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Challenges and opportunities for the development of Ukrainian agriculture in the context of EU enlargement

Comprehensive assessment of challenges facing Ukraine on its path towards EU accession must inevitably include identification of those faced by the Ukrainian agricultural sector. Here, it is necessary to adapt to the rules, norms, and standards of the European Union, especially in the cases of the Common Agricultural Policy and the European Green Deal, as well as to identify ways to expand mutually beneficial cooperation between all connected parties within agricultural value chains. Analysis of Ukraine's Input-Output tables and turnover of goods and services undertaken by the authors of this paper reveals deep integration of Ukrainian agriculture within the global economy. Dynamics of Ukrainian agri-food exports in 2014-2023, analysed according to the product structure and geographical directions, demonstrate stability of volumes and shares of exports to the EU, both in the pre-war period and currently – in conditions of a full-scale war. Furthermore, the study confirms the economic implausibility of most of the claims made recently by Eastern European farmers regarding the extreme influx of Ukrainian agri-food products. Among the anticipated benefits for Ukrainian agricultural sector accruing from joining the EU are the sector's potential greening and diversification, as well as the likely development of domestic agri-food processing and increase of financing and innovations.

Keywords: agri-food production, exports, sustainable development, war, EU, Ukraine

JEL classifications: F14; Q17; Q18

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Introduction

Agriculture in Ukraine is one of the leading and most resilient sectors of the national economy, even during a period of full-scale war. Ukrainian agricultural business demonstrates a high level of integration into the global economy, mainly as an exporter of agricultural raw products (corn, wheat, oilseeds), as well as sunflower meal and sunflower oil.

Following the Revolution of Dignity in 2014, Ukraine approved its official course towards the European integration. Subsequently, the Association Agreement was signed (Cabinet of Ministers of Ukraine, 2014), active from September 1, 2017. During the period 2014-2021, reorientation of Ukraine's foreign trade away from the Russian Federation (RF) and the Commonwealth of Independent States (CIS) towards the European Union (EU) occurred, with the total agri-food exports growing by 1.6 times, reaching 7.7 billion USD in 2021. This was facilitated, among other, by implementation of European safety standards in Ukrainian production (including food processing), opening the way to the demanding European market.

Ukraine applied to join the EU on the fifth day of the RF's full-scale invasion (February 28, 2022). On June 23 of the same year, the European Council granted Ukraine the candidate status for the EU membership. The decision was based on the EU members' unity on strategic objectives and security concerns in sight of the ongoing war of RF against Ukraine (Bourguignon *et al.,* 2022). This situation altered the cost-benefit equation in favour of new members, providing the EU with a geopolitical incentive to resume enlargement (Karjalainen, 2023). Despite the rapid approval of Ukraine's European integration intentions, it is evident that this will not result in an equally accelerated process of actual EU membership. Certain criteria must be met, which are challenging even for countries that are not engaged in a full-scale war. In this context, it is anticipated that one of the greatest challenges will be encountered in the coordination of Ukraine and the EU positions in the field of agricultural production.

One of the key concerns of EU member states, particularly those that have joined the European community since 2004, is the potential reduction in their share of CAP financing due to the accession of Ukraine, the country being a significant agricultural producer and exporter. They are also concerned about the increased competition that will ensue in the common European market. It is evident that the enlargement of the EU will require clarification of the objectives of its extension, the criteria for joining it, and the corresponding adjustments of the CAP (Economides *et al.,* 2024). The experience of Poland, which joined the EU in 2004 on terms which included a gradual period of introduction of agricultural payments, may be viewed as beneficial in this regard.

One of the significant challenges for Ukraine and its agricultural sector in the context of accession to the EU is the fulfilment of conditions within the thematic cluster "Resources, agriculture & cohesion", including, in particular, Chapter 11: Agriculture & rural development and Chapter 12: Food Safety, Veterinary and Phytosanitary Policy (Stanicek *et al*., 2023). The new drivers for the development of Ukrainian agricultural production can be seen primarily in the country's export capacity based on global food demand. This is being achieved by attracting foreign investments in the field of deep processing of agricultural products and by increasing the presence of Ukrainian producers in the global value chains (GVCs). The efficiency of transport logistics is being expanded, innovative resource-saving practices are being introduced, and the condition of natural resources for agricultural production are being improved.

There is also a negative sentiment of European farmers towards the intensification of Ukraine's European integration. In this context, it is important to conduct in-depth analysis of the mutual agri-food trade Ukraine and key EU importers. It is necessary to outline possible positive developments for the economies of these countries from the expansion of trade and economic cooperation with the agricultural sector of Ukraine. Consequently, this article aims to assess the challenges and opportunities for Ukrainian agriculture in the context of accession to the EU, as well as to identify the starting points in the area of harmonisation of interests of both Ukrainian and European agricultural producers.

Methodology

The time series of exports covering the period of 2014-2023 are analysed from the point of view of the commodity structure. It is based on the Ukrainian Classification of Goods of Foreign Economic Activity (UCGFEA), whereas we have considered the correspondence between the UCGFEA positions and positions of the Combined Nomenclature (CN), which is the primary nomenclature used by the EU Member States to collect and analyse data concerning their trade. It is based on the Harmonised Commodity Description and Coding System (managed by the World Customs Organisation).

The volume of Ukrainian agrarian foreign trade flows is estimated in United States dollars (USD). The authors also used the data of the State Statistics Service of Ukraine Ministry of Agrarian Policy and Food of Ukraine, EUROSTAT, Directorate-General for Agriculture and Rural Development of the European Commission.

The research encompasses an estimation of the impact of international fragmentation of production on trade and production, with a particular focus on the last decade. The time series of Ukraine Input-Output tables provide a comprehensive map of transactions of goods and services. The value of these flows is estimated in Ukrainian national currency – hryvnia (UAH).

Results

The role of Ukrainian agriculture in the national economy and on the global food market - The impact of full-scale hostilities.

For decades, agriculture has been one of the most dynamically developing areas of Ukrainian economic landscape. The pre-war year of 2021 was characterised by high average profitability of production by agricultural enterprises (41.9%), considerable investments (10.1% of the total domestic investments), and significant innovative activity. Even during periods of considerable turbulence (such as the crisis of 2008-2009, hostilities of 2014-2021, and the full-scale RF invasion in 2022), the agricultural sector demonstrated a higher level of resilience compared to other sectors of Ukrainian economy, keeping the provision of agri-food products to satisfy both domestic and foreign demand.

Despite the active hostilities, in 2022 agricultural output decreased only by 25%, caused by a 20% decrease in cultivated areas and loss of over 10% of livestock and poultry. The whole economy's output, at the same time, reduced by 30.4%. In addition, agricultural enterprises have maintained production profitability (21% in 2022). Typically, Ukrainian agri-food production satisfies 80% of the domestic food demand, and even during the war, it annually exports more than 22 billion USD worth of products, contributing to half of the total export revenue of Ukraine.

This determines the leading position of agricultural sector in Ukrainian economy and the high degree of its integration into the global economy. In 2021, the share of agri-food in Ukrainian GDP was close to 16%. Ukraine supplied more than 14% of the global food market (FAOSTAT, 2024), including 12.5% of the world exports of wheat and 12.8% of corn, as well as 47% of the world trade in sunflower oil and 54% of sunflower meal (USDA, 2024). According to the USDA estimates, in the last year before the full-scale war (2021), Ukraine was the fourth largest corn exporter in the world (after the USA, Brazil, and Argentina). By the end of 2021, Ukraine was the fourth supplier of food to the EU with value of 6.93 million EUR (European Commission, 2023b).

The high level of Ukrainian agricultural business integration into the global economy is also confirmed by the increase in indicators of its involvement in GVCs, demonstrated by a dynamic growth of the index of participation of Ukrainian agriculture in such chains (GVC participation rate). To verify this statement, we calculated indicators based on the Input-Output tables (Table 1) for 5 consecutive pre-war years. While it is difficult to identify the export streams that will be included in GVCs, the table shows data on exports of products of section A (Agriculture, forestry, and fishing), which are essentially raw products and require further processing, and therefore the exported volumes of these products with a high probability will be directed to further processing and will become a component of foreign GVCs.

Table 1: Global value chain participation rate for agriculture, forestry, and fishing (at basic prices, million USD).

Indicators	**2017**	**2018**	**2019**	**2020**	**2021**
Use of goods and services for exports	9,185	9,829	12,846	11,587	15,857
Output	27,328	32,024	33,720	33,654	51,214
GVC participation rate	0.336	0.307	0.381	0.344	0.310

Note: calculated at the average annual exchange rate of the National Bank of Ukraine (NBU) for 2017 (26.62 UAH/USD), 2018 (27.23 UAH/USD), 2019 (25.69 UAH/USD), 2020 (27.21 UAH/USD), and 2021 (27.27 UAH/USD).
Source: own elaboration and calculations based on (State Statistics Service of Ukraine, 2024).

In 2022, the full-scale war unleashed by the RF in Ukraine brought destruction and losses in all sectors of Ukrainian economy. According to the Kyiv School of Economics (KSE Agrocentre), conducted jointly with the World Bank, Ukrainian agricultural sector has suffered at a scale of more than 80 billion USD in direct losses, this being solely the result of the RF full-scale invasion. In particular, 10.3 billion USD represents the value of destroyed assets, and 69.8 billion USD – foregone income of agricultural producers and increased production costs (losses caused by lower production, lower domestic prices for main agricultural crops, higher produc-

tion costs and expenses for the reclamation of deteriorated lands) (Neyter *et al*., 2024). Losses of agricultural machinery are estimated at 5.8 billion USD, the damage caused by theft or destruction of already produced cereals and oilseeds – ca. 2.0 billion USD. Grain storage facilities were damaged in the amount of 1.8 billion USD, perennial plantations – ca. 0.4 billion USD, and livestock losses reached 0.3 billion USD. Moreover, 56 billion USD will be needed for reconstruction and restoration of Ukrainian agriculture over the next decade (Neyter *et al*., 2024).

The ongoing hostilities, occupation, and mining of Ukrainian territory have resulted in a significant loss of arable land. According to recent estimates, Ukraine has lost 19.3% (over 5 million hectares) of its arable land, with the total damage to the soil exceeding 900 billion UAH (Ukrinform, 2024), which amount to 24.42 billion USD at the average annual exchange rate of the National Bank of Ukraine for 2023 (36.86 UAH/USD). According to the State Forestry Agency of Ukraine estimates, the total area of forests affected by the war is approximately 3 million hectares (almost 30% of all forests in Ukraine). About 0.5 million hectares of forests of the State Forestry Agency of Ukraine require demining. The estimated damage to forestry is 20 billion UAH (State Forestry Agency of Ukraine, 2024), or 0.54 billion USD. Reduction of agricultural production resulting from the full-scale hostilities led to a decrease in agricultural exports in 2022 by 15.6%, and in 2023 by another 6%. Although trade routes have changed, the main directions of Ukrainian agricultural exports have practically stayed the same.

In the first year of the war, the situation with export-import logistics was especially critical. Farmers felt an acute shortage of imported production resources (plant protection products, seeds, and fertilisers), which led to a shortfall in harvest and an increase in production costs. The blockade of the Black Sea ports and the resulting inability to export most of the 2021 harvest to traditional markets led to a decline in prices on the domestic market and a sharp reduction in farmers' incomes. Ukrainian products were sold at prices below production costs, one of the reasons being the increased costs of logistics. Thus, solving the problem of exporting Ukrainian cereals and oilseeds has become a matter of survival not only for agricultural sector, but of the entire economy. This can be evidenced indirectly by the fact that in 2023, the country's agri-food exports constituted a significantly high proportion of its total exports, reaching over 60%. In such conditions, the functioning of the Black Sea grain corridor and EU-Ukraine Solidarity Lanes provided life-saving support to Ukrainian agri-food exports.

Ukraine's foreign agri-food trade with the EU countries – Economic component of the conflict

Until 2022, Ukrainian agri-food products expanded their presence annually both in the EU market and markets of Asia and Africa. Shares of agricultural exports to the EU oscillated around a quarter of total Ukrainian exports. Key exported products were sunflower oil, cereals, rapeseed and soybeans, fruits, berries and nuts, poultry meat and eggs. Key EU importers were the Netherlands, Spain, Poland, and Germany (Table 2). Since 2022, direction of export flows changed, with Romania becoming one of the largest importers (although a significant part of these exports is assumed to follow further to final destination markets).

Table 2: Dynamics of Ukraine's foreign agri-food trade with key EU importer countries (million USD).

Countries	Years					
	2014	2015	2017	2018	2021	2023
Romania	3.3	94.5	15.7	2.5	6.3	2,875.2
Spain	923.0	852.9	1,023.8	1,039.8	1,168.4	1,761.9
Poland	536.2	422.7	518.2	557.2	981.5	1,753.9
Netherlands	749.9	575.6	1,275.7	1,157.6	1,762.1	1,272.2
Italy	625.4	560.0	749.3	702.7	717.9	1,028.4
Germany	247.9	188.3	385.0	657.5	842.3	853.9

Source: Own calculations based on the data of the State Statistics Service of Ukraine

From a global perspective, the key importers of Ukrainian agricultural products in 2023 were Romania (13% of total agricultural exports), China (10%), and Turkey (9%), acquiring in total a third of all exported Ukrainian agricultural products.

Agricultural raw product exports dominate both the overall structure of exports and exports specifically to the EU (Table 3). This means increased risks of export profitability due to the high volatility of raw product market conditions. However, the share of processed products in exports gradually increased in the pre-war period, reaching 44.9% in 2021. Yet, with the outbreak of hostilities (largely due to the loss of processing capacity) it decreased again, while the share of processed agri-food imports showed an upward trend.

Countries in Eastern Europe that provided support to Ukraine from the beginning of the full-scale war took a significant responsibility for facilitating the exports of Ukrainian agricultural products. Considering that a certain part of products, for some reasons, ended up in domestic markets of these countries in 2022 and the beginning of 2023, the negative reactions of their farmers to national and regional price fluctuations is quite understandable.

From the middle of 2023, the grain corridor ceased to exist, and farmers of five EU countries – Ukraine's closest neighbours (Bulgaria, Poland, Hungary, Romania, and Slovakia) began to manifest demands to block Ukrainian agricultural exports. In September 2023, Poland, Slovakia, and Hungary announced restrictions on the imports of Ukrainian cereals after the European Commission decided not to extend the ban on imports to the five EU countries neighbouring Ukraine (which it previous introduced on June 5, 2023). Due to this, the Cabinet of Ministers of Ukraine approved a list of products, exports of which to Bulgaria, Romania, Slovakia, Hungary, and Poland were subject to licensing (Cabinet of Ministers of Ukraine, 2023b). This applies to wheat, corn, rapeseed, and sunflower.

Despite these circumstances, the situation along the western borders of Ukraine continued to deteriorate in 2024. At the beginning of January, the European Union's five above-mentioned eastern countries demanded that the EU impose import duties on Ukrainian cereals (as well as on the other most sensitive agricultural products), citing unfair competition (Reuters, 2024) and claiming that "cheaper agri-

Table 3: Structure of Ukraine's foreign agri-food trade with the EU countries by processed and unprocessed products (million USD).

Indicators	Years						
	2008	2014	2017	2020	2021	2023	Index (2023 vs. 2008), %
Exports							
Non-processed total (UCGFEA groups 1-14)	2,284.0	3,073.2	3,308.0	3,438.5	4,231.5	7,719.5	338.0
Processed total (UCGFEA groups 15-24)	902.4	1,692.3	2,340.8	2,699.0	3,442.5	4,935.2	546.9
Total agri-food exports	3,186.4	4,765.5	5,648.8	6,137.5	7,674.0	12,654.7	397.1
Share of non-processed (%)	71.7	64.5	58.6	56.0	55.1	61.0	85.1
Share of processed (%)	28.3	35.5	41.4	44.0	44.9	39.0	137.8
Imports							
Non-processed total (UCGFEA items 1-14)	1,262.4	1,208.6	798.8	1,232.0	1,412.2	1,292.4	102.4
Processed total (UCGFEA items 15-24)	1,250.0	1,270.5	1,215.0	1,940.0	2,351.9	2,338.8	187.1
Total agri-food imports	2,512.4	2,479.1	2,013.8	3,172.0	3,764.1	3,631.2	144.5
Share of non-processed (%)	50.2	48.8	39.7	38.8	37.5	35.6	70.9
Share of processed (%)	49.8	51.2	60.3	61.2	62.5	64.4	129.3

Source: own calculations based on the data of the State Statistics Service of Ukraine.

cultural products from Ukraine are eating into their export markets". The blockade of border checkpoints by farmers, especially in Poland, intensified, and the prices for freight trucking on the Ukrainian-Polish and Ukrainian-Romanian borders increased by 15-20%. The imposition of a border blockade has had a significant impact on the financial resources of Ukraine. According to Ukrainian experts, in November 2023, exports across the Polish-Ukrainian border decreased by 40%. As a result, the state budget of Ukraine lost 9.3 billion UAH (252 million USD at the average annual exchange rate of the National Bank of Ukraine for 2023 – 36.86 UAH/USD) of uncollected customs payments (Epravda, 2024). At the beginning of March 2024, the total losses of the Ukrainian economy from the blockade were estimated at 500 million USD (Agroportal, 2024).

Ukrainian requests for constructive dialogue to preserve the paths of Ukrainian economic survival were unsuccessful. In similar fashion, the European Commission's proposals regarding the introduction of enhanced protective mechanisms in the markets of individual EU member states in the event that Ukrainian import flows exceed the average import volumes for 2022 and 2023 did not have the desired effect on European farmers. Currently, the European Commission has already adopted a decision regarding changes to the temporary agreement on extension of the suspension of import duties and quotas for Ukrainian exports to the EU until June 5, 2025. The Regulation, which will be in effect from June 6, 2024, to June 5, 2025, has been agreed and confirms the continuation of the suspension of all customs duties and quotas under Title IV of the EU-Ukraine Association Agreement. However, the Regulation will also include a safeguard mechanism that will oblige the Commission to re-impose tariff quotas if imports of poultry meat, eggs, sugar, oats, maize, groats, or honey exceed the arithmetic mean of quantities imported in the second half of 2021, as well as in 2022 and 2023 (Council of the EU, 2024).

It should be noted that Polish farmers are under pressure caused not only by the increase in the volume of Ukrainian imports but also by the simultaneous influence of several global market factors (primarily the decrease of global prices). It is significant that in 2022, the net entrepreneurial income of agriculture in Poland grew by a third compared to the previous year, and in 2023, it decreased by a quarter (EUROSTAT, 2024). However, farmers attributed this reduction not to the effect of several global and regional factors, but exclusively to Ukrainian imports.

It would be a mistake to consider imports from Ukraine to be solely responsible for the decrease in prices in Eastern Europe, since this had almost no effect on the price difference between the Ukrainian, European and American markets. In the current situation, there is considerable doubt as to the economic viability of the claims made by European farmers against Ukrainian agricultural exports. This applies both to the assertion that it is responsible for the decline in European prices and to the claim that those products are of poor quality. Neither of these accusations are supported by evidence.

In 2022, Ukraine was in third place (after Brazil and Great Britain) among the main exporters to the EU with a share of 7.7% (European Commission, 2023b). In 2022–2023, Ukrainian producers exported mainly cereals, sunflower oil, oilseeds, poultry meat and eggs, and sugar. These groups accounted for ca. 80% of all Ukrainian exports to the EU. Therefore, in the study we will focus on these product groups.

Agricultural market developments

Since 2022, Ukraine has significantly increased *cereals'* exports to the EU countries. In particular, in the marketing years (MY) 2022/2023 and 2023/2024, Ukraine became the main supplier of wheat (with a share of 65% and 70% of all wheat imported into the EU, accordingly), barley (45% and 48%), maize (55% and 67%), sorghum (84% and 68%) (European Commission, 2024b). Export volumes of wheat flour also increased (second place after Great Britain with a share of 26% and 28%, accordingly). It should be noted

in particular that Ukrainian cereals affect only the European corn market, since the share of EU imports of this product from Ukraine in domestic consumption in 2022/2023 MY reached 20% (in the previous MY – 10%). The share of wheat increased from insignificant figures to 5.6%.

Polish farmers are also voicing claims to the transit flows of Ukrainian cereals due to its alleged domination in Polish ports, which hinders the export of Polish products. However, according to competent Polish sources, such information is incorrect (Farmer, 2024). The economic groundlessness of such Polish accusations regarding Ukrainian products is also confirmed by researchers from the Institute of Public Finance of Poland (Czubak *et al*., 2024). In addition, due to the recent significant increase in transshipment of Ukrainian products through Black Sea ports, transit through Poland is losing its appeal. Thus, according to the Ministry of Agrarian Policy of Ukraine, in 2023, 76% of all agri-food exports were exported through ports, 17% by rail, 5% by road transport, and 2% by ferry, and in the three months of 2024, 87%, 10%, 2% and 1%, respectively (Ministry of Agrarian Policy and Food of Ukraine, 2024). Thus, only a small share of agricultural exports is exported by road transport, an amount which, moreover, is now tending to decrease.

Ukraine holds an important position in *the EU market of oil crops and products of their processing*. It is the main exporter of rapeseed with a share of 66%, sunflower meal with a share of 38%, sunflower oil with a share of 93%, rapeseed oil with a share of 35%, soya oil with a share of 40% (European Commission, 2024b). The USA and Brazil dominate the world soybean market, and Ukraine, unlike the sunflower market, does not affect prices there. In addition, supplies of rapeseed and sunflower oil to the European market are decreasing in the current marketing year.

In 2022/2023 MY, the most significant share among all oilseed products in domestic consumption of EU countries had the Ukrainian imports of rapeseed (10.5%), soybeans (8.3%), soybean oil (10%), and all sunflower products: sunflower seeds (16.4%), sunflower meal (18.5%) and sunflower oil (34.1%). The share of sunflower oil in comparison with the pre-war period remained virtually unchanged.

In the global *poultry meat market*, Ukraine is also not one of the main exporters (its share does not exceed 2.5%). However, during the war, with opening of the EU market and due to complicated logistics, Ukraine significantly increased exports to EU countries. In 2022, export volumes increased by 1.6 times, and in 2023 by 1.4 times compared to the previous year. Thus, in 2023, Ukraine became the second supplier of poultry meat to the EU countries after Brazil (European Commission, 2024b). Accordingly, in 2021, Ukraine's share in poultry meat imports to the EU was 13%, in 2022 – 19%, and in 2023 it increased to 26%. However, due to the insignificant volume of supplies to the global market, Ukraine, unlike Brazil, the USA, and the EU, has no influence on the level of the global poultry meat prices. Despite the growth of exports of poultry products to the European Union in 2023, the share of Ukrainian exports in the total consumption of poultry meat by EU countries was only 1.6%, and in the consumption of eggs - only 0.8%. Therefore, it is not confirmed it has a potential to affect the European market of poultry products.

Determining the place of Ukraine in the EU's *egg market*, it should be emphasised that in the global egg market, where the top exporters are Turkey, China, the EU, and the USA, Ukrainian products do not play a significant role and do not affect the economic situation. However, since the beginning of the war, Ukrainian producers have increased exports of eggs to the EU, and in 2022–2023 Ukraine was the main supplier there (European Commission, 2024b). In 2022, export increased by 3.2 times compared to the previous year, in 2023, it increased by 2 times compared to 2022. In 2021, the share of Ukraine in the egg imports to the EU was 22.5%, in 2022 it was 51.4%, and in 2023 it increased to 60.8%. However, during this period the total egg imports into the EU increased in volumes, namely: in 2023 by 78% compared to 2022 and 2.5 times compared to 2021. Prices until the beginning of 2023 tended to gradually increase, and from the beginning of 2023 they stabilised. There was no sharp decline in prices following the increase in egg imports from Ukraine.

Ukraine has always been present in the EU *sugar market*, but the export volumes were insignificant. However, with the beginning of the war, the situation changed. According to Eurostat, in 2022/2023 the share of Ukraine in the imports of sugar to the EU countries equalled 16%, while, based on the balance sheets published by the EU, the share of this volume in consumption for the corresponding period was 3% (European Commission, 2024b). In the current marketing year, Ukraine is still the main supplier of sugar to the EU market with a share of 35%. Exports were mainly directed to Italy, Romania, Hungary, Bulgaria, and the Czech Republic (70% of all exports to the EU). Ukraine exports sugar ready for final consumption in the EU countries. Processing of raw sugar usually allows European sugar factories to earn additional funds. Therefore, such a situation can also be a factor in the dissatisfaction of European manufacturers with the appearance of Ukrainian products on their market. In addition, despite the increase in the import of Ukrainian sugar, its prices in the EU remain high against the background of the global deficit. Domestic prices for sugar are above 800 EUR per ton, the highest in ten years.

The possibility of the EU establishing quotas for the import of certain types of Ukrainian agricultural products from June 6, 2024, increases the uncertainty of exporters regarding sales markets, since the mechanism proposed by the EU is new and difficult to predict. In addition, it is not known whether it will be applied and how it will work. Thus, Ukrainian producers have huge losses not only due to lost acreage, low purchase prices, complex logistics, but also due to expected trade restrictions. And all this is against the background of the revival of trade between the RF and the EU. In 2023/2024 MY, RF flooded the European Union market with significant volumes of cereals. Notably, it became the top supplier of rye with a share of 96% and achieved a 21% share of the durum wheat market, as well as 24% of the sorghum market.

In the context of assessing the validity of the claims of European countries to Ukrainian agricultural products, it should also be mentioned that, for example, Bulgaria in 2022-2023 increased the volume of production and export of sunflower oil, largely obtained from Ukrainian seeds.

Romania received a powerful incentive to develop export logistics capacities in the Black Sea. Livestock breeders and processing enterprises in Germany, the Netherlands, and Spain are interested in Ukrainian exports of agricultural products. This means that on its way to the EU, Ukraine will have to coordinate the development of agriculture and the agri-food sector with almost every country of the association, taking their specific interests and claims into account.

Some of the above arguments have already been repeatedly voiced at the level of Ukrainian agricultural associations, government representatives and scientists. In addition, in recent months, Ukraine, as noted, has managed to redirect its export flows almost completely towards sea and river ports. This has significantly reduced the scale of export of agricultural products across the Ukrainian–Polish border in particular, limiting such exports mainly to perishable goods. The European Commission also provided 230 million EUR in aid to Polish corn farmers to compensate them for damages caused by the Russian invasion of Ukraine (European Commission, 2023a). However, all this did not contribute to the unblocking of the Ukrainian–Polish border. Thus, the obvious conclusion from the above is that the significant role of the Ukrainian factor in the months-long large-scale protests of European farmers has not been confirmed.

Key issues and expected benefits for Ukraine's agriculture due to joining the EU

As noted earlier, the greatest challenges for Ukrainian agriculture on its path to the EU are connected with the implementation of CAP guidelines in the national agrarian policy, as well as with the harmonisation of the interests of European and Ukrainian agricultural producers. The main positions on the reconciliation of farmers' interests were detailed above. Therefore, let us discuss the challenges related to the application of EU norms, as well as give a brief assessment of the process of harmonisation of Ukrainian and European legislation in the sections "Agriculture and rural development" and "Food security, veterinary and phytosanitary policy".

Ukraine's accession to the EU is a challenge for both sides. This is first of all due to the size of the Ukrainian agricultural sector, which will require the allocation of significant amounts of direct payments and payments for rural development from the EU budget. Thus, if Ukrainian producers receive the same direct payments per hectare that European producers now receive (250 EUR), this will amount to ca. 10 billion EUR annually, since the area of agricultural land in Ukraine exceeds 40 million hectares. In addition, there are other payments in the EU: from the European Regional Development Fund and Cohesion Fund. Understanding this already provokes resistance from the governments of the EU member states. The debate intensifies regarding the potential impact of Ukraine and other countries joining the EU. It is posited that this could result in certain countries experiencing a shift from being net recipients of EU benefits to becoming net donors. Preliminary estimates indicate Ukraine could potentially receive up to 18.9 billion EUR in annual payments from the EU in the event of immediate accession (Emerson, 2023). This amount is close to the amount of annual EU payments under the Ukraine Facility programme for the period from 2024-2027, some 12.5 billion EUR (50 billion EUR over four years), which should not lead to a significant overload of the EU budget.

Secondly, the challenge for Ukraine and the EU is the atypical structure of the Ukrainian agricultural sector compared to European countries. There are large agricultural enterprises and agricultural holdings as well as a significant number of households in which the non–commodity nature of production prevails and there is a potential for reformatting them into small family farms.

The advantages for Ukrainian farmers from joining the EU will be to receive payments for agricultural development and payments from The European Structural and Investment Funds, which depend on the size of the agricultural sector and the gap in living standards. It is worth noting that , Ukraine's GDP at purchasing power parity per capita is only 26.3% of the EU average (for example, Poland – 77.9%, France – 104.3%) (Emerson, 2023).

Table 4 shows the level of support for farmers in some EU countries and Ukraine. The authors tried to assess the situation in Ukraine and, based on available information, calculated the indicators as close as possible to those given by the EU. Assessments were carried out for enterprises and farmers since the households received practically no support. Data for Ukraine indicates a low level and significant unevenness of this support. Per hectare, producers received 35 times less compared to Polish producers. Only 1.4% of agricultural factor income generated by Ukrainian producers went to support. Moreover, the amount of support per recipient is quite significant, which indicates that these funds were received mainly by a small number of large enterprises (in 2021, 11 thousand producers received support, and in total, while there were 70 thousand business entities in the agricultural sector, including individual entrepreneurs).

Table 4: Indicators of support for agricultural producers in Ukraine and within the CAP in selected EU countries in 2021.

Indicators	Countries				
	France	Germany	Netherlands	Poland	Ukraine
Average income support per ha, EUR	289	282	373	246	7
Average income support per beneficiary, EUR	23,670	15,380	15,030	2,740	12,886
Share of direct support in agricultural factor income, %	22	31	9	29	1.4

Source: for the EU countries the data was derived from the European Commission; for Ukraine, the assessment was based on the data of the State Statistic Service of Ukraine and the Ministry of Agrarian Policy and Food of Ukraine.

Ukraine should therefore assume that its accession to the EU will be preceded by an EU CAP reform. Taking the current discussions into account, it can be expected that the CAP change will head in the direction of linking direct payments to certain conditions (including environmental ones) and their differentiation depending on the size of producers. It is also likely that a transition period will be introduced for Ukraine before it is granted full access to all types of support, as previously happened in the cases of Poland and Romania.

The process of adaptation of Ukrainian legislation to EU norms began back in 1998 after the entry into force of the Partnership and Cooperation Agreement between Ukraine and the EU. This process significantly intensified after 2014 with the signing of the Association Agreement with the EU (Cabinet of Ministers of Ukraine, 2014). The biggest incentive to the process was given after the adoption by the European Council in 2022 of the decision to grant Ukraine the status of a candidate country for the EU membership. At the end of 2023, the government of Ukraine published a report on the results of the initial assessment of the state of implementation of EU legislative acts. It was found that the largest number of acts of the EU law, which are already fully implemented in Ukrainian legislation and are subject to further full and/or partial implementation, concerns the section "Food security, veterinary and phytosanitary policy" (Cabinet of Ministers of Ukraine, 2023a). It can be seen that in these areas, Ukraine is significantly closer to the relevant EU legislation. Within the framework of this section, 80 acts are fully implemented, and 311 are subject to implementation, and 93 of them are implemented partially. The main obstacles to accelerating the implementation process are the insufficient number of qualified personnel and the lack of translation of relevant acts of the EU law.

In the section "Agriculture and Rural Development", 11 acts are fully implemented, 84 are subject to implementation, of which 18 are implemented partially. Here, in addition to the same lack of relevant national specialists, the main factors constraining harmonisation are also recognised as the need for expert support for the project of international technical assistance, strengthening institutional capacity, the need for additional funding for the creation of new public authorities, etc.

Despite the presence of some objective obstacles and the expected severity and duration of the negotiation process, most domestic experts agree that the very beginning of the negotiations is already a landmark step towards agreeing on the positions of Ukraine and the EU.

Among the main challenges now facing the European (and in future – also Ukrainian) agricultural sector is the need to comply with somewhat strict European Green Deal (EGD) standards. All EU member states have committed to make the European Union climate-neutral by 2050. According to this, by 2030, greenhouse gas emissions should be reduced by at least 55% compared to the 1990 levels (European Commission, 2024a). To achieve this goal, specific objectives were formulated and measures envisaged in many sectors. These included reducing the use of pesticides (by 50%) and mineral fertilisers (by 20%), expanding the organic farming sector (up to 25%), and implementing measures to improve biodiversity (10% of territories with a high level of biodiversity), ensuring proper conditions for livestock and poultry.

Adaptation to the EGD can become a challenge for Ukrainian agricultural producers not only in connection with the final accession to the EU, but also during this process. We can, in particular, expect a decrease in Ukrainian agri-food exports due to the announced European Union introduction of protective duties on imports of agricultural products from third countries (which is now Ukraine), created without taking into account the requirements of the European Economic Community (EEC). In the case of Ukraine's full membership in the EU, the need to implement the EEC guidelines in agriculture will undoubtedly entail changes in the volume and structure of Ukrainian agricultural production, which may affect its profitability. In this case, problems may arise primarily among small and medium-sized producers who will apply for appropriate support from European funds. Large producers, mainly those who are cereals – and oilseeds – oriented, will be able to avoid risks by fully focusing on trade with Asian and African countries since they will not need these payments from EU funds.

In addition, Ukraine will not prioritise the objective of increasing the share of organic agriculture to 25% within the near future. The expansion of agricultural land for organic production to the required share, that is, to more than 10 million hectares, will significantly exceed the real possibilities of marketing these products in Ukraine and the EU. Since within the framework of negotiations, there is a certain freedom of action to adapt the ambitious goals of EGD to Ukrainian opportunities and needs, the 3% level of such an indicator (or 1.2 million hectares) set by the Ukrainian government, which should be achieved by 2030, seems much more realistic (Cabinet of Ministers of Ukraine, 2022). Among the challenges for Ukraine's agricultural production from the EU accession, it is also necessary to mention the risk of significantly tightening competition on the domestic market due to the rapid increase in supply of European food and a high probability of skilled workforce outflow.

European integration of Ukraine could give a new incentive to the diversification of domestic agricultural production and the development of agricultural products processing. Thus, to harmonise the parameters of Ukrainian agricultural production development with norms of CAP and EGD, as well as to comply with the requirements of above-mentioned Ukrainian government regulation adopted in this context, significant changes can be expected in the agricultural sector. It should be borne in mind that such regulation would aim to optimise the structure of farmland and agrarian landscape, reduce by 5% the level of utilised agricultural land and by 10% the ploughed land, by 40–50% increase their productivity primarily through the rational use of fertilisers. It can be expected that the need to take the agri–ecological and climatic requirements of the EU and Ukrainian legislation into account will improve the state of natural resources of agricultural production and increase the volume of production grown in compliance with the European requirements. As noted, all of this should also lead to production structure transformation, which until recently focused mainly on the cultivation (and exports) of cereals and oilseeds. Hence, we

estimate that Ukraine can expect an increase in livestock and vegetable production, while the production and exports of corn and sunflower will decrease the most (Shubravska and Prokopenko, 2022). This would be facilitated by the presence of logistical problems of domestic agricultural exports described above, under the influence of which business is also increasingly relying on the development of agri-food processing. Primarily, this applies to biofuels, as well as animal feed. Biofuel production in Ukraine is already actively developing. Prospects for in–depth grain processing development depend on attracting large investments, most likely foreign, which could be obtained after the end of hostilities and accession of Ukraine to the EU. In the meantime, the lack of access to relevant technologies (due to their high cost or the reluctance to share them) and major problems with the availability and qualification of working personnel are the most significant factors hindering the establishment of these enterprises in Ukraine.

The expected positive consequence of Ukraine's accession to the EU should also be the intensification of innovation processes in the agricultural sector. It is assumed to be achieved through increased inflows of foreign direct investment and an inclusive European agrarian policy that addresses the interests of all groups of farmers, especially small ones. Before the beginning of the full–scale war in Ukraine, agricultural holdings and large agricultural enterprises actively introduced agricultural innovations and formed their research units. Thus, it is estimated that at least half of farms with an area of more than 2000 hectares to one degree or another used elements of precision agriculture or planned to work in this direction (Agrobusiness, 2022). In the EU countries, the share of farmers working on such technology is constantly growing, primarily due to CAP incentives (Zakupka, 2024). For Ukraine, such a support is especially relevant primarily for small producers who do not have the proper financial resources for implementation of modern innovative solutions and are deprived of the opportunity to receive appropriate state support.

One of the significant results of Ukraine's accession to the EU is expected to be an increase in Ukrainian exports. It is not the expansion of agricultural products onto the European market. Opportunities are seen primarily in the expansion of food exports to third countries due to the optimisation of European transit flows and the availability of European certificates (CE certificates) for exported products. That is, Ukrainian large producers, will be able to continue focusing on effective mass production and export to countries outside the EU. Relatively small and generally environmentally-oriented producers will be able to receive additional payments within the CAP.

Conclusions

The main challenges for Ukraine's agriculture in connection with its possible accession to the EU can be summarised as follows: first, the need to comply with the EU rules, norms and standards, as well as adjust to the EGD and CAP expectations and obligations; second, to avoid the competition with European farmers on the EU market; third, to establish coordination of interests with the EU countries regarding the integration of Ukrainian agricultural products into the European GVCs; and fourth, to work towards the development of reliable and mutually beneficial European transit routes for exports to the world market. Additionally, there is a strong possibility for a rapid and straightforward integration of European businesses into the Ukrainian market, which could result in the loss of domestic market share on the part of Ukrainian producers and a significant outflow of qualified personnel and labour beyond Ukraine.

Opportunities for agriculture in the context of European integration are seen primarily in the diversification of production and export structure; development of agricultural processing; accelerating the transition to innovative resource-saving production technologies; regulation of transit flows; increasing exports to international markets; and growth in the share of agricultural products cultivated in Ukraine in compliance with EU's environmental and climate requirements.

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Analysis of the impact of macroeconomic turmoil (COVID-19 and RUW) on Ukrainian agroholdings

This paper examines the impact of the macroeconomic turmoil, in particular the COVID-19 pandemic and the Russian-Ukrainian war (RUW) in Ukraine, on Ukrainian agroholdings. Before the full-scale Russian invasion, Ukraine was a major global exporter of agricultural commodities, playing a crucial role in global food security and contributing significantly to the national economy. However, the outbreak of war in Ukraine brought with it unprecedented challenges such as loss of assets, damage to infrastructure, labour shortages and more. Despite these adversities, the Ukrainian agricultural sector remains resilient, attracting investment and maintaining its global presence in agriculture. This study aims to comprehensively analyse the resilience and vulnerability of Ukrainian agroholdings before and after these shocks. Our analysis shows different responses to the pandemic and war shocks, with agroholdings being resilient during the first shock but suffering significant setbacks during the second shock. These results underline the crucial role of the Ukrainian agricultural sector and provide valuable insights into its adaptability under turbulent macroeconomic conditions.

Keywords: agroholdings, COVID-19, risk, risk assessment, shock, Russian-Ukrainian war, Ukraine
JEL classifications: Q18, F36, O16

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Introduction

The agricultural sector is a cornerstone of the Ukrainian economy, accounting for 10% of GDP and 40% of exports (Voronenko *et al.*, 2020; Kaminskyi *et al*., 2021). It is the main source of livelihood for about a third of the Ukrainian population. Ukraine has approximately 25% of the world's most fertile black soil, which makes Ukrainian agriculture unique in terms of its potential (Kadiyevskyy and Klymenko, 2014).

Prior to the full-scale Russian invasion, Ukraine was one of the world's leading exporters of agricultural commodities, which are crucial to ensuring global food security. However, agriculture has also been an area of tension in Ukraine, where two different modes of production have coexisted for many years: large industrial agribusinesses and small farms. Agribusinesses control 53.9% of the arable land and account for 54.5% of Ukraine's gross domestic agricultural production, specialising mainly in the production of cereals and oilseeds for export. Some agroholdings have developed primarily based on internal capital flows, while others are part of multinational corporations. Many Ukrainian agroholdings have raised funds through public offerings on international stock exchanges and have also received funding from international organizations such as the European Bank for Reconstruction and Development and the International Finance Corporation. The full-scale war that began in 2022 did not eliminate tensions between large and small agricultural producers in Ukraine.

The war - as well as other major global shocks such as the Covid-19 pandemic - has exposed the systemic fragility of globalised neoliberal agriculture (Barrett *et al.*, 2021), characterised by narrow specialisation in agricultural production and reliance on international trade in food, fuel and fertiliser. The outbreak of war in Ukraine marked the beginning of what economists describe as the third asymmetric shock to hit the European Union in the last two decades, following the 2008 financial and economic crisis, the subsequent Eurozone crisis and the COVID-19 pandemic (Barrett *et al.*, 2021; Hassen *et al.*, 2022 Simchi-Levi and Haren, 2022). Not only does the destruction of trade routes and infrastructure threaten the viability of Ukrainian agribusinesses, but the way they are organised makes them extremely vulnerable to major shocks and disruptions. Nearly 90% of crop farms and 60% of industrial livestock farms reported a significant or sharp decline in income in the first year of the war (FAO, 2023).

The challenges facing Ukraine's agricultural sector in the context of a full-scale war are unprecedented. These include the damage to property, the expansion of mined areas, the blockade of ports, the bombing and destruction of port infrastructure, the damage to farms and equipment, the closure of borders with western neighbours, labour shortages and fluctuations in global markets (Celi *et al.*, 2022; Glauben *et al.*, 2022). While all categories of agricultural producers face formidable hurdles, the lion's share of war-related losses have fallen on large industrial agribusinesses (agroholdings). (Klymenko *et al.*, 2023; Nasibov *et al.*, 2024; Noack *et al.*, 2024). Family farmers and individual smallholders proved more resilient during the war, as confirmed by an FAO report (FAO, 2022). Despite these adversities, Ukraine's agricultural sector continues to attract investment, create employment opportunities, and expand its agricultural presence on the global stage. It remains a significant contributor to the national budget, generating substantial revenues and playing a key role in the country's overall GDP.

This study provides a comprehensive analysis and assessment of the risks facing the Ukrainian agricultural sector in the context of various macroeconomic instabilities. The aim of the paper is to analyse the multifaceted impact of the

Russian invasion on the Ukrainian agroholdings and to compare it with the COVID-19 impact. Our particular focus is on the resilience and vulnerability of Ukrainian agroholdings before and after these shocks.

To achieve these objectives, we have adopted a multidimensional approach which includes (i) analysis of data from the Warsaw and London Stock Exchanges, (ii) Implementing special indicators for shock risk analysis and (iii) a comprehensive comparable risk analysis for both shocks. Finally, our research extends to the identification of key challenges for the Ukrainian agroholdings.

The following sections of this paper are structured as follows. First, a literature review on shock impact assessment is presented. This is followed by an in-depth analysis of the impact of the war on the Ukrainian agricultural sector and its consequences for global agricultural markets. Next, the paper examines agroholdings during two shocks. Finally, a comprehensive discussion of the main findings and their implications for policy and research is presented.

Literature review

The question of the impact of crises, shocks and wars on the agricultural sector has been analysed in depth by various researchers. With the outbreak of the Russian-Ukrainian war, issues and problems that had not been critically addressed for years came to the fore. First, the issue of food security arose, as Ukraine was a major supplier of agricultural products to Europe and Africa (Deininger *et al.*, 2023; Davdenko *et al.*, 2024). In particular, the main factors that have a devastating impact on food security at the European and global levels are global warming leading to climate change and its consequences for agriculture (Chen *et al.*, 2017; Passel *et al.*, 2017; Skrypnyk *et al.*, 2021); the global COVID-19 pandemic (Kaminskyi *et al.*, 2021) and the war in Ukraine with consequences for both the domestic agricultural economy and global food markets (Banse, 2022; Câmpeanu, 2022). In particular, scholars stress that the food crisis will worsen as the war intensifies (Glauben *et al.*, 2022; Hassen and Bilal, 2022; Fiott, 2022), posing a challenge to many countries, especially those dependent on food imports, such as those in the Middle East and North Africa. The war has had a cascading effect on global food security over time (Hassen & Bilal, 2022; Simchi-Levi and Haren, 2022). Almost all pandemics, past and present, cause food crises, disrupt agricultural labour flows and reduce the efficiency of agricultural operations, leading to food losses (Roubík *et al.*, 2024; Karamti and Jeribi, 2023). Shocks such as wars and pandemics have a cumulative and cascading effect on food security (Paudel *et al.*, 2023) and the dynamics of global food imports and exports (AL-Rousan *et al.*, 2024).

COVID-19 not only caused problems in agricultural supply chains during the pandemic, but also led to a significant increase in risks after the pandemic ended. Supply risks, demand risks, financial risks, logistics and infrastructure risks, management and operational risks, political and regulatory risks, and biological and environmental risks have a significant impact on agribusinesses, depending on the scope and size of the organisation (Sharma *et al*., 2020).

The periods of the COVID-19 pandemic and the RUW Russian-Ukrainian war in 2022 brought great uncertainty to global food and financial markets. It is therefore important to study the impact of extreme risks and manage investment portfolios to increase stability during and after crises (Hu *et al*., 2024; Kaminskyi *et al*., 2020).

The war of 2022 is expected to have an impact similar to the financial crisis of 2009 and the COVID-19 pandemic, as there is an exponential increase in uncertainty that negatively affects consumption and investment, which has a depressive effect on GDP and employment: the longer the war lasts, the larger and more persistent its effects will be (Bentley, 2022; Celi *et al*., 2022). The impact of two successive crises, the COVID-19 pandemic and the Russian-Ukrainian war, on stock markets and the investment attractiveness of agribusinesses is examined in (Mroua and Bouattour, 2023).

After three decades of focusing agriculture on environmental and social sustainability goals, the war in Ukraine has brought productivity and supply-side goals into focus. The views and opinions of farmers and consumers on the direction of agriculture during and after the war do not match the old and new societal demands on agriculture (Noack *et al.*, 2024). Destruction, damage and losses from the war have resulted in reduced crop areas and yields, destroyed infrastructure, and soil and water pollution (Nasibov *et al*., 2024). Assessing these impacts on Ukrainian farms helps to understand the scale of the problem and to develop recovery and risk management strategies.

Methodology

We used a consistent methodology to assess the risks faced by Ukrainian agroholdings in the context of macroeconomic instability, particularly in times of significant shocks. We selected the largest Ukrainian agribusinesses listed on either the Warsaw or London Stock Exchange, including companies such as MHP, Astarta, Agroton, IMC, Ovostar, Agroleague, KSG Agro and Kernel. Our dataset included daily share prices of these selected agroholdings. We conducted analyses for two different shock periods: the COVID-19 pandemic and the war in Ukraine.

The sample was then divided into three periods for each of the shocks:

- 1st period (pre-shock) – the period before the shock, characterised by a certain degree of stability;
- 2nd period (shock) – the period of the shock;
- 3rd period (after shock) – the period of recovery after the shock.

By shock, we do not mean the entire period of the critical situation, COVID-19 or war, but only the time when the most dramatic changes occurred at the beginning of these, during which agricultural holdings, the agricultural sector and the world food market were unable to adapt.

To assess the risks of the shock period, 2 indicators were used: shock depth and recovery rate:

$$Shock\ depth = \frac{\text{Min price in shock period}}{\text{Average price before shock}} - 1 \quad (1)$$

$$Recovery\ rate = \frac{\text{Average price after shock}}{\text{Average price before shock}} \quad (2)$$

Our analyses were based on relevant indicators reflecting the magnitude of the shock and the degree of subsequent recovery. Risk was assessed using the concept of volatility, alongside established methodologies such as Value at Risk (VaR) and Conditional Value at Risk (CVaR). We also included liquidity, as measured by trading volumes, as an additional parameter for assessing risk. Through this comprehensive approach, we aimed to provide a detailed understanding of the risks faced by Ukrainian agricultural producers during macroeconomic turbulence.

Results

Our study analysed the resilience and vulnerability of Ukraine's agricultural sector in the face of unprecedented macroeconomic shocks, in particular the COVID-19 pandemic and war. Despite significant challenges, including infrastructure destruction and labour shortages, Ukraine's agricultural landscape has shown considerable resilience. Our analysis of key agroholdings during these shocks reveals different responses and variations in investment vulnerability. Agroholdings proved resilient to the COVID-19 pandemic, but the war had a devastating impact on all. These findings underscore the critical role of Ukraine's agricultural sector within the national economy and offer valuable perspectives on its adaptability under turbulent macroeconomic conditions.

The structure of the Ukrainian agricultural sector has evolved over the last decade based on a three-pillar model combining agricultural enterprises, small family farms and very large farms (agroholdings). Export-oriented production is increasingly in the hands of a small number of vertically integrated farms (Hervé, 2013; Cochet *et al*., 2021). The agricultural sector in transition and developing economies is characterised by a high share of agroholdings, i.e. conglomerates of agricultural enterprises that control a large bank of farmland. Institutional turbulence in such economies leads to the emergence of agroholdings (Gagalyuk, and Valentinov, 2019).

The emergence of large, horizontally integrated agribusinesses, particularly in Eastern Europe, raises the question of whether these agroholdings can act as price leaders in local land markets (Graubner, *et al*., 2021; Klymenko *et al*., 2023a).

Since 2022, Ukrainian agribusinesses have been operating in a context of war and economic instability, overcoming difficulties such as the occupation and mining of part of Ukrainian territory, the blockade of seaports, shelling and the destruction of agricultural infrastructure. The result has been a shortage of resources, reduced revenues and even bankruptcies.

But even amid the losses, Ukraine's agricultural sector attracted investment, created jobs, promoted Ukrainian agriculture globally, generated significant revenues for the state budget and contributed a large share of Ukraine's GDP.

In 2023, the 10 largest tax-paying enterprises in Ukraine's agricultural sector paid almost UAH 19.4 billion to the budgets of all levels, which is 36% more than in 2022 (Figure 1). Almost all agricultural holdings increased their tax payments in 2023 compared to 2022 (Forbes, 2024).

The majority of agroholdings were able to make adjustments to their operations to maintain profitability. According to the Ukrainian Grain Association, in the 2022/2023 season domestic farmers exported 67.8 million tons of

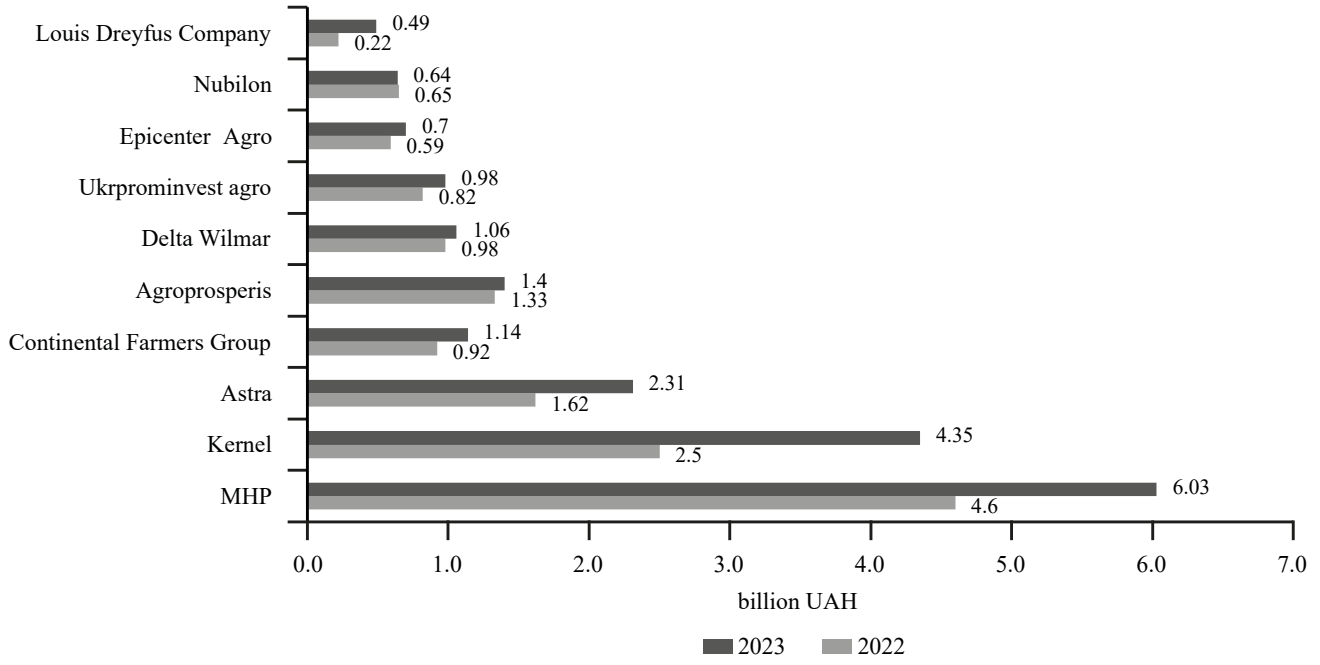


Figure 1: The largest taxpayers in the agricultural sector of Ukraine, billion UAH.
Source: own composition based on Forbes (2024)

products, 12% more than in the previous year and 15% more than in 2020/2021. Studies of the investment activities of large agricultural enterprises have shown an increase in their efficiency and the adoption of corrective investment decisions to ensure Ukraine's sustainable development (Sokolovska, *et al.*, 2021 Klymenko *et al.*, 2023b). The capitalisation of most Ukrainian agroholdings reacted to the disruptions caused by the global crisis, COVID-19 and Russia's full-scale invasion, with falling share prices and declining trading volumes. The main factors behind the decline were the continuation of hostilities in the conflict zone, a significant decline in economic activity, the destabilisation of the financial and stock markets, the reduced activity of agribusinesses on the stock exchanges and the destabilisation of the currencies in which agribusiness shares are traded. The fall in capitalisation led to a fall in farm profits, a fall in the volume of shares traded on stock exchanges and a fall in fixed and working capital. The companies also lost a significant amount of funds that would have been used for various purposes, including the sowing campaign. In addition, the agroholdings lost some positions on the stock exchange and the stock market. The war also led to a reduction in expenditure on the development and operation of agroholdings and to the partial or complete closure of some agroholdings. All in all, this had a negative impact on the further development of the Ukrainian agricultural sector.

We examine the dynamics of the share prices of Ukraine's agroholdings during the shocks of the COVID-19 pandemic and the war. Our analysis includes an examination of the depth of the shock and the degree of recovery of Ukraine's leading agroholdings (Kaminskyi *et al.*, 2020; Klymenko *et al.*, 2023).

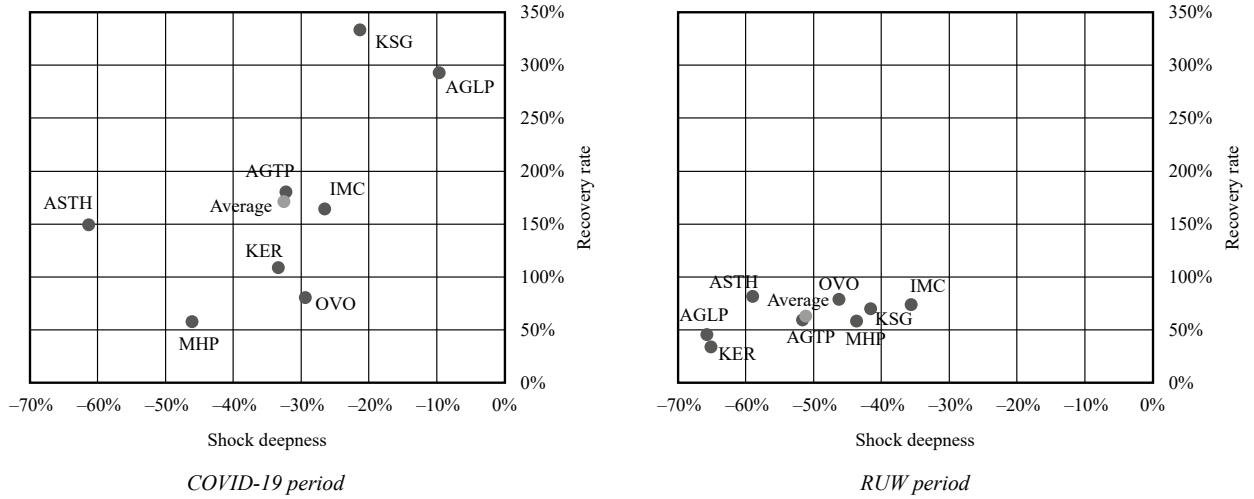
The comparative analysis of the risk and profitability adjustment of agroholdings over three intervals is presented in Table 1.

On average, companies barely felt the impact of the pandemic and, on the contrary, grew by more than 1.5 times. The COVID-19 pandemic led to an economic downturn that reduced demand for certain types of products, including agricultural products. MHP and Ovostar suffered most, recovering only 58% and 80% respectively. KSG Agro and Agroliga, on

Table 1: Indicators of risk analysis of agricultural holdings of Ukraine.

COVID-19 period (15.07.2018 - 19.12.2021)									
Period	**MHP**	**ASTH**	**AGTP**	**IMC**	**OVO**	**AGLP**	**KSG**	**KER**	**AVG**
Average after shock	6.05	6.66	1.13	4.02	13.79	8.69	0.59	9.35	6.28
Min in shock	5.64	1.72	0.42	1.80	12.11	2.68	0.14	5.74	3.78
Average before shock	10.46	4.45	0.62	2.45	17.16	2.97	0.18	8.61	5.86
Shock deepness	–46%	–61%	–32%	–27%	–29%	–10%	–21%	–33%	–32%
Recovery rate	58%	150%	180%	164%	80%	293%	333%	109%	171%
RUW period (23.08.2020 - 31.12.2023)									
Period	**MHP**	**ASTH**	**AGTP**	**IMC**	**OVO**	**AGLP**	**KSG**	**KER**	**AVG**
Average after shock	3.54	5.70	0.70	3.18	10.82	4.16	0.43	3.28	3.98
Min in shock	3.41	2.86	0.57	2.77	7.33	3.13	0.36	3.34	2.97
Average before shock	6.06	6.98	1.17	4.31	13.66	9.13	0.62	9.57	6.44
Shock deepness	–44%	–59%	–52%	–36%	–46%	–66%	–42%	–65%	–51%
Recovery rate	59%	82%	60%	74%	79%	46%	70%	34%	63%

Source: own composition based on Forbes (2024).



COVID-19 period *RUW period*

Figure 2: Comparison of SD-RR correspondence for shocks.
Source: own composition

the other hand, not only withstood the difficult conditions, but actually tripled their sales. However, the impact of the war was devastating for all the companies. On average, agroholdings fell by 51% during the shock period, with a recovery rate of only 63%. Kernel and Agroliga were the worst off, failing to recover even half of their losses. Astarta and Ovostar proved the most resilient to the difficult conditions, recovering 80% and now showing positive momentum.

The fundamental difference between the shocks is the gap between the RR for the RUW shock and the COVID-19 shock. In fact, if we compare linear trends RR from SD, the slopes of the lines are quite different; the depth of the shock and the level of recovery of assets of agricultural enterprises of Ukraine.

RR=3,8SD+2,9 (COVID-19 shock)
RR=0,9SD+1,1 (RUW shock)

The R-squares of these trends are not so high. This indicator shows that agroholdings reacted differently to the shock. Taking into account the economic essence of the slope, we can see that on average the recovery was about 4 times more intense after the COVID-19 shock.

One of the key approaches to risk assessment is based on the concept of variability. We have used this concept in our comparative analysis. The results of the statistical analysis of the stocks, which include: minimum and maximum values, mean value, standard deviation, skewness and kurtosis, are presented in Table 2.

Table 2: The results of the statistical analysis of the stock returns.

COVID-19 period (15.07.2018 - 19.12.2021)									
Company	**Min**			**Max**			**Mean**		
	Before shock	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**
MHP	–0.081	–0.163	–0.104	0.066	0.119	0.120	–0.004	–0.013	0.002
ASTH	–0.194	–0.249	–0.145	0.227	0.174	0.265	–0.007	0.001	0.015
AGTP	–0.140	–0.204	–0.148	0.489	0.303	0.329	0.004	0.012	0.008
IMC	–0.140	–0.125	–0.077	0.193	0.155	0.149	0.000	–0.001	0.014
OVO	–0.102	–0.099	–0.113	0.115	0.099	0.117	–0.004	0.099	0.001
AGLP	–0.105	–0.074	–0.242	0.288	0.080	0.539	0.005	0.002	0.019
KSG	–0.145	–0.141	–0.220	0.197	0.340	0.806	0.003	0.009	0.024
KER	–0.111	–0.125	–0.075	0.087	0.106	0.120	–0.001	–0.003	0.005
Average	–0.127	–0.147	–0.140	0.208	0.172	0.306	–0.0004	0.013	0.011
Diff. %			110%			147%			–2,594%
Company	**Standard deviation**			**Skewness**			**Kurtosis**		
	Before shock	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**
MHP	0.030	0.061	0.042	0.190	–0.313	0.301	0.213	1.080	0.257
ASTH	0.063	0.106	0.079	0.751	–0.665	0.823	4.061	0.133	1.051
AGTP	0.087	0.101	0.077	2.504	0.468	1.098	11.662	2.918	3.333
IMC	0.046	0.068	0.049	0.678	0.626	0.520	3.908	0.134	0.004
OVO	0.036	0.053	0.044	–0.278	–0.129	–0.174	1.592	–0.703	0.974
AGLP	0.068	0.044	0.106	1.199	0.057	1.288	2.644	–0.803	6.857
KSG	0.073	0.091	0.157	0.293	2.123	2.293	0.076	7.627	8.306
KER	0.037	0.054	0.037	–0.173	0.086	0.689	0.173	0.152	1.155
Average	0.055	0.072	0.074	0.645	0.282	0.855	3.041	1.317	2.742
Diff. %			134%			132%			90%
RUW period (23.08.2020 - 31.12.2023)									
Company	**Min**			**Max**			**Mean**		
	Before shock	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**
MHP	–0.302	–0.205	–0.147	0.120	0.320	0.136	–0.002	–0.001	–0.001
ASTH	–0.402	–0.222	–0.145	0.265	0.291	0.258	0.007	0.005	0.011
AGTP	–0.352	–0.146	–0.201	0.329	0.151	0.472	0.005	–0.018	0.004
IMC	–0.259	–0.141	–0.133	0.149	0.128	0.281	0.008	–0.007	–0.001
OVO	–0.116	–0.166	–0.145	0.113	0.111	0.254	–0.002	–0.017	0.013
AGLP	–0.242	–0.464	–0.114	0.539	0.241	0.314	0.012	–0.036	0.004
KSG	–0.367	–0.103	–0.143	0.806	0.150	0.204	0.013	0.009	0.003
KER	–0.425	–0.230	–0.319	0.120	0.710	0.213	–0.001	–0.014	–0.001
Average	–0.308	–0.210	–0.168	0.305	0.263	0.266	0.005	–0.010	0.004
Diff. %			55%			87%			81%
Company	**Standard deviation**			**Skewness**			**Kurtosis**		
	Before shock	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**	**Before shock**	**Shock**	**After shock**
MHP	0.055	0.112	0.050	–1.895	1.300	0.022	10.775	3.998	1.028
ASTH	0.092	0.142	0.065	–0.497	0.873	0.883	4.770	0.243	2.761
AGTP	0.089	0.081	0.086	–0.023	0.125	2.852	4.258	–0.039	14.095
IMC	0.060	0.074	0.063	–0.879	0.114	1.353	4.410	–0.541	4.508
OVO	0.044	0.059	0.065	–0.463	–0.368	0.790	0.859	2.419	2.279
AGLP	0.105	0.143	0.063	1.415	–1.299	1.735	7.464	5.026	6.823
KSG	0.153	0.077	0.056	2.161	0.681	1.091	0.076	–0.614	3.382
KER	0.060	0.210	0.077	–4.313	2.747	–0.395	31.366	9.477	3.966
Average	0.082	0.112	0.066	–0.562	0.522	1.041	7.997	2.496	4.855
Diff. %			80%			–185%			61%

Source: own calculations.

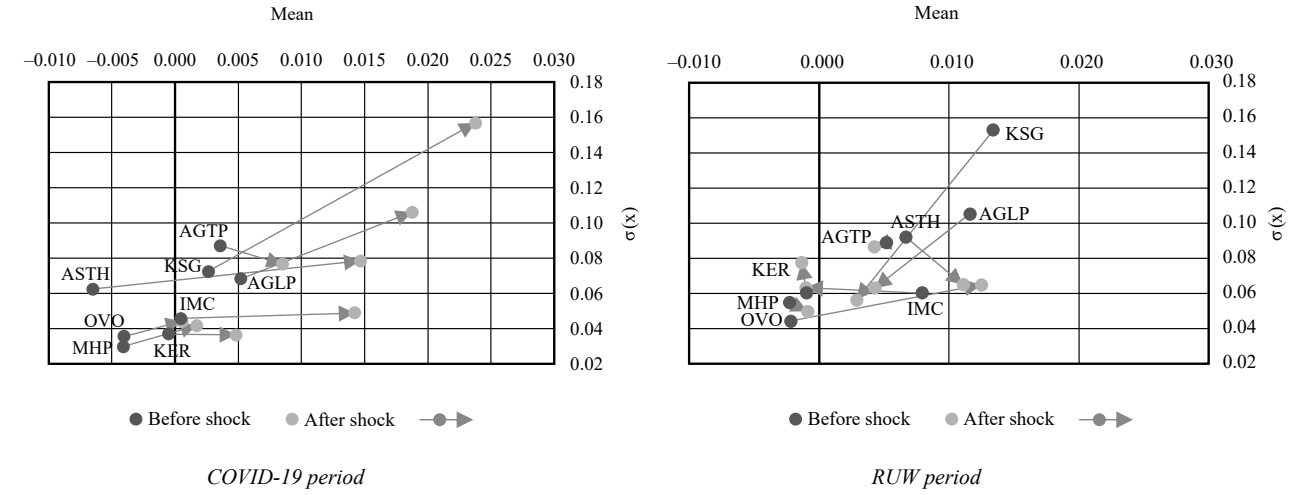


Figure 3: Changes in the risk-expected return correspondence through passing shocks: comparative analysis.
Source: own composition

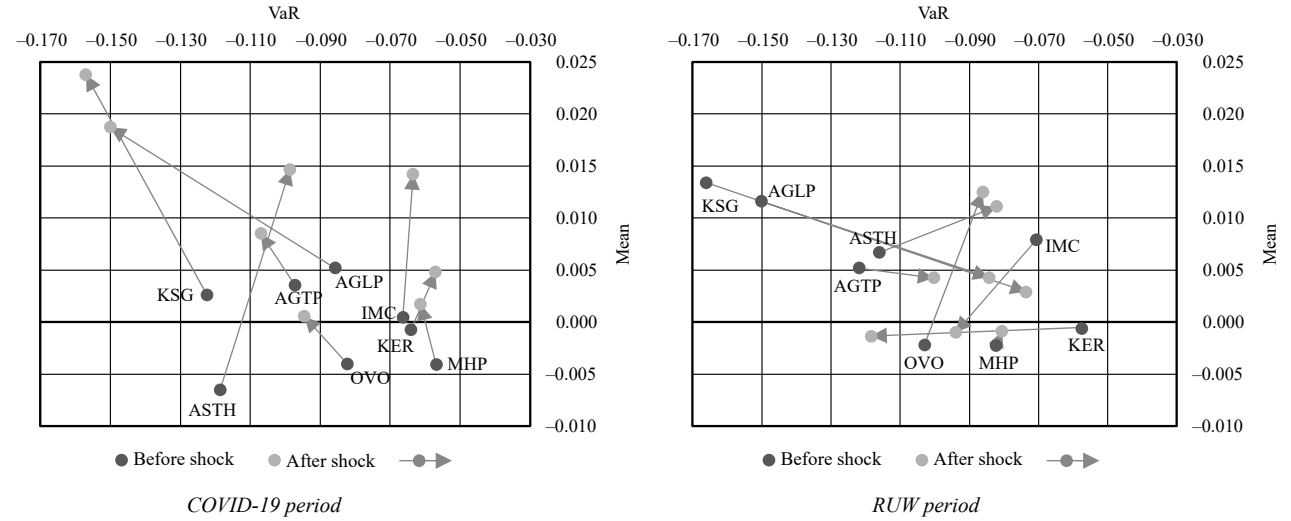


Figure 4: Changes in the VaR-expected return correspondence through passing shocks: comparative analysis.
Source: own composition

After the pandemic, the average share value increased for all companies, and while half of the companies had negative average profitability before the pandemic, all agroholdings had positive profitability after the pandemic. However, investment risk increased for most companies, on average by 134%. The impact of the war was more pronounced. Most companies experienced a decline in average profitability, but MHP, Ovostar and Astarta managed to improve their position slightly. It's interesting to note the decline in investment risk, which was 8.2% before the war, peaked at 11.2% during the shock period and then fell sharply to 6.6%. This again underlines the importance of agriculture as one of the most, if not the most, important sectors in Ukraine. The figure shows the risk-return relationship based on the classical Markowitz risk-return frameworks.

Risk assessment has also been realised within the Value at Risk (VaR) and Conditional Value at Risk (CVaR) frameworks. Value at Risk (VaR) assesses the amount of potential loss, taking into account the confidence level and time horizon. CVaR is a forward-looking measure that focuses on the tail of the probability distribution function of losses. CVaR is calculated by taking the weighted average of the "extreme" losses in the tail of the distribution above the VaR cut-off point.

It should be noted that while the choice of VaR or CVaR is not always clear-cut, the majority of respondents believe that using the latter method generally leads to a more conservative risk approach. Figure 4 illustrates the results.

Based on Figure 4, we draw some conclusions. The pandemic did not have a significant impact on agricultural holdings. For most agroholdings we observe an increase in return, but the high level of uncertainty also led to an increase in risk. Conversely, the results after the RUW shock are quite the opposite. The decrease in average return was quite predictable, but the decrease in investment risk was not. This method also confirms our earlier findings using the variability assessment method.

The final step of our comparable analysis concerns liquidity. Liquidity is assessed using a measure such as the

average daily trading volume of stocks. Examining changes in risk and profitability confirms assumptions about fluctuations in daily trading activity over periods.

For most companies, there is a slight decrease in average trading volume during the COVID-19 shock period and a significant increase in the post-shock period. Only MHP and Ovostar show a negative trend. During the RUW, however, share trading decreased significantly: no company returned to pre-shock levels, but half of the companies showed a positive trend. A comparison is shown in Figure 5.

Overall, we can conclude that agroholdings were resilient to the pandemic and continued to grow, but the war had a devastating effect on all of them. The explanation, in our view, is that there are different degrees of uncertainty about the shocks. For the first shock, the uncertainty was global and all investors reduced their activity. However, the recovery from the COVID-19 shock was quite rapid. There was a strong rebound in business activity. Investment in the food industry and commodities revived. Investors began to reformat their portfolios. Ukrainian agroholdings were part of this process. As a result, liquidity increased.

The liquidity situation of shares of Ukrainian agricultural holdings during the RUW is different. The high uncertainty about the business development of these companies limits the interest of investors and their low liquidity. It has decreased.

From the results, it can be said that Astarta and Ovostar have the best dynamics, as evidenced by their recovery almost to pre-shock levels, while the worst situation is seen in Kernel and MHP. At the beginning of the war, Verevsky bought 134,000 hectares of land on the Warsaw Stock Exchange to reduce business risks and improve liquidity. The company was forced to take this step because of the high level of uncertainty. As a result of the sale of almost 30% of its land, Kernel will receive about $210 million, which will be used to service its debts. In addition, Kernel has lost over $100 million due to spoiled meals and the devaluation of its business reputation in the oilseed processing industry. MHP suffered colossal losses in poultry farming, leading the agribusiness to reduce production capacity to 85%.

In particular, the impact of the pandemic on agroholdings was relatively muted, with a remarkable post-pandemic growth boost of more than 1.5 times. However, the COVID-19 pandemic led to an economic downturn that reduced demand for some products, including agricultural products. MHP and Ovostar were hardest hit, recovering only 58% and 80% respectively. At the same time, KSG Agro and Agroleague managed not only to withstand the shock but also to grow three times. Conversely, the outbreak of the war had a devastating effect on the entire spectrum of agricultural holdings. On average, agricultural stocks fell by 51% during the shock period, with a subsequent recovery rate of 63%.

In the aftermath of the pandemic, there was a marked increase in the average share prices of all companies, a marked departure from the negative average returns observed before the pandemic. In stark contrast, the post-pandemic period saw a more pronounced effect, with the majority of companies experiencing significant declines in average profitability.

In addition, the results of the Value at Risk (VaR) and Conditional Value at Risk (CVaR) assessments underlined the differences in risk escalation during periods of instability. In particular, COVID-19 did not have a significant impact on agroholdings. Most of them experienced an increase in profitability, but the high level of uncertainty also led to an increase in risk. The opposite results were observed after the war shock. The decline in average returns was fairly predictable, but the decline in share price volatility was not.

We use the average daily trading volume of shares to measure liquidity. For most companies, there was a slight decrease in average trading volume during the shock period and a significant increase in the post-shock period. MHP and Ovostar showed negative dynamics. During the war, however, share trading decreased significantly: none of the companies reached the level of the pre-shock period, but most companies showed positive dynamics.

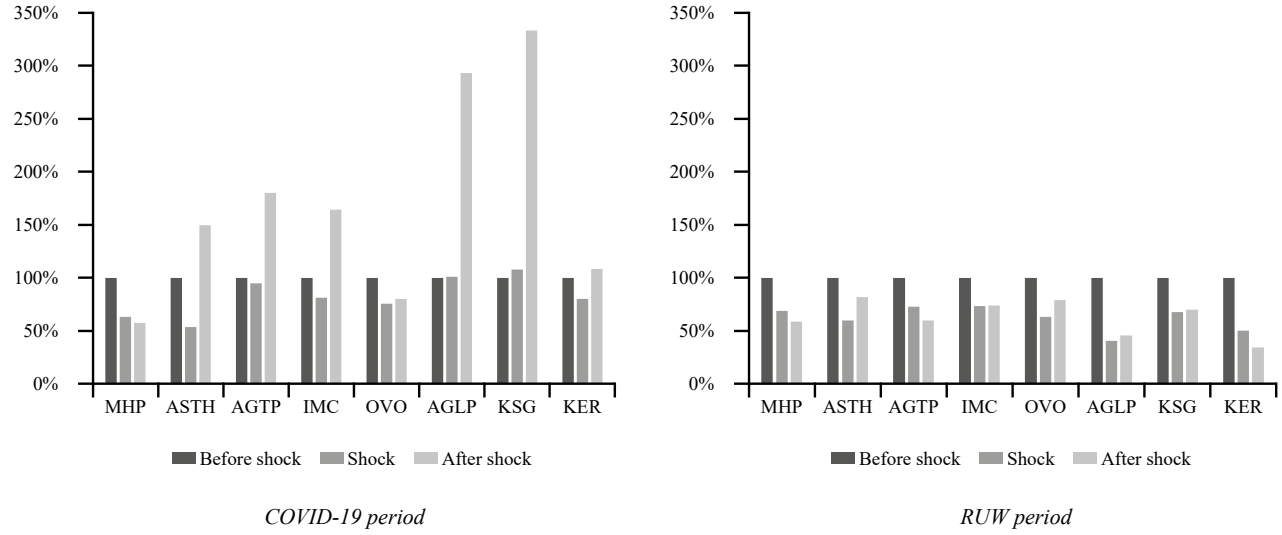


Figure 5: Comparison of the liquidity of agroholdings' stocks in passing shocks.
Source: own composition

Discussion and Conclusions

Our study analyses the impact of two macroeconomic shocks (COVID-19 pandemic and RUW) on the agricultural sector in Ukraine, focusing on agroholdings. Our results show significant differences in the resilience and vulnerability of these subjects to the shocks under consideration.During the COVID-19 pandemic, agroholdings showed considerable resilience. Despite the initial drop in demand for agricultural products, most farms managed to recover and even exceed their pre-pandemic performance. This period highlighted the adaptive potential of Ukrainian farms, as they used their operational flexibility and market positioning to mitigate the negative impact of the pandemic.By contrast, the full-scale war that began in 2022 had a devastating impact on the agricultural sector. The destruction of infrastructure, the loss of farmland and the disruption of transport routes have had a severe impact on all major agroholdings. Our analysis shows that the war led to a sharp decline in share values and trading volumes, significantly affecting the financial stability and operational capacity of these companies. Recovery from the crisis has been much slower than during the pandemic, indicating the deep and long-term impact of this shock. This brings to the fore the risk of competition from global players. The difficulty of attracting investors under wartime conditions.

The policy implications of our study are twofold. The first is the need to develop an adaptation strategy for Ukrainian agroholdings. The second is the need for robust risk management strategies and investment in resilient infrastructure to protect the agricultural sector from future shocks. Increased support for smallholders and family farms, which have shown greater resilience, could also be a strategic focus for policymakers. In addition, promoting diversification within the agricultural sector can mitigate the risks associated with overdependence on specific commodities and markets.

In conclusion, while Ukraine's agricultural sector faces unprecedented challenges, it also shows remarkable resilience and adaptability. It can be further explored through continued investment, strategic policy interventions and a focus on sustainable practices. This will manage future uncertainties and ensure the long-term viability of Ukraine's agricultural economy.

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Governance priorities for the post-war development and European integration of rural local communities in Ukraine

Rural local communities of Ukraine have faced serious socio-economic problems under theconditions of war. Among the most critical are the low level of entrepreneurial activity and pre-existing challenges related to the quality of governance. As a result, the resource potential utilisation of these communities has become less efficient, against a further backdrop of deteriorating human capital quality and investment attractiveness. All this creates a number of barriers to Ukraine's further integration into the EU and limits the prospects for post-war economic development of its rural economy. This being so, it is advisable to focus on the implementation of managerial innovations that can enhance the efficiency of governance of rural local communities in Ukraine and facilitate their adaptation to EU institutional standards. Primarily, this concerns the implementation of modern project management tools, activation of cross-sector partnerships, application of effective territorial marketing and branding means, and the dissemination of democratic public administration practices, among other measures. At the same time, significant attention should be given to the educational component, which should ensure that the managerial competence of local self-government employees in rural local communities is enhanced as well as stimulate the entrepreneurial activity of their residents. This will enable Ukraine to attract additional grant and investment resources amid the further deepening of Ukraine's European integration, particularly in the post-war phase of its development.

Keywords: Ukraine, rural communities, European integration, post-war development, efficient management, territorial marketing
JEL classifications: O10, R22

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Introduction

Rural local communities of Ukraine, in the current socio-economic conditions, have faced a number of new challenges caused by the war and the intensification of global political instability. Some of them are in zones of active combat or under constant artillery or missile shelling, some are in liberated territories that, however, require a long time for demining and economic recovery, and some, although in relatively calm rear regions, despite apparent stability, are experiencing a significant decline in the quality of their human and social capital (primarily due to the outflow of part of the working-age population abroad). This is accompanied by a deterioration of the investment climate and is exacerbated by the loss of traditional markets for agricultural products, which is particularly dangerous in view of Ukraine's uncertain prospects for further European integration.

In many local communities, the situation is complicated by the influx of a large number of internally displaced persons and representatives of relocated businesses, forcing local authorities to address incomers' adaptation to the community's social and cultural environment, while lacking the necessary administrative and managerial experience. This is often accompanied by a shortage of necessary personnel and the absence of effective business communications with regional authorities, local businesses, and civil society institutions. Moreover, the military actions in the east of the country have negatively impacted the investment climate in most rural local communities of Ukraine. While large cities have been able to maintain investor interest to a degree, the situation is much more challenging in rural communities, especially smaller and mono-functional ones.

All this highlights the urgent need to find adequate administrative approaches and management tools that can ensure sufficient efficiency in utilising the available resource potential of Ukraine's rural areas under current conditions and create a reliable institutional foundation for the further recovery of their economy in the post-war development phase, primarily in the context of aligning with EU institutional standards.

The aim of the article is to identify and analyse the key priorities for the development of rural local communities in Ukraine in the context of post-war recovery and European integration. The specific objectives include:

- To explore and propose innovative management practices that can enhance the efficiency of rural community governance, thereby improving the utilisation of natural and human resources.
- To identify effective strategies for attracting both domestic and foreign investment into rural areas, which is critical for economic modernisation and sustainable development.
- To propose measures for addressing socio-economic challenges such as depopulation, unemployment, and low levels of entrepreneurial activity in rural communities.
- To align the development strategies of Ukrainian rural communities with European Union standards, thereby facilitating smoother integration into the EU and ensuring that rural areas can benefit from this process.

The article aims to provide a comprehensive framework for policymakers, community leaders, and stakeholders to effectively navigate the complex process of rural development in the challenging context of post-war reconstruction and European integration.

Methodology

The methodological basis of the research conducted in the process of writing the article included theoretical postulates of regional economics, the theory of human and social capital, conceptual foundations of institutionalism, as well as the theories of neoclassicism and economic growth.

The methodology of the article is centred on a multidisciplinary approach that combines elements of economics, sociology, and management studies. The first methodological step involves identifying the primary socio-economic challenges faced by rural communities in Ukraine, particularly in the context of post-war recovery and European integration. The authors evaluate existing management practices in these communities, with a focus on identifying areas where improvements can be made. This includes an assessment of project management techniques, investment attraction strategies, and community engagement practices. Based on the findings from the literature review, case studies, and empirical data, the authors formulate a set of recommendations aimed at improving the efficiency and effectiveness of rural community management. These recommendations are designed to align with European Union standards and best practices. The authors test several hypotheses regarding the factors that contribute to successful rural community development, such as the role of education, the impact of decentralisation, and the benefits of cross-sector partnerships.

The following methods were used in the work: analysis and synthesis – to identify the most pressing issues of development in rural local communities of Ukraine, comparisons – to outline the primary tasks for improving the efficiency of their economies in the context of European integration, scientific abstraction – to formulate proposals aimed at modernising the economies of the studied communities during the post-war recovery phase, graphical – for visual representation of research results, and monographic – to generalise the results of empirical observations. The base of scientific-analytical materials and primary data for the research comprised scientific publications of Ukrainian and foreign scientists, results of the authors' personal observations, as well as systematised materials from state and local authorities and expert communities of Ukraine.

Results

The development of most modern rural local communities in Ukraine is limited by existing financial-economic, social, and security problems. Some of these problems are common to all rural areas, including ageing and declining populations, fundamental technological changes in food systems, income inequality and the spread of poverty in rural areas, and the low institutional capacity of local self-government bodies in rural local communities, among others (Dax *et al.,* 2023).

At the same time, it is evident that the problems of the rural economy in Ukraine have significantly worsened (and often been supplemented by new ones) following the large-scale Russian invasion. Moreover, missile strikes across the entire country have led to the damage of numerous infrastructure facilities in rural communities, a decrease in entrepreneurial activity, a deterioration in the investment climate, job losses, and the worsening condition of many social and engineering infrastructure facilities.

Given the nature of these described problems, and considering the objective difficulties currently faced by rural local communities in modern Ukraine, there is an urgent need to eliminate several destructive factors that reduce the efficiency of local community governance, thereby limiting the potential for their post-war development and European integration. These factors primarily include:

- Institutional remnants relating to the functions of local self-government bodies, which limit efficiency primarily due to their lack of any real capacity to influence the economic development of rural local communities;
- The inertia of community leaders' thinking, which has formed and become entrenched over a long period;
- The lack of qualified personnel, caused by the continuous outflow of the best specialists and managers to cities and abroad.

Another issue hindering the development of rural local communities is the low level of cross-sector partnership culture within them. Additionally, the development of participatory management and entrepreneurship in rural local communities is significantly hampered by the existing shadow redistribution of some goods and services within their boundaries, which distorts the structure of trade in the rural economy and increases the transaction costs of local businesses.

The shadow market also negatively affects the productivity of agriculture and the quality of public goods provided to rural residents. Specifically, there is a resource outflow from farms favoured by the market to large agroholdings favoured by policymakers, leading to slower growth rates and losses in the economic efficiency of the rural economy (Kubakh, 2021).

The described problems and the factors contributing to their formation and entrenchment also reduce the potential for Ukraine's European integration, especially when the prospects for post-war recovery of the Ukrainian economy are taken into consideration (Figure 1). The preservation of institutional remnants and shadow resource redistribution reproduce negative post-Soviet management stereotypes; the inertia of community leaders' thinking and the deficit of qualified personnel decrease the management efficiency of self-governing bodies and limit their application of the subsidiarity principle, and gaps in the cross-sector partnership system block the development of civil society institutions, which are an important institutional component of the European integration process.

Therefore, the contemporary conditions for the development of Ukrainian villages and agriculture require a new

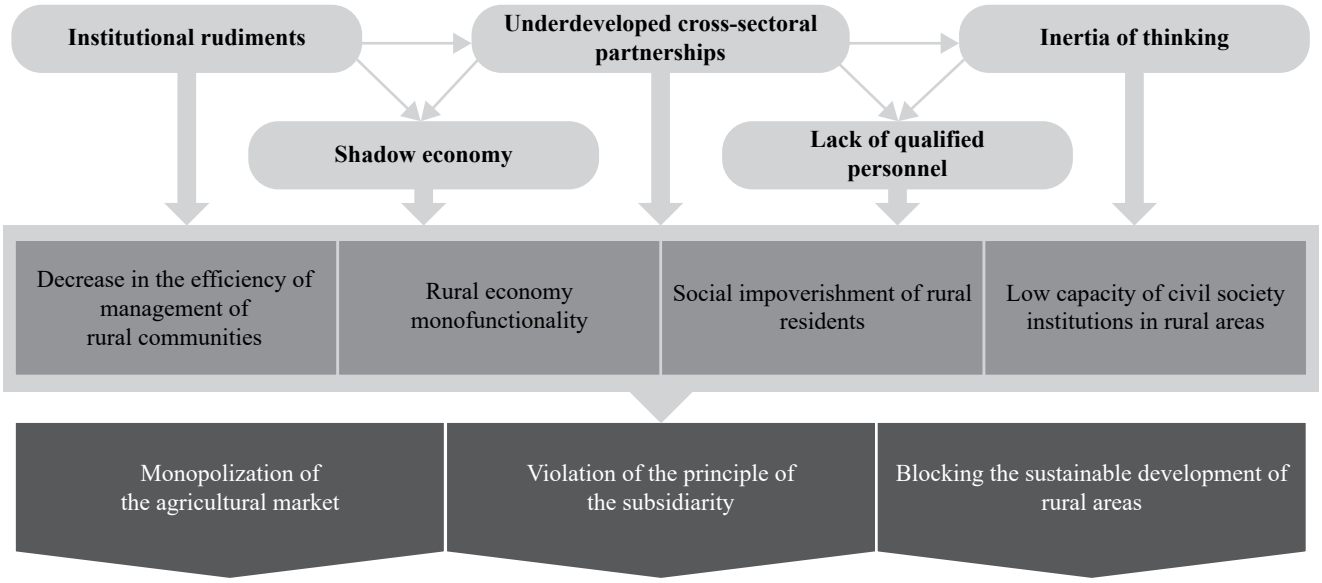

Figure 1: Main problems of development of rural local communities in Ukraine in terms of prospects and priorities for deepening European integration.

Source: authors' composition

perspective on their development in the context of European integration, especially after the active phase of hostilities has ended. Specifically, the potential for the development of organic farming and livestock in Ukraine deserves attention. These sectors produce high added value, which is important for the transformation of the Ukrainian rural economy in the context of alignment with EU institutional standards. Although the value created in organic production is higher than that of agroholdings, this increase is fully compensated by its positive impact on the diversification of agricultural production (Zegar, 2018).

Decentralisation of power opens broad opportunities for diversifying the rural economy and developing self-organisation and local governance institutions within Ukraine's rural local communities, particularly in line with European integration policies. It aims to change the model of social organisation: instead of a "top-down" approach, a "bottom-up" society is formed, eliminating the contradiction between the citizen and the state (Riabokon, 2020). The new state mechanism should align with modern trends in spatial development and mobility, considering international migration trends and the impact of social transformations, which are integral elements of European integration (Mulska *et al.,* 2023).

The main criteria determining the direction of transformation in the management of rural local communities in Ukraine, considering the prospects of European integration, should include: the professionalisation of local self-government, increasing its competence and democratisation of the management process; the informatisation and digitisation of management; and the adaptation of innovative forms and means of community management that have proven effective in developed countries, particularly in EU member states (Hazuda *et al.,* 2015).

For example, Poland faced a situation where the adopted strategy of implementing a large number of diverse measures led to the fragmentation of resources directed at specific goals. This increased transaction costs associated with building, operating, and controlling the entire management system. Despite the transparency of the fund distribution system among different voivodeships, based on clear and published indicators (though their appropriateness could be debated), the distribution of funds among specific measures at the national level was overly secretive and difficult to explain scientifically, indicating a high degree of politicisation and subjectivity in this area (Zawalińska, 2009).

However, timely responses to the problem and the application of adequate management mechanisms allowed for the localisation of existing difficulties and threats. Therefore, creating a modern management system for the development of rural local communities, based on effective interactions between state, regional, and local authorities, is a primary priority in addressing the socio-economic problems of these communities, significantly increasing the potential of their economy and its efficient use.

It is also necessary to consider the differentiation in the socio-economic development of different rural areas and the regional specifics of their spatial location. This should ensure the rationalisation of management programmes for each rural community based on identifying its endogenous features in line with European integration policies. At the same time, the social responsibility of management should be ensured by the potentials of technical-economic and organisational-economic property relations and economic mechanisms (Kravchuk and Rakovych, 2018).

Another direction for stimulating the development of Ukraine's rural economy, considering its European integration priorities, is the combination of efforts by the population,

state authorities, and local self-government in implementing public-private partnership projects funded through grants and loans. It is important to ensure the transfer of new knowledge and technologies, provide technical assistance, and engage in joint labour, procurement, consultancy, and marketing activities by local authorities and businesses (Shvets *et al.,* 2021).

The educational component is gaining increasing significance in overcoming the existing capacity limitations of rural residents in Ukraine. Acquiring new knowledge and skills in the context of mastering modern business technologies and their practical application can significantly increase the efficiency of utilising the human capital of Ukrainian villages and contribute to positive shifts in the European integration progress of the rural economy in the post-war development stage.

For example, researchers note that prior to the large-scale invasion, certain positive shifts could be observed (albeit with some fluctuations) in many rural local communities in Ukraine in terms of institutional development, infrastructure quality, market environment dynamics, and technology levels. However, negative trends were noted in indicators such as human capital, business environment conditions, and creative components (Kucher *et al.,* 2023).

This underscores the need to activate the role of educational institutions and research centres in promoting the development of rural local communities, by improving their human capital in particular. Notably, the implementation of joint projects with foreign partners under international technical assistance programmes involving qualified specialists from EU member states should have long-term effects and improve both human and social capital in ruralcommunities. This, in turn, should positively impact management quality, reduce conflicts andtensions among various social groups, develop entrepreneurial skills among young people, establish cooperation with foreign investors, enhance intersectoral partnership efficiency, solve environmental problems, and stimulate sustainable development.

Sustainable development of rural local communities, based on the mutual complementarity of their main economic, social, and environmental functions, in the context of European integration should be accompanied by balanced development in the respective spheres of the rural economy. The challenge also lies in maintaining the balance of economic, social, and environmental functions without creating or exacerbating constraints on the efficient use of existing human and natural resource potential for the development of rural local communities (Niedzielski, 2015).

From the perspective of the Common Agricultural Policy (CAP), sustainable development of rural areas should also involve supporting the income levels of rural community residents by strengthening their social, environmental, and economic resilience. This is achieved through measures which aim to promote and support the competitiveness of agriculture and forestry; to encourage sustainable management of natural resources and climate action; and to achieve balanced territorial development of rural economies and communities, while creating and maintaining employment within them (Korinets, 2023). Moreover, fully leveraging the development potential of rural local communities in Ukraine, in the context of their adaptation to EU institutional standards, depends on the effectiveness of cooperation between local residents and entrepreneurs within these communities. One tool for forming a reliable foundation for the future development of rural areas in Ukraine based on shared decisions and procedures is participatory governance. This approach encourages local political representatives, the business community, and residents to take joint responsibility for fulfilling various management functions to develop their communities (Becker, 2022).

To ensure the diversified development of the rural economy, it is also advisable to outline such important priorities as: increasing agricultural production by expanding the range of products; promoting organic and niche production; activating industrial cooperatives, folk crafts, and rural and green tourism; and producing specific localised products. Simultaneously, it is necessary to increase the number and capacity of funding sources for local economic projects (state and local budgets should be supplemented by investments from Ukrainian and foreign companies, individuals, and grant resources). Another direction for diversifying the rural economy is encouraging various forms of farming in villages, particularly through promoting agricultural cooperation and clustering of agribusiness and related industries (Pavlikha and Khomiuk, 2020).

Attention should also be paid to the socio-psychological modernisation of rural areas in Ukraine in the context of the Euro-integration transformations of their economy. Rural residents are often prone to opportunistic behaviour, manifested in their reluctance to change their traditional way of life, maintain usual behavioural stereotypes, or prioritise economic activities. This situation is often complicated by the predominance of older age groups in rural communities and significant youth outflow to large cities and abroad (Chitea and Dona, 2018).

One of the primary Euro-integration priorities for local authorities should be ensuring the coordinated and efficient use of the available natural-resource and socio-economic potentials of Ukrainian villages to achieve sustainable development of rural local communities in Ukraine (Herasymchuk, 2022). One of the main problems accompanying the evolution of Ukrainian agricultural production over the past decades is the constant reduction in the rural population. The decrease in its productive segment occurs historically, and these changes to a certain extent represent an objective socio-economic phenomenon (Rossokha and Plotnikova, 2018).

This perspective echoes the conclusions of A. Tkachuk: “Against the backdrop of quite dynamic GDP growth in Ukrainian agriculture and its products conquering foreign markets, we have a completely different situation in rural areas: accelerated depopulation of rural settlements, degradation of rural education, healthcare, social services, pollution and dehydration of territories… The concentration of agricultural production among large and very large producers and the total dominance of grain farming in the production structure have led to a sharp reduction in jobs in the traditional agricultural sector of rural areas” (Tkachuk, 2016, p20.). Moreover, the global trend towards implementing knowledge economy elements means that employment opportunities in the agricultural sector for rural communities in Ukraine are becoming increasingly limited. At the same time, the development level of non-agricultural

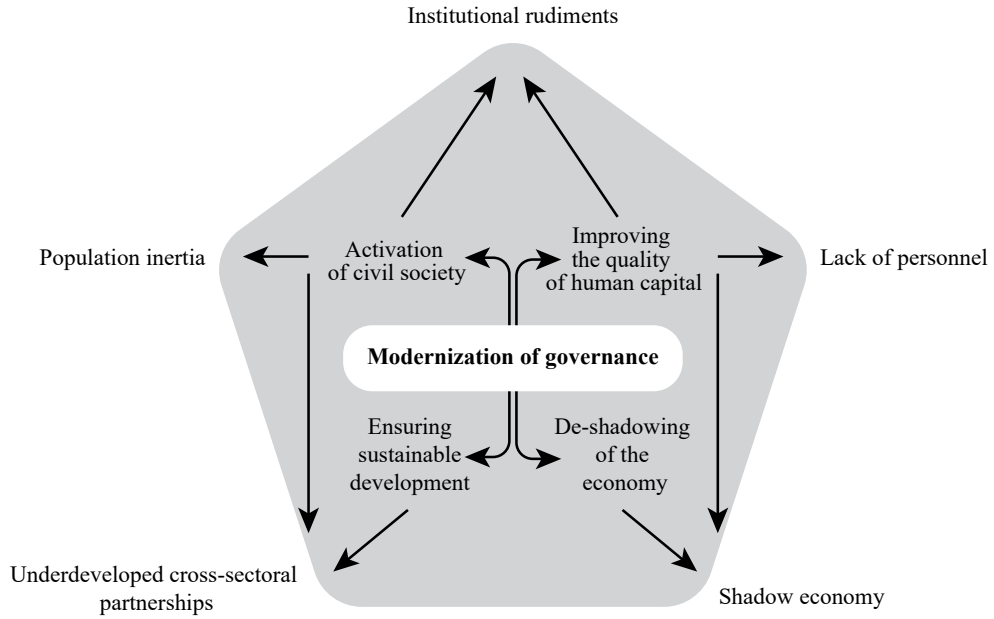

Figure 2: Modernisation of rural local community governance to overcome the existing problems of their development in the context of European integration.
Source: authors' composition

sectors leaves much to be desired. For young people, rural areas with a high amount of traditional agricultural production appear quite unattractive (Klonowska-Matynia, 2022).

Given all this, it is necessary to substantially modernise the management of rural local communities in Ukraine. The application of project management principles and mechanisms should play a priority role in this context. On the one hand, this will significantly expand the range of community funding sources by increasing grant and investment inflows (since traditional community management methods will be supplemented by project management practices familiar to most donors and investors). On the other hand, it will help overcome development problems (including mitigating their spread), such as institutional remnants, management stereotypes, gaps in cooperation culture, and inertia in leaders' thinking (Figure 2).

The primary areas of application for project management in rural local communities in Ukraine should include:

- Developing well-substantiated plans of action that are financially and humanly resource-supported for implementing current community development strategies;
- Attracting grant resources into the community economy;
- Enhancing the quality of human and social capital and increasing their entrepreneurial potential;
- Addressing existing environmental issues;
- Increasing the volume of investment resources attracted to the community economy;
- Solving social problems of rural residents, reducing unemployment, and ensuring the full integration of internally displaced persons into the economic and social environment of host communities.

Each of the outlined areas of project management is important not only in terms of changing the principles and approaches to governance of rural local communities in the context of overcoming existing management problems and implementing EU institutional standards but also encompasses a wide range of tasks aimed at significantly increasing their financial and economic capacity in light of the prospects for post-war economic development.

Another important issue that rural local communities in Ukraine will have to address in the context of implementing Euro-integration prospects at the post-war stage of development is the implementation of the "Green Deal" (Heffner, 2012). The implementation of the principles of the "green" economy is a crucial tool in achieving sustainable development, which is a priority for the EU. However, under wartime conditions, such a transition may be accompanied by significant risks (Iakymchuk *et al.,* 2019).

An important area to note regarding Ukraine's Euro-integration prospects is attracting investment for the recovery of the rural economy. Unfortunately, this area is currently not given adequate attention. However, in the context of accelerating European integration at the post-war stage of development, such projects will gain primary importance. This situation compels rural leaders and community activists to actively seek opportunities to develop high-quality and relevant investment proposals to attract sufficient investment resources into the local economy, both in the present and with an eye to the post-war development of Ukraine.

For instance, considering the current challenges for Ukraine's energy sector, an essential direction for investment attraction is the development of energy generation from alternative sources. Analysis shows that Ukraine has significant potential for agricultural biogas production from manure. However, the potential utilisation is significantly limited by the structure of agriculture, as more than half of the available manure is produced on small livestock farms, which are too small to independently invest in biogas plants (Wąs *et al.,* 2020).

Experts also note that obtaining candidate status for EU membership and the consequent socio-economic reforms will allow Ukraine to attract more investment resources during the post-war reconstruction phase. This will also spur the deepening of several transformations initiated in previous years, including real decentralisation of power, energy modernisation, and increasing the real financial capacity of local communities (Erman, 2022). Unlike the issues of local budget revenue, where communities largely remain hostages to legislative gaps and contradictions, there are currently a whole range of opportunities to attract additional resources for financing development projects, primarily through funds from foreign partners. Moreover, after the war, these opportunities will only increase, and each community must be ready to demonstrate its advantages to potential investors, creditors, or donors. Therefore, the pre-war situation, where many community leaders and local deputies could not formulate relevant ideas even for themselves, must become a thing of the past (Dzhus, 2024).

Finally, another important aspect of adapting project management tools to the needs of rural local communities in Ukraine should be the educational component, namely raising the general informational and educational level of rural residents and acquiring new knowledge and skills in entrepreneurial and organisational-management areas. This will improve conditions for self-employment of the rural population, expand development prospects for small businesses in new niches and sectors of the rural economy, stimulate public activity among rural residents, etc. The primary support should be directed towards developing non-agricultural types of business, reviving traditional crafts, creating small light industry enterprises, encouraging entrepreneurship in woodworking, services, tourism, IT, transport, logistics, etc (Naherniuk and Nepochatenko, 2021).

Researching the aspects of financial self-sufficiency of rural local communities in Ukraine in the context of their European integration, it is also worth noting that the current system of horizontal budget equalisation leads to increased withdrawal of funds from the budgets of more financially self-sufficient communities, while a significant number of communities with low tax revenues per capita and high levels of basic subsidies exist, negatively affecting their economic development. This highlights the need for improved budget equalisation among communities of different types (Vozniak *et al.,* 2022).

Simultaneously, attention should be given to such important directions of Euro-integrative evolution of Ukrainian rural communities as: de-agrarianisation of rural areas; economic diversification; de-peasantisation or changing the traditional rural way of life; suburbanisation (increasing population in rural communities adjacent to large cities); and gentrification (the phenomenon opposite to suburbanisation, where previously neglected buildings and adjacent areas in rural areas, mainly in peripheral and unattractive settlements, are reconstructed and renewed due to the relocation of wealthy residents from cities) (Czapiewska, 2021).

Special attention should also be paid to preserving the social functions of the rural economy, particularly through the proliferation of non-agricultural enterprises, whose role in improving the living standards of rural community residents in the EU is constantly growing. The multifunctional development of these communities' economies should become one of the basic goals of both agricultural and regional policies of the state. An important prerequisite for implementing this concept is adherence to the principles underlying the EU's common agricultural policy, particularly the principle of prioritising innovation during the economic diversification of rural communities (Adamowicz and Zwolińska-Ligaj, 2009).

Moreover, it is worth noting that the deepening of European integration will mean inevitable intensification of competition for investments for Ukrainian rural communities, and their development will increasingly depend not so much on available natural and human resources, but on the ability of local authorities to use and promote them effectively. As a result, the proper positioning of communities and the ability of their governance institutions to successfully apply marketing tools for attracting internal and external investments will gain increasing importance.

There is significant positive experience in applying territorial marketing for rural communities in European countries. This concept has been in use for a considerable time, especially in enhancing the economic potential of rural areas. For example, in Bavaria, Germany, local and regional marketing initiatives are combined into a single regional marketing strategy, thereby strengthening local projects with regional and federal support (Budnikevych *et al.,* 2018). Numerous local communities in France actively use an approach that can be called "targeted marketing". Its essence lies in identifying the main economic priority of the community (e.g., tourism, winemaking, or agriculture) and focusing all marketing means on promoting it in the eyes of potential investors, from visual advertising (billboards, posters, announcements, etc.) to creating promotional offices in each settlement (Perepeliuka, 2020). In Polish rural communities, branding the territory, based on historical development milestones, is often used to attract potential investors. Therefore, investment-successful communities frequently achieve popularity among investors by positioning themselves as continuers of long-standing local traditions, adorning their logos with characteristic patterns. Thus, there are communities of hereditary "beekeepers", "knights", "farmers", "foresters", "brewers", "miners" and others. Investors know in advance which businesses are worth investing in each community and which to avoid (Iurkiv, 2021).

Given the features and development prospects of Ukrainian rural communities in the context of post-war recovery and European integration, part of the described approaches can be applied as effectively as in EU countries. For example, one of the most effective ways to attract investors to rural communities in modern Ukraine could be the use of internet marketing. Its application can attract attention not only from businesses but also from grant givers. Internet resources are also quite effective information channels for establishing feedback with grant givers and investors. Their proper use allows highlighting the community's advantages and development prospects, which is very important for local residents and potential tourists.

Ensuring a constant presence at various exhibition and fair events held in Ukraine and EU countries is also significant for the economy of rural communities. These events can not

Figure 3: Priorities of territorial marketing for rural communities in Ukraine at the post-war stage of European integration
Source: authors' composition

only present the economic potential of communities but also gather information from investors about their primary needs and expectations. Moreover, modern exhibitions and fairs are excellent platforms for developing international cooperation among communities and establishing their partnerships with analytical centres, consulting companies, educational and scientific institutions, financial institutions, and others.

It is also important to note that the activation of exhibition and fair activities in Ukrainian regions today is inextricably linked with the formation and implementation of regional investment policies, which gain increasing importance in the context of deepening European integration. In the EU, the necessary condition for the development of national economies of member countries is, first and foremost, the implementation of regional investment activities. Furthermore, within the EU's plans to create a single European innovative economy, an integrated model of local and national investing is being implemented (Serednytska and Heha, 2017).

A sufficiently important marketing tool that can significantly contribute to the economic development of rural communities in our country at the post-war stage of European integration is the publication of high-quality (and at the same time not too costly) presentation materials, and their subsequent distribution among target audiences. For this purpose, it is advisable to primarily use such effective information channels as business representations of foreign companies in Ukraine and Ukrainian firms abroad, chambers of commerce and industry, business associations, diplomatic representations of our state in EU countries, etc.

Thus, the post-war economic development of rural local communities in Ukraine should rely on the formation of a modern marketing ecosystem of spatial development, capable of combining into one whole: promoting the economic interests of local communities, achieving their Euro-integrative goals, and stimulating the effective use of available human and natural resources (Figure 3).

The successful use of marketing tools by rural local communities in Ukraine largely depends on their adaptability to the specific economic development of each community and its spatial location. For example, traditional agricultural communities typically prioritise the development of their agricultural sector and the encouragement of food processing based on it. Communities located in mountainous areas are more inclined to promote rural and green tourism, engage in craft livestock farming (such as cheese-making and the production of craft meat products), or develop winemaking or the recreational and leisure industry. Border communities tend to focus more on transport logistics.

It is also worth noting that for Ukraine's border rural communities, especially those bordering EU member states, the main marketing efforts should be directed towards activities within the framework of cross-border cooperation. This primarily involves cross-border business and educational forums, the implementation of projects related to the transfer of innovative agro-technologies, and the formation of networks of cross-border clusters and agro-industrial parks.

Furthermore, the effective application of territorial marketing can help many rural local communities in Ukraine avoid some of the problems encountered by neighbouring countries in the process of European integration. For example, in Poland, the diversification and development of agriculture were significantly limited by the size of farms. Empirical survey results indicate that small farms, owning from 1 to 5 hectares of land (which make up nearly 50% of the country's farms), tend to further divide, gradually turning into reserve plots that serve as insurance policies or dowries (Sikora, 2012).

In summary, it is worth highlighting several marketing tools that are relevant for all rural local communities, regardless of their type, such as: creating brands for producers of organic agricultural products, rural areas with high potential for developing innovative processing industries, or environmentally clean areas with unique natural features combined with distinctive farming traditions.

Conclusions

In the context of war, the economy of Ukraine's rural local communities has faced a number of new challenges and threats, necessitating the search for solutions to their development issues. This primarily concerns the need to increase the efficiency of the natural-resource and human potential of these communities by improving their management systems, enhancing the investment climate, and identifying priority areas and methods for attracting investment resources for the development of Ukrainian rural areas during the post-war recovery phase. Additionally, it involves addressing the urgent problems that need immediate resolution. These include abandoning the remnants of post-Soviet management practices, eliminating existing institutional barriers and dysfunctions, improving the quality of human and social capital in rural areas, overcoming negative behavioural and psychological stereotypes of the residents, and implementing a range of innovative management tools for rural local communities.

In particular, it is important to complete reforms aimed at enhancing the real financial and institutional capacity of Ukraine's rural local communities and their local self-governing bodies. Equally significant is establishing a continuous process of training and skill development for local managers and community activists, alongside implementing a series of educational programmes for rural residents. These programmes should cover topics such as entrepreneurship development, the application of modern agricultural technologies, cooperation, and environmentally friendly natural resource management.

Furthermore, as Ukraine deepens its European integration, the role of innovative community management tools will continue to grow. Therefore, leaders and employees of local self-government bodies should start mastering modern digital technologies, project management skills, and effective municipal marketing tools. All this emphasises the importance of such crucial factors for the socio-economic development of Ukraine's rural local communities as open data resources, democratic public management practices, continuous online presence, and the activation of inter-municipal cooperation and cross-sectoral partnerships.

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Ukrainian agriculture in times of war: Analysis of support programmes

Agriculture is a leading sector in the Ukrainian economy, providing a significant share of export revenues and guaranteeing the food security of other countries. However, the war with Russia has profoundly challenged the sector, which now faces the following problems: insufficient financial resources to ensure the production of agricultural products; reduced fertiliser use; crisis in animal husbandry sectors; labour shortage; destruction of the infrastructure for production, processing and storage of products; environmental threats; and insufficient attention on the part of the EU to the environmental component in support programmes. Different support programmes have been created to ease the challenges above, and these are analysed by the paper. In light of the country's prospective EU membership, the paper proposes the following solutions to ensure safe and high-quality production of Ukrainian food: budget financing, effective taxation, a fair price policy, soft loans (in particular for organic farming), grant support, and new subsidy programmes.

Keywords: Ukraine, war, agriculture, challenges, European integration
JEL classification: Q18

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Introduction

Ukraine has a developed agricultural and food sector, which is capable not only of fully providing food products for the country's own population, but also to actively influence international markets through the export of key agricultural products. Agriculture in Ukraine is recognised as a priority area of the economy. In the pre-war period, a lot of state resources and foreign investments were spent on reforms and programmes designed to support the development of agriculture. Fertile lands, a favourable climate and investments not only ensured an increase in the production of agricultural products, but also contributed to their export to Asia, Africa and the Middle East. However, due to the war, there were changes both in the directions of supply of Ukrainian exports and in the product structure. In the pre-war period, ferrous metals occupied first place among exported categories of goods, and in 2022, grain and oil crops, as well as meat (Ministry of Agrarian Policy and Food of Ukraine, 2023).

Starting from 2022, EU countries became the leaders among the importers of Ukrainian agricultural products (about 60% of the export structure). Outside the European Union, the largest supply goes to Turkey, China and India. In general, the share of agriculture and food industry in export is more than 50%, while in the GDP, it is 8%. Moreover, 30% of the population of Ukraine lives in rural areas (Ministry of Agrarian Policy and Food of Ukraine, 2023). Accordingly, the agricultural sector is one of the strategic areas of development of the Ukrainian economy and has huge export potential.

The war in Ukraine has created a new environment and agriculture is now faced with many profound challenges. This paper aims to analyse these challenges, together with the support programmes different institutions have provided to ease these challenges. In light of the signature of the Association Agreement between Ukraine and EU countries and the creation of a deep and comprehensive free trade zone with the European Union, it also recommends some solutions for the future.

Challenges of the Ukrainian agriculture sector

Military actions in Ukraine, caused by Russia's large-scale aggression, have led to a significant deterioration of the agriculture sector. This is explained by the destroyed infrastructure, destroyed farms and production, and disrupted logistics chains. The main challenges for the agricultural sector of Ukraine in the conditions of war are (Committee of the Supreme Council on Agrarian and Land Policy, 2023):

1. *The lack of financial resources*: Agricultural producers are in serious lack of financial resources due to the increase in the cost of production. The profitability of all activities was 14.1% in 2022, which is significantly less than 37.8% in 2021. Capital investments decreased by 26.1%, amounting to UAH 51.4 billion in 2022, compared to the previous year.
2. *Reduced fertiliser use:* The war brought a reduction of applied fertilisers and plant protection products, which negatively affected the condition of the soils and reduced the level of crop productivity. Insufficient funding and the need to economise have led to a 50-60% reduction in fertiliser application. Large and medium-sized agricultural enterprises plan to use fertilisers for only 47% of agronomic needs, and plant protection products for 56% by 2024. Only 10% of farmers are ready to use fertilisers in full, and plant protection products - by 18%.
3. *Reduced number of animals:* Animal husbandry was one of the most affected sectors, primarily in the meat and dairy industry. As of January 2024, there were 2,233,600 head of cattle in Ukraine, which is 3.3% less when compared to January 2023. The number of cows was 1,290,200 heads, which was 4.9% less. At the same time, about 29% of livestock are kept by enterprises and 71% by households.

4. *Labour shortage:* A labour shortage arose as a result of hostilities, which forced some workers in the agricultural sector and farmers to stop economic activity and leave their homes. According to FAO (2024), more than 150,000 farmers were affected by the war and migrated. The situation was particularly difficult for small-scale producers who specialised in growing seasonal products. The forced migration of manufacturers and the conscription of men into the Armed Forces of Ukraine caused a labour shortage and an increase in the burden on women.
5. *Destruction of the infrastructure*: This affected all the production process, from production to processing and storage of agricultural and food products. Russia is purposefully destroying granaries, food warehouses and agri-food logistics infrastructures, which also complicates the export of grain from Ukraine. Difficulties with electricity supply in the winter of 2022-2023 caused part of the crop to spoil. Currently, the destroyed capacity of grain storages is 8.2 million tons, and 3.25 million tons of simultaneous storage capacities are damaged.
6. *Environmental threats*: Due to hostilities and mining of the territory in 2022 led to the fact that up to 30% of fields (approximately 5 million hectares) could not be used for sowing, because it is a "zone of increased danger in agriculture caused by mining and pollution of soils by heavy metals, mechanical deformations, thermal and chemical pollution" (Ecodiya, 2022).

Researchers note that in 2023, these problems affected 25% of the areas that became unsuitable for use. In addition, both the agricultural sector and land resources suffered significant losses as a result of the destruction of the Kakhovska dam. The total area of land plots affected by the flood reaches about 25 thousand hectares, of which 9.8 thousand hectares (38%) are agricultural land (Dorosh *et al.,* 2023b; Dorosh *et al.,* 2023c).

In June 2023, direct losses caused to the agro-industrial complex of Ukraine amounted to 8.7 billion US dollars. This amount includes losses due to the destruction and damage of agricultural machinery in the amount of more than 4.7 billion US dollars, as well as losses due to the destruction and theft of produced products in the amount of 1.9 billion US dollars. Indirect losses of the agricultural sector are estimated at 40.3 billion US dollars (Ministry of Agrarian Policy and Food of Ukraine, 2023).

As a result of the war, according to FAO (2024), rural households suffered losses of approximately 2.25 billion US dollars. Of these, approximately 1.26 billion US dollars of losses were incurred by the plant industry, and 0.98 billion US dollars by livestock. In addition, 25% of households engaged in the production of agricultural products stopped or reduced their volume due to the war, and in the frontline regions this indicator is 38% (Ministry of Agrarian Policy and Food of Ukraine, 2023). Accordingly, due to hostilities and a difficult socio-economic situation, Ukraine is deprived of the opportunity to allocate a significant amount of funds for budgetary support of the agricultural sector, which complicates the situation and increases the requirements for the efficient use of resources during the period of martial law. Under such conditions, the financial and economic tools for supporting the agricultural sector are lending to agricultural enterprises, grant support, effective state regulation, and international cooperation.

Support received by farmers during wartime

We have analysed the amount of financial support received by agricultural producers during the period of martial law. Farmers received access to loans during martial law under the State Programme "Affordable Loans 5-7-9%", which has been extended by the government, and its implementation is carried out by authorised banks with the participation of the Entrepreneurship Development Fund. According to the Ministry of Finance, since the launch of the programme, business entities have received 77,669 loans for a total amount of UAH 260.2 billion.

In accordance with this programme, credit agreements for the total amount of UAH 36.18 billion were concluded with agricultural producers. Kharkiv farmers received the largest amount of loans under the programme (362.5 million UAH), followed by Kyiv (313.7 million UAH), Vinnytsia (282.2 million UAH), Odesa (UAH 226.8 million), Lviv (226 million UAH) and Dnipropetrovsk (UAH 242.5 million) regions. In the total volume of loans to economic entities, the share of loans granted to enterprises of the agro-industrial complex has increased significantly since the beginning of the implementation of this programme (Figure 1).

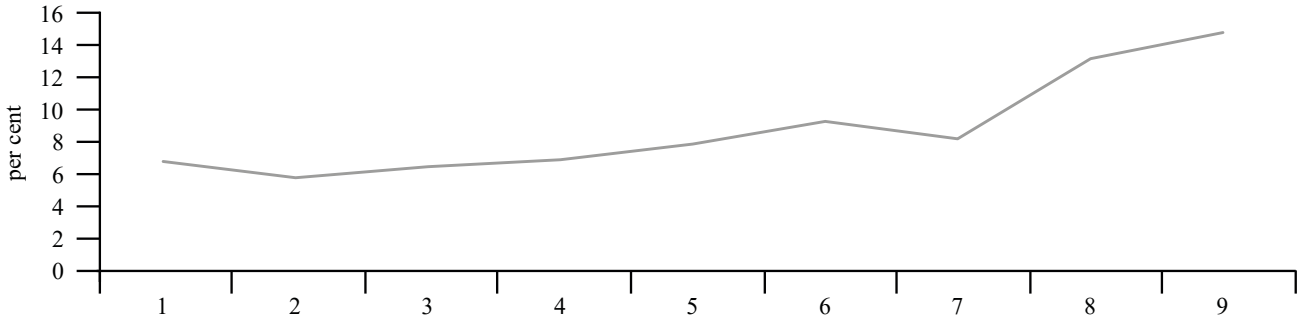

Figure 1: The share of loans by enterprises of the agricultural sector in the total amount of loans to economic entities, %.
Source: authors' calculation based on data from the Ministry of Agrarian Policy and Food of Ukraine

Since the beginning of 2024, according to the Ministry of Agrarian Policy and Food of Ukraine, 8,212 agricultural farms have received 54.4 billion UAH in bank loans for development. Of these, 4,986 farms were financed for 23.5 billion UAH under the state programme "Affordable Credits 5-7-9". Agricultural enterprises of the Kyiv, Kirovohrad, Dnipropetrovsk, Lviv, Ternopil, Vinnytsia, Odesa, and Poltava regions received the largest amount of loans under various programmes (Figure 2).

According to the "Affordable loans 5-7-9" programme, enterprises from Kyiv, Kirovohrad, Vinnytsia, Kharkiv, Odesa, Dnipropetrovsk, and Volyn regions received the most (Figure 3).

At the same time, a fund for the partial guarantee of loans in agriculture was created in Ukraine thanks to the joint efforts of the Government of Ukraine and the active support of experts from the World Bank and the European Union. The creation of the fund took place in accordance with the Law of Ukraine dated 04.11.2021 No. 1865-IX "On the Fund for Partial Guarantee of Credits in Agriculture". Its activity serves as an additional state instrument for financial support of small forms of entrepreneurship. This fund is aimed at improving farmers' access to financial resources and expanding opportunities for development.

The authorised capital of the above fund is 735.6 million UAH. As of January 1, 2024, Ukraine's share of UAH 374.0 million (50.5%) was transferred to the fund. The fund will provide credit guarantees for newly created enterprises to produce agricultural products, in the cultivation of which there will be no more than 500 hectares of land. Guarantees will be provided for a period of up to 10 years and will cover up to 50% of credit obligations, both for investments and for working capital. The Fund for Partial Guarantee of Loans in Agriculture began its activity at the end of January 2024 and issued the first guarantee for a bank loan in the amount of UAH 870,000. The fund will operate together with the current 5-7-9% Programme, creating a more reliable support system for small farmers.

Financial support for agricultural producers during the period of martial law in the area of influence of the Kakhovka hydroelectric station is also implemented. In the Mykolaiv and Kherson regions, individuals who own plots of land and use them for personal farming, construction of residential buildings and other structures, or individual gardening are provided with a one-time financial assistance. It amounts to UAH 3,318 for one hectare of land where the vegetable harvest was lost. The maximum area for which assistance can be provided is 20 acres in the Mykolaiv region and 30 acres in the Kherson region.

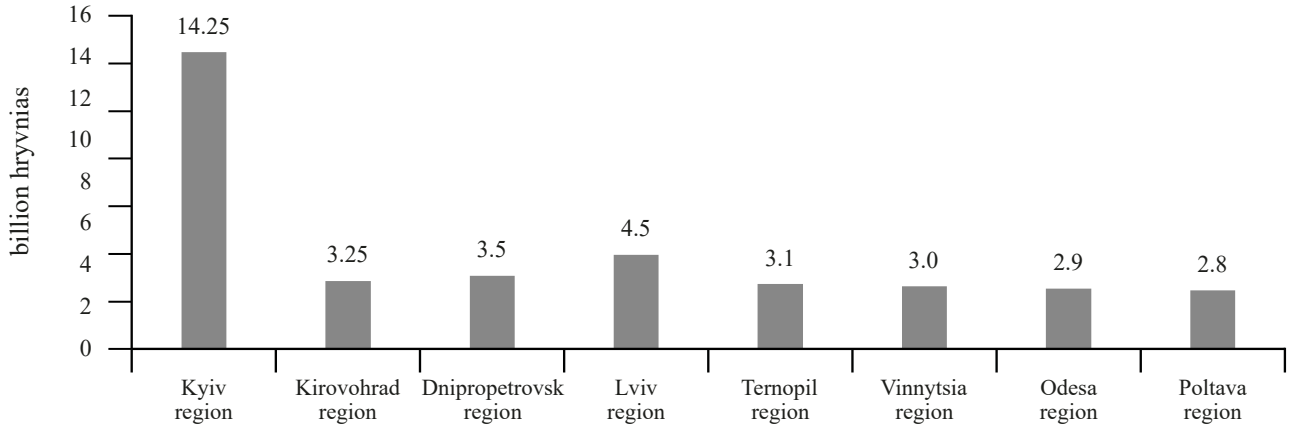

Figure 2: The volume of loans received by agricultural producers in the regions of Ukraine under various programmes from the beginning of 2024.

Source: authors' calculation based on data from the Ministry of Agrarian Policy and Food of Ukraine

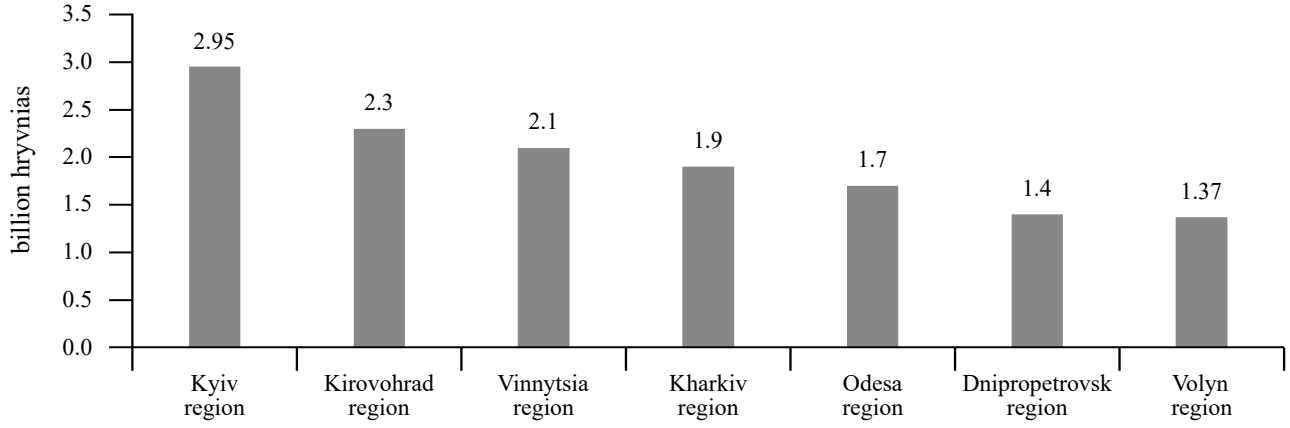

Figure 3: The amount of loans received by agricultural producers in different regions of Ukraine under the "5-7-9 Available Loans" programme

Source: authors' calculation based on data from the Ministry of Agrarian Policy and Food of Ukraine

As part of the budget programme "Financial support for agricultural producers", state support is provided to farmers who use reclaimed land. Funds are allocated on a non-refundable basis depending on the type of irrigation: UAH 13,250 per 1 ha for sprinkler irrigation without including the cost of irrigation equipment and irrigation equipment; UAH 25,300 per hectare for sprinkler irrigation, including the cost of irrigation equipment and pumping equipment; UAH 24,500 per hectare for drip irrigation, including the cost of domestically produced drip irrigation equipment and pumping equipment. State support is also provided to water user organisations that use reclaimed land. Funds will be provided on a non-refundable basis in amounts of up to 50% of the total cost of expenses incurred in accordance with the project documentation, excluding value added tax (Cabinet of Ministers of Ukraine, 2023).

To stimulate job creation under martial law, in July 2022, the Government introduced a grant programme for the creation or development of processing enterprises as part of the Government's financial support program for businesses "eRobota" (Resolution of the Cabinet of Ministers of Ukraine dated 24.06.2022 No. 739). One of the advantages of the programme is the opportunity for anyone to create or develop their own business in areas such as "Your Business", "Your Garden", "Your Greenhouse", "New Level". There is also an opportunity to involve new members in farming activities. However, the programme's requirements do not include environmental obligations, except for the necessity to use certified seeds. The programme includes grants for the creation or development of processing enterprises on the condition of co-financing from the grant recipient. The grants paid out promote the development of sectors such as food production, beverage production, and other sectors of the economy. In fact, since the start of the programme, as of February 15, 2024, the Ministry of Economy has paid out 503 grants amounting to 2,619.6 million UAH. In particular, 209 grants amounting to 1,320.3 million UAH were provided for "Food Production". The State Budget of Ukraine for 2024 allocates 1,370 million UAH for grants for the creation or development of agricultural product processing enterprises. In 2023, businesses engaged in agriculture were reimbursed 10.5 billion UAH of value-added tax from the state budget (4.1 times more than in 2022 (2.5 billion UAH) and 2.8 times more than in 2021 (3.8 billion UAH)) (Ministry of Agrarian Policy and Food of Ukraine, 2023).

State support for farmers in Ukraine includes direct budget support (subsidies and grants), tax benefits, and price regulation (export or import restrictions). The most attractive of these forms of support is the direct budget support provided in the State Budget for agricultural producers. However, due to the war, budget constraints have complicated the implementation of these programmes for the second consecutive year. In 2023, state support for farmers was distributed between the Ministry of Agrarian Policy and Food, the Ministry of Economy, and the Ministry of Finance.

We have also analysed studies related to the system of distribution of funds allocated by the Government of Ukraine for subsidies and subventions to local budgets, as well as their distribution among community budgets by expenditure items. According to their results, it was determined that the majority of communities need an increase in budget revenues by 6.9-10.0% annually, therefore, the financing of community economic development programmes needs a significant increase (Dorosh *et al.,* 2019).

The results of the agricultural sector's activities in 2023 indicate that state support for this sector is economically necessary. Many countries around the world recognise this and employ various methods, forms, and instruments to provide such support. This support for agricultural producers and communities during the war is implemented through a number of projects within the framework of international assistance and cooperation (Table 1).

Table 1: List of projects that support agricultural producers and communities during the war as part of international aid and cooperation

Project name	Methods of economic stimulation	Amount of funds
Food and Agriculture Organization of the United Nations (FAO). Support programme with funding from the European Union.	Provision of investment grant assistance to small agricultural producers, cooperatives and associations of producers of geographical indications for agricultural producers from Lviv, Ivano-Frankivsk, Zakarpattia and partially Chernivtsi regions.	From 1,000 up to 25,000 US dollars.
Food and Agriculture Organization of the United Nations (FAO). Programme for providing seeds of spring crops (wheat, barley, peas).	To support small farmers in the frontline regions, legal entities and individual entrepreneurs who have registered agricultural land with an area of 10 hectares to 500 hectares can participate in the programme.	2 tonnes of spring crop seeds per farm to choose from, depending on the region.
Financial assistance programme for persons relocated (or in the process of relocation) due to war; small and medium-sized businesses.	The programme is available in Kyiv, Ivano-Frankivsk, Lviv and Ternopil regions to preserve and create jobs for forcibly resettled persons and the population affected by hostilities.	The average amount of financial assistance is 20,000 US dollars, provided for the purchase of fixed assets, provided that participation in the specified programmes involves an investment of one's own funds up to 50% of the amount of financial assistance.
International cooperation project ReACT4UA ("Application and implementation of the Association Agreement between the EU and Ukraine in the field of trade") funded by the German government.	The Vrozhai Peremogy Farming Development Centre provides services focused on the needs of farmers, informs about innovations in crop production and helps strengthen the ability of farmers to adapt to changes in the agricultural sector and new needs, change their business models, diversify production and attract financial resources for business development.	On a free basis.
USAID Program for Agrarian and Rural Development (AGRO).	The programme provided agricultural producers with seeds and fertilisers for the sown area of about 370,000 hectares. Farmers who cultivate from 5 hectares to 500 hectares will receive mineral fertilisers amounting to a total volume of 14,000 tonnes.	On a free basis.
Harvest Program (USAID).	Reconstruction and expansion of the agricultural sector.	250 million US dollars.

Source: made by authors' based on information from the Ministry of Agrarian Policy and Food of Ukraine, Food and Agriculture Organization of the United Nations (FAO), United States Agency for International Development (USAID) and Mercy Corps UERP.

Future support in light of EU accession

It seems evident from the programmes above that little attention is given to the environmental component. Accordingly, as a candidate for EU membership, Ukraine must take into account the priorities of the Common Agricultural Policy (CAP). Alongside primary funding in the form of direct payments per hectare and income support for farmers, particularly young ones, the CAP has significantly increased funding for the "green component", which will be implemented from 2023 to 2027, taking into account the goals of the "Farm to Fork" strategy.

Despite this, Ukraine needs to develop its own "Green Deal" strategy, which should allocate funds for the implementation of corresponding measures. This involves the gradual withdrawal from cultivation of degraded and low-productive lands contaminated with chemicals due to emergencies or military actions, whose further use is economically inefficient and environmentally hazardous. Before the war, over 2 million hectares of land were earmarked for conservation, and after the war, their number will significantly increase. To address the problem of degraded lands, economic incentives should be applied to landowners for grassing and afforestation. This includes financial support in the form of compensation for the cost of grass seeds and sowing expenses for grassing, and for afforestation – compensation for the cost of forest plantations, their planting, and care until canopy closure. There should be annual reimbursement of part of the foregone income in the form of premiums over a twenty-year period (Dorosh *et al.,* 2021)

Apart from the existing problems due to military actions, there are also polluted soils caused by the destruction of their structure from mechanical, physical, and chemical damage. Transforming contaminated lands for further use requires reclamation work. Before choosing a reclamation technology, the consequences of hostilities need to be analysed. This process includes inventorying damaged lands, identifying impact factors, determining the type of impact and its consequences, assessing the level of soil contamination, and developing a land management project (Dorosh *et al.,* 2023a). To allocate funds for land reclamation, legal formalisation of this important compensation instrument is necessary, with clearly defined sources, grounds, procedures for compensation payments, and their amount, as we intend to integrate into European markets.

The restoration and conservation of ecosystems necessary for human life directly impact sustainable development and biodiversity support. It is necessary to implement financial support for the preservation of natural reserves, such as areas of the Emerald Network. Without targeted state financial support, these vital sources of biodiversity maintenance, ecosystem services support, scientific research, and environmental awareness raising may lose their functionality. State investments in these areas will contribute to the long-term conservation of natural resources, ecosystem stability, and improvement of environmental education.

The environmental safety of agricultural products is closely related to adherence to principles in the livestock sector regarding the handling of animal by-products. This includes the arrangement of manure storage facilities and installations for the disposal of animal carcasses and other by-products at both the enterprise and state levels. Given the catastrophic state of infrastructure for handling animal by-products, proper and effective conditions for their disposal need to be created. This will promote the further development of the livestock sector and prevent negative impacts on the environment and human health.

The support vector should also shift towards small producers, considering the multifunctional role of agriculture. It is worth changing state support for the agricultural sector, directing it mainly towards small-scale farming. According to the Law of Ukraine "On Agricultural Advisory Activities" (2004), the Ukrainian advisory system includes a set of actions and measures aimed at meeting the needs of personal peasant and farm households, business associations, other agricultural enterprises of all forms of ownership and management, as well as rural populations in increasing knowledge levels and improving practical skills for profitable farming. The Registry of Advisory Services lists 32 organisations.

Peasant and farm households play a key role in ensuring food self-sufficiency for the population, aiding the Defence Forces, and supporting internally displaced persons. It is necessary to preserve and strengthen the stabilising role of farming by giving this segment priority in post-war financial support for Ukraine's agricultural sector. Implementing support for small farms following the EU model and simplifying funding conditions will help reduce the gap between agricultural incomes and the average wage. Support for personal peasant households will facilitate their formalisation and increase production. Therefore, there is a need to normalise the share of financial support directed at the development of the family farming segment in the agricultural sector, considering the volume of production they generate. The share of farm households and household farms in the gross agricultural production in 2019-2021 was almost 46%, making them a promising reserve for the development of the family farming system. It is important to direct a significant portion of funds to encourage these households to gain farmer status. Additionally, a special financial support programme should be created for the establishment and development of farms by veterans of the Russo-Ukrainian war.

At the same time, businesses in Ukraine's agricultural sector, as recipients of state support, must be responsible both socially and environmentally. The mechanism for using state funds is outlined in the Order for each programme according to regulatory documents. However, social and environmental requirements are absent. Therefore, there is a need to introduce a minimum set of requirements for recipients of state funds. Regarding the social aspect, this includes the creation of jobs, decent wages, minimum incomes in agriculture, employment of young people, and support for newly established farms, among others. As for environmental requirements, recipients of state funds for agricultural activities must adhere to sustainable development conditions, comply with fertiliser application standards, use plant protection products responsibly, manage livestock waste properly, and utilise green manures.

Conclusions

The agro-industrial complex is a critically important sector of the economy, especially under martial law. Supporting this sector is particularly crucial due to the need to ensure food security and the stability of agricultural production. Improving the quality, safety, and environmental friendliness of their products, as well as reducing the negative impact on the environment, agricultural businesses can primarily achieve with proper financial support from the Ukrainian government through legislative regulation of the support mechanism and enhanced assistance from the European Union countries both during the war and in the post-war reconstruction period. This involves:

1. Developing and implementing state programmes for the development of agriculture and rural areas, taking into account the goals of the CAP to ensure stable support for Ukraine's agricultural sector, allowing it to adapt to new challenges such as climate change, global market changes, and socio-economic transformations;
2. Developing its own "Green Deal" strategy, planning funds for the gradual withdrawal from cultivation of degraded and low-productive lands contaminated with chemicals due to emergencies or military actions, whose further use is economically inefficient and environmentally hazardous;
3. Changing the vector of financial support in favour of small and medium-sized farms to create favourable conditions for agricultural activities;
4. Key areas of state regulation should include: adequate budget financing; effective taxation; fair pricing policy; financial and credit system; provision of subsidies, grants, and subventions; compensation payments; and social policy, among others;
5. Enhancing the social and environmental responsibility of recipients of state support to meet sustainability requirements and comply with standards and regulations in agricultural activities as provided by Ukrainian legislation and EU countries, thereby fully realising the control function at all stages of agricultural production.

This approach will solve a number of problems in Ukraine's agricultural sector both during the war and in the post-war reconstruction period. The proposed economic regulation tools for agricultural production by businesses will allow for the production of safe and high-quality products and integration into European markets.

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The agriculture of Ukraine amidst war and agroecology as a driver of post-war reconstruction

This paper reveals the nature and extent of the damage inflicted upon Ukraine's agrarian sector by Russian military actions, as well as the pre-existing deficiencies that have adversely affected its functioning during wartime. Proposals from governmental institutions, researchers, agricultural producers' associations, and civil society may be categorised into three potential post-war reconstruction scenarios: maintaining its pre-war predominantly raw model, enhancing investment attractiveness, and strengthening the orientation towards sustainable development. The potential consequences of implementing each identified model for economic entities in agriculture and for society in the progression towards European Union membership have been outlined. This paper contends that transition towards development based on contemporary (innovative) principles of agroecology is essential for creating resilient local and, consequently, national agricultural and food systems. Meanwhile, the role played by different categories of agricultural producers utilising agroecological practices in enhancing the resilience of agrifood systems and the main directions for promoting the dissemination of these practices have both been revealed. The practical significance of the research results involves the possibility of their implementation in developing a coordinated version of the post-war reconstruction and the further development of Ukraine's agrarian sector, the defining feature of which should be an approach that aligns with the principles of the EU's Common Agricultural Policy, further incorporating a transition to agricultural development based on agroecology.

Keywords: agri-food sphere, losses of the agrarian sector, directions of post-war development, European Integration, organic production

JEL classifications: O13, Q18, Q28

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Introduction

The full-scale Russian war against Ukraine has dramatically changed the development of all spheres of human life and triggered an economic decline in most sectors of the national economy. The losses incurred by the agricultural sector are significant and specific due to the territorial attachment and impossibility of physical relocation of business, withdrawal of agricultural land from cultivation caused by mining, contamination with chemical elements, mechanical deformations, and other related factors. Challenges and uncertainties have also been caused by the disruption of logistics chains, including the blockade of the Black Sea ports, resulting in significant export complications, physical destruction of elevators, machinery, livestock, and shortages of fuel, fertilisers, and pesticides. The extreme conditions have also revealed the shortcomings of the national agricultural system that came into existence during the transition from an administrative command to a market economy. These include the dominance of large-scale corporate enterprises and their associations (agroholdings) with a focus on raw exports, and the marginalisation of the family-farming type of economy.

Taking into account the role of agriculture in guaranteeing the national economic and food security and the well-being of almost a third part of the country's population, as well as the prospects of Ukraine's accession to the European Union, post-war development within the sector will require, along with financial resources, effective decisions that will not only restore its potential but also set the foundations for its restructuring. The raw model of agricultural development should be changed to a value-added model coinciding with the dissemination of ecologically sound farming practices to provide people with safe and high-quality food, strengthen the competitiveness of agricultural producers and enhance the sustainability of local and national agri-food systems.

The purpose of the paper is to characterise the losses and lessons of wartime for Ukraine's agrarian sector, outline probable scenarios for its post-war reconstruction, and substantiate the necessity of further development based on agroecology principles.

Literature review

During the ongoing Russian military aggression in Ukraine, opportunities for the efficient functioning of economy are being explored with the overarching objectives pointing towards ensuring food security and sustaining the financial resilience of the country. Concurrently, directions and pathways for its post-war development have been considered. The impact of hostilities on the agri-food sphere of Ukraine, as well as the challenges and prospects of its post-war reconstruction appear in a variety of publications. Mamonova *et al.* (2023) provide a thorough analysis of Ukrainian agriculture, consequences of hostilities for different categories of producers, intentions of the authorities, proposals of researchers and representatives of civic society for its post-war development. The objectives of national food security, risks of the wartime period and post-war pathways to achieve these objectives are outlined by Shubravska and Prokopenko (2022). Ibatullin *et al.* (2022) present a mechanism for assessing economic damages inflicted on farmland, necessitating demining and restoration of

its suitability for safe food production. Cherevko (2022) delineates the losses incurred by Ukrainian agriculture and emphasises that the post-war recovery of the agrarian sector should be based on innovative principles and funded through the state budget and assistance from international organisations. A crucial factor for macroeconomic stabilisation, he contends, lies in boosting agricultural exports to sustain foreign exchange reserves and ensure the stability of the national currency.

Researchers also simulate development plans for the agrarian sector, drawing on successful steps taken by foreign countries. Taking aside the experience of the Republic of Korea, Nebrat (2022) stresses that post-war agricultural transformation should be oriented towards the development of highly productive family farming, which will contribute to strengthening food self-sufficiency, increasing employment, and expanding the domestic market. Based on the example of Croatia's recovery, Gorin (2022) concludes that economic revitalisation in rural areas is linked to stimulating the development of small-scale agricultural producers. Didkivska (2022), focusing on the achievements of Italy, finds significant opportunities in enhancing capacities for agricultural raw processing, promoting organic farming, and implementing structural reforms, often feasible in the aftermath of particularly challenging crises.

Some of the publications also draw attention to the necessity of adhering to principles of agroecology in the post-war period, particularly emphasising the main provisions of the European Green Deal. Khodakivska *et al.* (2023) also stress the importance of developing a "green" economy, noting that the production of ecologically sound products will have competitive advantages at the national and international levels and will retain the characteristics necessary for production efficiency indicators. The monograph edited by Drebot *et al.* (2023) puts the agroecological foundations of developing sustainable food systems and shapes the market for ecologically safe products. However, organic farming, other forms of ecologically friendly production, and the overall concept of "agroecology" in Ukrainian scientific literature are predominantly examined within the framework of the "natural environment – agricultural production" system (Furdychko, 2017; Shkuratov *et al.,* 2015), while socio-economic aspects of such a system, and the utilisation of agroecology as an innovative approach to ensuring sustainable development receive insufficient attention.

On the whole, assessments of the effects of hostilities on the development of Ukraine's agrarian sphere require more comprehensive synthesis and systematisation, while the determination of pathways for its post-war development, taking into account the benchmarks of the EU Association Agreement and the principles of the European Green Deal, necessitates more detailed elaboration. Given that agroecology is one of the key directions of Ukraine's sustainable development strategy at a time when the country is moving towards full membership in the European Union, and that it also now represents a way to mitigate the damage inflicted by war on farmland and other natural resources, a more complete demonstration of its impact in terms of increasing the resilience of agricultural and food systems is needed. This paper aims to examine these issues and explore ways of addressing them.

Methodology

This study is based on recent data assessment of the impacts of war on Ukrainian agriculture in light of the 17 UN Sustainable Development Goals, adapted to the Ukrainian realities. The information basis of the research includes EU legislation and regulations related to the implementation of the European Green Deal; scientific papers and open data from information sources assessing the losses of the agrarian sector from a full-scale war and its implications for development; statistical data, published information about producers of ecologically sound products, and expert evaluations regarding the distribution of agroecological methods in national agriculture.

Results

Modern agriculture in Ukraine is represented by two groups of producers: agricultural enterprises and farming households. Enterprises are legal entities, including private farms engaged in systematic agricultural production. As of early 2024, 73.9 thousand enterprises had been registered (State Statistic Service of Ukraine, 2024c), of which 50.1 thousand private farms (State Statistic Service of Ukraine, 2024b). However, only 39.9 thousand enterprises were recorded as active, meaning they carried out economic activities (for comparison: in 2021, there were 46.2 thousand active enterprises) (State Statistic Service of Ukraine, 2024a). A significant portion of agricultural enterprises are part of vertically integrated structures (agroholdings). According to the National Scientific Centre "Institute of Agrarian Economics NAAS", in 2022, the number of large enterprises in the industry (over 250 employees, annual income equivalent to 50 million euros) decreased by 20.4%, medium enterprises by 19.5%, small enterprises (up to 50 employees, income up to 10 million euros) by 31.8%, and microenterprises (up to 10 employees, income up to 2 million euros) by 34.5% (Lupenko, 2023).

Farming households are those who engage in agricultural activities both for self-sufficiency in food and for the production of marketable agricultural products. This category of producers also includes individual entrepreneurs conducting agricultural activities[1]. In the pre-war period, 98% of households had land plots (State Statistic Service of Ukraine, 2018), 26% kept cattle, 37% pigs, and 96% poultry (State Statistic Service of Ukraine, 2021).

The dynamics of gross agricultural production by categories of producers show a gradual increase in the share of enterprises. In 2023, the volume of output produced by agricultural enterprises amounted to 68.5% (Figure 1).

Agricultural enterprises, particularly those within agroholdings, possess (or lease) significant land areas, modern agricultural machinery and developed infrastructure for processing and storing products for subsequent sale primarily on global agri-food markets. To achieve their goals, they often engage in monoculture production and intensive technologies, which contradict the requirements of ecologically sound farm-

[1] The article presents data provided by the State Statistics Service of Ukraine, according to which agricultural enterprises and farming households represented as two groups of producers. In fact, Ukrainian agriculture is divided into large industrial agribusinesses, including agricultural enterprises, and small producers, consisting of small and medium-sized family farms and peasant farms.

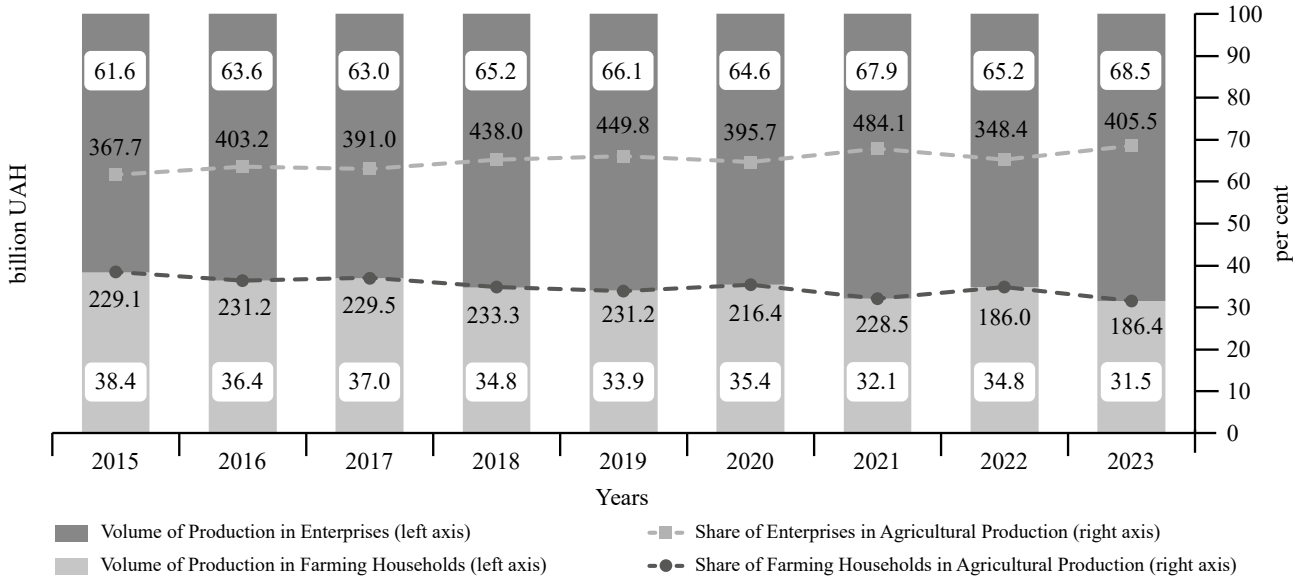

Figure 1: Agricultural output by category of producers.
Source: own composition based on data from the Statistical Yearbook "Agriculture of Ukraine" for the respective years

ing. Farming households are mainly oriented towards meeting the country's internal food needs. They are characterised by the sustainable use of natural resources, preservation of biodiversity, and the application of circular economy elements.

Consequences of military actions

The Russian invasion of the territory of Ukraine resulted in a colossal destructive impact on agriculture: according to World Bank estimates as of the end of 2023, the total losses incurred by the agrarian sector amounted to $10.3 billion. Within this structure, the largest share (56.7%) pertains to fully or partially destroyed machinery and equipment; 18.2% corresponds to looted produce from storage facilities, and 17.5% accounts for lost grain storage capacities. Other losses include destroyed perennial plantations, livestock, and beekeeping resources, stocks of mineral fertilisers, plant protection products, fuel and lubricants and more.

Agriculture suffered losses totalling approximately $69.9 billion due to foregone revenues resulting from reduced production volumes, decreased domestic prices for agricultural products, increased costs of resources engaged in production processes, etc. (including losses from the detonation of the Kakhovka Hydroelectric Power Station) (Himmelfarb, 2024). These include reductions in the production volumes of annual crops (49.2%), decreases in domestic prices for primary agricultural products (35%) and reductions in livestock production volumes due to herd reductions and decreased productivity (8.1%).

Furthermore, as of the beginning of 2024, the area of agricultural land available for use in production activities has decreased by 20.3% (Nikoliuk *et al.,* 2024). The area of land abandoned due to the proximity of combat operations ranges from 2.1 to 2.8 million hectares, constituting 6.5 to 8.5% of the total arable land area in Ukraine. According to NASA Harvest estimates, in 2023 alone Ukraine suffered about $2 billion in economic losses due to the loss of crops on fields that had already been sown. Given the conditions for harvesting, the yield obtained would have been sufficient to feed 25 million people for a year (HARVEST, 2023).

The detonation of the Kakhovka Hydroelectric Power Station has resulted in the inundation of tens of thousands of hectares of agricultural land. Such soils are expected to continue degrading due to the gradual re-moistening of drained lands, siltation, and wind erosion. Desertification is possible in some areas. Presently, 94% of irrigation systems in the Kherson region, 74% in the Zaporizhzhia region, and 30% in the Dnipropetrovsk region lack water supply. Over 400 thousand hectares of land remain without irrigation (UkrInform, 2023).

Soil pollution, manifesting as changes in soil structure, physical characteristics, and physicochemical parameters, should be considered a distinct component of the inflicted damage. Experts from the Ministry of Environmental Protection and Natural Resources of Ukraine estimate its cost at $18 billion (Government Portal, 2023). According to the Ukrainian Environmental Organisation, nearly one-third of the territories in Ukraine could be contaminated with munitions and hazardous substances, with significant impacts observed in the southern and eastern regions of the country (Man'ko, 2023).

In the medium and long term, the agrarian sector will face the reduction of sown areas, shifts in crop rotation models, a decrease in livestock numbers, disruption of supply logistics chains, destruction of sales networks, and a significant reduction in the workforce due to mobilisation and migration leading to the loss of highly qualified specialists, carriers of unique knowledge and skills, and the destruction of social and human capital. However, the Ukrainian agrarian sector has generally demonstrated the ability to recover relatively quickly. Currently, the production of agricultural outputs is gradually increasing: the agricultural production index in 2023 exceeded the corresponding figure for 2022 by 36.4 percentage points, including crop production by 42.1 percentage points and livestock

production by 12.2 percentage points. Evidently, the pace of agricultural recovery is accelerating - however, the volume of production in 2023 amounted to only 83.1% of the pre-war level.

At the same time, the existing model of agriculture's functioning in the context of wartime has demonstrated a lack of resilience and adaptability to the war challenges and sudden changes in the economic environment. The severe destructive impact of hostilities has demonstrated the vulnerability of long supply chains that rely on stable, optimal logistics systems, as well as the low mobility and overly rigid specialisation of large agricultural enterprises, which predominantly focus on cultivating grain and oilseed crops for export.

A significant imbalance exists in the areas of agricultural production. In 2021, the share of crop production in the total volume comprised 86%, while the volumes of livestock production have been continuously decreasing: from 2010 to 2021, the number of cattle decreased by 53%, cows by 49.5%, pigs by 65.5%, and sheep and goats by 62%. This differs significantly from the structure of agricultural production in the EU, where 57% of the production is attributed to crop farming and 43% to livestock farming, with a high share of dairy and pig farming (Gadzalo, 2023).

The prolonged prioritisation of large agricultural enterprises within the framework of state agrarian policy, the lack of financial resources among small producers, challenging competitive conditions, the absence of a comprehensive approach to organising state support, its sporadic nature have led to the fact that small producers in the pre-war period were unable to accumulate sufficient resilience and robustness to contemporary challenges.

The results of a survey conducted by the United Nations Food and Agriculture Organisation (FAO, 2023) show that the total estimated losses for agricultural enterprises cultivating up to 250 hectares are valued at $3.85 billion in both the crop and livestock sectors; the income for nearly 90% of small crop producers have significantly decreased, with more than 70% experiencing reductions of nearly a quarter; the income for 60% of small livestock producers decreased, while their debt obligations significantly increased. Meanwhile, human development history shows that the institution of self-sufficiency becomes critically important during periods of heightened crisis. From this perspective, small producers are most oriented towards the development of this institution. Immediately following the Russian invasion, they provided food security for local communities, while state food security required a global transformation of logistics chains, reorientation of commodity flows, and the implementation of new mechanisms for product realisation to ensure food supplies for people. Small producers have convincingly demonstrated their significant role in ensuring food security and thus should become the focus of active state support.

Post-war reconstruction of the agrarian sector

Since 2022, representatives from academia, government, and civil society have been working on developing post-war reconstruction plans for the country, including the agrarian sector. In the draft Strategy for the Development of Agriculture and Rural Areas until 2030, presented by the Ministry of Agrarian Policy and Food of Ukraine, emphasis is placed on the need for changes in the implementation of state agrarian policy. These changes are particularly related to granting Ukraine candidate status for EU membership and other international obligations, which will contribute to achieving overall economic, ecological, and social goals following Ukraine's Plan for implementing the Ukraine Facility programme (Ministry of Agrarian Policy and Food of Ukraine, 2024b).

Researchers at the Ukrainian Academy of Agrarian Sciences believe that the post-war reconstruction of agriculture should not only restore production volumes and address the damage inflicted but also ensure structural transformations for the further agricultural and rural development of Ukraine. Researchers highlight the key components of state policy formation in the agri-food sphere, which include self-sufficiency, financial independence, economic and physical accessibility, quality, social and health effects, and stability (Gadzalo, 2023). Representatives of small agricultural producers and civil society organisations, in turn, emphasise the need to establish the family farm model of governance in the legal framework, focusing on the necessity of enhancing the protection of peasant land rights in Ukraine and ending the over-concentration of agricultural lands in the hands of individuals and interest groups as private property (URDN, 2023).

Considering Ukraine's European prospects, the post-war reconstruction of its agri-food sphere should be oriented towards the Common Agricultural Policy of the European Union (CAP). The European Green Deal has been identified as one of the main strategic directions of development, which is subordinated to current changes in various sectors of the economy. Measures to achieve the objectives of the Green Deal in agriculture are specified in strategies such as "Farm to Fork" (F2F), "Biodiversity 2030" and "Soil Strategy for 2030". The common goal of these initiatives is to mitigate the adverse effects of climate change, enhance the sustainability of food systems, preserve and restore biodiversity, and rehabilitate all soil ecosystems in the EU by 2050.

In 2024, due to growing political opposition from farming lobbies and pressure from European farmers, the implementation of certain provisions and specific requirements of the "Farm to Fork" Strategy, particularly regarding the use of pesticides, has been suspended. This suspension will remain until auxiliary measures are developed to protect European farmers from reductions in productivity and income losses (European Commission, 2024). The "convincingness" of the economic justification for measures to protect natural resources is recognised as insufficient, and there is a need for more dialogue and exploration of alternative approaches to move forward (EuroNews, 2024). The European Commission's proposals to restrict the use of plant protection agents have been withdrawn. Additionally, the European Commission has introduced a one-year pause on the requirement for farmers to leave agricultural land fallow to preserve biodiversity. However, the primary focus on creating sustainable food systems in line with the EU Green Deal remains relevant. All this highlights the importance not only of adapting legislation and making appropriate decisions for the

transition to sustainable development but also of conducting vigorous preparatory and explanatory work with the target groups most involved in the process of change.

Ukraine needs to utilise the developments of European policy and apply them as benchmarks for further development. Given this context, the agri-food sphere in Ukraine can be developed in the post-war period according to the following three scenarios (Figure 2).

The first scenario envisions the restoration of the agrarian sector based on pre-war principles, prioritising industrial agricultural production. As a result of its implementation, the volumes of raw production and export will gradually be restored, and, consequently, in the short term, all the negative effects of resource-exhausting export-oriented agriculture with its ecological and social problems will return. The implementation of land reform, particularly its second phase, in which legal entities are granted the right to acquire agricultural land up to 10,000 hectares, will significantly accelerate the concentration of land resources by large agricultural enterprises focused on the export of grain and oilseed crops.

Such an export structure is typical for countries with low income levels. Continuing the raw model in Ukraine will perpetuate income polarisation, enriching the owners of agribusinesses, further depopulating rural areas, and leading to the loss of traditional rural lifestyles in their best manifestations.

The second scenario is aimed at a comprehensive restructuring of Ukraine's agrarian sector transitioning from a raw to a technological development model. This is a costly and time-consuming process, but it will allow the agricultural potential to be utilised for the benefit of society, ensuring economic interests, ecological requirements, and the social needs of the population, and will contribute to strengthening the sustainability of economic development. As noted above, the organisational structure of Ukrainian agriculture is represented by two sectors of producers - enterprises (including holding companies) and farming households. These two sectors differ significantly from each other both in terms of production potential and in terms of market positioning in the agri-food sphere, hence the directions taken by their further development will also differ.

The development prospects for agricultural enterprises lie in the realm of processing. According to expert assessments, deep processing of just five crops (wheat, soy, corn, barley, and rapeseed) would increase the added value share in agricultural production to 28%; and boost export revenue to $41 billion per year (a $30 billion increase); enhance annual tax revenues by 55 billion UAH; and create 26,500 new jobs, thereby generating an overall annual GDP growth of 5% (Batanin, 2022). Achieving such results will require not only significant investments but also an awareness of development prospects among entrepreneurs.

The state can use mechanisms of tax differentiation, additional export duties, and quotas on the sale of raw materials to stimulate the transition from selling to producing and marketing processed goods. In post-war plans, the state should announce the introduction of raw export duty within 5-10 years, coupled with incentives for new processing

Scenarios	Preservation of Raw Model	Establishment of the "Investment Attractiveness" Model	Focus on Sustainable Development Model
Mechanisms	Restoring agricultural production, increasing the volume of export-oriented crops, strengthening control over large scale rent-seeking businesses.	*For enterprises:* production of value-added products, reduction of raw material sales; *For farming households:* inclusion in product sales chains; enhancement of cooperation.	*For enterprises:* production of value-added products, reduction of raw material sales; *For farming households:* inclusion in product sales chains; enhancement of cooperation.
Consequences	Depletion of agro-resource potential for the enrichment of a limited number of business owners, further income polarisation and "conservation" of poverty, aggravation of the labour market situation, and intensification of migration processes.	*For enterprises:* increased efficiency of land use, reduced physical volumes of exports and increased profits; *For farming households:* increased profitability, improved welfare; *For the society:* increased economic activity, employment growth, increased budget revenues	Ensuring the sustainability of food production and agriculture, improving the quality of soil, water, air, preventing climate change, reducing greenhouse gas emissions from agriculture, restoring biodiversity, stopping land degradation, and increasing food sustainability
Role of the state	Neutral-stabilising	Protectionist (incentives and restrictions)	Simulating

Figure 2: Scenarios for post-war reconstruction of the agri-food sphere in Ukraine.
Source: own composition

enterprises. It would also be prudent to review labour tax rates, which significantly influence decisions regarding the establishment of processing systems. Support through diplomacy in opening new markets for processed agricultural goods could also be significantly helpful.

For farming households, the prospects of post-war restructuring involve their engagement in cooperation, inclusion in food supply chains through state orders for budgetary institutions, and opportunities to participate in tenders for product supply, among others. A separate focus should be state support for farming households in the process of acquiring land, through measures that include the provision of preferential loans, partial compensation, and financial and legal support. Expanding the land bank for small producers will enable them to significantly increase agricultural production volumes, which in turn will stimulate processing, the creation of joint ventures, and the establishment of productive interactions with other producers and communities to find new markets.

Under the third scenario, the restoration of the agrarian sector should occur with a primary emphasis on the ecological component, following a series of commitments made by Ukraine in connection with its application for accession to the EU. Participation in the European Green Deal will not only require adaptation of legislation in the ecological sphere but may also increase requirements for agricultural and food products, which could become an additional trade barrier and negatively impact Ukrainian exports (Mission of Ukraine to the European Union, 2021). However, the agroecological transition, as a system of redefining agricultural production aimed at balancing economic, ecological, and social interests by FAO principles (FAO, 2018), is a crucial tool for achieving the Sustainable Development Goals 2030.

The positive social effects of enhancing the ecological nature of agriculture are likely to be accompanied by a reduction in production volumes and an increase in the cost of production, which will affect not only prices but also the export potential. Moreover, the marketing of ecological, including organic, products will require the exploration of new markets, which in the short term could lead to decreased profits for producers. Therefore, enhancing the ecological sustainability of the Ukrainian agrarian sector aligns with the European development vector, but the cost of adhering to additional commitments will require additional financing. Incentives for farm producers to transition to sustainable farming methods and adopt ecological practices should include financial support programmes, favourable credit terms, and institutional assistance in implementing ecologically friendly innovations. Improving access to land for smallholders could be an important factor, given that they hold traditional knowledge about growing plants, keeping animals, preparing seeds, using natural resources, and producing agricultural products in an environmentally friendly way.

Agroecology as a factor in enhancing the resilience of agricultural and food systems

Agricultural and food production based on agroecology is carried out in various forms: organic farming, permaculture, regenerative agriculture, etc., aimed at the economical use of natural resources and minimising the negative ecological impact of agriculture. With the realisation of the importance of agroecology in addressing the issues of overcoming hunger and poverty, strengthening food security, improving nutrition and health, and achieving many other SDGs by 2030, the interpretation of its essence has significantly expanded.

In contemporary understanding, agroecology is an innovative approach to forming sustainable agricultural and food systems, which integrates ecological and social concepts, based on the application of scientific, traditional, and practical knowledge and adhering to the principles of health, fairness, and inclusiveness. It is fundamentally driven by grassroots initiatives and territorial processes, allowing for the consideration of local specifics and prioritising the needs of people (IFOAM, 2019). It is also rightly considered that agroecology is a key element in the balanced development of rural areas (Zielinski, 2021).

All forms of agroecology contribute to enhancing the resilience of agri-food systems. Unfortunately, apart from organic production, there is insufficient information on the prevalence of these forms in Ukraine. According to the monitoring data from the Ministry of Agrarian Policy and Food in pre-war 2021, the area of agricultural land occupied by organic production amounted to 422.3 thousand hectares (1% of the total agricultural land area), including lands with organic status totalling 370.1 thousand hectares with 528 operators of organic production, among them 418 agricultural producers (Ministry of Agrarian Policy and Food of Ukraine, 2024a). Certification of organic producers is performed by 17 bodies: 16 foreign and one Ukrainian – "Organic Standard". Among the operators certified by Organic Standard in 2023, nearly 60% were agricultural enterprises of various legal forms, 9% were family farms, 10% were individual entrepreneurs, and 11% were individuals (Organic Standard, 2021). Among these individuals, beekeepers – producers of honey and other beekeeping products – predominated.

In 2021, Ukraine marketed 9.8 thousand tons of organic products and exported 260 thousand tons (Ministry of Agrarian Policy and Food of Ukraine, 2024a), meaning that over 96 percent of the production was exported. The export predominantly consisted of crop production: cereals accounted for over 100 thousand tons, oilseeds (including soybeans) for 34 thousand tons, fruits for 20 thousand tons, oilcake for 13 thousand tons, and other types up to 10 thousand tons each (Organic-Info, 2022). Moreover, 73% of the organic exports were directed to EU countries (European Commission, 2022).

If the organic segment of Ukrainian agriculture is evaluated based on the proportion of certified land, it is significantly smaller compared to European Union countries. However, in the pre-war period, it grew at rates comparable to the EU average: from 2012 to 2021, the area of organic lands in Ukraine increased by more than 1.5 times (Table 2). During this period, significant increases in organic land areas occurred in Portugal and Croatia – by 3.8 times, France – by 2.7 times, and Bulgaria, Romania, and Hungary – by more than 2 times. Poland was the only European Union country that saw a decrease in organic farming areas, with organic land use decreasing by 16% over the specified period.

As noted, the "Farm to Fork" strategy adopted in Europe aims to increase the area under organic production to 25% by 2030 (European Commission, 2020a). Although the deadline requirements have been softened, the benchmarks remain relevant. Data from Table 1 suggest that several European countries are likely to achieve this target. Specifically, Austria, Estonia, and Sweden had already surpassed the 20% threshold by 2021, with Portugal closely approaching it. Meanwhile, major agricultural nations such as Poland, Romania, Bulgaria, and others have not even reached 5% in organic land use.

However, the area of organic lands can decrease in specific years due to non-compliance with certification requirements, refusal to certify, or other circumstances. In Ukraine, for example, in 2022, due to hostilities, the area of agricultural lands designated for organic production in the transition period decreased to 263.6 thousand hectares (0.6% of the total agricultural land area). However, the implementation of the directions of the European Green Deal, including the development of organic agriculture, is important in the context of Ukraine's further green reconstruction, particularly in the agrarian sector, as well as the country's application for accession to the EU. The enactment of this requires attention from governmental structures, professional associations of producers, and individual economic entities.

Certified producers of organic products in Ukraine are primarily large agricultural enterprises, whose operations are as export-oriented as those of most similar non-organic producers. Some small organic farms, especially those that grow labour-intensive crops such as blueberries and raspberries, as well as individual producers (beekeepers), are also focused on export. The activity of this category of producers primarily enhances the resilience of the global agri-food system.

Table 1: The organic segment of agriculture in the EU and Ukraine.

Countries	Organic crop area			Share of land under organic crop area in 2021 per cent
	2012 thousand ha	2021 thousand ha	2021 to 2012 times	
EU	9,457.9	14,724.3*	1.5	9.1*
Austria	533.2	680.0*	1.3	25.70*
Estonia	142.1	226.6	1.6	22.97
Sweden	477.7	606.7	1.3	20.2
Portugal	200.8	768.8	3.8	19.31
Italy	1,167.4	2,186.2	1.9	16.83
Czech Republic	468.7	548.8	1.2	15.55
Latvia	195.7	302.2	1.5	15.34
Finland	197.8	327.7	1.7	14.45
Slovakia	164.4	249.7	1.5	13.45
Denmark	194.7	303.1	1.6	11.58
Slovenia	35.1	51.8	1.5	10.81
Spain	1,756.6	2,635.4	1.5	10.79
Greece	462.8	534.6*	1.2	10.15*
France	1,030.9	2,775.7	2.7	9.67
Germany	959.8	1,601.3	1.7	9.65
Lithuania	156.5	261.8	1.7	8.91
Croatia	31.9	121.9	3.8	8.26
Belgium	59.7	102.4	1.7	7.48
Hungary	130.6	293.6	2.2	5.81
Luxembourg	4.1	6.9	1.7	5.19
Romania	288.3	578.7	2.0	4.42
Netherlands	48	76.4	1.6	4.22
Poland	655.5	549.4	0.8	3.78
Ireland	52.8	86.9	1.6	2.00
Bulgaria	39.1	86.3	2.2	1.71
Malta	0.04	0.07	1.8	0.61
Ukraine	272.9	422.3	1.6	0.97

Note: in decreasing order of share of land. * = data as of 2020.
Source: own composition based on data from Eurostat (2021a), Eurostat (2021b) and Organic Federation of Ukraine (2024)

Meanwhile, the export-oriented production of organic products contributes to the establishment of sustainable agricultural systems within the country as well. Agricultural enterprises certified as organic adhere to established rules of soil cultivation, seed requirements, animal husbandry conditions, the use of fertilisers, and plant protection products, thereby preserving the quality of natural resources and the environment. They typically practice crop rotation; some combine crop and livestock farming and process their products. The socioeconomic effectiveness of these enterprises lies in their creation of jobs for peasants who, through working on farms, acquire agroecological knowledge that they can apply in their households and disseminate within communities. Some of these enterprises collaborate with research institutions, educational establishments, and local self-governance bodies, thereby promoting and disseminating the principles of agroecology. A portion of the organic products is sold in the domestic market. However, their participation in fulfilling such an important task of agroecology as providing the country's population with healthy, ecologically clean food is limited.

Small agricultural producers and farming households producing organic products are more oriented toward internal agri-food markets and are more fully integrated into the local and national agri-food systems. Some of them undergo certification, while others usually have regular customers and use various forms of short production and distribution chains: their retail outlets, local agri-food markets, mobile trade, online sales, etc. Such relationships are based on trust and usually do not require product quality certificates. Similarly, small producers who implement agroecological practices other than organic farming. According to our estimates, the number of uncertified farms that produce marketable agricultural products for sale using agroecological practices is an order of magnitude larger than that of certified farms, but the area of their land use is an order of magnitude smaller, and the number of people employed in them is roughly the same.

In assessing the reach of agroecology, it should also be acknowledged that in Ukraine the extent to which agricultural and food products are produced by the population for food self-sufficiency (a traditional component of the agri-food system) is significant. In 2021, the share of consumed products from own production in rural households was: potatoes – over 90%, vegetables and melons – 57%, fruits, berries, grapes – 32%, milk and dairy products – 23%, meat and meat products – 28 percent (State Statistic Service of Ukraine, 2022). A significant portion of these products is obtained using agroecological practices, as their producers (who are also consumers) are directly interested in their safety and quality, as well as in the cleanliness of the environment, which is part of their living environment.

Notably, the food self-sufficiency of the population and the activity of small producers of commercial agricultural output and food products during the war positively impacted the resilience of the national agri-food system. The overall size of these two components can be expected to be maintained in the post-war period. At the same time, given changes in the number and structure of the rural population caused by the war, naturally occurring generational change, etc., the ratio between them will shift in favour of commodity production. The agroecological part of these components of the agri-food system must not decrease but should instead increase.

Discussion

The research results presented in the article are derived from a comprehensive analysis of the losses experienced by Ukraine's agriculture and rural areas due to Russian military aggression, scientific studies focused on identifying the directions, methods, and mechanisms for their post-war development, as well as considering the country's European integration requirements and international obligations in the agri-food sphere. The construction of scenarios for their post-war recovery was facilitated by examining the experiences of foreign countries that have faced similar situations both in the distant past (Pinilla, 2012) and more recently (Nebrat, 2022; Gorin, 2022; Didkivska, 2022), and by evaluating contemporary authors' proposals on the driving forces and sources of funding for this process. The recognition of not only the leading role of the state but also the assistance of the global community in the post-war recovery of Ukraine's agri-food sphere is undeniable, indicating that this recovery must take into account current global trends in the formation and functioning of agri-food systems.

According to the first development scenario proposed in the article, attracting significant financial investments, primarily from international institutions, requires aligning national strategies with the requirements of partners willing to invest in agriculture. Development under the second scenario, the "Investment Attractiveness Model", is clear and acceptable to the authorities and is partially supported by them. In contrast, the third scenario, which involves a more extensive use of agroecology to strengthen Ukraine's agricultural and food system, requires the formation of an active state policy to promote its development. This policy should include: transforming the institutional environment for the development of agriculture and rural areas following the modern interpretation of agroecology; integrating agroecological approaches into the strategies, programmes, and development plans of existing forms of agricultural production and food at national and local levels; creating mechanisms to facilitate the development of agroecological practices, particularly among farming households, to increase the production and consumption of ecologically clean products (Borodina and Prokopa, 2023).

The agroecological development of agriculture fully aligns with global trends. Its strategic importance for ensuring food security and supporting small producers in their fight for food sovereignty, particularly in times of crises and other energy, economic, and climate challenges, is highlighted in the works of various scholars (Akanmu *et al.,* 2023; Simon *et al.,* 2020; Altieri *et al.,* 2012). Researchers are exploring ways to support the transition process (Martin *et al.,* 2018; Anderson *et al.,* 2019) and describe effective and already implemented resource-saving practices (Jeavons, 2001). Public movements advocate for the interests of all those involved in agroecology (ViaCampesina, 2015).

Since agroecology is capable of ensuring the resilience and inclusiveness of the agri-food system primarily at the local level, the policy to promote its development should directly address potential producers and consumers of their products – high-quality food and a clean environment. It should consider the EU directives and guidelines on the CAP agroecological orientation and improve its own legal and regulatory framework for the development of agriculture and rural areas based on agroecology. In addition, efforts should also support awareness raising about agroecology as it is understood today, increase the demand for agroecological products among various categories of people, and facilitate producers' access to organic certification. They should also serve to enhance the attention paid to health, education, environmental protection, agricultural policy, and the food authorities, as well as to local self-governments, compliance with food safety and quality requirements, healthy eating, and more. The number of economic entities in the agri-food sphere introducing agroecological practices will then increase.

Conclusions

The Russian war against Ukraine has inflicted significant damage on its agri-food sphere, including extensive destruction of its natural resource potential, production and infrastructure base, and loss of income for agricultural producers. The country's functioning under martial law has also highlighted the lack of resilience and adaptability in this sphere, problems that stem from the country's excessive raw material export orientation, the vulnerability of its long supply chains, imbalances between crop and livestock farming, and the fact that methods of production vary considerably. Another major contributory factor has been the prioritisation of large enterprises and the concomitant marginalisation of small farms.

The direction to be taken by the post-war recovery of Ukraine's agri-food sphere is being elaborated with due regard being paid to the need to eliminate its war losses and adapt itself with a view to European integration. Three scenarios can be distinguished, dominated by proposals for 1) maintaining the raw material model; 2) developing an "investment attractiveness" model; and 3) focusing on sustainable development. Development under the third scenario aligns most closely with the requirements of European integration of Ukraine and will become an effective mechanism for overcoming the challenges of post-war reconstruction. However, its positive societal effects will evidently be accompanied by a reduction in production volumes and will require improvement of the state support system for the agrarian sector.

The post-war development of Ukraine's agri-food sphere based on sustainability needs to be accompanied by its more active greening, including an increase in organic production and the wider introduction of other agroecological practices. This necessitates the formulation of a state policy to support agroecological development, considering the tasks and principles outlined in EU directives, the main principles of the CAP for the new programming period, and UN guidelines. Its implementation should be systemic and aimed at producers of all categories and consumers of food, ensuring improved access to quality and healthy food products and a clean environment.

In the course of the study, the authors faced a lack of information on the use of agroecological practices by agricultural producers, except for organic production, which limited the assessment of the scope of agroecological initiatives in Ukraine. Further research should be directed at deepening the socio-economic aspects of the post-war reconstruction of agriculture and food supply based on agroecology, which, in particular, are related to strengthening the motivation of producers and consumers of ecologically friendly products and institutional support for their production. Additionally, a detailed analysis will be conducted on the potential economic consequences of implementing post-war agricultural recovery models.

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MARKET ANALYSIS

Norbert POTORI* and Zsuzsa MOLNAR*

Temporary Shifts in Agricultural Export Logistics: The Case of Hungarian Maize Imports During the Russia-Ukraine Conflict

This paper examines the impact of the Russia-Ukraine armed conflict on agricultural trade, focusing specifically on the surge in maize exports from Ukraine to Hungary during the marketing year 2022/23. The conflict has significantly disrupted maritime trade routes, particularly affecting export logistics of Ukraine. The study analyses shifts in trade patterns and market dynamics associated with these disruptions, emphasising that these changes appear temporary and do not pose a continuous threat to grain markets of EU member states neighbouring Ukraine. The findings underscore the importance of safe and adaptive logistics in maintaining market stability amidst geopolitical tensions.

Keywords: Russia-Ukraine conflict, maize trade, export routes, logistics
JEL classifications: Q17, Q18

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Introduction

Owing to its natural conditions, direct connection to the Black Sea, and the expansion of field crop cultivation on its fertile steppes, Ukraine has become a significant player in the global markets for grains, oilseeds, and their derivatives over the past two decades. In the calendar year 2021, preceding the full-scale Russian armed invasion, Ukraine exported 20 million tonnes of wheat, representing approximately 10% global market share. This wheat was primarily shipped to North African and Middle Eastern countries, as well as the South Asian region. In 2021, Ukraine was the fourth-largest maize exporter, with 24.7 million tonnes (12% global market share), following the United States, Brazil, and Argentina. It was also the third-largest exporter of rapeseed, with 2.7 million tonnes (20% global market share), following Canada and Australia, and the leading sunflower oil exporter with 5.1 million tonnes (43% global market share) (Tovstopyat, 2022).

Due to its geographical proximity and competitive pricing derived from low maritime transport costs, Ukraine has become an important trading partner for the European Union (EU), particularly for its Mediterranean member states and the Netherlands, especially (but not exclusively) for maize, sunflower oil, sunflower meal, and rapeseed. Based on data from Eurostat – COMEXT, Belgium and Germany also played significant roles in rapeseed imports, with a temporary shift of focus to more easily and cost-effectively accessible buyers in Romania and Poland during the 2022/23 EU crop marketing year (July-June, MY).

In MY 2021/22, even before the war, Ukraine exported substantial volumes of maize (about 30% of its total exports), sunflower oil (37%), sunflower meal (24%), and rapeseed (67%) to the EU. Following the outbreak of the war, Ukraine's exports of wheat and maize to the EU significantly increased during MY 2022/23 and 2023/24, to 35-45% and 55-63% of its total exports of these crops, respectively.

Additionally, owing to the temporary shutdown of oilseed crushing capacities because of the war (Duke and Beaman, 2022; APK-Inform, 2022a), Ukraine was forced to sell a significant 1.85 million tonnes of sunflower seeds on the international market in the 2022/23 season (September-August). Of this, 61% found buyers in the EU, while prior to the war, Russia and Moldova were the leading suppliers of sunflower seeds to the EU, but in substantially smaller volumes, amounting to a few hundred thousand tonnes per season.

From May to mid-September 2023, through Commission Implementing Regulation (EU) 2023/903, the European Commission replaced, at least temporarily, national import bans, first introduced by Poland in mid-April and subsequently mirrored by Hungary, Slovakia and Bulgaria, by restricting the imports of wheat, maize, sunflower, and rapeseed from Ukraine into Poland, Slovakia, Romania, Bulgaria, and Hungary, only allowing grain meant for transit to enter those member states neighbouring Ukraine. However, this measure and the national import bans did not drastically affect the dynamics of EU imports of any of the specified commodities from Ukraine, which followed their seasonal patterns, except for maize (Figure 1). As trade data shows, the import of Ukrainian maize halved after the measure took effect and did not return to previous levels until the 2023 crop harvest and export shipments began.

Notably, the 14.9 million tonnes of maize (including processed products) delivered to the EU during MY 2022/23, is not unprecedented. In MY 2018/19, 14.7 million tonnes of maize were imported (with the United Kingdom excluded) from Ukraine, accounting for 49% of the country's total exports then. According to market analyst Stratégie Grains, production and old crop carry-in stocks of maize in the EU totalled 68.9 million tonnes in the 2018/19 season (October-September) compared to 60.3 million tonnes in the 2022/23 season. This places the claims of maize from Ukraine "flooding" the EU in MY 2022/23 (see e.g. Bickert, 2023) in a different perspective. Traditionally, the largest buyers of Ukrainian maize have been Spain and the Netherlands, with their combined share exceeding 50% both before and during the war in 2022 and 2023.

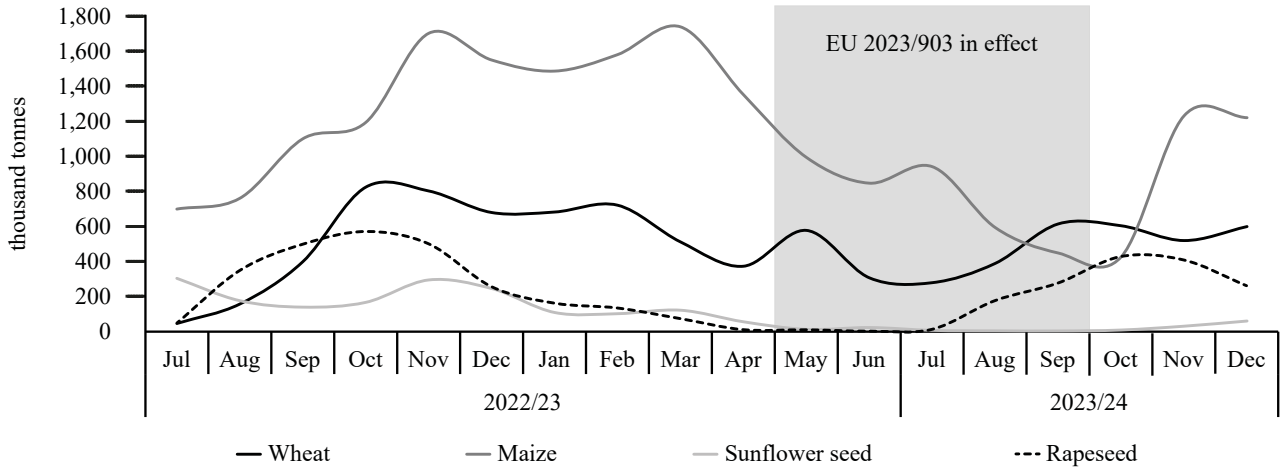

Figure 1: The EU's monthly imports of wheat (excluding durum wheat, but including flour and groats), maize (including processed products), sunflower seed, and rapeseed from Ukraine in MY 2022/23 and in the first half of MY 2023/24.
Source: own compilation based on Eurostat – COMEXT

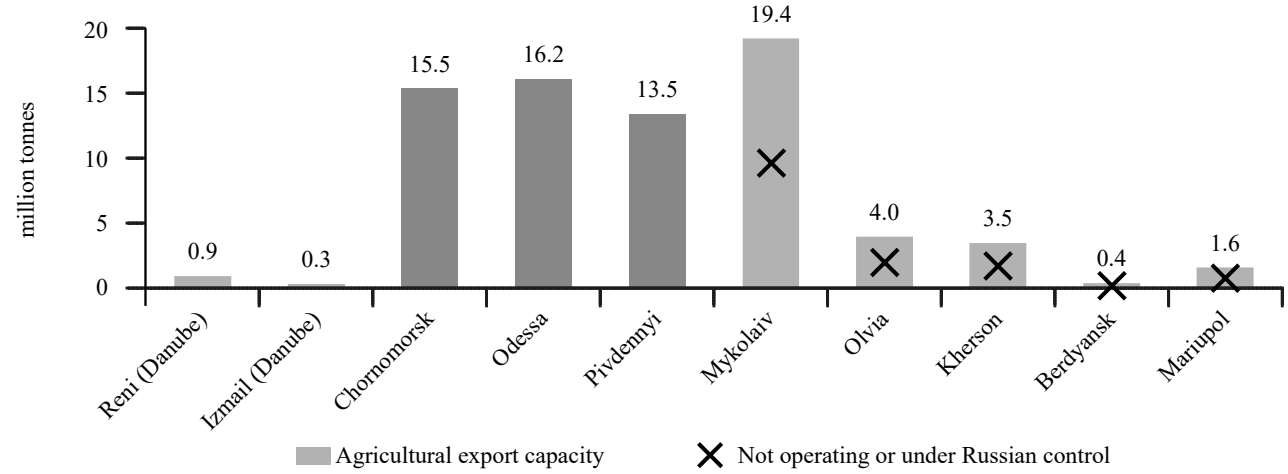

Figure 2: Agricultural export capacity of Ukraine's major ports in 2021
Source: own compilation based on Tovstopyat (2022)

In contrast to maize, the volume of Ukrainian wheat entering the EU during the wartime is exceptional. The 6.1 million tonnes imported in MY 2022/23 (excluding durum wheat, but including wheat flour and groats, expressed in wheat equivalent) is about ten times the average of the three seasons before the war and more than double the average of all imports from third-countries. In MY 2023/24, Ukrainian wheat exports to the EU have continued at a similar pace. Ukrainian exporters were mostly displaced from African and Asian markets, while Middle Eastern countries remained stable buyers, according to the agricultural business association UCAB (cited by Reuters, 2023). During the first nine months of MY 2023/24, nearly 75% of Ukrainian wheat exports to the EU were shipped to Spain (primarily for feed due to droughts in the country in 2022 and 2023), with Italy and Greece also being significant buyers. Romania and Poland took substantial volumes of wheat for re-export during MY 2022/23.

It should be noted that the increase in exports of maize, sunflower oil, sunflower meal, and the comparatively smaller volume of rapeseed meal to the EU is largely attributable to a normal market-driven process that began long before the war rather than as a consequence of the conflict.

The role of maritime transport in Ukraine's agricultural exports

The Black Sea provides a strategic route to global markets, allowing access to Europe, the Middle East, and Africa. Its proximity to these regions reduces transportation costs and transit times compared to other routes. Therefore, the continuous, undisturbed operation of its Black Sea ports is essential for Ukraine. These ports are connected by robust rail and road networks, facilitating the efficient transport of agricultural goods from the interior of the country.

In the calendar year 2021, Ukraine exported a total of 50.8 million tonnes of grains, of which approximately 90% passed through its Black Sea ports. Of this volume, 35% exited the country via Mykolaiv (see Figure 2), which has been closed since the war began. Transport to the Black Sea

ports was facilitated by rail (64%), road (27%), and rivers (9%) (Nycz-Wojtan, 2023). In 2022, 16.3 million tonnes of grains were exported via sea routes, with 15.9 million tonnes shipped through the United Nations-administered Black Sea Grain Initiative (BSGI) corridor, operational from 22 July 2022 through 17 July 2023, according to the Ministry of Agriculture in Ukraine. During the BSGI period, Ukraine's Black Sea ports loaded 16.9 million tonnes of maize, 8.9 million tonnes of wheat, 1.3 million tonnes of barley, 1 million tonnes of rapeseed, 0.8 million tonnes of soybeans, 1.9 million tonnes of sunflower meal, and 1.7 million tonnes of sunflower oil for export (UN, 2024).

In August 2023, after Russia's withdrawal from the BSGI in July 2023, Ukraine established a protected maritime corridor to the Bosporus to secure shipments from the Greater Odessa Ports (Odessa, Chornomorsk, and Yuzhny/Pivdennyi) through the coastal waters of three NATO countries: Romania, Bulgaria, and Turkey. By January 2024, the Greater Odessa Ports, capable of handling bulk carriers of Handy-size (up to 50,000 deadweight tonnage) and above, had exported a total of 6.8 million tonnes of goods, with agricultural products accounting for nearly 4.8 million tonnes. In March 2024, a total of 7.7 million tonnes of goods were exported, of which 5.2 million tonnes were agricultural products, as reported by the Ukrainian Sea Ports Authority (USPA). The traffic through the Greater Odessa ports had far exceeded pre-war levels.

With the temporary closure of Ukrainian Black Sea ports from March through July 2022, the role of Ukrainian ports along the river Danube (Reni, Izmail, and the smaller Ust-Dunaisk) in the export of agricultural products became increasingly important. The maximum combined monthly export loading of Ukrainian Danube ports was 550 thousand tonnes in August 2021. In 2023, 23 new berths were established in Reni and the more developed Izmail, with plans for an additional 15 berths in 2024. As a result of these expansions and developments, the combined export loading of these ports approached 2.8 million tonnes in August 2023, an all-time record, with agricultural products accounting for about 85%. According to USPA data, Ukrainian Danube ports handled over 13 thousand ships and loaded a total of 29 million tonnes of cargo in 2023, roughly twice the volume of 2022 and six times that of 2021 (Centre for Transport Strategies, 2024). Of this, 14.1 million tonnes were grains. Reni, the largest grain-loading port, is currently capable of serving 22 seagoing ships and 40 barges simultaneously. For comparison, in 2021, Ust-Dunaisk's annual nominal capacity was around 1 million tonnes, Reni's around 7 million tonnes, and Izmail's around 8.5 million tonnes, with actual loadings of 67.5 thousand tonnes, 1.37 million tonnes, and 4.07 million tonnes (mostly iron ore and coal), respectively, based on data from the Association of Seaports Ukraine. By early 2024, up to 1.2 million tonnes of agricultural products were loaded monthly at Ukraine's Danube ports.

The intensified protests in Poland in autumn 2023, continuing into early 2024, against the import of Ukrainian agricultural products and the repeated border closures have strongly incentivised the further development of Ukrainian Danube ports. This development will allow for the circumvention of Polish road and rail transit, making cost-effective access possible for Ukraine to countries along the Danube-Rhine-Main waterway (Safronova and Krasnolutska, 2024). In the future, the role of river shipping in Ukraine's agricultural exports to the European Union is expected to grow.

With the temporary closure of Ukrainian Black Sea ports, the role of the Romanian port of Constanța, which is situated on the western coast of the Black Sea, is connected with the river Danube, and is now the largest grain export hub on the European continent, has also become more significant for the export of agricultural products via the Black Sea. According to data from the Port of Constanța, of the 24 million tonnes of grains and 3.5 million tonnes of oilseeds handled in 2022, the transit from Ukraine accounted for 6.9 million tonnes and 1.8 million tonnes, respectively. In 2023, grain handling increased to 36.2 million tonnes and oilseed handing to 9.3 million tonnes, with Ukrainian transit accounting for 15.3 million tonnes and 5.4 million tonnes, respectively.

The economic rationale of Ukraine's maize export to Hungary

Hungary, a land-locked EU member state neighbouring Ukraine, is one of the EU's major exporters of maize, with an average annual net export of around 3.1 million tonnes during the 2018-2020 period. In MY 2022/23, Hungary imported 1.56 million tonnes of maize (including processed products) from Ukraine, an unprecedented increase compared to the typical annual volume of 10-20 thousand tonnes. Of this, 509 thousand tonnes arrived in autumn 2022, while 895 thousand tonnes were imported in the first half of MY 2022/23. In the following, we will explore the background of this sharp rise in maize imports from Ukraine through a specific example.

Information on logistics transport costs for Ukraine is difficult to obtain and not frequently and readily available. Therefore, a specific time period was selected for investigation. The average Ukraine FOB (Free on Board[1]) price for grain maize for November delivery was around USD 255 per tonne (for loads over 30 thousand tonnes) at the Greater Odessa Ports during the last week of October 2022, USD 20 per tonne less than the average FOB price in Romania (Port of Constanța) (Hammersmith, 2022). The difference primarily reflects additional costs associated with shipping grains through the BSGI corridor, including sea freight and risk insurance, which ranged between USD 20-25 per tonne at that time, according to Miroshnicenko (cited by Grain Trade, 2022).

At the end of October 2022, CPT (Carriage Paid To[2]) prices for maize delivered by rail to Odessa port ranged between USD 185-205 per tonne (APK-Inform, 2022b). The difference from the FOB price typically covers insurance costs until loading onto ships, transshipment (fobbing) expenses such as unloading from rails and possible storage

[1] The seller is responsible for arranging and paying for transportation to the ship and is also responsible for loading the goods onto the ship (https://www.customssupport.com/insights/incoterms-explained-free-board-fob).

[2] The seller is responsible for the costs until the goods are delivered to the place of destination, but the risks are transferred to the buyer when the goods are loaded and handed to the selected carrier (https://www.eurosender.com/en/incoterms/cpt-vs-dap).

in terminal silos, as well as the exporter's margin. In this case, the difference ranged between USD 50-70 per tonne. The cost of fobbing reportedly increased by USD 15-20 per tonne compared to pre-war times, attributed to the inefficient organization within the BSGI corridor, with an average cost of USD 25 per tonne during the corridor's operation (Kharchenko, 2024).

Miroshnicenko (cited by Grain Trade, 2022), plus Häberli and Kostetsky (2023), suggest that demurrage (the fee paid by the charterer to the ship owner for delays in loading) was also passed upstream, ultimately to farmers, embedding some risks into the FOB price, which is not typical. Data published by Häberli and Kostetsky (2023) indicates that the average demurrage in October 2022 was USD 26 per tonne, including both inbound and outbound demurrage. Russian inspector-related delays reportedly caused detention periods up to 60 days on average: 8-12 days outbound and 40-50 days inbound. Therefore, fobbing and demurrage combined amounted to USD 51 per tonne.

Based on data published by Rail.insider (2023), the cost of transporting 1 tonne of maize by rail in Ukraine to the Greater Odessa Ports using 94 m³ and 116-120 m³ private grain hoppers averaged UAH 1,038.5 or USD 28.1 in October 2022 (with an average exchange rate of USD 1 = UAH 36.90). This estimate excludes the freight forwarder's commission, fees for locking and sealing, loading and unloading operations, and other additional charges at departure and destination stations. It compares to the USD 26.9 per tonne average railway transport cost (including solely the delivery cost to the railway station and the rental cost of a grain hopper) calculated by Salin (2023) for the entire fourth quarter of 2022 from Central Ukraine to Odessa port over an average distance of 341 miles (549 km).

Salin (2023) estimates the average rail distance to Odessa port as 343 miles (552 km) from Western Ukraine, 521 miles (838 km) from Eastern Ukraine, and 341 miles (549 km) from Central Ukraine, averaging 402 miles (647 km) for all of Ukraine. Based on this data, the average cost of railway transport in October 2022 is assumed to be USD 0.0700 per mile or USD 0.0435 per kilometre. The 647 km average distance closely aligns with the distance from Kyiv, centre of Ukraine, to Chop in Zakarpattia Province by train (641 km), near the international railway border crossing to Zahony, Hungary. It is reasonable to assume that the average cost of railway transport in Ukraine to Chop is approximately equivalent to the average cost of railway transport to Odessa port, i.e., USD 28.1 per tonne in October 2022.

According to APK-Inform (2022b), DAP (Delivery at Place[3]) prices for maize ranged between USD 270-300 per tonne in Hungarian cities and USD 225-250 per tonne when delivered for export to Chop by rail within Ukraine at the end of October 2022. The difference between these two parities covers the costs of transshipment or bogie changes, customs, transport to the final destination in Hungary, and the importer's margin.

By deducting the USD 28.1 per tonne rail transport cost from the Chop DAP prices and the Odessa CPT prices, the average DAP price for maize received at interior Ukrainian railway stations for export to Hungary was USD 196.9-221.9 per tonne at the end of October 2022. In contrast, the average DAP price received at interior Ukrainian railway stations for maize exported through the Greater Odessa Ports was USD 156.9-176.9 per tonne at the same time. This clearly highlights the economic advantage of exporting maize via rail to Hungary during that period.

For comparison, a year later, during the last week of October 2023, the average FOB price for maize for November delivery was around USD 185 per tonne (for loads over 30 thousand tonnes) at the Greater Odessa Ports, USD 25 per tonne less than the average FOB price at the port of Constanța (Hammersmith, 2023). The difference again primarily reflects insurance costs, which remained significant due to frequent attacks against port facilities by the Russian military after Russia exiting the BSGI.

Although Ukraine resumed operations of the Greater Odessa Ports by October 2023 through the new "humanitarian corridor" established in August 2023, it was not until November, that insurance brokers Marsh and Lloyd's, in collaboration with Ukrainian state banks, launched a marine war insurance programme specifically for grain shipments, aimed at reducing the cost of claims for damage to ships and crew transporting grain through this new Black Sea corridor. The insurance programme cut war insurance premiums back by more than half (Cohn, 2024). For comparison, by the end of March 2024, the gap between Romanian and Ukrainian FOB prices for maize for April delivery narrowed to USD 12 per tonne (Hammersmith, 2024).

In the last week of October 2023, CPT bid prices for maize in Odessa ranged between USD 122-128 per tonne, according to data from APK-Inform's database (https://www.apk-inform.com/en/prices) (A bid price represents the highest price a buyer is willing to pay, typically lower than the actual selling price). The difference between the FOB and CPT bid prices in Odessa varied from USD 57 to USD 63 per tonne.

During the 2023/24 season, grain fobbing costs at the Greater Odessa Ports ranged between USD 20-24 per tonne (Kharchenko, 2024), indicating potential significant demurrage due to factors such as missile attacks, suspension of cargo operations during air raid warnings, unavailability of pilotage at night, etc. Data on demurrage at Ukrainian sea ports was not readily available for this period.

Based on data published by Rail.insider (2023), the cost of transporting 1 tonne of maize by rail in Ukraine to the Greater Odessa Ports using 94 m³ and 116-120 m³ private grain hoppers averaged UAH 696 or USD 26.5 in October 2023 (with an average exchange rate of USD 1 = UAH 36.52), excluding the fees and charges mentioned above. Consequently, the average DAP price for maize received at interior Ukrainian railway stations is estimated to range between at least USD 95.5-101.5 per tonne.

For October 2022, DAP maize prices for Hungarian cities were not readily available. Therefore, data from the Hungarian Market Price Information System (MPIS, operated by the Institute of Agricultural Economics, Budapest, Hungary, accessible at https://www.aki.gov.hu/piaci-arinformacios-rendszer/) is used to indicate year-on-year changes in price levels. In the 43rd week of 2023 (end of October), the

[3] The seller is responsible for the costs and risks until the goods are delivered to the place of destination (https://www.eurosender.com/en/incoterms/cpt-vs-dap).

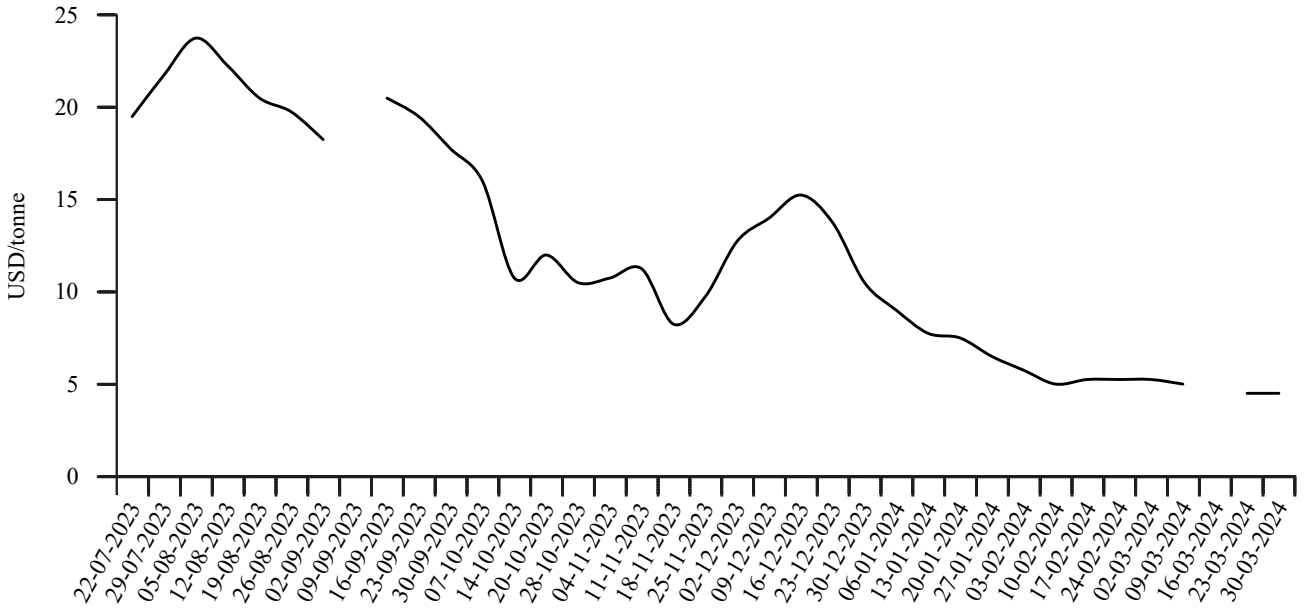

Figure 3: 4-week moving average of the difference in dry bulk sea freight costs (30 thousand tonnes) in Ukrainian and Russian ports to Alexandria (Egypt) from July 2023 (termination of the BSGI) to March 2024.

Note: The gaps indicate the dates when weekly reports were not published
Source: own compilation based on data from Hammersmith (2024)

net producer (farm gate) price for maize averaged USD 156 per tonne (with an average exchange rate of USD 1 = HUF 361.9). DAP prices for maize for export at stations on the western Ukrainian border, including Chop, ranged between EUR 110-120 (Spike Brokers, 2023), or USD 116.5-127.1 (with an average exchange rate of USD 1 = EUR 0.9441) per tonne at that time.

Assuming, as before, that the average cost of railway transport within Ukraine to its western border (i.e., to Chop) is approximately equivalent to the average cost of railway transport to the Odessa port, deducting the USD 26.5 per tonne rail transport cost from these DAP prices estimates USD 90.0-100.6 DAP for maize at interior Ukrainian railway stations for export to Hungary.

This brief analysis suggests a notable reduction in the economic incentive for Ukraine to export maize to neighbouring Hungary by the last quarter of 2023, coupled with a heightened financial attractiveness of exporting through seaports. Importantly, this shift does not suggest that exporting from regions closer to the border became unfeasible. However, for most of the maize exports, utilising the new maritime corridor emerged as the preferred choice, substantially mitigating market pressures on countries such as Hungary, or Slovakia, and Poland.

Hungary introduced an import ban on various agricultural products, including grains, from Ukraine, on 19 April 2023, through Governmental Decree 130/2023 (IV. 18.). This ban remained in effect as of June 2024, permitting only the transit of these goods. However, changing market and logistics conditions, as demonstrated above, raise questions about the necessity of maintaining the import ban through 2023 and beyond. The difference in sea freight costs from ports in Ukraine compared to ports in Russia, for which data were available, to the same destination steadily declined since December 2023 (see Figure 3). This improved the competitiveness of maritime transport and further diminished the appeal of land exports of grains, including maize, to neighbouring EU countries such as Hungary, or even Romania. In Romania, grain exports transiting through the Port of Constanța declined by 35.1% year-on-year to 2.16 million tonnes in the first quarter of 2024 (Hellenic Shipping News, 2024), reflecting the narrowing of the gap between Ukrainian and Romanian FOB prices. For most grains in Ukraine, the optimal export route has become through the ports of Greater Odessa.

Discussion and Conclusions

The market penetration of Ukrainian maize in Hungary in the autumn of 2022 can be explained partly by the drastic increase in the costs associated with exports through the Black Sea ports and partly by the extremely high physical market price level in Hungary. During this period, the MPIS average net producer price of maize in Hungary was more than EUR 20 per tonne higher compared to the MATIF front-month average, whereas the basis (physical market price minus futures price) averaged around EUR -40 per tonne during the 2018-2020 period (see Figure 4), which is typical for Hungary, as a net maize exporting country.

This clearly indicated that Hungary had become a net importer of maize due to the 2022 drought affecting spring-sown crops, resulting in a significant 63% drop in maize production compared to the average of the previous five years. Additionally, farmers held back their produce, partly due to the rapid depreciation of the Hungarian national currency, the forint. The unusual price constellation provided a lifeline for Ukrainian grain exporters, who were otherwise forced sellers.

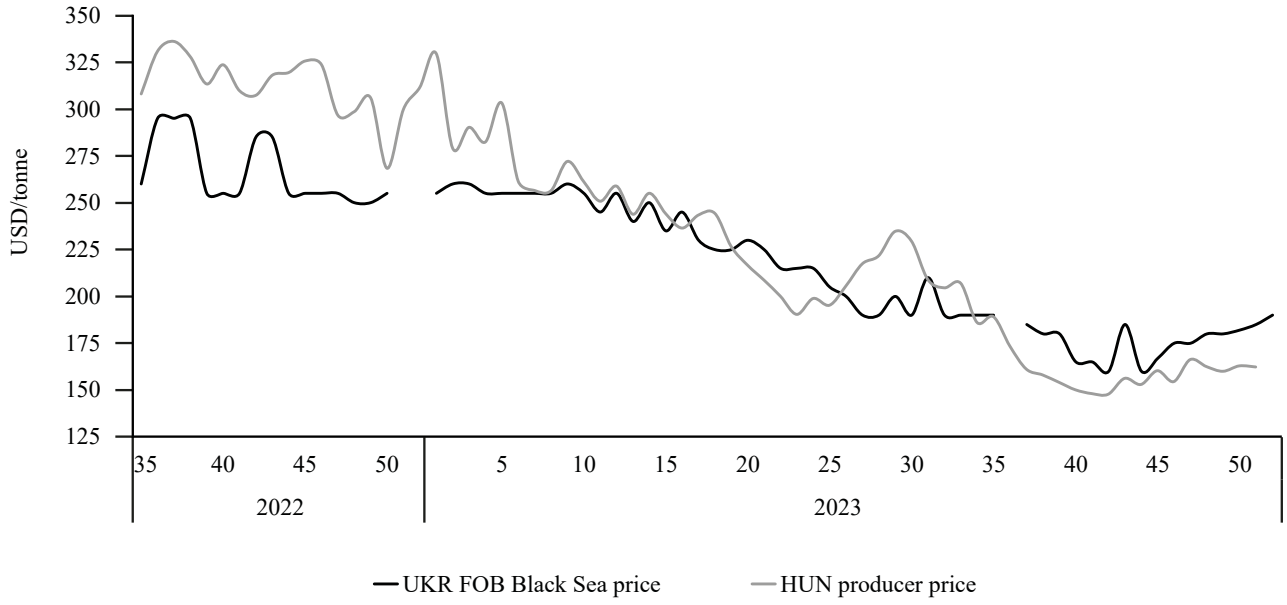

Figure 4: Comparison of Ukrainian Black Sea FOB maize prices for nearby shipments and Hungarian producer prices for maize from week 35 of 2022 to the end of 2023.

Source: own compilation based on data from Hammersmith (2024) and MPIS

The appearance of Ukrainian sellers was also advantageous for domestic maize processors, such as compound feed producers and starch and ethanol plants, seeking feedstock. At the same time, arable farmers, as well as investors who had not previously been involved in agricultural production, processing, or agricultural commodity trading, also tried to profit from the market anomaly and bought Ukrainian maize in hopes of further price increases. However, lacking experience, many of them were unaware, among other things, that export restriction (Government Decree 83/2022 (III. 5.) on the notification procedure and measures related to the export of agricultural products of strategic importance in terms of feed and food supply security) effective from 6 March 2022 to 20 January 2023 had long deterred EU importers from the Hungarian grain market, resulting in sluggish demand from foreign buyers.

In conclusion, the shifts observed in trade patterns, influenced by factors such as conflict-related disruptions and evolving market dynamics, appear to be temporary and do not represent a continuous threat to grain markets in EU member states neighbouring Ukraine. These shifts underscore the importance of safe, flexible, and resilient logistics for maintaining market stability amidst geopolitical tensions.

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