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Trends in global grain and seed trade, Ukrainian position on the global market

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Abstract. The study aimed to comprehensively analyse the Ukrainian grain market during the war and its prospects after its end, as well as an assessment of key trends in the global grain market in 2020-2024. The research methodology was based on the collection of data from reports of international organisations and open sources, their processing through statistical, comparative and forecasting analysis, as well as the synthesis of quantitative and qualitative indicators. The results demonstrated that global production in 2023/24 totalled 789.8 million tonnes of wheat, 1.22 billion

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tonnes of corn, 149 million tonnes of barley and 57 million tonnes of sunflower seeds, led by China, the US, the EU and Ukraine. The study determined that in Ukraine, the war reduced the area under crops from 15.4 million hectares in 2021 to 9.1-10.2 million hectares in 2024, while yields reduced from 47.8 hwt/ha in 2021 to 38.3 hwt/ha in 2022, before recovering to 43.8 hwt/ha in 2023. The study also determined that exports decreased from 85 million tonnes (in the 2021/22 marketing year) to 46-50 million tonnes (2022/23) but increased to 67.4 million tonnes (2023/24) thanks to the Solidarity Roads and the humanitarian corridor. Analysis of wheat prices determined that the price ranged from 6000-6500 UAH/t (USD 210-230/t FOB) in 2020/21 to 5500-6000 UAH/t (USD 200-220/t) in 2022/23 and 8191-9500 UAH/t (USD 220-250/t) in 2024. The sector's losses included machinery (4.7 billion USD) and irrigation (225 million USD), while logistics costs increased by 30-50%, affecting global prices (12-13 USD per bushel for wheat in 2022, 8-9 USD in 2024). The analysis of the prospects for the development of the Ukrainian grain market after the war found that the restoration of infrastructure worth 29 billion USD, modernisation of elevators, expansion of markets to the EU, Africa and Asia, as well as investments supported by international organisations and the World Bank will return exports to 85 million tonnes and potentially reach 100 million tonnes annually, strengthening Ukraine's role in global food security

Keywords: crop exports; planted areas; yields; logistics; infrastructure destruction and reconstruction; agricultural sector

INTRODUCTION

Agriculture, in particular the grain sector, is the backbone of Ukraine's economy and is key in ensuring global food security, which determines the relevance of an analysis of its state and prospects in the context of a full-scale Russian invasion that began in 2022. The war caused significant losses in agricultural infrastructure, a reduction in acreage, disruption of supply chains, and a drop in exports, which not only weakened Ukraine's position on the global market but also exacerbated the problem of access to grain in countries in Africa, Asia, and the Middle East that depend on its supplies (Panfilova *et al*., 2025). At the same time, the resilience of Ukraine's agricultural sector, adaptation to wartime conditions, and support from international organisations open up prospects for recovery and modernisation after the war, which requires a detailed study of the current state, assessment of losses, and forecasting of future development to identify strategies that could return Ukraine to its pre-war status as one of the world's leading grain exporters.

One of the main challenges is the lack of studies that comprehensively cover the impact of the war on the grain market and offer specific recovery scenarios. L. Osipova (2022) noted that the war caused a significant reduction in grain exports, but the analysis was limited to general data, without a detailed consideration of logistical changes and their impact on pricing, and forecasts for post-war development. I. Lynnyk (2024) assessed the loss of infrastructure, such as elevators and ports, noting their importance to the sector, but without the potential of alternative routes and the role of international support, which reduces its practical value. L. Pobochenko *et al.* (2023) highlighted changes in global grain trade due to the war, noting the critical importance of Ukraine in these processes, but ignoring the impact on domestic prices and prospects for market expansion, leaving gaps in the analysis of local factors.

Another important aspect of highlighting the impact of the war in Ukraine on food security in the world, as well as determining its investment potential and the role of international organisations in the recovery of the agricultural sector, requires additional research to fully understand the prospects. X. Wang *et al.* (2023) analysed global grain trends, which traced the impact of external market factors on trade, but without considering the specifics of the war in Ukraine, in particular its impact on the processing industry and domestic logistics, which reduces the relevance to the local context. A. Abu Hatab (2022) analysed in detail the impact of the war on food security in Africa, highlighting the global consequences of the decline in Ukrainian exports, but not the prospects for the recovery of these exports and adaptation to new conditions, leaving gaps in the analysis of future development. T. Ben Hassen and H. El Bilali (2022) assessed the impact of the war on global food security in detail, providing a valuable basis for analysis, but without a detailed analysis of global trends in world trade, leaving the overview incomplete for assessing post-war prospects.

Another important aspect is the insufficient coverage of global trends in the grain sector related to geopolitical factors and their impact on trade flows (Cheremisina *et al*., 2025). A. Lukyanova and A. Zeynalov (2022) discussed in detail the redistribution of grain markets due to sanctions against Russia, assessing new opportunities for other exporters, but they do not address the long-term consequences of these changes for importing countries, which limits their predictive depth. S. Nate *et al.* (2024) analysed the impact of geopolitical tensions on logistics in the Black Sea region, emphasising its importance for global supply, but not considering the potential of alternative logistics corridors outside the region, which narrows the scope of the results. L. Liu *et al.* (2023) analysed the growth of

competition between key grain exporters such as Argentina and Brazil during the crises, but did not address the role of developing countries as new players in the market, which reduces the completeness of the findings.

The study aimed to provide a comprehensive analysis of the Ukrainian grain market, incorporating changes in the global grain sector in 2020-2024. To achieve this goal, several key tasks were set, including: studying the dynamics of production, exports and prices for major grains (wheat, corn, barley) and sunflower seeds in the world and Ukraine, analysing the impact of the war on these indicators; assessing direct losses of the Ukrainian agricultural sector and changes in global grain logistics caused by the conflict; developing scenarios for the post-war recovery of the Ukrainian market, addressing the role of infrastructure, investment and international support, as well as the state of the industry and its potential in the future.

MATERIALS AND METHODS

The methodology of this study was based on a comprehensive approach to the analysis of the Ukrainian and global grain market for the period of 2020-2024, emphasising the impact of the war on the Ukrainian agricultural sector and its development prospects. To achieve these goals, various sources of information, methods of data collection, data processing and analysis were used, ensuring the objectivity and reliability of the findings. The main principles of the study were systematic, comparative analysis and synthesis of quantitative and qualitative data, adapted to the specifics of the subject of the study – grain production, logistics, prices and trade relations.

The information base is based on official reports of international organisations, in particular the Food and Agriculture Organisation (n.d.a; n.d.b; 2024; 2025), as well as data from the U.S. Department of Agriculture (2025a; 2025b) and FAOSTAT statistical databases (n.d.). For the analysis of the Ukrainian market, it was used the materials of the Ministry of Agrarian Policy and Food of Ukraine (n.d.), as well as estimates of losses in the agricultural sector by the Kyiv School of Economics (Neyter *et al*., 2024) and the World Bank (2025). Additionally, analytical reports from private agricultural companies such as UkrAgroConsult (n.d.) and SuperAgronom (n.d.) were used to provide data on prices, yields and logistics on the domestic market. Primary data was supplemented with information from open sources – press publications, and regulatory documents, such as Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions No. COM/2022/217 "An Action Plan for EU-Ukraine Solidarity Lanes to Facilitate Ukraine's Agricultural Exports and Bilateral Trade with the EU" (2022). To update the information for 2024, preliminary forecasts and press releases from the Ukrainian Grain Association and the U.S. Department of Agriculture were used, given that full annual reports were not yet available as of February 2025.

Data was collected through a systematic review of statistical reports and databases available online, followed by verification through cross-checking sources. For example, global grain production figures for 2022/23 and 2023/24 were taken from the Food and Agriculture Organisation and the U.S. Department of Agriculture and then updated through FAOSTAT to ensure consistency of figures. For Ukraine, data on planted areas, yields, and exports for 2020-2024 were collected from official reports of the Ministry of Agrarian Policy and the Ukrainian Grain Association, supplemented by estimates of war losses by the Kyiv School of Economics (Neyter *et al*., 2024). Prices for cereals and sunflower seeds were based on weighted averages from UkrAgroConsult and SuperAgronom reports, incorporating the exchange rate (27-40 UAH/USD for the period) and logistics costs obtained from the Grain Corridor and Solidarity Roads publications. In cases of discrepancies (for example, between the export estimates of the U.S. Department of Agriculture and the Ukrainian Grain Association for 2023/24), the average value was preferred. For the qualitative analysis of the prospects, the method of expert estimates based on the forecasts of the World Bank and the Food and Agriculture Organisation was used.

Data processing included quantitative and qualitative analysis. Quantitative indicators, including production volumes, planted areas, yields, exports, and prices, were systematised in tables and converted into percentages to compare the contribution of individual countries (e.g. Ukraine's share of global corn exports) or dynamics over the years. For this purpose, statistical processing methods were used: calculation of averages, determination of price ranges and trend-based forecasting. Currency conversions were made based on the official exchange rate of the National Bank of Ukraine for the respective years (27-28 UAH/USD in 2020-2021, 36-38 UAH/USD in 2022-2023, 38-40 UAH/USD in 2024). The qualitative analysis included an assessment of logistical changes, infrastructure losses (machinery, irrigation), and development prospects, for which a synthesis and summary of information from various sources were used. Data on prices on global markets were taken from the Chicago Mercantile Exchange and correlated with Ukrainian conditions.

The analysis was conducted in several areas. The comparative method was used to compare Ukraine's performance with that of global leaders (China, the US, and the EU). Historical analysis traced the dynamics of sown areas and prices. A systematic approach was used to assess the relationship between logistics, prices and markets. The forecasting method was based on data extrapolation and estimates of international organisations. Scenario analysis was used to draw qualitative conclusions about development prospects:

infrastructure rehabilitation, market expansion and the role of the Food and Agriculture Organisation were assessed through potential development scenarios. All methods were combined to create a holistic picture adapted to the conditions of war and post-war recovery.

RESULTS

The global grain trade is a strategically important segment of the agricultural economy that determines food security, influences macroeconomic indicators of countries and shapes the balance of power in international trade relations. In 2020-2024, the global grain market will show steady growth driven by several factors. Firstly, there is a steady increase in the global population, which stimulates the growth of demand for food. In addition, changes in consumption patterns in many countries, including increased demand for meat and dairy products, have increased the need for feed grains. The dynamics of global grain production in 2020-2024 were characterised by overall growth, although there were periodic declines due to adverse weather conditions, political factors and logistical problems. The total grain production in the 2023/24 marketing year reached 2.854 billion tonnes, slightly higher than the average for the last five years (2.7 billion tonnes) and the previous year (2.8 billion tonnes). One of the key trends is the strengthening of the position of major producers such as the US, China, Brazil, India and the EU, which together account for about 70% of global production of major grains (Fig. 1).

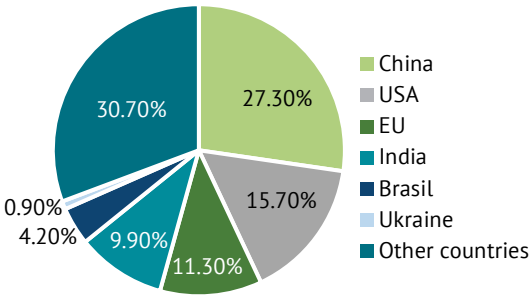

***Figure 1**. Leading countries in grain production (2023/24 marketing year)*
***Source:** compiled by the authors*

Wheat remains one of the most important crops in the world, key in meeting the food needs of billions of people, through its use in the production of bread, flour products and other staple foods (Panfilova *et al.*, 2023). In the 2023/24 marketing year, global wheat production reached 789.8 million tonnes, one of the highest levels on record, reflecting sustained growth driven by improved agricultural technologies and favourable weather conditions in several regions (Fig. 2).

China remains the leading producer, annually supplying around 135 million tonnes of wheat, which accounts for a significant portion of its domestic food market, although the country is rarely a major exporter. The EU, with 125 million tonnes of wheat, is second, being substantial in both domestic supply and exports, particularly to North Africa and the Middle East. India, with 108 million tonnes, ranks third, demonstrating steady production growth to meet the needs of its huge population and build up strategic reserves. This trend is affecting traditional trade routes, forcing producers to adapt to new market conditions that include both logistical challenges and price fluctuations due to geopolitical factors and climate change. Corn also remains one of the most important cereals, playing an indispensable role in both the food and feed industries, where it serves as the main source of energy for livestock and poultry, as well as a feedstock for bioethanol and other industrial products (Bulgakov *et al.*, 2020). In the 2023/24 marketing year, global corn production reached an impressive 1.22 billion tonnes, reflecting steady growth driven by both higher yields thanks to modern technologies and expanding acreage in key regions (Fig. 3).

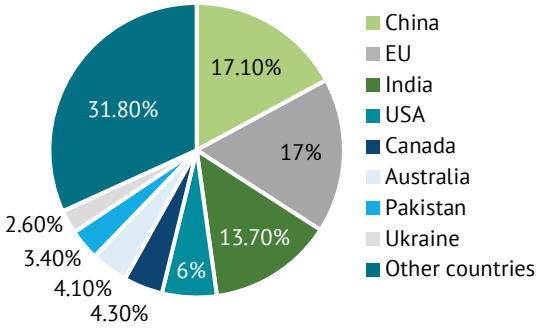

***Figure 2**. World leaders in wheat production (2023/24 marketing year)*
***Source:** compiled by the authors*

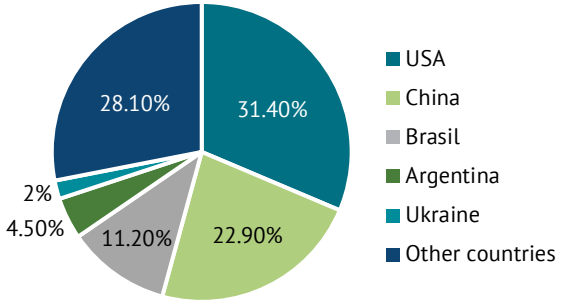

***Figure 3**. World leaders in corn production (2023/24 marketing year)*
***Source:** compiled by the authors*

The United States remains the undisputed leader in this area, with an annual corn harvest of more than 383 million tonnes, accounting for almost a third of global production; a significant portion of this volume is used for domestic consumption, particularly in the livestock and biofuel industries, and the rest is

exported, strengthening the US position in the global market. China, with 279 million tonnes, is the second largest producer, but its production is mainly focused on domestic needs, particularly the rapidly growing livestock industry, which supports demand for feed, as well as food and industrial purposes, and therefore the country exports only a small part of the harvest (Kulazhanov *et al.*, 2024). Brazil, with 137 million tonnes, and Argentina, with 55 million tonnes, have seen significant production increases, thanks to the expansion of cultivated areas in favourable climates, the introduction of advanced agricultural technologies such as precision farming and drought-resistant hybrids, and improved infrastructure for grain storage and transportation. These South American countries are not only meeting their demand, but are also increasingly competing on the international market, supplying corn to Asia, Africa and Europe, which strengthens their position as leading players in global trade in this crop.

Barley is significant among cereals, remaining an indispensable component of global trade due to its wide use in the food industry, in particular to produce malt, beer and some types of bakery products, and in the feed sector, where it is an important source of nutrients for livestock and poultry. In the 2023/24 marketing year, global barley production reached 149 million tonnes, reflecting stable demand for the crop and its adaptability to different climatic conditions (Fig. 4).

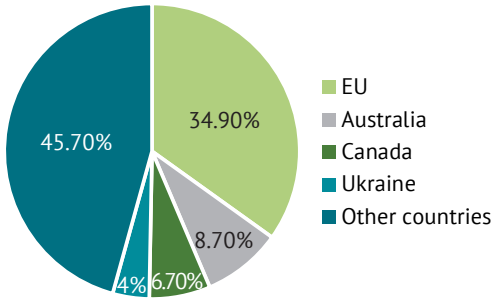

***Figure 4**. World leaders in barley production (2023/24 marketing year)*
***Source:** compiled by the authors*

The EU remains the leading barley producer, with 52 million tonnes of barley, thanks to countries such as Germany, France and Spain, where advanced farming techniques and favourable weather conditions contribute to high yields; much of Europe's barley is used for domestic consumption, particularly in brewing, and for export. Australia, which harvested 13 million tonnes, benefits from an arid climate ideal for barley cultivation and is a key exporter focused on Asian markets such as China and Japan. Canada, with 10 million tonnes, is known for its high-quality barley, which is in demand in the North American brewing industry and beyond, making it a consistent leader. Despite the war, Ukraine has managed to produce about 6 million tonnes of barley, although this is less than pre-war levels; its contribution is still valuable, especially for exports to the Middle East. Barley is a strategically important export product, particularly for countries such as Saudi Arabia, where it is in steady demand in the feed industry for livestock feeding and in processing, which maintains its importance on the global market even in the face of competition from other cereals.

Sunflower seeds have a special place in the agricultural sector due to their key role in the production of sunflower oil – a strategic product that is not only a staple of the food basket in many countries, but also an important component in cosmetics, pharmaceuticals and other industries, making it economically significant on a global scale. In the 2023/24 marketing year, global sunflower seed production reached 57 million tonnes, reflecting stable demand for the crop and its adaptability to different agricultural and climatic conditions (Fig. 5).

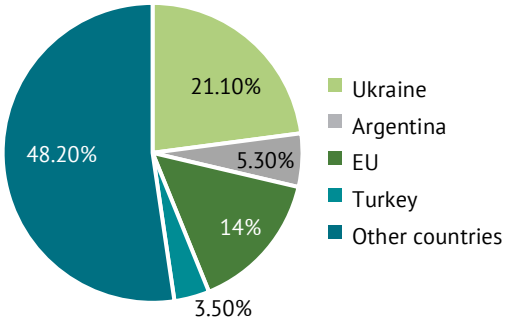

***Figure 5**. World leaders in sunflower seed production (2023/24 marketing year)*
***Source:** compiled by the authors*

Analysing the top sunflower seed producing countries, it is worth noting that over 21% of this volume is accounted for by Ukraine, which holds a dominant position in the global market due to its fertile soils, large, planted areas and developed processing infrastructure. Despite the substantial challenges posed by the war, including the occupation of some agricultural land and disruption of supply chains, Ukraine managed to harvest around 12 million tonnes of sunflower seeds, an achievement made possible by the resilience of the agricultural sector and its focus on growing this highly profitable crop, which provides a significant portion of the country's foreign exchange earnings through the export of sunflower oil – a product in demand in Europe, Asia and the Middle East.

Concerning Ukraine's position on the global market, Ukraine has traditionally been one of the key players on the global grain market, playing an important role in ensuring global food security. Thanks to its fertile black soil, which covers a large part of the national territory, and favourable climatic conditions for growing grain crops such as wheat, corn and barley, Ukraine is consistently among the leading exporters of these products

(Pichura *et al.*, 2024). Despite the challenges posed by the full-scale invasion in 2022, the country has managed to maintain its position on the international stage by adapting to the new conditions through alternative logistics routes and support from international partners. In the 2023/24 marketing year, Ukraine exported over 67.4 million tonnes of grains and oilseeds, which is a significant figure given the temporary occupation of some agricultural land and disruption of traditional export routes through the Black Sea. The dynamics of crop areas in Ukraine have undergone significant changes due to the war and economic factors (Fig. 6).

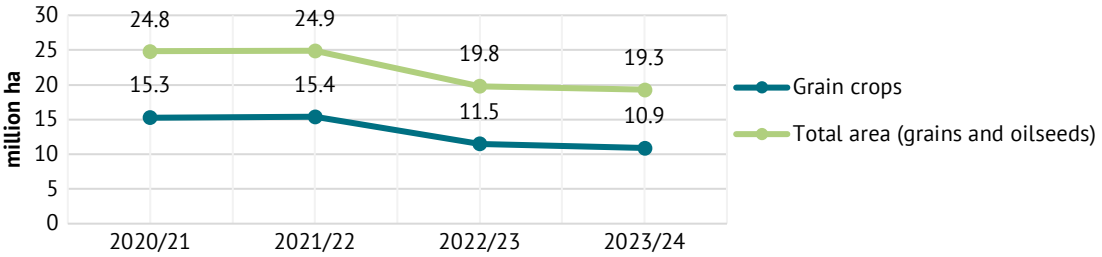

***Figure 6**. Dynamics of grain crops planted areas in Ukraine, million ha (2020-2024)*
***Source:** compiled by the authors based on the Ministry of Agrarian Policy and Food of Ukraine (n.d.)*

In the pre-war period, Ukraine demonstrated impressive results in the agricultural sector, particularly in 2021, when the country achieved a record harvest of 100 million tonnes of grain and oilseeds, made possible by the expansion of grain crop acreage to over 15 million hectares, and the total area under crops to 24.9 million hectares. This success was due to optimal weather conditions, high yields, and access to resources such as fertilisers and machinery, which enabled the fertile black soil to be used to its full potential. However, Russian full-scale invasion in February 2022 drastically changed the situation: the area under grain crops reduced substantially to 11-12 million hectares, which is 10-22% less than in 2021, depending on the region and estimates (Food and Agriculture Organisation (n.d.a; n.d. b) and the Ukrainian Grain Association indicate a range of reductions). The main reasons were the temporary occupation of approximately 20% of agricultural land (about 5 million hectares), the mining of fields, and logistical disruptions that hampered the spring sowing campaign, especially for spring crops such as maize and barley. In 2023, Ukrainian farmers managed to partially adapt to the war conditions, restoring grain crops to approximately 11 million hectares, although the total area under all crops was 19.3 million hectares; however, significant areas of over 174,000 km^2 remained mined, and 109,000 km^2 were under occupation, limiting access to land, especially in the east and south of the country, where crops were traditionally grown. km^2 remained mined, and 109,000 km^2 were under occupation, limiting access to land, especially in the east and south of the country, where a significant part of the grain was traditionally grown. For 2024/25, a reduction in the area under grain crops, in particular winter wheat, to 9.1-10. This shift in crop structure is a strategic response by farmers to high global prices for oilseeds (e.g., sunflower oil remains a key export product). This shift in the crop structure is a strategic response by farmers to high global prices for oilseeds (for example, sunflower oil remains a key export product) and to the difficulties in grain exports, which require larger volumes and more stable transport access. As a result, sunflower acreage in 2024/25 may remain at 4.8-5 million hectares, while soybean and rapeseed acreage may increase to 1.6-1.8 million hectares and 1.5-1.6 million hectares, respectively, reflecting farmers' desire to maximise profits amid uncertainty and war. Notably, grain and oilseed yield in Ukraine are stable even under difficult conditions (Fig. 7).

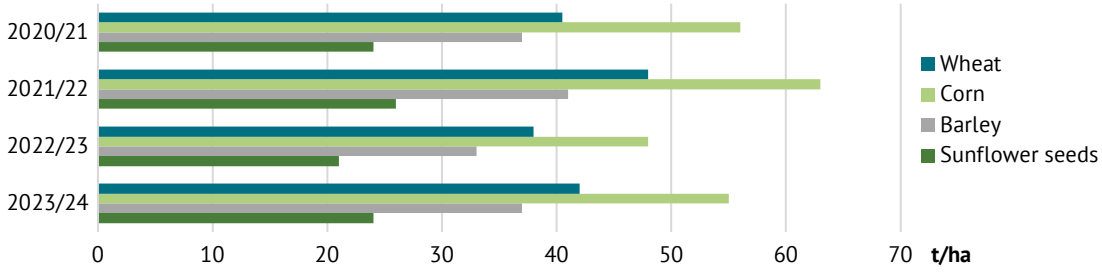

***Figure 7**. Dynamics of grain and sunflower yields in Ukraine, t/ha (2020-2024)*
***Source:** compiled by the authors based on the Ministry of Agrarian Policy and Food of Ukraine (n.d.)*

In 2022/23, the Ukrainian agricultural sector faced unprecedented challenges due to Russia's full-scale invasion, which began in February, as well as unfavourable weather conditions, particularly drought in the southern and eastern regions, which further complicated the cultivation of grain crops. Despite this, the average grain yield was 3.83 t/ha, which was significantly lower than the pre-war level of 2021 (4.78 t/ha), but still demonstrated the resilience of farmers in extreme conditions. Wheat yielded about 3.78 tonnes per hectare, maize 4.76 tonnes per hectare, and barley 3.35 tonnes per hectare, but the gross harvest of cereals and oilseeds reduced to 56 million tonnes, of which cereals accounted for approximately 53.1 million tonnes. In 2023/24, the situation improved slightly as farmers adapted to the realities of war. They optimised their use of resources, for example by increasing the application of available fertilisers where possible and returned to cultivating some of the deoccupied land in the Kharkiv, Mykolaiv and Kherson regions. Better weather conditions, including a mild winter and sufficient rainfall in the spring, contributed to an increase in yields to 4.38 tonnes per hectare: wheat reached 4.25 tonnes per hectare, maize 5.5 tonnes per hectare, and barley 3.7 tonnes per hectare. As a result, the total harvest increased to 70 million tonnes, of which grain crops accounted for about 60 million tonnes, with the rest being oilseeds such as sunflower (12.2 million tonnes). This 25% increase compared to 2022 demonstrated the agricultural sector's ability to recover even in crisis conditions. According to estimates for 2024/25, yields may decline slightly to 4.05-4.2 tonnes/ha due to less favourable weather conditions and the gradual depletion of soils in regions of intensive agriculture, such as the Poltava and Cherkasy regions, where, according to a report by the Kyiv School of Economics, no proper crop rotation has been carried out for years due to economic priorities (Neyter *et al.*, 2024). It is estimated that wheat yields will be around 4-4.2 t/ha, corn 5-5.3 t/ha, and barley 3.4-3.6 t/ha, which, together with a reduction in acreage to 9.1-10.2 million hectares, will result in a gross grain harvest of 65-69 million tonnes. These figures highlight the extraordinary resilience of Ukrainian agriculture, which, despite the war, the mining of over 174,000 km^2 of land and the occupation of 109,000 km^2, continues to produce significant volumes. At the same time, a full return to pre-war levels, such as 86 million tonnes of grain in 2021, remains unattainable without the cessation of hostilities, demining of territories and restoration of logistics infrastructure, in particular Black Sea ports, which are critical for exports. Exports of grain and oilseeds are the backbone of Ukraine's agricultural economy, providing a significant portion of foreign exchange earnings and supporting the stability of the national currency even in wartime, as the agricultural sector traditionally accounts for up to 40% of the national export earnings (Fig. 8).

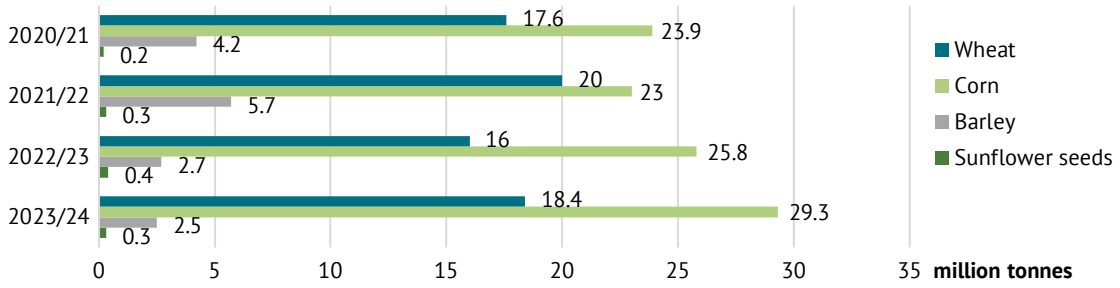

***Figure 8**. Dynamics of exports of grain crops and sunflower in Ukraine in 2020-2024, mln tonnes*
***Source:** compiled by the authors based on the Ministry of Agrarian Policy and Food of Ukraine (n.d.)*

In the 2021/22 marketing year (July 2021 to June 2022), Ukraine achieved a record high, exporting 85 million tonnes of grain and oilseeds to foreign markets, including 48.6 million tonnes of grain (20 million tonnes of wheat, 23 million tonnes of corn, 5 million tonnes of barley) and significant volumes of sunflower oil and seeds, which was made possible by the developed infrastructure of Black Sea ports such as Odesa, Chornomorsk and Pivdennyi, as well as the high harvest in 2021 (106 million tonnes). However, in 2022/23 (July 2022 to June 2023), exports redu substantially to 46-50 million tonnes due to Russian full-scale blockade of Black Sea ports, which paralysed traditional sea routes, which transported up to 90% of agricultural products; this caused accumulation of grain in warehouses, increased transport costs and a drop in incomes of farmers, although a partial resumption of exports became possible through land routes via Poland, Romania and Hungary, as well as thanks to the launch of a "grain corridor" in August 2022, brokered by the United Nations (UN) and Turkey. In 2023/24 (July 2023 to June 2024), the situation improved: thanks to the extension of the "grain corridor" until September 2023, and subsequently the creation of a humanitarian sea route along the coast after Russia's withdrawal from the agreement, as well as the development of alternative routes through EU countries, rail and river routes through the Danube (Romania) and transhipment points in Poland, Ukraine

exported 67. 4 million tonnes of grain and oilseeds, including 23.1 million tonnes of corn, 16.6 million tonnes of wheat and 4.2 million tonnes of barley, as well as significant volumes of sunflower oil (over 5 million tonnes), demonstrating its adaptation to the war conditions and the support of international partners.

According to the forecasts for 2025 (July 2024 – June 2025), exports of grains and oilseeds are expected to reach 50-60 million tonnes, depending on logistical capacities, in particular, the capacity of the western borders, where delays on the Polish-Ukrainian border periodically create bottlenecks, – and the geopolitical situation, including the stability of sea routes and potential attacks on port infrastructure; estimates vary from 50 million tonnes to 60 million tonnes depending on the harvest (65-69 million tonnes). The main markets remain Asia, such as China (corn and soybeans) and Indonesia (wheat), North Africa, in particular Egypt (wheat), and the EU, where Spain (corn) and the Netherlands (oilseeds) are key importers, although competition is increasing from Russia, which is actively dumping wheat prices, and Latin American countries, such as Brazil and Argentina, which are increasing their corn supplies. Despite these challenges, Ukraine maintains its global leadership in sunflower and sunflower oil exports (over 50% of the global market), fourth place in corn (after the US, Brazil and Argentina) and sixth in wheat (after the EU, US, Canada and Australia), which underscores its strategic importance in the global grain market and the resilience of agricultural exports even during the war, when every million tonnes is the result of heroic efforts of farmers and logisticians.

Notably, the direct losses of the Ukrainian agricultural sector as a result of the full-scale Russian invasion that began in 2022 cover a wide range of destruction and damage, going far beyond grain theft or the destruction of elevators and storage infrastructure. One of the most critical blows was the massive destruction and damage to agricultural machinery, which is essential for proper farming. According to estimates by the Kyiv School of Economics in cooperation with the Ministry of Agrarian Policy, as of mid-2023, the loss of equipment – tractors, combines, seeders, cultivators and other specialised machinery – reached a value of over USD 4.7 billion (Neyter *et al*., 2024). Southern regions, such as Kherson, Zaporizhzhia and Mykolaiv regions, were particularly affected, where Russian forces targeted or seized equipment in the occupied territories, and in some cases took it to Russia or to temporarily controlled lands. In the government-controlled areas of the south, such as the Mykolaiv region, farmers lost equipment due to artillery strikes, making it impossible to harvest crops or prepare for new sowing campaigns in a timely manner. Restoring this fleet requires not only significant financial resources, but also time, which is almost unattainable for most farms, especially small and medium-sized ones, in times of war.

The destruction of irrigation systems has also caused significant losses to the agricultural sector, which has become a critical problem for the southern regions of Ukraine – Kherson, Zaporizhzhia, Mykolaiv and Odesa regions, where irrigated agriculture was the basis for growing grain, vegetables and fruits in an arid climate. The World Bank (2025) estimates that as of 2023, the value of damaged or destroyed irrigation infrastructure exceeds 225 million USD, but the actual losses could be much higher due to the long-term impacts. These losses culminated in the explosion of the Kakhovka hydroelectric power station in June 2023, which led to catastrophic flooding of thousands of hectares of land on the right bank of the Kherson region, destruction of crops in the fields and disruption of irrigation canals that supplied up to 580,000 hectares of farmland in the south. For instance, the North Crimean Canal, which supplied water not only to the occupied Crimea but also to a large part of Kherson and Zaporizhzhia regions, stopped functioning, leaving farmers without access to irrigation in the face of natural drought. This has caused soil degradation, salinisation and loss of productivity, which will require years of effort and billions of dollars in investments to restore, significantly undermining the agricultural potential of the southern regions.

The loss of processing capacity has been another painful aspect for the agricultural sector, with southern Ukraine being particularly hard hit. Plants producing sunflower oil, flour, sugar and other processed products located in cities such as Mykolaiv, Kherson and Melitopol (Zaporizhzhia region) were repeatedly targeted by Russian attacks or occupied. According to a report by the Kyiv School of Economics, direct losses to the processing infrastructure exceed 1 billion USD, and this does not include lost value added, as farmers are forced to export raw materials (e.g. sunflower seeds) at lower prices due to a lack of processing capacity within the country (Neyter *et al*., 2024). In the south, where processing has traditionally been an important part of the economy, these losses have led to economic decline, job losses and a deterioration in the financial health of farms, which, together with other factors, creates a complex picture of the devastation that the region will be recovering from for decades after the war.

Notably, the war in Ukraine caused major changes in global grain logistics, disrupting the traditional export routes of one of Ukraine's largest grain suppliers (Penkova & Kharenko, 2023). Before the full-scale invasion, the country transported up to 90% of its wheat, corn and barley through Black Sea ports such as Odesa, Chornomorsk and Pivdennyi, from where the products were shipped to countries in Asia, Africa and Europe. Russian blockade of these ports in the first months of the invasion led to the accumulation of millions of tonnes of grain in warehouses, causing not only economic losses for Ukraine but also a threat to global food

security, especially in countries dependent on Ukrainian imports, such as Egypt, Turkey and the Middle East. In response, the international community and Ukraine were forced to look for alternative transport routes, which led to the restructuring of logistics chains and increased transport costs, affecting global grain markets. One of the key decisions to resume exports was the creation of alternative routes through EU countries, through the so-called "Solidarity Corridors" initiated by the EU in May 2022. These routes involved transporting grain by rail, road and river through Poland, Romania, Slovakia, Hungary and other countries to European ports such as Constanta (Romania), Gdansk (Poland) and the Baltic ports. The EU played a decisive role: in the first months of the Solidarity Corridors, around 20 million tonnes of grain were exported via these routes, partially compensating for the loss of Black Sea routes. The port of Constanta became particularly important, becoming the main hub for transhipment of Ukrainian grain, handling over 8 million tonnes in 2022. In addition, from August 2022 to September 2023, the Black Sea Grain Initiative, mediated by the UN and Turkey, was in effect, which enabled another 32.9 million tonnes to be exported through partially unblocked ports. After its completion, Ukraine created its humanitarian corridor along the western coast of the Black Sea, which added another 27 million tonnes to exports in the 2023/24 marketing year. However, these alternatives proved to be more expensive and less efficient due to limited railway capacity, track gauge incompatibility (Ukrainian gauge is wider than European gauge) and border congestion, which increased logistics costs by 30-50% compared to the pre-war period.

Internal logistics in Ukraine faced numerous challenges due to the war, which complicated the delivery of grain from fields to export terminals (Shevchuk, 2024). One of the main obstacles was the physical destruction of transport infrastructure: bridges, railways and roads, especially in the east and south, were severely damaged by shelling, disrupting links between agricultural regions and logistics hubs. For instance, in the Mykolaiv and Kherson regions, key roads to ports became impassable, forcing farmers to seek detours through western regions. The shortage of rolling stock and locomotives added to the problems, as a significant part of the railway fleet was destroyed or remained in the occupied territories; according to estimates by Ukrzaliznytsia (n.d.), up to 15% of freight cars were lost in 2022. At the same time, the war has stimulated the development of river logistics: according to the Ukrainian Sea Ports Authority (2024), transport on the Danube increased from 1 million tonnes in 2021 to 4 million tonnes in 2023, thanks to the modernisation of ports in Izmail and Reni. The prospects for domestic logistics are related to investments in railway infrastructure (e.g., electrification and track expansion projects), the expansion of river terminals, and the creation of temporary storage facilities closer to the western borders. However, these initiatives require billions of dollars and time, which remain limited resources in the context of the war. Changes in Ukrainian grain logistics significantly affected international logistics chains, forcing global traders and carriers to revise routes and optimise costs. The blockade of the Black Sea has forced importing countries such as Egypt and Turkey to switch to other suppliers in the United States and Argentina or wait for slow deliveries via European ports, extending delivery times from 10-15 days to 30-40 days when using the "Solidarity Routes". Transportation costs have increased due to the need to use several modes of transport (rail, road, barges), transhipment at borders and insurance of cargo in the conflict zone. For example, before the war, transporting a tonne of grain from Ukraine to Egypt cost 20-25 USD, but in 2022, the price jumped to 70-100 USD, depending on the route. This led to congestion in European ports such as Constanta, where cargo handling times doubled, and put additional pressure on global freight rates, which rose by 15-20% in 2022 due to a shortage of vessels in the Black Sea region. At the same time, competition from Russia, which increased exports through its ports (Novorossiysk, Rostov), exacerbated the imbalance in logistics flows, shifting part of Ukraine's traditional markets to eastern routes. The restructuring of grain logistics due to the war in Ukraine affected pricing on world markets, causing initially sharp price increases and subsequently volatility (Fig. 9).

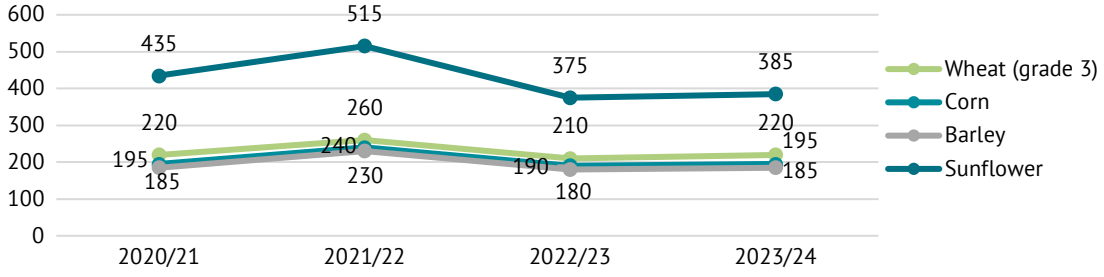

***Figure 9**. Dynamics of grain prices for sunflower seeds after the start of the full-scale invasion of Ukraine – average (USD/t)*

***Source:** compiled by the authors based on UkrAgroConsult (n.d.) and SuperAgronom (n.d.)*

Prices for grain and sunflower seeds in Ukraine during the 2020/21-2023/24 marketing years have undergone significant changes under the influence of yields, global demand, logistical conditions and the war. In the 2020/21 marketing year (July 2020 to June 2021), average purchase prices on the domestic market were 6,000-6,500 UAH/t (USD 210-230/t FOB in Black Sea ports) for wheat (grade 3), This was facilitated by a stable harvest (65 million tonnes of grain) and high export demand (17.6 million tonnes) from Egypt, Indonesia and Turkey; prices rose at the end of the season due to drought in the southern regions and the revival of global trade after the pandemic. Corn costs 5,500-5,800 UAH/t (190-200 USD/t FOB), with an increase in the second half of the year, thanks to China, which actively imported (exports of 23.9 million tonnes) for feed needs after the resumption of pig farming. Barley remained at 5,200-5,500 UAH/t (180-190 USD/t FOB), supported by exports of 4.2 million tonnes to Saudi Arabia and China, where it was in demand for livestock farming. Sunflower seeds cost 12,000-13,000 UAH/t (420-450 USD/t), with an upward trend due to demand for sunflower oil (oil exports of 5.5 million tonnes) and average yields (15.1 million tonnes); only 0.2 million tonnes of raw materials were exported, with the rest being processed domestically. The dollar exchange rate remained stable (27-28 UAH/USD), but rising freight rates due to global logistics problems added pressure on export prices.

In the 2021/22 marketing year (July 2021 to June 2022), a record harvest of 106 million tonnes kept prices somewhat subdued, but global demand and fears of war pushed them to a peak: wheat (grade 3) reached 7,000-7,500 UAH/t (250-270 USD/t FOB), with a peak in December-January due to exports of 20 million tonnes to Asia (Indonesia, Pakistan) and Africa (Egypt); corn 6,500-7,000 UAH/t (230-250 USD/t FOB), driven by Chinese demand (over 8 million tonnes) and high yields, which ensured exports of 23 million tonnes by February 2022; barley 6,200-6,700 UAH/t (220-240 USD/t FOB), with growth due to exports of 5.7 million tonnes to Turkey and a reduction in supply from Russia; sunflower seeds 14,000-15,000 UAH/t (500-530 USD/t), with a peak due to a harvest of 17 million tonnes and oil exports of 5.7 million tonnes, while only 0.3 million tonnes of raw materials were exported. In the 2022/23 marketing years (July 2022 to June 2023), the war and the blockade of ports caused prices to fall: wheat 5,500-6,000 UAH/t (200-220 USD/t FOB after August), corn 5,000-5,500 UAH/t (180-200 USD/t), barley 4,800-5,200 UAH/t (170-190 USD/t), sunflower 10,000-11,000 UAH/t (350-400 USD/t); the "grain corridor" aided in export of 46-50 million tonnes, but the devaluation of the hryvnia to 36-37 UAH/USD and the increase in transport costs (to 70-100 USD/t) reduced profitability. In the 2023/24 marketing years (July 2023 to June 2024), prices recovered thanks to a harvest of 79 million tonnes and logistics: wheat 5,700-8,191 UAH/tonne (210-230 USD/tonne), corn 5,570-6,721 UAH/tonne (190-210 USD/tonne), barley 4,383-6,597 UAH/tonne (170-200 USD/tonne), sunflower seeds 11,000-14,500 UAH/t (370-400 USD/t), with exports of 67. 4 million tonnes; an exchange rate of 36-40 UAH/USD and competition from Russia (230-250 USD/t for wheat) influenced price dynamics, while world prices stabilised (9-10 USD per bushel for wheat).

Once the war in Ukraine is over, the key task for the development of the grain market will be to rebuild the destroyed infrastructure, including ports, railways, bridges and storage facilities, which have suffered significant damage as a result of the hostilities. Black Sea ports such as Odesa, Chornomorsk and Pivdennyi, which accounted for up to 90% of grain exports before the war, will require significant investment to resume full operations, while the de-occupied ports of Mykolaiv and Kherson will need additional modernisation to return to their pre-war capacities (7-10 million tonnes per month). The modernisation of the elevator industry will also be a priority, as many elevators in eastern and southern Ukraine have been destroyed or damaged, and their total capacity has been reduced by 20-30%. Post-war recovery will also involve not only reconstruction, but also the introduction of modern technologies for automated storage systems, energy-efficient dryers and digital platforms for monitoring stocks. This will improve grain storage efficiency, reduce losses (which reached 10-15% before the war due to outdated infrastructure) and make the Ukrainian market more competitive. The development of river logistics, particularly through the Danube ports (Izmail, Reni), which grew from 100,000 tonnes to 2.5 million tonnes per month during the war, could be a long-term solution for diversifying transport capacity.

The war has forced Ukraine to review its trade relations and seek new markets, which opens prospects for expanding the geography of grain exports after the war is over. Until 2022, the main markets were Asia (China, Indonesia), North Africa (Egypt) and the EU (Spain, the Netherlands), but the blockade of the Black Sea and logistical difficulties have increased dependence on European routes such as the Solidarity Road. In the post-war period, Ukraine could strengthen its position in the EU, where its grain has already been integrated into supply chains, but this requires harmonising quality standards with European norms (e.g., pesticide content and certification). At the same time, African countries are a promising destination, where demand for grain is growing due to demographic growth and the need for affordable products; according to the Food and Agriculture Organisation (2022), Ukraine could increase its supplies to 5-7 million tonnes annually to countries such as Nigeria or Kenya, subject to the development of trade agreements. The Asian market, in particular India and South Korea, could also become a new focus due

to their needs for corn and wheat, if Ukraine invests in marketing and logistics. Changes in trade relations with Poland, Slovakia, and Hungary, which imposed temporary bans on imports of Ukrainian grain in 2023, will require diplomatic efforts and the establishment of export verification mechanisms to avoid conflicts and ensure stable access to EU markets. Expanding sales markets will help diversify and reduce dependence on certain regions, which will be a lesson learned from wartime.

The investment potential of the Ukrainian agricultural sector after the war is significant, as the country has unique natural resources (33% of the world's black soil) and a proven ability to adapt to crisis conditions, as demonstrated by exports of 67.4 million tonnes in the 2023/24 marketing year despite the war. Foreign direct investment will be directed towards rebuilding infrastructure, modernising production and increasing added value through grain processing (e.g. flour, compound feed, bioethanol). According to government estimates, the needs for the restoration of the agricultural sector exceed 29 billion USD, which creates opportunities for international investors, particularly from the US, Canada and the EU, who had already expressed interest in Ukrainian projects before the war, as noted in the report of the Ministry of Agrarian Policy and Food of Ukraine (2023). Domestic investors, such as large agricultural holdings (Kernel, MHP), may also become more active if the state provides transparent conditions, tax incentives, security guarantees and risk insurance. The development of the processing industry, where margins on value-added products (oil, cereals) are 20-50% higher than on raw materials, could attract capital to medium and small enterprises, which have proved more resilient during the war than large holdings. Furthermore, innovative technologies such as precision farming, drones and IT solutions for crop monitoring will increase the sector's attractiveness to technology companies. However, the implementation of this potential will depend on land clearance (over 174,000 km^2), political stability and access to credit, as the war has destroyed the financial capacity of many farmers.

International organisations will be central in the post-war recovery of the Ukrainian grain market, providing financial, technical and humanitarian support. The UN, through the Black Sea Grain Initiative, has already proven its ability to unblock exports, exporting 32.9 million tonnes in 2022-2023, and could become a coordinator of logistics projects after the war, contributing to the stability of supplies. The Food and Agriculture Organisation (2024; 2025) prioritises support for farmers and restoration of production: in 2022-2024, the organisation funded 17 million USD in projects to provide seed, fertiliser and small grants to farms in the frontline areas, and after the war, its role will be to modernise agricultural technologies and adapt to climate change (e.g. breeding drought-resistant varieties). The World Bank, which is assessing the sector's losses and needs, has already allocated more than $1 billion for agricultural projects in Ukraine since 2022 and plans large-scale infrastructure reconstruction programmes (ports, elevators) and farm loans worth up to 5 billion USD in the post-war period (National Institute for Strategic Studies, 2024). These organisations will also facilitate Ukraine's integration into EU standards through technical assistance and funding for green initiatives such as bioenergy and energy efficiency. Their cooperation with the Ukrainian government and the private sector will be crucial to attracting donor funds and creating a sustainable development model that will enabled Ukraine not only to return to pre-war volumes (85 million tonnes of exports) but also to exceed them, reaching 100 million tonnes annually if all projects are implemented.

DISCUSSION

The study analysed the positions of global leaders in the production of grain crops and sunflower seeds for the 2023/24 marketing year, as well as key trends shaping the global market, providing insight into the dynamics of the global grain sector and its response to current challenges. The results demonstrated that China (24% of global grain production, 135 million tonnes of wheat), the United States (16%, 383 million tonnes of corn), and the EU (11%, 52 million tonnes of barley) remain the dominant players, while Ukraine holds significant positions with 2% of corn (25 million tonnes) and 21% of sunflower seeds (12 million tonnes). These figures highlight the high concentration of production among a few countries, which makes the global market vulnerable to geopolitical shocks such as sanctions or regional conflicts and also point to growing demand in Asia and Africa, increased competition due to price dumping by Russia, and the reorientation of logistics to alternative routes. These trends signify a gradual shift in trade flows from traditional routes to new logistics corridors and the growing role of Latin American and Asian countries in compensating for deficits, which affects the stability of global supplies and pricing. A study by J. Clapp (2023) also analysed in detail the concentration of grain production among key countries, highlighting their vulnerability to crises such as supply disruptions, but did not consider the impact of local conflicts on global prices, which limits the depth of the results obtained. R. Sendhil *et al.* (2022) addressed the growth in demand for grain crops in Asia, providing important data on consumption and highlighting the demographic and economic factors behind this trend, but ignoring competition between exporters such as the United States and Australia, which reduces the practical value of the conclusions for assessing market dynamics. M. Aghayev (2023) highlighted changes in logistics due to geopolitical factors, highlighting the role of sanctions against Russia in redirecting flows through Caspian ports, but without considering the potential

of developing countries as alternative suppliers, which narrows the scope of the results obtained. S. Erol (2024) analysed the impact of full-scale war on the situation in the Black Sea, noting the importance of logistical changes in the region, but without addressing Ukraine's adaptation capabilities, which limits the predictive potential of the study. A comparison of the results of these studies with the results of this study reveals a common recognition of the concentration of production and geopolitical influence on the market. However, this study is distinguished by its broader coverage of trends, including an analysis of changes in global trends, trade and logistics, which provides a more comprehensive understanding of global shifts and their implications for the global grain sector.

The study also included a detailed analysis of the dynamics of grain acreage, yields and exports in Ukraine for 2020-2024 to assess the impact of the war on the agricultural sector and its adaptation capabilities. The results demonstrated that grain sowing areas decreased from 15.4 million hectares in 2021 to 9.1-10.2 million hectares in 2024 due to occupation (109,000 km^2 of land), mining (174,000 km^2) and the transition to oil crops such as sunflower and soybeans, reflecting economic expediency in the context of difficult grain exports; yields reduced from a record 47.8 hwt/ha in 2021 to 38.3 hwt/ha in 2022 due to hostilities and resource shortages, but recovered to 43.8 hwt/ha in 2023 thanks to farmers' adaptation and better weather conditions. Grain exports reduced from 85 million tonnes in 2021/22 to 46-50 million tonnes in 2022/23 due to the blockade of ports but reached 67.4 million tonnes in 2023/24 thanks to the "Solidarity Routes" and the humanitarian corridor. These results demonstrate a significant impact on the productivity of the sector but also highlight its resilience: reductions in area and yields were offset by logistical solutions, which stipulated exports at a level close to pre-war levels. For Ukraine, this highlights the potential for reorientation towards oilseeds as a strategic direction in the short term, which could strengthen its position in the global market in competition with other players. T. He *et al.* (2023) analysed in detail the decline in grain production in Ukraine due to the war, with accurate statistical data on losses, but without considering the impact of these processes on domestic prices and crop redistribution, which limits the breadth of the conclusions drawn. W. Martin and N. Minot (2022) examined the decline in grain exports in 2022, noting the role of the war in the global crisis, but without touching on the recovery processes of 2023, which reduces its relevance for a full cycle analysis. D. Özocakli *et al.* (2024) provided a detailed overview of export changes through the "grain corridor" supported by an analysis of its impact on grain prices, but did not consider the long-term logistical prospects, which narrows the predictive value of the results obtained. Thus, compared to these studies, the study is notable for a comprehensive approach that covers not only the dynamics of area, yield and exports, but also their interrelationship with other indicators of the global grain market, providing a broader basis for assessing the current state and future development of Ukraine's agricultural sector.

An analysis of price trends for grain crops and sunflower seeds in Ukraine for the 2020/21-2023/24 marketing years revealed significant fluctuations caused by the war, global demand and logistical challenges, assessing the impact of these factors on the agricultural sector's economy. The results indicated that wheat prices rose from 6,000-6,500 UAH/t (210-230 USD/t FOB) in 2020/21 marketing year to 7,000-7,500 UAH/t (250-270 USD/t) in 2021/22 marketing year thanks to a record harvest, dropped to 5,500-6,000 UAH/t (200-220 USD/t) in 2022/23 marketing year due to excess stocks and port blockades, but recovered to 8,191-9,500 UAH/t (220-250 USD/t) in 2024 due to reduced production and drought; corn fluctuated from 5,500-5,800 UAH/t (190-200 USD/t) to 10,150 UAH/t (210-212 USD/t), barley from 5,200-5,500 UAH/t (180-190 USD/t) to 8,000 UAH/t (200-220 USD/t), and sunflower seeds from 12,000-13,000 UAH/t (420-450 USD/t) to 14,500-15,000 UAH/t (400-420 USD/t). These data indicate an initial rise in prices due to high demand, a sharp decline in 2022 due to military restrictions, and a gradual recovery peaking in 2024 due to climatic and market factors, although competition with Russia (230-250 USD/t for wheat) has held back potential. For Ukraine, this means that the war has increased dependence on logistics (costs have risen by 30-50%), but steady demand for grain and oil has kept the sector profitable; High prices in 2024 (up 21-68% compared to 2023) underscore the need to stabilise production and exports to avoid volatility that could affect competitiveness in the global market amid dumping and rising supply from Latin America. Z. Zhang *et al.* (2023) analysed in detail the impact of global crises on grain prices, highlighting their vulnerability to supply disruptions, but did not consider the impact of regional conflicts on global trade flows, which limits its depth. G. Mustafa and A. Iqbal (2021) examined trends in sunflower seed production and trade in the global market, noting the important role of Asian markets in this segment, but ignoring the role of competition between key exporters, which reduces its completeness. S. Devadoss and W. Ridley (2024) addressed wheat price fluctuations on global exchanges, noting the impact of sanctions against Russia, but did not sufficiently account for the growth in supply from Latin American countries, which narrows its practical context. E.M. Kacperska *et al.* (2025) presented a detailed analysis of wheat price volatility in the global market related to the Black Sea Agreement, but did not address the impact of other factors on freight rates, which limits its predictive value. Thus, compared to these studies, this paper is

distinguished by its approach, which combines an analysis of local price trends in Ukraine with a broader global context, considering competition, logistics and market factors, providing a comprehensive overview of the economic implications and stabilisation strategies at the national and international levels.

In summary, the study synthesised the main aspects of the grain sector development, integrating the analysis of global trends and changes in the Ukrainian agro-industrial complex in the context of the war, which provides a basis for assessing its future opportunities. The study covered the positions of major producing countries, global market trends and the dynamics of Ukrainian production, prices and exports, providing a holistic view of the current state and development potential. After the end of the war, Ukraine has significant prospects for recovery and growth, including rebuilding infrastructure, improving logistics and strengthening its position in international markets with the support of the international community. These efforts could return it to a leading role in the grain sector, as well as contribute to broader progress in ensuring the stability and development of the global food system in the face of current challenges.

CONCLUSIONS

An in-depth analysis of key trends in the global grain market for the period 2020-2024, as well as the Ukrainian grain market in the context of the war, was conducted, and its prospects after the war were outlined. In particular, the study determined that global production in the 2023/24 marketing year amounted to 789.8 million tonnes of wheat, 1.22 billion tonnes of corn, 149 million tonnes of barley and 57 million tonnes of sunflower seeds, with China, the United States, the EU and Ukraine occupying the leading positions. In Ukraine, the war caused a significant reduction in grain acreage from 15.4 million hectares in 2021 to 9.1-10.2 million hectares in 2024, while yields ranged from a record 47.8 hwt/ha in 2021 to 38.3 hwt/ha in 2022, with a subsequent recovery. Grain exports reduced from 85 million tonnes in 2021/22 to 46-50 million tonnes in 2022/23 due to the blockade of ports but increased to 67.4 million tonnes in the 2023/24 marketing year thanks to the adaptation of logistics. Domestic prices reflected these changes: wheat cost 6,000-6,500 UAH/t (210-230 USD/t FOB) in 2020/21 marketing year, reduced to 5,500-6,000 UAH/t (200-220 USD/t) in 2022/23 marketing year due to excess stocks, and increased to 8,191-9,500 UAH/t (220-250 USD/t) in 2024 due to reduced harvest and logistical difficulties.

Direct losses in Ukrainian agriculture, in addition to reduced crop areas, included the destruction of agricultural equipment worth 4.7 billion USD, the destruction of irrigation systems worth 225 million USD (especially after the bombing of the Kakhovka hydroelectric power plant in 2023), and damage to processing facilities, which most affected southern regions such as Mykolaiv and Zaporizhzhia. The war has radically changed global grain logistics, forcing Ukraine to reorient itself to land routes through Poland, Romania and the Danube ports, which has increased transport costs by 30-50% (from 20-25 USD/tonne to 70-100 USD/tonne) and affected global prices. The prospects for the development of the Ukrainian grain market after the war are linked to the restoration of infrastructure, which requires 29 billion USD, the modernisation of elevators to reduce grain losses, the expansion of sales markets to Africa and Asia, the strengthening of positions in the EU, and the attraction of investment with the support of international organisations such as the UN, the Food and Agriculture Organisation and the World Bank. Notably, the study has some limitations in terms of focusing on cereals and sunflower seeds, which omitted a wider range of agricultural products, such as pulses or industrial crops. Further research could focus on analysing the impact of geopolitical changes and trade agreements on the long-term competitiveness of the Ukrainian agricultural sector in the world, which could be used to compile strategies to strengthen positions in the international arena and adapt to new economic realities.

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CONFLICT OF INTEREST

The authors of this study declare no conflict of interest.

REFERENCES

[1] Abu Hatab, A. (2022). Africa's food security under the shadow of the Russia-Ukraine conflict. *The Strategic Review for Southern Africa*, 44(1), 37-46. doi: 10.35293/srsa.v44i1.4083.

[2] Aghayev, M. (2023). *New opportunities and challenges for transportation corridors in the South Caucasus in the light of the Russian-Ukrainian war*. doi: 10.2139/ssrn.4482389.

[3] Ben Hassen, T., & El Bilali, H. (2022). Impacts of the Russia-Ukraine war on global food security: Towards more sustainable and resilient food systems? *Foods*, 11(15), article number 2301. doi: 10.3390/foods11152301.

[4] Bulgakov, V., Nikolaenko, S., Holovach, I., Adamchuk, V., Kiurchev, S., Ivanovs, S., & Olt, J. (2020). Theory of grain mixture particle motion during aspiration separation. *Agronomy Research*, 18(1), 18-37. doi: 10.15159/AR.20.057.

[5] Cheremisina, S., Rossokha, V., Selinnyi, M., Balan, O., & Nahornyi, V. (2025). Assessment of structural changes in exports and price situation on the Ukrainian grain market during the war. *Ekonomika APK*, 32(2), 50-62. doi: 10.32317/ekon.apk/2.2025.50.
[6] Clapp, J. (2023). Concentration and crises: Exploring the deep roots of vulnerability in the global industrial food system. *Journal of Peasant Studies*, 50(1), 1-25. doi: 10.1080/03066150.2022.2129013.
[7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions No. COM/2022/217 "An Action Plan for EU-Ukraine Solidarity Lanes to Facilitate Ukraine's Agricultural Export and Bilateral Trade with the EU". (2022, May). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2022:217:FIN.
[8] Devadoss, S., & Ridley, W. (2024). Impacts of the Russian invasion of Ukraine on the global wheat market. *World Development*, 173, article number 106396. doi: 10.1016/j.worlddev.2023.106396.
[9] Erol, S. (2024). The early impact of the Russia-Ukraine war on seaborne trade and transportation in the Black Sea. *International Journal of Shipping and Transport Logistics*, 18(3), 305-323. doi: 10.1504/IJSTL.2024.139063.
[10] FAOSTAT. (n.d.). Data. Retrieved from https://www.fao.org/faostat/en/#data.
[11] Food and Agriculture Organization. (2022). *Note on the impact of the war on food security in Ukraine*. Retrieved from https://openknowledge.fao.org/server/api/core/bitstreams/bab94e66-bac6-4519-9b4f-47e8b68b8d5f/content
[12] Food and Agriculture Organization. (2024). *Food outlook: Biannual report on global food markers*. Retrieved from https://openknowledge.fao.org/server/api/core/bitstreams/825dc0b7-57bc-4a53-8182-056c40c1c80f/content.
[13] Food and Agriculture Organization. (2025). *World food situation*. Retrieved from https://www.fao.org/worldfoodsituation/csdb/en/.
[14] Food and Agriculture Organization. (n.d.a). *Markets and trade. Grains*. Retrieved from https://www.fao.org/markets-and-trade/commodities-overview/basic-foods/grains/en.
[15] Food and Agriculture Organization. (n.d.b). *SDG indicators data portal*. Retrieved from https://www.fao.org/sustainable-development-goals-data-portal/data/.
[16] He, T., Zhang, M., Xiao, W., Zhai, G., Wang, Y., Guo, A., & Wu, C. (2023). Quantitative analysis of abandonment and grain production loss under armed conflict in Ukraine. *Journal of Cleaner Production*, 412, article number 137367. doi: 10.1016/j.jclepro.2023.137367.
[17] Kacperska, E.M., Łukasiewicz, K., Skrzypczyk, M., & Stefańczyk, J. (2025). Price volatility in the European wheat and corn market in the black sea agreement context. *Agriculture*, 15(1), article number 91. doi: 10.3390/agriculture15010091.
[18] Kulazhanov, T., Uazhanova, R., Baybolova, L., Yerzhigitov, Y., Kemerbekova, A., Tyutebayeva, K., Izembayeva, A., & Zhengiskyzy, S. (2024). Ensuring quality and safety in the production and storage of grain crops. *Caspian Journal of Environmental Sciences*, 22(5), 1279-1284. doi: 10.22124/cjes.2024.8343.
[19] Liu, L., Wang, W., Yan, X., Shen, M., & Chen, H. (2023). The cascade influence of grain trade shocks on countries in the context of the Russia-Ukraine conflict. *Humanities and Social Sciences Communications*, 10(1), article number 449. doi: 10.1057/s41599-023-01944-z.
[20] Lukyanova, A., & Zeynalov, A. (2022). *Russian agricultural industry in the conditions of sanctions wars*. doi: 10.48550/arXiv.2211.09205.
[21] Lynnyk, I. (2024). Analysis of losses to the transport infrastructure of Ukraine as a result of Russian aggression. *Spatial Development*, 8, 302-314. doi: 10.32347/2786-7269.2024.8.302-314.
[22] Martin, W., & Minot, N. (2022). The impacts of price insulation on world wheat markets during the 2022 food price crisis. *Australian Journal of Agricultural and Resource Economics*, 66(4), 753-774. doi: 10.1111/1467-8489.12498.
[23] Ministry of Agrarian Policy and Food of Ukraine. (2023). *Strategy for the development of the agricultural sector until 2030*. Retrieved from https://surli.cc/twmfve.
[24] Ministry of Agrarian Policy and Food of Ukraine. (n.d.). *Export performance*. Retrieved from https://uga.ua/eksportni-pokazniki/.
[25] Mustafa, G., & Iqbal, A. (2021). Economics of oil plants: Demand, supply, and international trade. In H. Tombuloglu, T. Unver, G. Tombuloglu & K. Rehman Hakeem (Eds.), *Oil crop genomics* (pp. 393-413). Cham: Springer. doi: 10.1007/978-3-030-70420-9_19.
[26] Nate, S., Colibăşanu, A., Stavytskyy, A., & Kharlamova, G. (2024). Impact of the Russo-Ukrainian war on Black Sea trade: Geoeconomic challenges. *Economics & Sociology*, 17(1), 256-279. doi: 10.14254/2071-789X.2024/17-1/16.
[27] National Institute for Strategic Studies. (2024). *Support to Ukraine by the World Bank Group after February 2022*. Retrieved from https://surl.li/cyjveo.

[28] Neyter, R., Zorya, S., & Muliar, O. (2024). *Agricultural war damages, losses, and needs review*. Retrieved from https://kse.ua/wp-content/uploads/2024/02/RDNA3_eng.pdf.
[29] Osipova, L. (2022). Dynamics of Ukraine's export in the conditions of a full-scale war: Problems and possible ways of their elimination in the context of European integration. *Herald of Khmelnytskyi National University. Economic Sciences*, 312(6), 50-54. doi: 10.31891/2307-5740-2022-312-6(2)-9.
[30] Özocakli, D., Doğan Başar, B., Ekşi, İ.H., & Ginn, W. (2024). Effect of grain corridor agreement on grain prices. *International Economic Journal*, 38(3), 489-506. doi: 10.1080/10168737.2024.2372764.
[31] Panfilova, A., Korkhova, M., & Markova, N. (2023). Influence of biologics on the productivity of winter wheat varieties under irrigation conditions. *Notulae Scientia Biologicae*, 15(2), article number 11352. doi: 10.55779/nsb15211352.
[32] Panfilova, A., Korkhova, M., Domaratskiy, Y., & Kozlova, O. (2025). Development of winter wheat productivity under the influence of biopreparations and different moisture conditions in the steppe zone. *Ecological Engineering & Environmental Technology*, 26(3), 245-254. doi: 10.12912/27197050/200245.
[33] Penkova, O., & Kharenko, A. (2023). Transformation of marketing logistics for the export of Ukrainian crop production in the context of a full-scale war with the russian federation. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 10(1), 37-48. doi: 10.52566/msu-econ1.2023.037.
[34] Pichura, V., Potravka, L., Domaratskiy, Y., & Drobitko, A. (2024). Water balance of winter wheat following different precursors on the Ukrainian steppe. *International Journal of Environmental Studies*, 81(1), 324-341. doi: 10.1080/00207233.2024.2314891.
[35] Pobochenko, L., Tatarenko, N., & Prokopyeva, A. (2023). Current trends in the development of the world grain market in the conditions of war in Ukraine. *Economy and Society*, 48. doi: 10.32782/2524-0072/2023-48-29.
[36] Sendhil, R., Kumari, B., Khandoker, S., Jalali, S., Acharya, K.K., Gopalareddy, K., Singh G.P., & Joshi, A.K. (2022). Wheat in Asia: Trends, challenges and research priorities. In P.L. Kashyap, V. Gupta, O. Prakash Gupta, R. Sendhil, K. Gopalareddy, P. Jasrotia & G.P. Singh (Eds.), *New horizons in wheat and barley research: Global trends, breeding and quality enhancement* (pp. 33-61). Singapore: Springer. doi: 10.1007/978-981-16-4449-8.
[37] Shevchuk, N. (2024). The current status and prospects of growing plant-based food products in the present conditions of the Ukrainian agricultural sector. *Ukrainian Black Sea Region Agrarian Science*, 28(1), 79-88. doi: 10.56407/bs.agrarian/1.2024.79.
[38] SuperAgronom. (n.d.). *News*. Retrieved from https://superagronom.com/news.
[39] U.S. Department of Agriculture. (2025a). *WASDE report*. Retrieved from https://www.usda.gov/about-usda/general-information/staff-offices/office-chief-economist/commodity-markets/wasde-report.
[40] U.S. Department of Agriculture. (2025b). *World agricultural supply and demand estimates*. Retrieved from https://usda.library.cornell.edu/concern/publications/3t945q76s.
[41] UkrAgroConsult. (n.d.). *LINE UP report. Tracking agri exports from the Black Sea ports*. Retrieved from https://ukragroconsult.com/en/publication/line-up-reports/.
[42] Ukrainian Sea Ports Authority. (2024). *Financial plan and reporting*. Retrieved from https://www.uspa.gov.ua/pro-pidpryyemstvo/finplan-ta-zvitnist.
[43] Ukrzaliznytsia. (n.d.). *News*. Retrieved from https://uz.gov.ua/press_center/up_to_date_topic/.
[44] Wang, X., Ma, L., Yan, S., Chen, X., & Growe, A. (2023). Trade for food security: The stability of global agricultural trade networks. *Foods*, 12(2), article number 271. doi: 10.3390/foods12020271.
[45] World Bank. (2025). *Ukraine – fourth rapid damage and needs assessment (RDNA4): February 2022 – December 2024 (English)*. Retrieved from https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099022025114040022.
[46] Zhang, Z., Abdullah, M.J., Xu, G., Matsubae, K., & Zeng, X. (2023). Countries' vulnerability to food supply disruptions caused by the Russia-Ukraine war from a trade dependency perspective. *Scientific Reports*, 13(1), article number 16591. doi: 10.1038/s41598-023-43883-4.

Тренди у світовій торгівлі зерном і насінням, позиція України на глобальному ринку

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Анотація. Дане дослідження було спрямоване на комплексний аналіз українського зернового ринку в умовах війни та його перспектив після її завершення, а також оцінку ключових тенденцій світового ринку зернових за 2020-2024 роки. Методологія дослідження ґрунтувалася на зборі даних із звітів міжнародних організацій та відкритих джерел, їх обробці шляхом статистичного, порівняльного та прогнозного аналізу, а також синтезі кількісних і якісних показників. Результати роботи показали, що світове виробництво у 2023/24 році склало 789,8 млн тонн пшениці, 1,22 млрд тонн кукурудзи, 149 млн тонн ячменю та 57 млн тонн насіння соняшнику, де лідирують Китай, США, ЄС та Україна. В результаті дослідження було встановлено, що в Україні війна скоротила посівні площі з 15,4 млн га в 2021 році до 9,1-10,2 млн га в 2024 році, урожайність впала з 47,8 ц/га в 2021 році до 38,3 ц/га в 2022 році, після чого відновилася до 43,8 ц/га в 2023 році. Також було визначено, що експорт знизився з 85 млн тонн (у 2021/22 маркетинговому році) до 46-50 млн тонн (2022/23), але зріс до 67,4 млн тонн (2023/24) завдяки «Шляхам солідарності» та гуманітарному коридору. При аналізі цін на пшеницю було встановлено, що ціна коливалася від 6000-6500 грн/т (USD 210-230/т FOB) у 2020/21 до 5500-6000 грн/т (USD 200-220/т) у 2022/23 і 8191-9500 грн/т (USD 220-250/т) у 2024 році. Втрати сектору включали техніку (4,7 млрд доларів) і зрошення (225 млн доларів), а логістичні витрати зросли на 30-50 %, вплинувши на світові ціни (USD 12-13 за бушель для пшениці у 2022 році, USD 8-9 у 2024 році). При аналізі перспектив розвитку українського зернового ринку після війни встановлено, що відновлення інфраструктури вартістю 29 млрд доларів, модернізація елеваторів, розширення ринків збуту до країн ЄС, Африки та Азії, а також інвестиції за підтримки міжнародних організацій і Світового банку дозволять повернути експорт до 85 млн тонн і потенційно досягти 100 млн тонн щорічно, зміцнюючи роль України у світовій продовольчій безпеці

Ключові слова: експорт культур; посівні площі; урожайність; логістика; руйнування та відновлення інфраструктури; аграрний сектор