

# The Effectiveness of the Management System in the Conditions of War and its Influence on the Development of Agribusiness

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**Abstract:** Ukraine's agrarian business suffered significantly during the war due to the destruction of infrastructure, equipment, granaries, smuggling of grain products, etc. The agricultural sector of Ukraine is one of the leading branches of the economy, and the export of products of which has decreased by 35% during the war. The purpose of the academic paper is to assess the market, direct and indirect losses of Ukraine's agrarian business in war conditions. A systematic approach was used to comprehensively assess the impact of direct and indirect market effects of the war in Ukraine on developing agrarian business. Losses are estimated by indirect methods and by combining international, state, regional statistics, data from surveys of agricultural producers. The results demonstrate significant direct and indirect losses of the agricultural sector for the period from the beginning of the invasion to December 2022. Direct losses of agribusiness and land resources are estimated at 6,6 billion USD (5,2% of all direct losses by type of property). The largest share of losses belongs to losses due to destruction and damage to agricultural machinery (2,89 billion USD) and losses due to destruction and theft of manufactured products (1,87 billion USD). The infrastructure for storing produced agricultural products has suffered significant losses. Indirect losses of agribusiness due to the invasion of Russia have reached more than 34 billion USD. The total direct losses to the port infrastructure and its related enterprises are estimated at 496 million USD. The key market changes of the agricultural sector include as follows: negative indicators of export and import of food products and raw materials for their production; a reduction of grain prices in the world after a sharp rise in March 2022; a significant increase of the prices for agricultural products in the world; loss of sales markets due to complications and changes in logistics supply routes. The war in Ukraine has led to the transformation of the food system in the world. After all, the food situation in several countries depends on Ukraine's supply capacity.

**Keywords:** Agrarian business, losses of the agrarian business, war in Ukraine, direct losses of the agrarian business, indirect losses of the agrarian business.

## INTRODUCTION

The agricultural sector of Ukraine is one of the leading sectors of the economy, which accounted for 10,1% of the

added value of GDP in Ukraine in 2021 (for comparison, in the Eurozone – 1,5% in 2021) (World Bank, 2023). In 2022, the share of exports of products of animal and vegetable origin, fats and oils was 47,3%, in particular 20,6% - grain crops (State Statistics Committee of Ukraine, 2023h). During 2022, the export of goods in Ukraine decreased by 35,1%, the import of goods – by 24,1%, respectively (State Statistics Committee of Ukraine, 2023h). Agrarian business in Ukraine suffered significantly in connection with the war due to the destruction of infrastructure and supply chains (railways, bridges, roads, granaries, equipment, etc.), blockade of sea-

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ports, rising energy prices, and occupation of territories. As a result, the ways of supplying and selling agricultural products of Ukraine are changing. According to the data of the Ministry of Economy of Ukraine (2023), in 2022, 63% of goods exports fell on EU countries (39% in 2021); Turkey and China were the next countries of export of Ukrainian goods.

Among the tendencies in the agricultural market in 2022, the following ones can be highlighted: rapid growth of grain prices in March 2022 and their further maintenance at a high level; significant increase in world prices for other agricultural products; low prices for grain in Ukraine due to logistical problems, destruction of infrastructure (ports, railways, roads), loss of sales markets, destruction of the world's food system (Agribusiness of Ukraine, 2022). The key problems of agribusiness in the war conditions are determined by the increase in the cost of transportation, the lack of working capital, the increase in prices for production tools, the loss of production capacity, etc. (Ukrainian Club of Agrarian Business, 2022).

According to the data of the analytical center "UA War Infographic", the direct losses of the Ukrainian economy (damaged infrastructure) from the war amounted to 94,3 billion USD as of May 2022, in particular, roads and bridges – 31,4 billion USD, industrial enterprises, factories – 10,4 billion USD, railway infrastructure – 3,6 billion USD, land fund – 1,1 billion USD (UA War Infographic, 2023). The outlined tendencies actualize the study of the impact of the war on developing agribusiness in Ukraine.

The purpose of the research is to assess the market, direct and indirect losses of Ukraine's agrarian business in war conditions.

## LITERATURE REVIEW

Considering the need to assess the quantitative data on the influence of the war on the agrarian business of Ukraine, it is advisable to carry out a review of the literature clarifying direct and indirect losses from military actions and terrorism (Czinkota et al., 2010; Brück, Naudé & Verwimp, 2013; Britchenko & Saienko, 2017; Khan et al., 2021; Saienko et al., 2020) characterize the evaluation indicators. The scientific literature discusses the consequences of terrorism, organizational readiness, strategies and performance of companies, the global supply chain and distribution channels, and issues related to human resources (Czinkota et al., 2010), and impact on landscape space, namely mountains, and plains (Shavarskyi, I., Falshtynskyi, V., Dychkovskyi, R., Akimov, O., Sala, D. & Buketov, V., 2022). The direct consequences of conflicts on the agricultural sector are as follows: exit, entry, infrastructure and human capital; the indirect ones are loss of talent and other environmental factors (Adelaja & George, 2019). The market consequences of the war include the impact on product and resource prices, increase in risk premiums (Adelaja & George, 2019). Ukraine had prospects for the development of agriculture, in connection with the development of the world market of organic food products (Bazaluk, O., Yatsenko, O., Zakharchuk, O., Ovcharenko, A., Khrystenko, O. & Nitsenko, V., 2020), an analysis of production capacities in agricultural farms was conducted (Ostapenko, R.,

Herasyenko, Y., Nitsenko, V., Koliadenko, S., Balezentis, T. & Streimikiene, D., 2020). Using fuzzy logic data analysis for business (Gupta, M., Alareeni, B., Akimova, L., Gupta, S.K. & Derhaliuk, M.O., 2021), measures were taken to ensure financial and economic security at the stage of European integration (Novak, A., Pravdyvets, O., Chorny, O., Sumbaieva, L., Akimova, L. & Akimov, O., 2022) and proposed a model of entrepreneurship with an adaptive management model (Akimova, L., Akimov, O., Maksymenko, T., Hbur, Z. & Orlova, V., 2020). The team of authors conducted a financial and economic cross-section of enterprises and developed a procedure for improving crisis diagnosis at the enterprise (Vovchak, O., Kulinyak, I., Halkiv, L., Pavlyshyn, M., & Horbenko, T., 2021).

The war in Ukraine is also of a terrorist nature. Terrorism refers to the illegal use of any resources in the economy, such as smuggling, or also includes any attack that harms the state (Rasheed & Tahir, 2012). This definition confirms that the war in Ukraine contains elements of terrorism, such as the illegal export of grain or missile strikes on private infrastructure. The scientific literature examines the influence of terrorism in Borno State, Nigeria, which has led to a reduction in the volume of agricultural production and the total area of arable land (Jelilov et al., 2018).

Terrorist activity affects a particular region or a country's infrastructure, investment, general welfare, migration and employment, creating a high risk of uncertainty and instability. Terror causes a loss of confidence on the part of foreign investors in the economy, thus, reducing the level of foreign investment, digitalization contributes to increasing the level of investments in the modern development of the world economy (Bezrukova N., Huk L., Chmil H., Verbivska L., Komchatnykh O., & Kozlovskiy Y., 2022). Terror of the private sector negatively affects FDI by damaging the buildings of multinational corporations, destroying their products, trade inventories, human capital (employees) and causing insurance premiums to rise (Powers & Choi, 2012). Terror of the non-private sector is mainly characterized by a lower impact on the country's FDI (Powers & Choi, 2012). For instance, Pakistan is facing a decline in foreign direct investment due to increased terrorist activity (Rasheed & Tahir, 2012). The cumulative estimate of Pakistan's losses from terrorism is approximately 33,02% of its real national income or about 1% of real GDP per capita growth each year (Mehmood, 2014). In India, there was a significant negative impact of terrorism on the level of investment in long-term agricultural technologies during the Punjabi uprising, with farmers losing 4% of their income annually (Singh, 2013). At the same time, an insignificant and small influence of the uprising on short-term investments was revealed (Singh, 2013). In Boko Haram (Nigeria), conflicts cause a decrease in aggregate farm output, productivity of sorghum, cassava, soybeans and yams (Adelaja & George, 2019), reduction of employment and growth of unemployment (Adebayo, 2014). Food security caused by the conflict is mainly materialized through agricultural inputs and income shocks (George, Adelaja & Weatherspoon, 2020). The estimates of long-term and short-term parameters of Turkey indicate the existence of a negative causal effect of terrorism on tourism (Feridun, 2011).

Thus, the scientific literature actively discusses the consequences of military conflicts and terrorism for developing the agricultural sector according to key indicators: output, infrastructure, human resources, employment, unemployment, productivity. At the same time, there are no comprehensive studies of the influence of the war in Ukraine on developing agribusiness according to the indicators outlined.

## RESEARCH METHODOLOGY

A systematic approach was used to comprehensively assess the impact of direct and indirect market effects of the war in Ukraine on developing agribusiness. In the course of the research, a quantitative assessment of the influence of Russia's war against Ukraine on the agribusiness development was conducted based on secondary data on direct and indirect losses. The analysis of the impact was carried out based on the indicators of the National Bank of Ukraine, State Statistics Committee of Ukraine, 2023a, the Verkhovna Rada of Ukraine, the Ministry of Agrarian Policy and Food of Ukraine, Administration of Sea Ports of Ukraine, Kyiv School of Economics, FAO, World Bank, information and analytical resources of Latifundist Media, Agribusiness of Ukraine, UA War Infographic.

The assessment of direct losses of the agro-industrial complex and agricultural infrastructure includes the following main components (Kyiv School of Economics, 2023a):

- 1) losses of agricultural machinery;
- 2) loss of elevators and other granaries;
- 3) loss of livestock production from the death of animals;
- 4) losses of producers of perennial crops due to damage to plantations;
- 5) losses of beekeeping;
- 6) losses of factors of production and finished products due to their damage and theft.

The above-mentioned losses were estimated by indirect methods and by combining state and regional statistics, data from surveys of agricultural producers. Data from a survey commissioned by the World Bank team in Ukraine for rapid damage assessment and recovery needs were used to calculate the losses of agricultural producers. The survey was conducted by the IPSOS Company during July 2022 (Kyiv School of Economics, 2023a).

The assessment of direct physical damage was conducted within the framework of the National Council for the Recovery of Ukraine from the Consequences of Wars by the analytical team of Kyiv School of Economics (KSE) with the support of the Government of Great Britain (UK Aid) together with the Ministry of Community Development, Territories and Infrastructure, the Ministry of Health, the Ministry of Reintegration and in cooperation with other relevant ministries and the National Bank of Ukraine (Kyiv School of Economics, 2023a).

## RESULTS AND DISCUSSION

European and Asian countries prevailed in the structure of Ukraine's foreign trade in goods: in January 2022, the share of exports to Europe was 40%, to Asia – 37,1%; in January

2023 – 61,5% and 28,2%, respectively (the National Bank of Ukraine, 2023a). Ukraine supplies food products to many low-income, food-deficient countries, particularly Africa. Before the beginning of the war, Ukraine provided about 50% of the world's production of sunflower oil and 13% of grain exports (Agribusiness of Ukraine, 2022). However, since the beginning of the war, negative indicators of export and import of food products and raw materials for their production have been constantly observed in Ukraine (for instance: -54,9% exports and -74,8% imports in March 2022 compared to March 2021; -32,5% exports and -15,6% imports in January 2023 compared to January 2022) (the National Bank of Ukraine, 2023a).

The real GDP in the IV quarter of 2022 decreased compared to the previous quarter of 2022 by 4,7% in connection with the war (taking into account the seasonal factor), and compared to the IV quarter of 2021 - by 31,4% (State Statistics Committee of Ukraine, 2023a).

Before the war, for the period 2010-2021 in Ukraine, the share of active economic entities in agriculture, forestry and fisheries was 4%. Small businesses made up the majority of economic entities, with an average share of 96,3% from 2010 to 2021. The share of large enterprises was 0,1% for 2010-2021 (49 large companies in 2021), medium-sized enterprises – 3,6% with a tendency to decrease for 2010-2021 (2095 companies) (State Statistics Committee of Ukraine, 2023b).

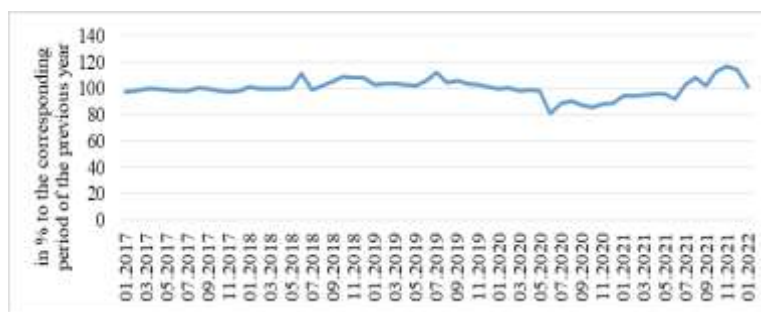
The share of employed workers in the sector was 7% on average for 2010-2021 of the total number of employees in various sectors of the economy of Ukraine. The average employment rate at large enterprises of the industry was 5,9% for 2010-2021, at medium-sized enterprises – 55,1%, at small enterprises – 39,2%, respectively (State Statistics Committee of Ukraine, 2023c).

Over the period 2010-2021, the share of sales volumes of products (goods, services) of large, medium, small and micro enterprises in the industry increased: from 3% in 2010 to 6% in 2021 of all sales volumes in the economy of Ukraine. For the years 2010 to 2021, small businesses made up 34,6% of sales, medium-sized businesses made up 53,7%, and large enterprises made up 12,2% of sales (State Statistics Committee of Ukraine, 2023d).

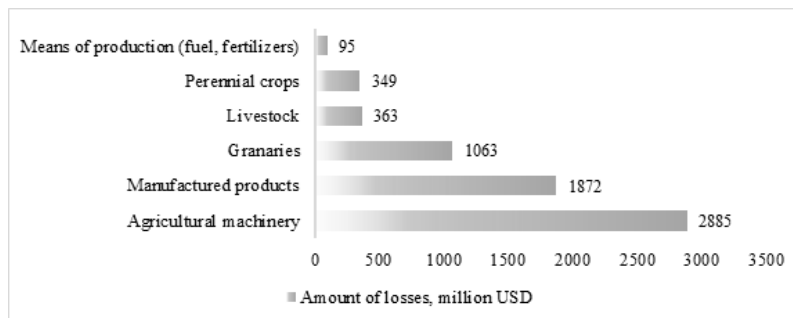
Over the past five years (2017 – 2022), diverse dynamics of agricultural production volumes have been observed in Ukraine (Fig. 1). In particular, during the period from March 2020 to June 2021, a reduction in production volumes was observed, while from July 2021, volumes began to increase.

Over the period of 2012-2021, the share of capital investments from the total volume of investments in the economy of Ukraine had been growing specifically in the agriculture, forestry and fisheries sector: from 8% in 2012 to 13% in 2021. At the same time, in the structure of capital investments in the sector, 98% accounted for tangible assets in 2021 and during 2012-2021 as a whole (70,03% - for machinery and equipment, 18,74% - for construction and reconstruction of buildings, 1,59% - for existing buildings and structures, 0,26% - for land) (State Statistics Committee of Ukraine, 2023e).

The level of profitability (unprofitability) of the operational activities of agricultural, forestry and fishing enterprises var-



**Fig. (1).** Agricultural production volume index, cumulative since the beginning of the year, in % to the corresponding period of the previous year.  
 Source: the National Bank of Ukraine (2023).



**Fig. (2).** Amount of losses by category, million USD.  
 \* monetary value of tangible assets that were destroyed, stolen, or partially damaged (but still suitable for repair, restoration) due to military actions and occupation.  
 Source: Agribusiness of Ukraine (2022).

ied in 2010-2021: it was 22,9% in 2020; 41,7% in 2015; 40,3% in 2021; 24,4% on average during 2020 - 2021.

The impact of the war on the tendencies of the agricultural market of Ukraine in 2022

The key tendencies in the agricultural sector according to the data of Agribusiness of Ukraine (2022) are as follows:

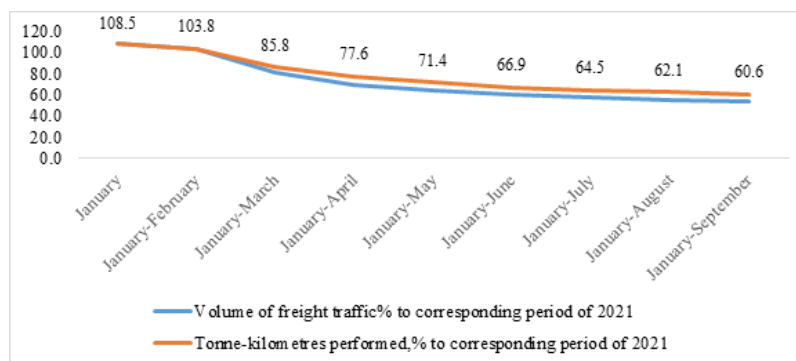
1. A certain reduction in world grain prices after a sharp rise in March 2022, holding prices at a high level.
2. A significant increase in world prices for agricultural products. For example, the FAO food price index (CPI) in September 2022 was 136,3%, which is 6% higher than in September 2021. Despite the fall in the CPI in February 2023 to the level of 129,8%, food prices remain at a high level. In February 2023, the average price index for grains for the year was 147,3%; the average price index for vegetable oil was 135,9%; the average price index for dairy products was 131,3% (FAO, 2023). At the same time, grain prices in Ukraine remain low due to logistical problems in war conditions (the Ministry of Agrarian Policy and Food of Ukraine, 2022).
3. As a result of losing sales markets due to the complication of logistical supply routes, key partners of Ukraine are reorienting to other suppliers. For instance, India increased imports of sunflower oil from Russia and Argentina, and China plans to increase imports of corn from Brazil.
4. Transformation of the food system in the world due to changes in Ukraine, the supply of which depends on the food situation in several countries. The situation requires advanced countries to develop institutional mechanisms for the

protection of the food system and allocate additional funds for food security. The launch of the “grain corridor” has partially improved the situation. However, a number of problems related to control and security still remain.

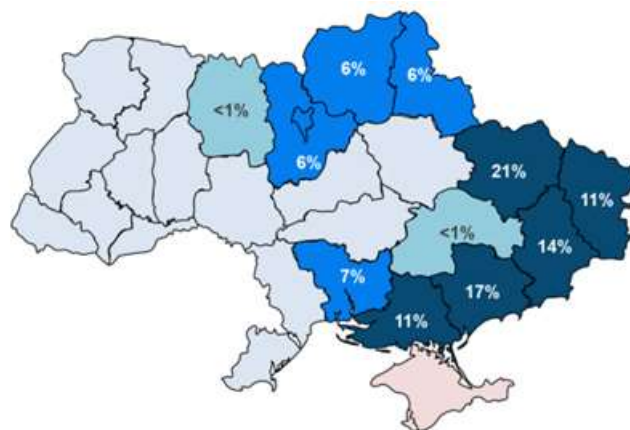
According to analysts of Kyiv School of Economics (2023a), the total amount of direct documented damage caused to the infrastructure of Ukraine due to the war since February 24, 2022 is estimated at 137,8 billion USD as of December 2022 (on the basis of replacement cost). Infrastructure remains to be the area most damaged by the war, with losses of 35,6 billion USD and industry and enterprise losses amount 13 billion USD. Direct losses of agriculture and land resources are estimated at 6,6 billion USD (5,2% of all direct losses by type of property). Since the beginning of the full-scale invasion of Russia in Ukraine, at least 64 large and medium-sized enterprises, 84,3 thousand units of agricultural machinery were damaged, destroyed or captured (Kyiv School of Economics, 2023a).

As of the beginning of September 2022, the sum of direct losses caused to the land fund and agro-industrial complex of Ukraine amounted to 6,9 billion USD (Kyiv School of Economics, 2023a). The largest share of losses belongs to losses due to the destruction and damage of agricultural machinery, as a result of which the estimated losses of agricultural producers amount to more than 2,89 billion USD (Fig. 2).

The second largest category is losses due to the destruction and theft of manufactured products. The total value of destroyed and stolen products is estimated at 1,87 billion USD. The infrastructure for the preservation of produced agricultural products suffered significant losses. The total capacity



**Fig. (3).** Freight transportation and freight turnover in Ukraine in 2022, in % by the corresponding period of 2021. *Source:* State Statistics Committee of Ukraine (2023g).



**Fig. (4).** Distribution of direct monetary road losses by regions of Ukraine as of September 2022. *Source:* Kyiv School of Economics (2023b).

of destroyed granaries reaches 6,5 million tons of produced products (1,06 billion USD), and the capacity of damaged granaries exceeds 2,9 million tons of simultaneous storage capacity. The cost of restoring destroyed facilities is estimated at 1,06 billion USD (Kyiv School of Economics, 2023b).

Elevators, livestock farms and poultry farms were destroyed; fields were mined and damaged by trenches, shells and the movement of military equipment; tractors and combines were burned. This list of agricultural sector losses can be continued. The KSE Institute and the Ministry of Agrarian Policy calculated that only indirect losses of agribusiness due to the invasion of Russia reached more than 34 billion USD (Kyiv School of Economics, 2023b).

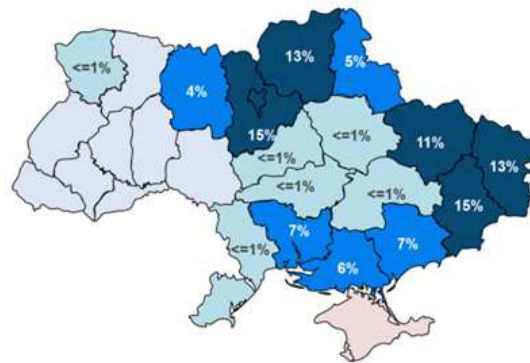
The amount of indirect losses (the difference between actual incomes and incomes that agriculture would have received if Ukraine had not been invaded) was:

- 1) 18,5 billion USD in disruptions in logistics and price reductions for export-oriented goods;
- 2) 11,5 billion USD due to a decrease in the production of agricultural crops in 2022;
- 3) 3,0 billion USD due to a decrease in the production of winter crops in 2023;
- 4) 0,9 billion USD due to increased production costs;
- 5) 0,3 billion USD due to a decrease in livestock production (Latifundist Media, 2023).

It is difficult to estimate the cost of full damage, harm and losses for the agricultural sector of Ukraine until the end of the war. Russian aggression affected not only the possibility of free export of products, but also caused damage and destruction of the land fund, infrastructure, equipment, which led to a reduction in production. Kyiv, Chernihiv, Sumy, Kharkiv, Luhansk, Donetsk, Zaporizhzhia, Kherson, Mykolaiv regions suffered most of all. The war has indirectly affected the agricultural sector and business in other regions, in particular, due to changes in supply chains, interruptions in the supply of electricity, changes in the conditions of foreign economic activity (export-import operations, investments, customs regulation, etc.).

As of September 2022, the infrastructure sector was in the second place in terms of losses, amounting to 35,3 billion USD (27,7% share), of which 26,6 billion USD was due to direct destruction of roads and 4,3 billion USD fell on losses due to the destruction of the railway. The damage caused to the railway infrastructure increased by 1,7 billion USD during June - August 2022 due to the destruction of the infrastructure in Ukraine; the volume of freight transportation and freight traffic decreased significantly (Fig. 3).

Since the beginning of the war and until September 2022, at least 2,910 trading points, 19 airports and civilian airfields, 110 railroad passenger terminals and stations, 315 bridges and highway stream crossings of state, local or communal importance, 10 thermal power plants, 322 boiler facilities



**Fig. (5).** Distribution of direct monetary losses of bridges and highway stream crossings by regions of Ukraine as of September 2022. *Source:* Kyiv School of Economics (2023b).



**Fig. (6).** Activity of ports of Ukraine in war conditions, 2022. *Source:* UA War Infographic (2023).

were damaged, destroyed or captured. These losses also affected the activities of the agricultural sector, in particular, the supply chain of raw materials and products to consumers (Kyiv School of Economics, 2023a).

Infrastructure is also gradually being restored. According to the data of the Ministry of Development of Communities, Territories and Infrastructure, 72 objects were restored from more than 150 destroyed or damaged bridges or highway stream crossings of state importance as of the beginning of December 2022; and there were already 78 objects at the beginning of January, 2023. Most bridges or highway stream crossings were restored in Kyiv (20 out of 24 objects) and Chernihiv (20 out of 27 objects) regions. Over the past month, traffic has been additionally restored on the bridges of the Kharkiv, Mykolaiv and Kherson regions.

**Losses Due to the Destruction of the Port Infrastructure**

The agricultural sector of Ukraine plays one of the key roles in the country's economy and at the same time depends on

the activity of related industries, in particular the maritime. According to seaport reporting data, the total revenue generated by the services market in seaports of Ukraine amounted to at least 50 billion hryvnias, which is equal to about 1,5% of Ukraine's GDP. This indicator was achieved thanks to the activities of about 1,300 economic entities with a staff of almost 50,000 employees. The seaports of Ukraine ensure the export of products of the country's agro-industrial and mining and metallurgical complexes. More than 37% (916 908 million hryvnias in 2018) of the total volume of international trade of Ukraine with various countries of the world, including more than 57% of domestic exports, is processed in the seaports of Ukraine (the Verkhovna Rada of Ukraine, 2023).

98% of agribusiness in 2021 was exported through sea ports. On February 26, 2022, the Sea of Azov and the northwestern part of the Black Sea were blocked by Russian ships. Cargo operations were suspended or partially executed. In March-June, entrepreneurs together with the government established



alternative routes and ways of selling products. The railway and small ports of the Danube region became the key logistics arteries in this period. On July 22, the delegations of Ukraine, Russia, Turkey and the UN signed an agreement on unblocking “Odesa”, “Chornomorsk” and “Pivdenny” ports for 120 days, which was extended on November 17 for 120 days. However, Russia slows down the inspection of ships under various pretexts, which leads to queues. 16,3 million tons of agricultural products had been exported to 42 countries through the grain corridor by the end of 2022.

The total direct damage to the port infrastructure and related enterprises is estimated at 496 million USD. This assessment includes both seaport infrastructure and inland waterway transport facilities destroyed as a result of the war. In total, property has been destroyed or damaged in at least four ports since the beginning of the war (Kyiv School of Economics, 2023b). For instance, on June 4, 2022, the grain terminal in the Mykolaiv port “Nika-Tera”, which was among the three largest grain terminals in terms of transshipment volume in 2020-2021, was destroyed. The moderate destruction of the ports is connected with two factors. Firstly, a port is a fairly complex and spatially distributed object, consisting of many large parts. Therefore, it is impossible to destroy such an object with several precise missile strikes completely. Secondly, the aggressor captured or used its and other states’ cargo ships in order to export supplies of grain, ferrous metals, etc. It needed working ports for that. For instance, the “Metinvest” group reported on the plans of the occupiers to remove 200 000 tons of products worth 170 million USD from Mariupol factories. In turn, with regard to grain, it was reported that 400-500 thousand tons (also worth hundreds of millions of US dollars) were stolen from the four occupied southern regions, which is more than a third of local stocks. It is expected that the aggressor will try to sell these stocks through partners in the Middle East, in particular through Syria (Kyiv School of Economics, 2023b). (Clarification: stolen stocks of goods are not included in the above figure; they are included in the losses of the relevant industries). The ports of Mariupol, Berdyansk, Skadovsk and Kherson are occupied. The ports of Mykolaiv and some other cities do not work. There is no traffic on the Dnipro due to the blocking of the lower parts of the river.

Ukraine’s opportunities to export its goods faced logistical difficulties due to blocking seaports and limited capacity of land routes, which was partially compensated by implementing the grain corridor. As a result, since the beginning of 2022, exports to all regions of the world, except the EU, decreased. This is explained by the fact that Ukraine redirected the export of goods through the ports of neighboring countries, primarily Romania. An additional positive factor for exports to the EU was the abolition by the Union of all customs duties and taxes on Ukrainian agricultural goods for the period from June 4, 2022 to June 5, 2023, which helped support the Ukrainian economy and created the basis for growth in the following periods.

It is worth noting that five ports of national significance were key facilities in terms of the volume of cargo processing in Ukraine before the war, the share of which was 91% of cargo transportation. There were also four medium-sized ports and four small ports in Ukraine, which accounted for 9% of

freight traffic (Ukrainian Sea Ports Administration, 2023a). Five seaports were the leaders in terms of transshipment volume. Totally, they handled 120,96 million tons of cargo, which is 91,6% of the total indicators of handling in Ukrainian seaports. The seaport “Pivdenny” was the flagship of cargo transshipment in January - September 2020 with a volume of 51,55 million tons of processed cargo (+17,6%). The Mykolaiv seaport was on the second place with transshipment of 24,69 million tons (-8,4%); Odesa and Chornomorsk seaports were on the third and fourth places in the amount of 19,44 million tons (-6.1%) and 19,42 million tons (-7.7%), respectively. The Mariupol seaport was on the fifth place, which increased transshipment to 5,86 million tons (+11%). By the way, the Olvia seaport dynamically increased the transshipment of cargo to 3,38 million tons in January - September 2020, which is 0,97 million tons or 40,2% more than the same period of 2019, the Berdyansk seaport - to 1,89 million tons with an increase 0,26 million tons or 16% (Seaports Administration of Ukraine, 2023b). Thus, Mykolaiv, Olvia, Kherson, Skadovsk, Mariupol, Berdyansk seaports lost the ability to process, transship and ship cargo because of the war. In turn, the load on the ports of Pivdenny, Odesa, Chornomorsk has been increasing. According to the data of Administration of Sea Ports of Ukraine, the signing of the Grain Agreement in Istanbul on July 22 provides for the unblocking of the work of the specified three Ukrainian ports, Odesa, Chornomorsk and Pivdenny, for the export of Ukrainian food. Despite the introduction of the electronic queue, which made it possible to optimize and make transparent the planning of the arrival and departure of ships to / from the ports of Velyka Odesa, the problems with the inspection of ships in the Bosphorus Strait were not resolved due to the destructive position of the Russian Federation. The latter causes an increase in the time for passing the control of ships: only 3,5 ships for entry and 3 for exit are actually inspected instead of the planned 24-30 ships per day (in equal parts for entry and exit). As a result, indirect losses include as follows: 1) a delay and a queue of 96 vessels, which will grow if the number of inspections per day is not increased; 2) reduction of port loading by less than 50% and as a result of the countries of the world not receiving 3 million tons of agricultural products from Ukraine in November 2022 (Administration of Sea Ports of Ukraine, 2023c).

## CONCLUSIONS

The academic paper reveals significant direct and indirect losses of the agricultural sector of Ukraine for the period from the beginning of the invasion to December 2022. Direct losses of agribusiness and land resources are estimated at 6,6 billion USD (5,2% of all direct losses by type of property). The largest share of losses belongs to losses due to destruction and damage to agricultural machinery (2,89 billion USD) and losses due to destruction and theft of manufactured products (1,87 billion USD). Thus, the military actions had a negative impact on product stocks in Ukraine, in particular, due to their illegal export or destruction of granaries, storage equipment, and transshipment terminals (Powers & Choi, 2012; Rasheed & Tahir, 2012). At least 64 large and medium-sized enterprises, 84,3 thousand units of agricultural machinery have been damaged, destroyed or captured since

the beginning of the full-scale invasion of Russia in Ukraine. The infrastructure for storing produced agricultural products suffered significant losses. Indirect losses of agribusiness due to the invasion of Russia reached more than 34 billion USD. This confirms the conclusions of other studies regarding the reduction of agricultural production and the total area of cultivated land (Jelilov et al., 2018), in particular, due to the destruction of the land fund. The total direct damage to the port infrastructure and related enterprises is estimated at 496 million USD. The agricultural holdings of Ukraine reported about the export of significant volumes of products (700 000 tons) due to terrorism and smuggling, which is more than a third of local stocks. The following indirect losses were also identified: 1) regulation and control of port activities, delay in inspection and deliveries; 2) reduction of port loading by less than 50%, and, as a result, the world countries did not receive 3 million tons of agricultural products from Ukraine in November 2022. In contrary to other studies, it is impossible to estimate potential losses of investment resources in the agricultural sector of Ukraine caused by the war in the present academic paper due to the lack of statistical data. At the same time, one can agree that the war in the short term had a negative impact on investing in Ukraine. For comparison with other countries (for instance, in India), a significant negative impact of terrorism on the level of investments in long-term agricultural technologies was observed (Singh, 2013). Ukrainian farmers could also lose a significant share of income because of reduced prices, disruption of supply chains, and loss of sales markets. It can also be assumed that the war in Ukraine caused a decrease in the aggregate output of farm enterprises, the productivity of basic agricultural products due to the increase in their prices on the world market (Adelaja & George, 2019; George, Adelaja & Weatherspoon, 2020), a reduction in employment and an increase in unemployment due to migration, occupation of territories (Adebayo, 2014). Therefore, the present research has revealed the following key problems of large, medium and small companies in the agricultural sector of Ukraine (Hryhorenko & Shnitzer, 2022):

1) reduced demand for products: 75% of companies report a significant decrease in demand, with 70% looking for new customers and sales channels. 20% of enterprises are faced with late or missing payments on the part of customers.

2) enterprises face a lack of financing: 40% of companies need working capital due to the almost complete cessation of bank lending. 36% of enterprises are actively looking for financing. Only 4% of surveyed companies used the “5-7-9% Available Loans” program in 2022.

3) logistics problems: 44% of enterprises experience difficulties related to logistics and transportation; a break in the usual transport chains is observed;

4) human capital and labor shortages: at least 5,1 million people have left abroad since February 2022, and 25% of them are not sure they will return in the future.

The key market changes of the sector include as follows: negative indicators of export and import of food products and raw materials for their production; reduction in world grain prices after a sharp rise in March 2022; a significant increase in world prices for agricultural products; loss of

sales markets due to complications and changes in logistics supply routes. The war in Ukraine has caused the transformation of the food system in the world, on the supply of which the food situation in a number of countries depends.

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