduction in agricultural employment is accompanied by a transformation of the agricultural production model itself, which logically aligns with the need for a strategic rethinking of Ukraine’s economic development in the post-war period.

Employment reduction and import dependence as factors in the transformation of agricultural production under wartime conditions

To conduct a comprehensive assessment of the structural changes in Ukraine’s agricultural sector, it is necessary to analyze the foreign trade of agricultural products (Figure 1).

Fig. 1.

Share of agricultural goods in trade in Ukraine: imports versus exports, 1991–2023



Source⁴⁵.

Variation in the import volumes of agricultural raw materials to Ukraine during 1991-2023, according to World Bank data, shows a downward trend. In 1991, it accounted for 2.4% of total merchandise imports, while in 2023, this figure dropped to 0.85%. The export of agricultural raw materials has shown a growing trend since 2015, indicating the increasing role of Ukraine as an exporter of agricultural products. Through enhanced cooperation with international financial

⁴³ D.I. Shelenko, L.S. Sas, P.Ye. Matkovskiyi, *Peculiarities of the technology of renewal and modernization of enterprises of various organizational and legal forms in conditions of diversity of production in the countryside*. Economic discourse, 2017, vol. 4, p. 105-106.

⁴⁴ I.F. Balanjuk, *Agrarni vidnosyny: sotsial'no-ekonomichna sut' i mistse v systemi suspil'nykh vidnosyn*. Ekonomika APK, 2000, No. 8, p. 70.

⁴⁵ *World Development Indicators*, 2025.

institutions and donor organizations, Ukraine's agricultural sector received support for production modernization and gained the opportunity to improve transparency in trade policy, which collectively created preconditions for a gradual reduction in dependence on unstable Asian markets in favor of a more predictable and high-yield European sales vector.

International and national support as the foundation of resilience in Ukraine's agricultural sector

International support, particularly from the FAO⁴⁶, is crucial for stabilizing Ukraine's agricultural sector during the war, as it contributes to strengthening strategic cooperation and implementing the Emergency Response Plan for 2025-2026. The implementation of this plan focuses on preserving production, enhancing energy resilience, and developing value chains, especially in the vegetable sector. Ukraine's agricultural sector's adherence to these approaches enables the development of a scientifically grounded recovery model (a roadmap for FAO support to Ukraine), which integrates environmental sustainability, international standards, and effective resource management.

According to data from the SuperAgronom website⁴⁷, various directions of state support have been allocated to farmers by the Government of Ukraine and international funds. The Government of Ukraine allocated more than 5 billion UAH in 2025 to support the agricultural sector, which indicates a commitment to compensate for the losses caused by the war through direct financial assistance to agricultural producers.

The international financial project ARISE, implemented with the participation of the World Bank and the Government of Japan, has become an important tool for expanding the financial capacity of small agricultural producers⁴⁸.

The European Commission has proposed a new structure for agricultural financing within the framework of the EU's record €2 trillion budget, significantly reducing the share of funds allocated to the CAP (Common Agricultural Policy)⁴⁹ – from 32.2% to 16.5%. In this context, the consolidation of agricultural and regional funds into a “megafund” has been criticized for a potential “hidden reduction” and the risk of the renationalization of policy. The European Commission justifies the changes made by the need for flexibility, synergy, and adaptation to market risks.

During the war and the post-war recovery period, such models of assistance are truly effective and will continue to be used, forming the basis for the long-term socio-economic strengthening of rural communities.

⁴⁶ *Ukraine and FAO have drawn up a plan for the restoration of the agricultural sector for 2025-2026*, 2025.

⁴⁷ *Ukraine's agricultural sector after three years of war: losses and challenges*. 2025.

⁴⁸ *Ukraine's agricultural sector after three years of war: losses and challenges*. 2025.

⁴⁹ *European Commission cuts funding for subsidies for farmers*, 2025.

Reintegration of Veterans and Social Entrepreneurship in Post-War Recovery: Polish Experience and Ukrainian Perspectives

Poland has made significant progress in moving closer to the European Union not only due to its efforts but also with substantial support through the following key EU-funded special programs: PHARE – assistance to candidate countries from Central and Eastern Europe in their preparation for EU accession; SAPARD – Special Accession Programme for Agriculture and Rural Development; ISPA – Instrument for Structural Policies for Pre-Accession, aimed at developing transport infrastructure and environmental protection in accession countries. Comparing the experiences of Poland and Ukraine regarding the role of socially oriented business models, social entrepreneurship is viewed as a driving force for national recovery, capable of strengthening economic resilience and social cohesion at the local community level⁵⁰.

Simultaneously, given the devastating impact of war on the social structure of rural areas, the formation of effective mechanisms for veteran reintegration has become increasingly relevant. It is essential for Ukraine to ensure decent conditions for the return of its defenders to peaceful life and to create a favorable environment for their economic activity, particularly through their engagement in entrepreneurship.

The adoption of the Law on Veteran Business in Ukraine⁵¹ marks a step toward implementing an inclusive model of economic development. This legislative initiative officially defines the concept of “veteran business” for the first time and introduces a wide range of state support, including preferential lending, grant programs, and more. The government also plans to implement relevant instruments through the “Own Business” program and the initiatives of the Ukrainian Veterans Fund, aiming to establish support for veteran entrepreneurship as a component of post-war development⁵².

As demonstrated by Poland’s experience, which became a leader in economic recovery within the EU after the pandemic crisis, the foundation of regional economic stability was local agricultural producers who provided flexibility under external challenges⁵³. Extrapolating this to small-scale agricultural entrepreneurship in Ukraine shows not only economic but also social potential, as it combines employment functions, preservation of cultural heritage, and the implementation of environmentally friendly production practices.

Implementation of Loss Assessment Models in Agriculture: GFDRR Methodology for Ukraine

In light of global challenges, the work of the international expert community on rethinking the role of the agricultural sector within the framework of sustainable development is extremely relevant. In particular, the results of ForumforAg outline a new paradigm of agricultural

⁵⁰ O. Shpykulyak, D. Shelenko, I. Balaniuk, A. Diuk, H. Mazur, S. Balaniuk, A. Boychuk, *Social entrepreneurship in employment: the experience of Poland and Ukraine*. Journal of Vasyl Stefanyk Precarpathian University, 2024, Vol. 11, No. 4, p. 80

⁵¹ *Ukraine has adopted a law on veteran entrepreneurship*, 2025, Agroportal.ua.

⁵² *Ukraine has adopted a law on veteran entrepreneurship*, 2025, Agroportal.ua.

⁵³ O. Shpykuliak, I. Balaniuk, D. Shelenko, S. Balaniuk, A. Sukhovii, *The socio-economic role of small agribusiness in the development of modern Ukraine and Poland*. Journal of Vasyl Stefanyk Precarpathian National University, 2024, Vol. 11, No. 2, p. 32.

production, centered around the farmer as the key actor in Ukraine's recovery, integrated not only into economic processes but also into the shaping of environmental policy, food security, and innovation infrastructure⁵⁴.

Given the scale of challenges facing Ukraine, the integrated approach to agricultural sector development proposed by ForumforAg⁵⁵ serves as a conceptual guideline for forming a national model of agricultural recovery, competitive, environmentally responsible, and socially oriented.

The implementation of methodological approaches to damage assessment, adapted to practices endorsed by leading international institutions – particularly the Global Facility for Disaster Reduction and Recovery (GFDRR) – can serve as a foundation for unifying loss calculation procedures and building an evidence base for strategic post-crisis recovery planning. The adaptation of such models in Ukraine enables the application of standardized approaches to measuring economic, environmental, and social losses caused by external shocks.

A systematic approach to the research topic enabled the author to develop proposals for the implementation of loss assessment tools similar to those used by international organizations, particularly the GPDR. The introduction of a similar approach in Ukraine, especially the integration of elements from the DaLA methodology and GPDR practices, would allow for more effective assessment not only of physical and economic losses but also for a deeper analysis of the war's impact on macroeconomic indicators of agriculture, social infrastructure, and rural household incomes.

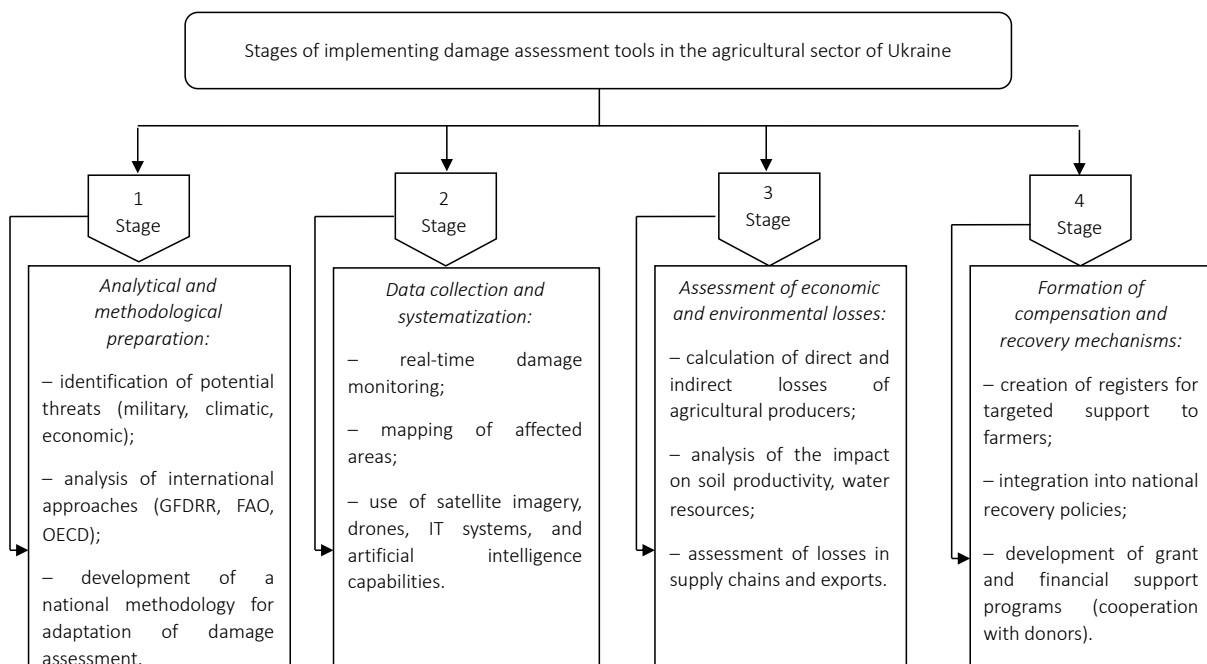
Rapid recording of physical and economic damages, large-scale threat modeling, qualitative risk assessment, and the formation of economic resilience would enhance the adaptability of agricultural policy to factor-related risks. It is also advisable to schematically present the structural-functional model of the stages for implementing agricultural loss assessment tools in Ukraine, developed by the conceptual framework of GFDRR (see Fig. 2).

⁵⁴ *New realities: Will Ukraine become an agrarian leader of European transformations?* 2025.

⁵⁵ *New realities*

Fig. 2.

Stages of implementing damage assessment tools in the agricultural sector of Ukraine (based on GFDRR practice)



Source: Author's development.

The integration of post-disaster needs assessment tools (GFDRR) in the Ukrainian context, particularly in the agricultural sector, will provide an evidence base for developing an effective recovery strategy and will help establish a coordinated inter-agency action roadmap, a financial framework, coordination mechanisms, and the principles of "Build Back Better."

SUMMARY

Under martial law, Ukraine's agricultural sector has undergone significant changes that have affected not only production volumes, logistics capacities, and market conditions, but also the very model of agricultural governance. The research results highlight the importance of addressing problems that have accumulated over the years. The war has opened up new opportunities to reorient Ukraine's agricultural sector toward sustainable, innovative, and export-oriented development models.

First and foremost, the formation of a modern crisis management model for the agricultural sector requires the implementation of damage assessment tools based on international practices (particularly GFDRR). The presence of standardized approaches will foster donor confidence and support the effective redistribution of resources.

Another important aspect is the assessment of current trade imbalances, which indicates a decline in the country's export potential: in January 2025, the export volume amounted to only 88.5% of the previous year's figure, while the import volume remained significantly higher. The increase in the negative foreign trade balance (\$2.335 billion USD) and the drop in the export-to-import coverage ratio to 0.58 are evidence of declining trade resilience and the urgent need to reconsider the export strategy of the agricultural sector, focusing on increasing the added

value of products. Overall, the adaptation of the agricultural sector to the conditions of martial law requires a shift from reactive to strategic management, focused on long-term resilience, decentralization of support, development of human capital, and digital transformation. Only under these conditions will Ukrainian agriculture be able to gradually integrate into the European sustainable production space, adapting the key instruments of the European Green Deal.

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