

The Role of Ukraine in Ensuring Global Food Security: Current Challenges and Prospects

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Abstract

Even though Ukraine's GDP is less than 0.2% of the world's GDP, it is one of the biggest exporters of agricultural products, accounting for 9–11% of global wheat exports and 13–16% of global corn exports. As such, Ukraine has been instrumental in ensuring global food security in recent years. Food insecurity and inflation have been made worse by the war in Ukraine, which has changed global patterns of commodity production, trade, and consumption in ways that will maintain prices at historically high levels. Ukraine managed to restore the main export route for its grain in the Black Sea in volumes close to pre-war levels. The indicators of April 2024 exceeded February 2022. The resumption of Ukrainian grain exports helps in decreasing market prices and reducing world hunger. With this in mind, the purpose of the article is to identify priority areas for strengthening Ukraine's role as a guarantor of global food security. It also highlights the dynamics of production of the main types of crop products in Ukraine. The following methods were used for the study: empirical, monographic, extrapolation, graphical, benchmarking, and SWOT analysis. An in-depth study of secondary data highlights that Ukraine currently holds leading positions in global agricultural production and exports, including sunflower seeds, sunflower oil, rapeseed, a quarter of corn, wheat and barley, and soybeans. Based on the extrapolation method, wheat exports to the world market were forecasted until 2027. The features of Ukraine's dominance in the world sunflower oil market were characterized. To reflect the impact of the war on global and Ukrainian food security, a benchmarking analysis of wheat exports in Ukraine and Russia for 2014–2024 was conducted, and the change in the global Food Price Index and certain types of products (2009–2024) was considered. A SWOT analysis of Ukraine's agricultural sector in the international market is presented. The article outlines priority directions for developing Ukraine's agricultural sector as a future guarantor of global food security.

Keywords

Food security; Export potential; Agricultural sector; Grains; Oilseeds

Introduction

Being one of the largest countries in Europe and possessing significant resources of fertile black soil, Ukraine has significant agricultural potential. These natural conditions contribute to high yields of crops such as wheat, corn and barley, which allow the country to be one of the leading countries in terms of grain production and exports. The agricultural sector is vital for Ukraine's economy, providing jobs and foreign exchange earnings. Grain exports provide a stable income that contributes to the country's economic development and financial stability (FAO, 2023a).

Ukrainian agricultural products are vital for global food security, particularly in countries with insufficient grain production (Bychkovska, 2024). Thus, the stability and development of the Ukrainian agricultural sector are not only of national but also global importance, especially in the context of growing food demand. However, the agricultural sector faces serious challenges, such as climate change, which affects yields and the sustainability of agricultural products. Droughts, temperature fluctuations, and extreme weather events are forcing farmers to adapt their growing and storage technologies. To this end, research is being conducted to help develop adaptive strategies to minimize the impact of climate risks on agriculture.

The integration of modern technologies, such as precision farming, biotechnology, and the use of digital solutions for monitoring and managing growing processes, is helping to improve the efficiency of agricultural production. These innovations allow for more precise management of resources, lower costs, and improved product quality, which in turn increases the competitiveness of Ukrainian agricultural products on global markets. Such technological and scientific advances are key to ensuring the long-term stability and resilience of Ukraine's agricultural sector in the face of current economic and environmental challenges. Ukraine is a key supplier of wheat, corn and barley to the global market, but the war poses significant challenges to its agricultural sector. Destroyed infrastructure, mined fields, disruptions in fertilizer imports and a lack of finance are reducing yields and exports. Blockades of ports limit access to markets, which increases global food prices and threatens food security, especially for countries in Africa and the Middle East. Soil contamination and the loss of markets make it difficult to sustain production. International support is essential to overcome these challenges.

Researchers have established the significance of Ukraine as a producer of agricultural products over a long period in ensuring global and domestic food security. It has been established that the involvement of the agricultural sector in global commodity flows related to food production is increasing (Shubravska and Prokopenko, 2022). It has been proven in practice that scientifically based use of fertilisers, rational land use, balanced pricing, developed logistics, and improvement of innovative, technological, and market components in the Ukrainian economy contribute to the development of the agricultural sector and its export potential (Lagodiienko, Bogdanov and Lagodiienko, 2019; Vasylieva, 2018).

Consolidating efforts by management bodies, socially responsible businesses, and rural populations contributes to ensuring effective production relations in the agricultural

market (Kravchenko *et al.*, 2020; Mykhailova *et al.*, 2018). Currently, the issues of the state and prospects of Ukraine's foreign trade in agro-industrial complex products in the context of European integration and global challenges are particularly relevant (Lohosha *et al.*, 2020; Matyushenko *et al.*, 2018). The peculiarities and trends in the export and import of agri-food products, evaluating the global impact, are being studied (Radchenko, 2022). As a result of scientific research, it has been established that Ukraine has unrealised export potential, which requires considering the experience of various countries worldwide (Bazaluk *et al.*, 2020). In particular, studying foreign experience in the rational use of fresh water has allowed for identifying priority vectors for adapting agribusiness to climate change (Dvigun *et al.*, 2022). Recently, increasing attention has been paid to the problems of exporting agricultural products in connection with Russia's military aggression on the territory of Ukraine (Halkin, 2023a; Mamonova, Borodina and Kuns, 2023; Tereshchuk, 2023).

According to Prokopa *et al.* (2024), in the contemporary Ukrainian context, alongside increasing Ukraine's export potential, it is also important to strengthen the resilience of its domestic agriculture. The war exposed significant weaknesses in Ukraine's agricultural infrastructure, including logistical bottlenecks and dependence on global trade routes that are now the subject of controversy (Skydan *et al.*, 2023). Strengthening domestic production chains, diversifying export markets, and developing strategic reserves are necessary for Ukraine to remain a reliable supplier even in the face of geopolitical instability (Krykavskyy, Shandrivska and Pawłyszyn, 2023).

A comprehensive assessment of the direct and indirect market consequences of the war in Ukraine on agricultural business development has been conducted (Lopatynskyy *et al.*, 2023). Scientists emphasise a scientifically based approach and balanced pricing policy to minimise the global food crisis caused by armed conflicts, the COVID-19 pandemic, and climate change (Halkin, 2022; Halkin, 2023b). The connections of global prices have been studied, and the current "price leaders" of the world wheat market have been identified, among which three countries of the Black Sea region stand out — Russia, Ukraine, and Kazakhstan. It has been established that creating a futures market in the Black Sea region will significantly improve the participation of Black Sea markets in forming the price of the world wheat market (Svanidze and Đurić, 2021). The main directions of intensifying Ukraine's agricultural production, considering the quality and safety requirements of products in the conditions of developing European integration processes, have been identified (Petrychenko *et al.*, 2022).

Mazur and Alieksieieva (2024) noted that the Ukrainian agricultural sector has the potential to emerge stronger after the war, provided that there is a concerted effort to modernize infrastructure and adopt more sustainable agricultural practices. Specifically, the current global food security crisis has highlighted the fragility of international supply chains and the growing need for self-sufficiency and resilience. Ukraine should endeavour to position itself not only as a food exporter, but also as a key player in global efforts to reform agricultural systems in response to climate change, rising food prices, and geopolitical instability (Prokopa *et al.*, 2024).

Thus, researching Ukraine's role as a guarantor of global food security is relevant and essential to economic development, global food security, adaptation to climate change, and innovation implementation.

European political analyst Amanda Paul (2023) noted at the second global summit “Grain from Ukraine” that Ukraine remains a reliable partner in the grain industry and can ensure global food security. European researchers have recognized that Ukraine has a developed agricultural sector (Roman, 2024). Ukraine is a major exporter of grains and oilseeds, staple foods that are currently suffering from supply risks caused by the war (Filho *et al.*, 2023). Ukrainian exports - especially wheat - are crucial for some countries in Asia and Africa (Jagtap, *et al.*, 2022; Holmberg, 2024; Ben Hassen and El Bilali 2024). The global scientific community notes that the war also affects the ability of international organizations to provide food aid to countries suffering from famine or other armed conflicts (Behnassi and El Halba, 2022; Chepeliev, *et al.*, 2023; Yıldırım and Onen, 2024). Chinese scientists estimate that as a result of the war in Ukraine, food trade will fall by 60%, and wheat prices will rise sharply (50%), especially for countries that import wheat from Ukraine (Lin, *et al.*, 2023).

The study aims to assess Ukraine's agricultural potential and determine specific measures to strengthen Ukraine's role as a guarantor of global food security. The study will assess the key resources and opportunities of the agricultural sector, taking into account current challenges and threats, including the impact of military operations on agriculture, logistical and infrastructure constraints, and market accessibility. The study focuses on strategies and innovations to enhance agricultural sustainability and resilience. Following the purpose of the article, the main objectives of the study were:

- 1) to determine trends in the production and export of the main types of agricultural products in Ukraine and their place in the world market;
- 2) to identify key export crops in Ukraine;
- 3) to monitor prices in the food market;
- 4) to conduct a SWOT analysis of the Ukrainian agricultural sector on the international market;
- 5) to determine priority areas for the development of the agricultural sector of Ukraine as a guarantor of world food security.

Methodology

This article conducts an empirical analysis of more than 50 scientific articles, 15 monographs, 20 reports and other publications on food security, the agricultural sector and Ukraine's role in international trade. The selection of publications was carried out using the Scopus, WoS, and Google Scholar databases. The monographic method allowed to formation of a database to identify trends in agricultural production. The extrapolation method was used to forecast the level of Ukrainian wheat exports to the world grain market and to identify trends in the role of Ukraine in the world agricultural market. The analytical review of production and export volumes of agricultural products on the global market and in Ukraine was based on processing statistical data from FAO, Statista, USDA, and SU (about 20 statistical reports were used to sample the information).

The graphical method was used to depict the dynamics of the development of Ukraine's agricultural sector from 2000–2023 and Ukraine's position in the global market for individual types of agricultural products (Stepasyuk and Titenko, 2020). To analyze the development of Ukraine's agricultural sector over the period, various approaches were used to address data gaps, in particular during the conflict period. Official national and international sources were used, as well as statistical interpolation to fill in the gaps. Structural changes were analyzed in the context of key events, such as the annexation of Crimea (2014) and the full-scale invasion (2022). The main focus was on long-term trends, supplemented by context from industry reports and expert opinions, which ensured the integrity and objectivity of the study. To compare the impact of Russia's military aggression against Ukraine on agricultural exports, the article uses a benchmarking analysis to quantify export losses compared to pre-war levels or other exporting countries. Statistical tools, including extrapolation, were used to create a trend line that visually represents future changes in the global agri-food market, with a particular focus on leading countries. A SWOT analysis of Ukraine's agricultural sector in the international market was employed to summarize the findings and provide a comprehensive understanding of the sector's strengths, weaknesses, opportunities, and threats. To complete the SWOT matrix of the Ukrainian agricultural sector in the international market, various data sources are used to provide a comprehensive analysis. The main sources and approaches include: data from the State Statistics Service of Ukraine on production, exports and imports; FAO data on global food markets; information from the WTO on barriers to international trade; and scientific and economic research. The assessment was conducted with due regard to the specifics of regions, product types and markets to avoid generalizations that may not be accurate for different conditions. Thus, a comprehensive approach and multi-stage verification allow us to create a relevant and reasonable SWOT analysis.

These methods allowed for identifying the main factors influencing the agricultural sector and developing effective strategies to ensure food security both at the national and international levels. The assessment was carried out taking into account the specifics of regions, product types and markets to avoid general conclusions that may not be accurate for different conditions. Potential limitations include data inconsistencies due to disruptions caused by the conflict and the rapidly changing geopolitical landscape, which may impact the accuracy of long-term forecasts.

Results

Ukraine is essential in the global food market due to its significant natural resources, particularly fertile soils and a favourable climate for agriculture. Crop production is a critical component of Ukraine's agricultural sector. Both domestic needs and export opportunities determine priorities in this area. Ukraine's significance in ensuring the food security of certain countries is also substantial, especially concerning the main export crops. The production of major crop products in Ukraine undergoes significant changes under various economic, technological, and climatic factors. Despite these challenges, the agricultural sector demonstrates stable growth trends in the production of the main types of crop products (see Table 1).

Table 1: Production Dynamics of Major Crops in Ukraine, thousand tons

Crops	Year									Growth, 2023 to	
	2000	2005	2010	2015	2019	2020	2021	2022	2023	2000, %	2010, %
Wheat	10197	18699	16851	26532	28328	24877	32151	20729	21625	112.1	28.3
Maise	3848	7167	11953	23328	35880	30290	42110	26187	31030	706.4	159.6
Sunflower seeds	2842	3689	4526	5166	5959	6481	6665	5238	12760	349.0	181.9
Soya beans	64	613	1680	3931	3699	2798	3493	3444	4743	7264.2	182.3
Winter rapeseed and colza	132	285	1470	1738	3280	2557	2939	3318	4184	3074.2	184.7

Source: SU (2024)

Modern technologies, innovation transfer, and expansion of sales markets contribute to strengthening the position of Ukrainian agrarian producers in the global market. In 2023, Ukraine ranked 2nd globally in sunflower and its processed products (oil, meal) production, 5th in walnut production, 6th in rapeseed production, 7th in barley and wheat, 9th in cherries and oats, and 10th in corn, according to the overall Top-10 ranking of countries worldwide (Filipenco, 2024) (see Figure 1).

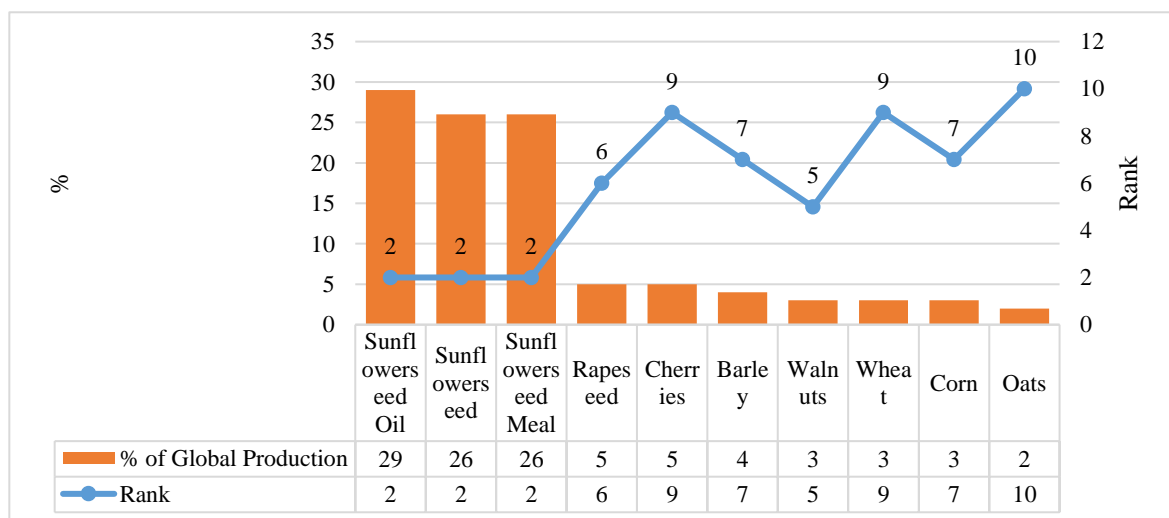


Figure 1: Ukraine's Place in Global Agricultural Production, 2023 (USDA, 2023)

Ukraine plays a pivotal role in the global food market, primarily due to its substantial production of grains and oilseed crops. Its influence extends to many countries and regions that import Ukrainian products to ensure food security. Below is the production of Ukraine's prominent export grain and oilseed crops (see Figure 2).

The growth in the production of grain, oilseed, leguminous crops, and vegetables contributes to ensuring food security in Ukraine and other countries. Wheat remains one of the main crops in Ukraine. The steady increase in wheat production is attributed to advancements in agricultural technologies and the adoption of high-yielding varieties.

Ukraine is important in the global food security system due to its ample agricultural resources and potential. Globally, Ukraine is the leading producer and exporter of sunflower oil. Annual sunflower production exceeds 15 million tons.

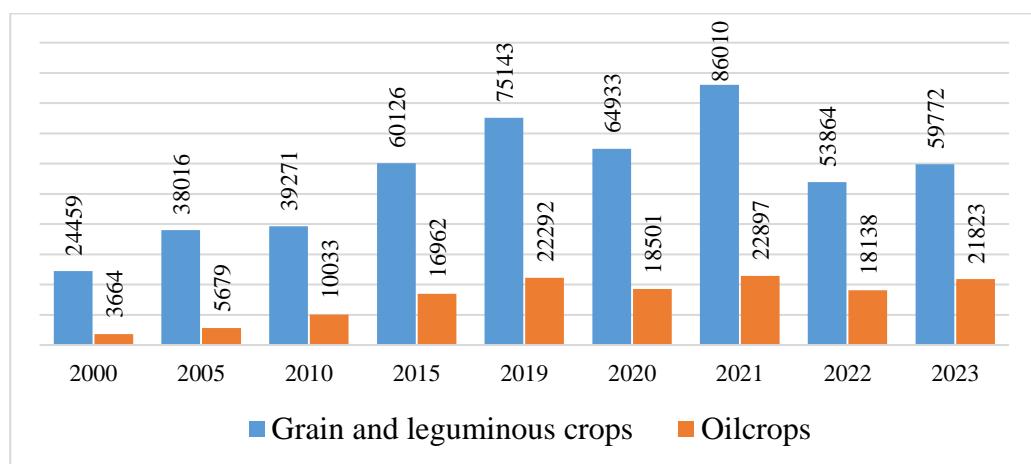


Figure 2: Production of Ukraine's Main Export Grains and Oilseeds, thousand tons (SU, 2024)

Ukraine is vital in global soybean production and contributes to food security. Although it is not the largest soybean producer in the world, its contribution to this sector is significantly increasing. Soybean production in Ukraine has grown significantly in recent years. FAO data shows that production volumes exceed 3.5 million tons annually (FAO, 2023a). Expanding soybean areas reflect rising farmer interest. Using modern technologies and high-yielding varieties contributes to increasing soybean yields in Ukraine. Ukraine is a significant exporter of soybeans. Annual export volumes exceed 2 million tons. The leading importers of Ukrainian soybeans are the European Union countries, China, and Turkey. Demand for Ukrainian soybeans is also growing in Southeast Asian countries. Soybeans are vital for food security as a protein source. They are used as a feed base in livestock, contributing to the production of meat, milk, and other animal products.

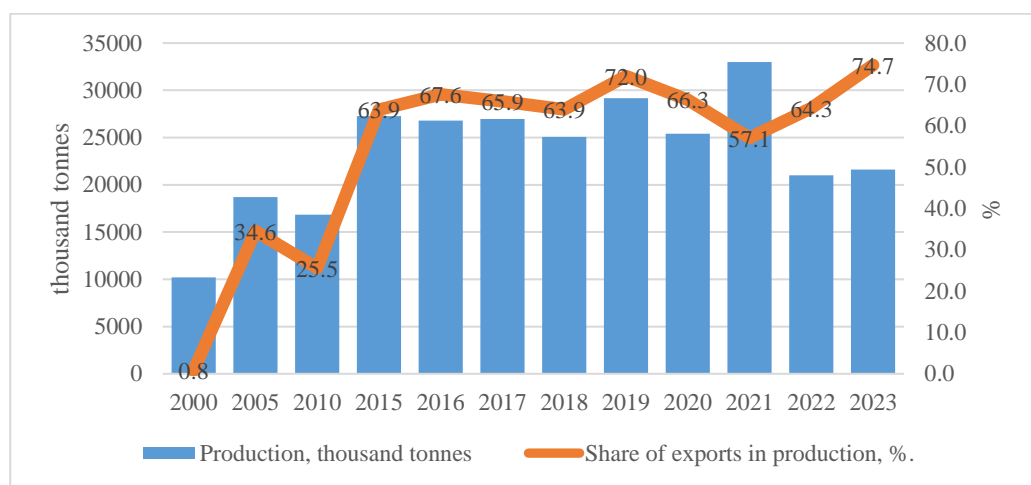
Table 2: Ukraine's Share in Global Oilseeds Production, %

Culture	Marketing year (MY)	World	Ukraine	Ukraine's share in the world production, %
Soybean	2021/2022	360.43	3.8	1.05
	2022/2023	378.37	4.1	1.08
	2023/2024	395.41	5.2	1.32
Sunflowerseed	2021/2022	56.86	17.5	30.78
	2022/2023	52.78	12.2	23.11
	2023/2024	55.14	14.5	26.30
Rapeseed	2021/2022	75.79	3.02	3.98
	2022/2023	88.75	3.5	3.94
	2023/2024	88.76	4.75	5.35

Source: FAO (2023b, 2023c); Statista (2024b); USDA (2024a)

Ukraine is one of the leading rapeseed producers in the world, with an annual production of about 3-4 million tons. Rapeseed from Ukraine is exported to the European Union countries to produce biodiesel and edible oil, contributing to the EU's energy and food security (see Table 2).

Ukraine continues to be one of the largest wheat exporters in the world. The main markets are the countries of Europe, the Middle East, and North Africa. Ukraine is among the top ten wheat producers (Statista, 2024a). In 2023, Ukraine produced 21.6 million (mln) tons, of which 74.7% were exported (see Figure 3).



According to preliminary estimates, considering current natural and climatic changes, the effects of the 2019–2020 pandemic, and the war, Ukraine will supply the world market with 14 mln tons of wheat in 2027 (see Figure 4).

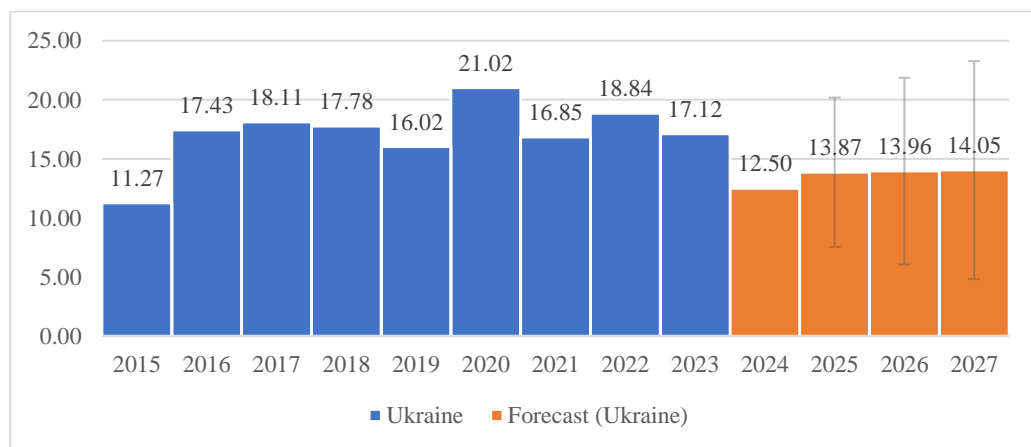


Figure 4: Actual and Forecasted Level of Wheat Exports from Ukraine to the Global Grain Market, million (mln) tons (USDA, 2024b)

Finally, for the long-term survival and resilience of the maize sector, the central maize-producing countries should focus on sustainable farming practices, resource management, and innovation. Ukraine is among the top three maize exporters in the

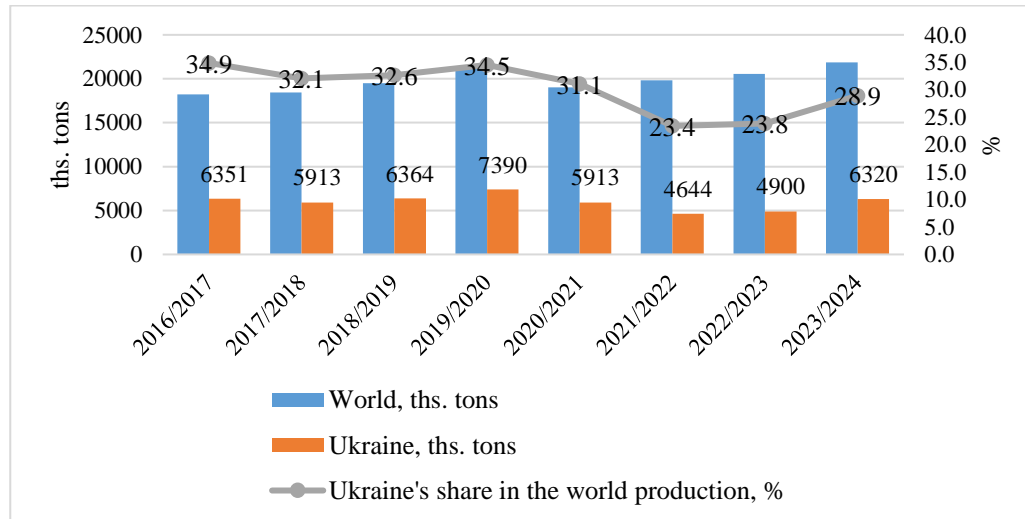
world, with the ten largest maize-producing countries playing a crucial role in supplying the world with this vital crop (see Table 3).

Table 3: Ukraine's Place in Global Corn Production

Marketing year (MY)	Million tons		Ukraine's share in the world production, %
	World	Ukraine	
2021/2022	1217.27	42.13	3.5
2022/2023	1159.6	27	2.3
2023/2024	1225.45	31	2.5

Source: USDA (2024b)

With large maize production capacities, these countries help ensure global food security and significantly impact agriculture and global trade. Maize is the second most important grain crop. The areas under maize cultivation are increasing due to the high demand for this crop in domestic and international markets. Ukraine occupies a leading position in the global sunflower oil market, being the largest producer and exporter of this product. Annually, the country produces about 6-7 million tons of sunflower oil, which accounts for approximately 30-35% of global production (see Figure 5).



Ukraine cultivates sunflowers in large areas, approximately 6-7 million hectares annually. Ukrainian farmers use modern technologies to grow and process sunflowers, allowing for high yields and quality oil. Ukraine is the world's largest exporter of sunflower oil, accounting for about 50-60% of global exports (FAO, 2023c). In 2023, export volumes amounted to about 5-6 million tons. The leading importers of Ukrainian sunflower oil are the European Union countries, India, China, Turkey, and the Middle Eastern countries. In recent years, demand for Ukrainian sunflower oil has been increasing in African countries and Southeast Asia. Due to high production and export volumes, Ukraine holds leading positions in the global sunflower oil market. Despite numerous challenges, the country has significant potential for further development and strengthening its position. Implementing modern technologies, expanding sales markets,

and improving infrastructure will help Ukraine maintain its leading role in the global sunflower oil market (see Table 4).

Table 4: Ukraine in the Global Sunflower Oil Market

<i>Advantages</i>	<i>Challenges and threats</i>	<i>Development prospects</i>
High soil fertility, especially black soil, is conducive to growing high-quality sunflowers.	Dependence on global sunflower oil prices may lead to financial risks for producers.	Opening new markets in Africa and Asia may contribute to export growth.
Favourable climatic conditions and modern cultivation technologies allow Ukraine to achieve high sunflower yields.	Climate change may affect sunflower yields, which will affect production and export volumes.	Implementation of new technologies for sunflower cultivation and processing can improve production efficiency and product quality.
Ukraine has a well-developed infrastructure for sunflower oil processing, which allows the production of high-quality products.	Insufficient development of transport and logistics infrastructure may complicate export operations.	Investments in transport and logistics infrastructure could improve export opportunities.
Relatively low production costs make Ukrainian sunflower oil competitive on the global market.	Increasing competition from other sunflower oil producers, such as Russia and Argentina.	Production of organic sunflower oil and other value-added products could increase the industry's profitability.

The development of Ukraine's agricultural sector has been negatively impacted by the global COVID-19 pandemic in 2019 and Russia's military aggression since February 2022. A direct consequence of this has been reduced agricultural production, exports, and Ukraine's GDP. Russia's war in Ukraine has also led to historic disruptions in global agricultural, energy, and fertiliser markets, worsening food security for millions of people (Dankevych, 2022). Since 2022, statistical data indicate a decline in the production and export of essential agricultural commodities in Ukraine and an increase in production and export in Russia (see Figure 6).

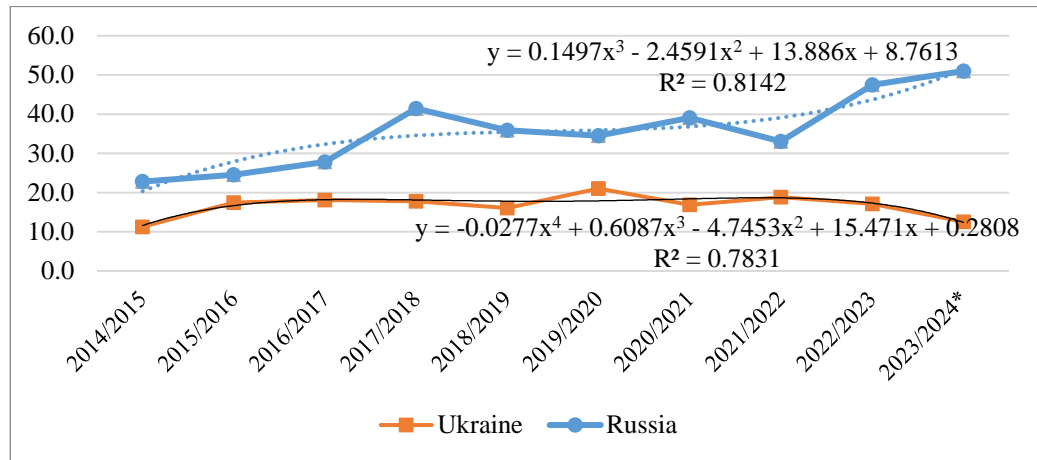


Figure 6: Benchmarking Analysis of Wheat, Flour and Wheat Products Exports in Ukraine and Russia, 2014/2015 – 2023/2024, thousand tons (Filipenco, 2024)

Global shifts in the agricultural market due to Ukraine’s reduced production and exports have been severe. According to the Food Price Index of the Food and Agriculture Organization of the United Nations, in March 2022, global food prices reached a nominal all-time high (FAO, 2024). The changes in the Food Price Index confirm this trend (see Figure 7).

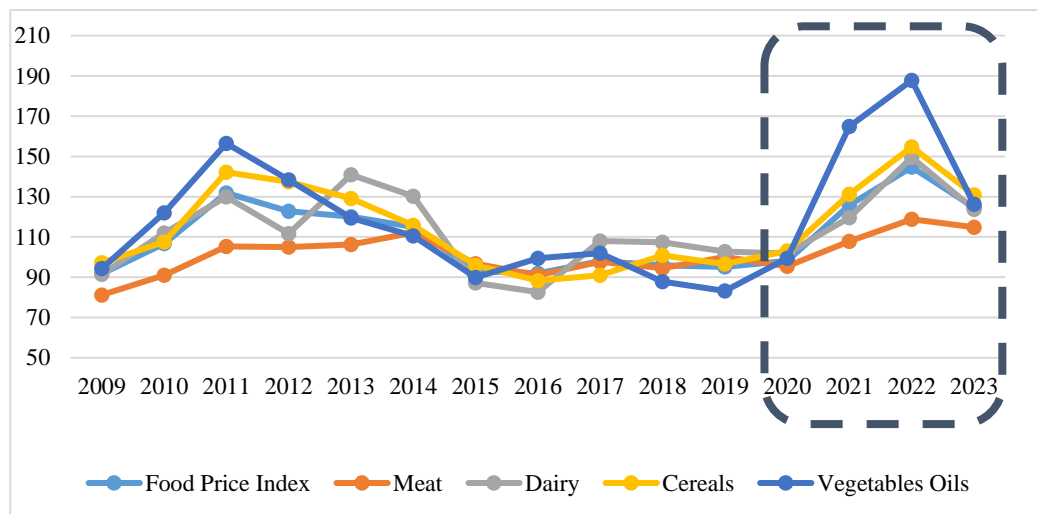


Figure 7: Dynamics of the Global Food and Commodity Price Index, % (FAO, 2024)

The Russian war in Ukraine has caused the most significant military destabilisation of global agricultural markets in the past century. The war has directly and indirectly impacted agricultural production in Ukraine. The occupied territories of Donetsk, Luhansk, Kherson, and Zaporizhzhia regions accounted for about 21% of wheat, 17% of barley, and 19% of sunflower seeds produced in Ukraine from 2016 to 2020, while very little maize was grown there (SSSU, 2024). According to NASA Harvest, the amount of abandoned arable land in Ukraine in 2023 due to the war is approximately 7.5% of the total arable land area in the country (Becker-Reshef and Mitkish, 2024). The war raised

transport costs, reducing crop profitability and forcing lower prices. As a result, Ukraine planted and harvested less. According to the State Statistics Service of Ukraine, sown areas under grain and leguminous crops in 2023 decreased by 31.3%, sunflower by 21.2%, vegetables by 13.7%, and fruit and berry crops by 13.8% compared to 2021 levels (SSSU, 2024). The total loss of agricultural land and unharvested crops as of June 2022 amounted to 50%, grain storage to 9%, and agricultural machinery to 22% (Neyter, Stolnikovych and Nivievskiy, 2022).

According to the Global Report on Food Crises, in 2022, 258 million people suffered from acute food insecurity, the highest number on record (GRFC, 2023). At the same time, the costs of addressing these issues also increased due to simultaneous shocks in global energy and fertiliser markets caused by Russia's war (Welsh and Glauber, 2024).

Ukraine's livestock sector has potential but less global impact than grains and oilseeds. However, the sector's development could increase its role. Beef and pork production in Ukraine is stable but does not reach the volumes of the leading global producers. The primary consumers are the domestic market and neighbouring countries (Georgia, Moldova). Ukraine is one of Eastern Europe's leading producers and exporters of poultry meat. Large poultry farms provide significant volumes of products for domestic consumption and export. Ukraine has a strong dairy industry that produces a wide range of dairy products. The leading producers are large agri-holdings and cooperatives. Dairy products are exported to the European Union, Asia, and Africa. Exports cover various products, from fresh milk to cheese and butter.

The livestock sector has also been significantly affected by the war. The estimated value of lost animals exceeds USD 136.4 million. Agricultural animals die not only from direct combat but also from limited access to farms, lack of feed, and veterinary services. The estimated number of animals lost due to Russian aggression in the affected areas includes 92,000 cattle, 258,000 pigs, and about 6 million poultry. Additionally, agricultural machinery and equipment are also damaged due to shelling, airstrikes, and combat operations (SSSU, 2024). The estimated cost of replacing and repairing machinery is USD 926.1 million (Neyter, Stolnikovych and Nivievskiy, 2022).

The appropriation of Ukraine's crops by Russia as a result of military aggression has caused severe economic and humanitarian consequences. Russian troops seize Ukrainian farms and agricultural enterprises, confiscate the harvest, and transport it to Russia. This leads to significant losses for Ukrainian farmers and the country's economy. Moreover, such looting results in food shortages in Ukraine, exacerbating the humanitarian crisis. These actions by Russia are part of a broader strategy to undermine Ukraine economically, highlighting the need for international support to restore Ukraine's economy and ensure food security. Despite all the upheavals, Ukraine has opportunities to increase its role in the global livestock market. Investments in technology and infrastructure can boost Ukraine's role in global food security.

Discussion

Ukraine occupies an essential place in the global food market due to its natural resources, significant production volumes, and export of major crops. Despite numerous

challenges, the country has significant potential for further development and strengthening its position in the international market. Foreign researchers point out that Ukraine's role in global food security is extremely important, especially in the context of military aggression. In particular, analysts from the Food and Agriculture Organization of the United Nations (FAO) note that Ukraine is a critical supplier of grain crops, especially for countries that depend on food imports, such as the regions of Africa and the Middle East (Clapp *et al.*, 2022; Hamulczuk *et al.*, 2023; Filho *et al.*, 2023; Sharma *et al.*, 2024; Zhang *et al.*, 2024). The war has severely disrupted logistics, destroyed critical agricultural infrastructure, and blocked ports, leading to rising global food prices, and worsening hunger in vulnerable regions (Aljounaidi *et al.*, 2024; Emediegw, 2024; Welsh and Glauber, 2024). According to researchers at the Peterson Institute for International Economics and the Oakland Institute (Ozili, 2022; Mousseau, 2023), Ukraine is a key link in global food supply chains. Military aggression and export restrictions from Ukraine may result in prolonged global food shortages, intensifying humanitarian crises in low-income nations. Studies from the University of Oxford (Hussein and Knol, 2023) and Harvard (Goldstein, 2024) also emphasize the need for international support for Ukraine to ensure its ability to restore production capacity and maintain access to foreign markets. They believe that the stable functioning of the Ukrainian agricultural sector is the key to reducing the risks of a global food crisis (World Food Programme, 2024). It implements modern technologies, expands into new markets, and improves its infrastructure (see Table 5).

Table 5: SWOT Analysis of the Ukrainian Agricultural Sector in the International Market

<i>Strengths</i>	<i>Weaknesses</i>
Ukraine has some of the most fertile soils in the world (chernozem), which contributes to high agricultural crop yields; Significant areas are suitable for agricultural production, allowing for the cultivation of large volumes of products; Ukraine is a major producer of grains (wheat, maize), oilseeds (sunflower), and other agricultural products; High levels of agricultural product exports, especially grains, to international markets; Relatively low cost of labour and land compared to other countries.	Poor state of transport and logistics infrastructure, which complicates the transportation of products; The low intensity of implementing new technologies and modern equipment; Frequent droughts and other adverse weather conditions affecting crop yields; Limited access to credit and investments, which hinders the development of the sector; Inadequate transport and logistics infrastructure impedes efficient product transportation, particularly during wartime disruptions; Restricted access to credit and investment stifles growth and development, further exacerbated by conflict-related risks; Corruption and complex regulatory requirements create additional difficulties for farmers and agricultural enterprises.
<i>Opportunities</i>	<i>Threats</i>
Increased demand for Ukrainian products in new markets such as Asia and Africa;	Geopolitical tensions and military aggression directly disrupt production and trade logistics, severely impacting Ukraine's role in international markets;

<p>Investments in precision farming, biotechnology, and other innovations can significantly increase yield and production efficiency;</p> <p>The growing demand for organic products can become an essential direction for development.</p> <p>Participation in international programmes and projects aimed at agricultural development can enhance competitiveness;</p> <p>Investments in transport and logistics infrastructure can significantly improve export capabilities;</p> <p>Targeted investments in transport and logistics infrastructure promise to improve export capabilities and reduce dependency on unreliable routes;</p> <p>International programs supporting post-conflict agricultural development can enhance competitiveness and rebuild trade relations.</p>	<p>Climate change may increase the frequency of extreme weather conditions, which will negatively affect crop yields;</p> <p>Growing competition from other agricultural exporting countries.</p> <p>Internal political conflicts and international sanctions may create risks for the agricultural sector;</p> <p>Dependency on global agricultural product prices can lead to financial risks.</p> <p>Imposing tariffs and other restrictions in international markets may reduce the competitiveness of Ukrainian products;</p> <p>Food insecurity risks in importing countries could complicate trade relations, placing additional pressure on Ukraine to fulfil its global role amid conflict.</p>
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Despite facing challenges such as war, climate change, and economic difficulties, Ukraine's rich natural resources, significant agricultural potential, and major grain crop exports have established it as a key player in the international market.

These findings coincide with the general international consensus that emphasizes the importance of Ukraine in ensuring a stable supply of food commodities, in particular wheat, corn, and oilseeds, which are critical for many countries. At the same time, current challenges require adaptation strategies aimed at strengthening the resilience of the agricultural sector and developing export potential, which will only strengthen Ukraine's role in shaping. However, several problems must be addressed to realise this potential, including improving infrastructure, implementing new technologies, and reducing dependency on climatic conditions. Overcoming corruption and creating favourable conditions for investment in the sector are also important aspects. Food security is critical to national security, especially for a country with great agricultural potential like Ukraine. Ensuring food security involves several key aspects: stable production, access to food, product quality, and supply stability (see Table 6).

Ukraine faces several challenges, including political instability, economic difficulties, climate changes, and conflicts. Expected long-term impacts include changes in agroclimatic zones that may reduce the available areas for growing certain crops while creating new opportunities for others (Benitez-Alfonso *et al*, 2023). An increase in the frequency of droughts and extreme weather events will lead to an increased need for drought-resistant crops and modern irrigation systems. Investments in research on

adaptive agriculture and the development of climate-resilient innovations will be critical (Grigorieva *et al*, 2023). Modernization of the logistics infrastructure (roads, railways, ports) will reduce the cost of transportation and expand export opportunities (Liu, 2024). The introduction of digital technologies and automation in the agricultural sector will help improve production efficiency (Ashoka *et al*, 2023) The development of “green” investments in renewable energy can support the sustainable development of the agricultural sector by reducing dependence on fossil fuels (Wang, *et al*, 2024). A climate change adaptation program, investment in innovation, and expansion of export potential can ensure Ukraine's leadership in the international food security market. However, due to its natural resources and agricultural potential, the country has significant opportunities to strengthen its food security. Food security in Ukraine requires support for production, quality access, exports, and international cooperation. The implementation of these strategies will contribute not only to enhancing food security in Ukraine but also to its contribution to global food stability.

Table 6: Priority Directions for Developing Ukraine's Agricultural Sector as a Guarantor of Food Security in the World

<i>Direction</i>	<i>Measures</i>
<i>National level</i>	
Supporting agricultural production	development of agricultural infrastructure, which could include expanding drip irrigation in southern Ukraine; provision of financial incentives and subsidies for farmers and agricultural enterprises; investment in agricultural research and development to enhance productivity and crop resilience to climate changes; increasing the share of exports of processed agricultural products; diversification of export product positions in agriculture, food, and processing industries (including organic products)
Ensuring access to food	introduce support programmes for low-income groups to ensure their access to basic foodstuffs; stimulate the development of local markets and cooperatives to ensure equal access to food in different regions of the country
Food quality and safety	establishment and control of compliance with food quality and safety standards; development of a system for monitoring and controlling food safety at all stages of production and sales (according to HACCP)
Sustainable land use and resource conservation	programmes for soil protection and restoration, prevention of erosion and land degradation, conservation of biodiversity through the introduction of sustainable land use practices
<i>International level</i>	
Expanding export opportunities	providing support to agricultural exporters through consultations, financing and participation in international exhibitions and forums; establishing strategic partnerships and alliances with other countries to share experience and technologies in the field of agricultural production
Humanitarian aid	participation in international humanitarian programmes through food supplies to countries suffering from the food

	crisis; providing technical assistance to other countries in the development of their agricultural sector; the need to fully unblock the Black Sea to ensure global food security
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Source: CMU (2019); Dankevych (2022); GRFC (2023); ISO (2018); Welsh and Glauber (2024)

Conclusion

Ukraine is one of the key players in the global agricultural market, playing an important role in ensuring global food security due to significant production volumes of grains, oilseeds and livestock products. To strengthen the country's position as a guarantor of food security, a systematic approach is needed, which includes increasing productivity, developing infrastructure, diversifying markets, improving legal regulation and implementing the principles of sustainable development.

One of the priority tasks is to restore the transport and logistics infrastructure that has been significantly damaged as a result of military operations. This includes the reconstruction of communication routes, the development of alternative export routes (railway connections with neighbouring countries) and the modernization of ports. To adapt to climate change, it is advisable to invest in irrigation systems and the development of drought-resistant crop varieties.

It is urgent to create state mechanisms for guaranteeing loans and low-interest financing programs for farmers in cooperation with international organizations. Integration into the international recovery programs of the EU and the UN will contribute to obtaining additional resources for the reconstruction of the agro-industrial complex and increasing competitiveness.

In conditions of war and geopolitical risks, ensuring food security both within the country and for importing countries is key. The proposed measures include the creation of strategic product reserves and the conclusion of long-term commercial agreements. Cooperation between the government and the private sector in the grain subsector will allow for strengthening trust in the market through transparency and joint implementation of anti-crisis measures.

The successful implementation of these initiatives will ensure the sustainable development of the agricultural sector of Ukraine and strengthen its position at the global level, contributing to both national and international food security.

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Author's Declarations and Essential Ethical Compliances

Author's Contributions (in accordance with ICMJE criteria for authorship)

This article is 100% contributed by the sole author. He conceived and designed the research or analysis, collected the data, contributed to data analysis and interpretation, wrote the article, performed critical revision of the article, edited the article, and supervised and administered the field work.

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Research involving human bodies or organs or tissues (Helsinki Declaration)

The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

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The author(s) solemnly declare(s) that this research has not involved the plants for experiment and field studies. Some contexts of plants are also indirectly covered through literature review. Thus, during this research the author(s) obeyed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora.

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The author(s) solemnly declare(s) that this research has not directly involved any local community participants or respondents belonging to non-Indigenous peoples. Neither this study involved any child in any form directly. The contexts of different humans, people, populations, men/women/children and ethnic people were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee

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(Optional) PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

The author(s) has/have NOT complied with PRISMA standards. It is not relevant in case of this study or written work.

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