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**CHALLENGES FOR THE AGRICULTURE OF UKRAINE
DURING THE WAR AND DIRECTIONS
OF ITS DEVELOPMENT**

Key words: Ukraine, war, agriculture, food security, challenges, losses,
development directions

ABSTRACT. The purpose of the research was to systematize knowledge about the effects of russian aggression as a colossal challenge for Ukraine's agriculture and to outline certain directions of development of this branch during the war and the post-war period. The subject of the study were phenomena taking place in Ukraine during the period of russian military aggression and are causing a number of negative consequences, including for agriculture as the basis of the country's food economy, the production of which constitutes the main share in its exports. The conducted research was based on the use of the descriptive-analytical method as well as inductive and deductive methods and the synthesis of the obtained results. The main result of the conducted research was the systematized knowledge about the effects of the russian invasion for the agricultural sector of the Ukrainian economy as a challenge for agricultural products producers and established trends in the development of the branch. The main challenges for Ukrainian agriculture during russian aggression are: destruction of equipment, buildings, biological resources, crops, animals, processing enterprises, energy facilities, product stocks, their theft; pollution of territories; ruination of port infrastructure and water reservoirs; seaports blocking. These challenges create a number of problems for agricultural products producers of different scales because of: lack of financial resources, rising prices of fertilizers, feed and other materials, reduction of the area of agricultural land because of its contamination and difficult access to fields and farms animals – because of occupation of the area and its mining, reducing the number of farm animals, complication and increase in logistics cost.

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INTRODUCTION

Striving to seize new territories and resources or to realize geo-economic interests have been usually accompanied by military conflicts or full-scale wars [Agronews 2023]. The imperial manners of Russia are known throughout practically the entire period of its history. Due to the extractive nature of its political and economic system [Acemolgu and Robinson 2012] even with the presence of huge natural resource potential, Russia remained a poor country aggressively tuned to the whole world. On the other hand, war is a challenge that confronts the attacked country in all its spheres of life. Such a challenge has fallen to the fate of Ukraine and it is the most powerful in the entire history of its existence. The war caused and continues to cause Ukraine terrible damage to people, nature, and the economy.

Since in recent years the agrarian sphere of the economy of Ukraine has played an ever-growing role in the national economy of the country and in the formation of its foreign currency revenues, and as a result of Russian military aggression this industry has suffered comparatively the largest losses, the purpose of the conducted research, the results of which are presented in this article, was to systematize the consequences of the Russian military aggression for the agriculture of Ukraine as the basis of its agrarian economy and to identify the trends of its development during the war and in the post-war period.

MATERIAL AND METHODS

The general methodological approach to the conducted research was based on the application of elements of dialectics in combination with scientific abstraction and the descriptive-analytical method and the methods of induction and deduction and synthesis of the obtained results. In addition, since the semiotic dimension is an important aspect of the theoretical and methodological understanding of modern military conflicts in the context of the economic development of states and their regions, the principle of adequacy of the perception of the investigated phenomena to their real essence was observed during the conducted research. If during the war, under the influence of certain factors, other value attitudes and social ideas begin to dominate in society than before the war, then post-war development may take place on a completely different economic basis than was seen on the eve of the war campaign.

The problem of a methodological nature in assessing the damage caused by Russian aggression to the agriculture of Ukraine is that there is currently no analogy with a similar situation – since the Second World War there has not been a case when a country with such a large-scale and important for the world agricultural market was involved in the war sector, like Ukraine. Therefore, the results of the calculations presented in the article are quite approximate and dynamic, because the war is ongoing.

The problem of an information-source nature is twofold – on the one hand, during the war there is a strict ban on the collection and publication of official statistical data, and the collection of data itself is made difficult by military operations and their consequences, secondly, there are difficulties with the collection and analysis of published materials, since the process of publishing an article is usually long, so in the course of the research it was necessary to be satisfied with the existing mainly operational material and use the analytical materials of some institutions, agencies and platforms that constantly monitor the situation, for example Agronews, KSE “Agrocente”, Ecoaction, Epravda, Interfax, SuspilneMedia, SlovoiDilo, Economcs, Ukrinform, Bizagro, Ukurier, Delo, UCAB and others and individual researchers, as well as the results of the author’s own observations. The results of the “Rapid Damage and Needs Assessments” (RDNA) [WB 2023], conducted jointly by the World Bank, the Government of Ukraine, the European Commission and the United Nations with the participation of the Kyiv School of Economics, were also used.

RESEARCH RESULTS

The war in Ukraine and its consequences have become a global phenomenon and one of the main topics for wide and active discussion in the world. Martin Banse et al. believe that the war in Ukraine will cause economic damage all over the world, which will lead to the third asymmetric shock [Banse et al. 2022]. Virginia Câmpeanu also analyzes the set of “3C” factors: climate (global warming), COVID-19, conflicts (war in Ukraine) and comes to the conclusion that this set can have a devastating effect on food security at all levels, while in the current the international perspective is dominated by the outbreak of the military conflict in Ukraine, which deepens the global food crisis [Câmpeanu 2022]. Giuseppe Celi et al. examine the asymmetric and depressing impact of the war in Ukraine on EU policy, as well as the depressing impact of the war on GDP and employment [Celi et al. 2022]. Thomas Glauben and others believe that disruptions in exports from the Black Sea region and high prices due to the war will further destabilize global food security [Glauben et al. 2022]. Daniel Fiott examines EU defense spending and military potential in the context of its assistance to Ukraine [Fiott 2022]. Olga Trofimtseva analyzes the role of Ukraine in the global economy, especially during the war, and outlines some prospects for the development of its agricultural sector [Trofimtseva 2022]. Pavlo Martyshch, Oleg Nivievskiy and Mariia Bogonos indicate that the world capacity to replace the expected missing exports from Ukraine, created as a result of russia’s aggression in Ukraine, are limited, at least in the short run [Martyshch et al. 2023]. That is, the problem of war and its local and global consequences, including and in the agrarian sector of the economy, finds multifaceted coverage in the works of scientists, however, all this information is somewhat scattered and fragmentary in nature, is very dynamic and requires systematization and

constant updating to be adequate with the changing reality, which greatly influenced the formation of the goal of this conducted research.

Russia's aggression in Ukraine caused large-scale destruction of the productive capital and infrastructure of the country's economy and social sphere, and caused terrible human casualties. According to The Washington Post with reference to the Canadian geopolitical risk assessment firm SecDev, huge deposits of high-value resources are in the hands of the russians in the occupied territory of Ukraine. Russia occupied Ukrainian territories with deposits of energy resources, metals (including lithium) and minerals, which together are estimated at at least USD 12.4 trillion. And that's only half the dollar value of the 2,209 deposits reviewed by SecDev [Kishchak 2022].

As a result of the war in 2022, Ukraine's economy lost 29.2% of real GDP, and 13.5 million people were forced to leave their homes. More than 7 million people in the country were below the poverty line, and the poverty level reached 24% of the population [Bohdan 2023].

Ukraine's most valuable production resource is its agricultural land as the basis of the functioning of the country's agrarian economy, which decisively forms its GDP and foreign exchange earnings. The RDNA-report notes that as a result of military operations, the total sown area in Ukraine will decrease by 20% compared to 2021 [Economics 2023]. The aggressor's actions are aimed both at reducing agricultural production and at worsening Ukraine's food supply and at forming negative expectations regarding food shortages among its population.

The agricultural sector is one of the largest in the economy of Ukraine. In 2021, about 14% of the country's population was employed in agricultural production. Every year, Ukraine produces about 100 million tons of grain – four times more than the needs of the domestic market, and the potential is 140 million tons [Negrei and Taranenko 2022].

The World Bank RDNA – report concluded, that during the only first year of the full-scale invasion (February 2022 to February 2023), direct damage to assets in the agricultural sector (USD 8.7 billion) and indirect losses due to reduced production opportunities and export losses, etc. (USD 31.5 billion) totalled USD 40.2 billion. The reconstruction and recovery needs for agricultural production in Ukraine are estimated to be USD 29.7 billion from 2024 to 2033, including USD 600 million in 2023, mostly for the immediate recovery of production [Ecoaction 2023]. In addition, the enemy's detonation of the Kakhovska HPP turns the south of the country into a desert due to the destruction of the land reclamation infrastructure that provided irrigation for 584,000 hectares harvesting area of 4 million tons of grain and oil crops, worth about USD 1.5 billion, which is not critical for Ukraine, but in a generally tense situation, even a small amount is important. In addition, 80% of vegetable growing and a large part of horticulture in the region may disappear. Southern farmers will not be able to use 1-1.5 million hectares of land. The only state sturgeon farm in Ukraine was flooded. Currently, the damage from the loss of all biological resources due to the

explosion is estimated at more than UAH 10.5 billion [Kravchenko 2023]. It is difficult to assess the consequences of the contamination of agricultural land with explosive objects, the destruction of the upper layers of the soil by explosions [Ukrinform 2023].

The largest share of losses in the agricultural sector is the destruction and damage of agricultural machinery – 109.6 thousand units worth USD 4.65 billion [Kyrychenko 2023]. According to RDNA-report, the assessment evaluates damages and losses for the irrigation and drainage sector at USD 380.5 and USD 282.5 million, respectively. As of February 2023, irrigation reconstruction costs were USD 8.9 billion [Ecoaction 2023]. The total capacity of destroyed and damaged granaries reaches 11.45 million tons of simultaneous storage. The cost of their restoration is estimated at USD 1.33 billion [Kyrychenko 2023].

Another category of losses in this area is related to the theft of agricultural products – only grain worth USD 1 billion was stolen (10 million tons of wheat and 5 million tons of sunflower and corn [USM 2023].

As of the end of May 2023, the total amount of indirect losses of the agricultural sector of Ukraine as a result of the war reached USD 31.5 billion. In this category, the main losses are associated with a decrease in the production of crop products – this is almost half of all indirect losses (USD 14.3 billion) [Babenko 2023].

Losses due to reduced productivity of animals amount to USD 1.1 billion [Delo 2023]. According to the results of 2022, the production of meat of all types in Ukraine decreased by 11% compared to 2021 and was at the level of 3.0 million tons, milk – 7.7 million tons (-12%) and eggs – 11.6 billion pcs (-18%) [UCAB 2023]. Due to the occupation, destruction of animals and violation of technologies compared to 1990, the cattle population in Ukraine in 2023 is only 11% (cows -15%), pigs – 35%, sheep and goats – 14%, which significantly complicates the situation with providing the population of Ukraine with foodstuffs of animal origin [Bizagro 2023c].

About 30% of the territory of Ukraine is mined [Matveyev 2023]. Including agricultural land – 8 million hectares. According to RDNA, the cost of demining is USD 37.6 billion, of which USD 24.5 billion – in agriculture [Ecoaction 2023]. It is good that demining for farmers is financed by foreign donors.

According to the FAO, during the war the total number of small farmers, cultivating up to 250 hectares of land (65% of the number of agricultural producers in Ukraine and 7% of the area of agricultural land) decreased by 8% [Mykhalchuk 2023]. According to a some of survey released by the FAO, one in every four of the 5,200 respondents surveyed had reduced or stopped agricultural production due to the war [FAO 2022].

In general, during the war, the Ukrainian agricultural sector demonstrated high resilience and adaptability to wartime. The harvest forecast in Ukraine for 2023 is more than 79 million tons. This is 10% more than in 2022. For domestic needs, 25% of the harvested grain is enough for the country. The rest can be directed to places where there is a threat of famine [USM 2023].

The share of agriculture in Ukraine's export revenues in 2020 was 45% [Negrei and Taranenko 2022]. Even the war only partially shook Ukraine's position in world agricultural exports – in 2021, the share of agri-food products in Ukraine's total exports decreased to 41%, retaining its leadership in its commodity structure. As of 2021, Ukraine accounted for more than 40% of world exports of sunflower oil, more than 10% of corn and barley, and about 10% of wheat and rapeseed [Matveev 2023]. The year 2022 could become a record year for Ukraine in terms of export volume for the entire history of independence. Back in January-February 2022, Ukrainian exports demonstrated positive growth dynamics – the increase in exports amounted to 34%. However, already in March, the reduction of supplies abroad amounted to 50% [Hvozdyova 2022].

Before the war, more than 95% of cultivated agricultural products were exported by sea. After blocking the sea routes, it was necessary to prevent the development of a food crisis, because almost 400 million people in the world depend on Ukrainian grain [Perehozhuk 2023]. All efforts directed on organizing the export of agricultural products from Ukraine by land have only a very partial effect because of the high cost of such an option and the lack of a significant part of technical capabilities. The transit of grain and other types of agricultural products through the territory of neighboring states to northern ports with the aim of their further transshipment to sea transport failed – Ukrainian agricultural products settled in Poland and other EU countries, which caused social tension in the region. And even at the first opportunity to restore the sea routes, land export of grain immediately loses its importance, since the sea route was and remains the cheapest option for this export.

In 2022, agricultural export revenues formed 52% of all export revenues, compared to 41% in 2021 due to the loss of other major export products like metals, ores and machinery. In absolute numbers, the revenues from agriculture were smaller: USD 21 billion in 2022 versus USD 27 billion in 2021. These imbalances in the Ukrainian food system have caused systemic consequences for supply chains both in Ukraine and globally [Ecoaction 2023].

The situation with the blocking of ports was saved by the “grain initiative”, which became operational on August 1, 2022. More than 30 million tons of grain were delivered by sea, despite Russia's constant sabotage of the work of the “agreement”, which as a result ceased to exist [Gordiychuk] 60% went to countries in Africa and Asia. Although the world's need is much greater. Ukraine could have provided at least 57 million tons if the Russians had not blocked the grain corridor [Bizagro 2023a]. But the situation has already radically changed: firstly, due to the war, the harvest last season was much smaller than in 2021 – now there are only 9 million tons of temporary grain residues on the market, and the capacities are enough to store 44 million tons. Secondly, the capacities of railways, motor vehicles and Danube ports increased significantly during the year. The railway can transport more than 1 million tons of grain per month, and motor vehicles – more than 600,000 tons. The Danube ports export more than 2 million tons per month and can reach 3 million tons [Gordiychuk 2023]. Already in September 2023, Ukraine managed

to export 4.2 million tons of agricultural products, what is only 3% less than the same indicator of the previous month. However, such indicators remain almost 2 times lower than the maximum possible [Bizagro 2023b]. As of November 2023, Ukraine ranks third among the largest suppliers of agricultural products to the EU (after Brazil and Great Britain) [Kachka 2023]. Ukraine secured the grain corridor in the Black Sea on its own, and since August 8, 2023, 200 vessels have passed through the Ukrainian sea corridor without Russia for exit from ports and 226 vessels – for entry. As of December 4, 2023, Ukraine has already exported more than 7 million tons by sea, of which almost 5 million tons is agricultural export [Ivanova 2023].

In addition, from April 2022 to March 2023, more than 32 million tons of grain and oilseed crops were exported through the “Solidarity Paths” initiated by the EU, designed to help Ukraine export its agricultural products (20 million tons of grain were expected to be exported at that time), despite numerous blockades of borders by different countries [Zelenyuk 2023].

The full-scale war affected the functioning of the newly created Ukrainian agricultural land market. In 2021, the monthly volume of transactions was about 10,000 transactions per month, at the beginning of 2022, it halved, but then it slowly started to work: almost 42,000 land transactions were concluded during the year on a total area of more than 77,600 hectares. In the first months of 2023, another 13,000 contracts were concluded for a total area of 26,000 hectares [Ecoaction 2023].

In general, life in Ukraine after the war will be difficult and with the next challenges, but Ukrainians have already shown their willingness to fight for their country and move forward. The majority of Ukrainians believe, that in ten years Ukraine will be a successful country within the European Union. As many as 96% of respondents are ready to endure financial difficulties for 3-5 years, if as a result Ukraine becomes a successful country and a member of the EU. The dream of the majority – a successful Ukraine in the family of European nations – is considered quite achievable and worth the tragic “investments” of today [SlovoiDilo 2022].

In the conditions of post-war recovery, the main course of agricultural development should be aimed at implementing this development at a qualitatively new level, which involves the spread of high-margin niche areas of production with correspondingly more variable possibilities for the logistics of its products, increasing the export of products with greater added value due to the in-depth processing of agricultural raw materials, increasing the efficiency of the use of bioenergy potential, expanding the sector of organic production and bioeconomy, as well as changing the structure of production in the direction of increasing the role of medium and small producers, while the aid programs that are already implemented in Ukraine by FAO and other donors provide for the maximum size of the land bank of its recipients at the level of 250-1,000 hectares. The small farming sector proved to be much more mobile and adaptable than large agricultural holdings during the war.

Against the background of global changes in the branch in wartime, Ukraine already shows the manifestation of certain formed microtrends, in particular: the already noted change in the structure of the wedge towards high-margin niche crops because of the identified shortcomings of traditional large-scale monoculture and the risks of large-scale export of raw materials, the improvement of qualifications and training of personnel and increasing the technology of agriculture, temporarily returning to the practice of homestead farms and gardening for personal needs, the beginning and activation of European prospects and entry into the European economic space, and the creation of processing and food enterprises on the territory of Ukraine with an export orientation to EU countries. Even partial processing of 30-50% of raw materials will provide an annual increase in foreign exchange earnings by USD 30 billion and an additional growth of GDP by about 5%, and processing a ton of corn into bioethanol increases the profit by 3.5 times, and the production of citric acid from this raw material by 8-9 times! [Obukh and Koloda 2023]. Therefore, international investors such as the EBRD must create stronger incentives for their clients to implement the EU's green agenda for agriculture in future investments and also accelerate the integration of EU requirements into Ukraine's production, namely: Good Agricultural Practices and Best Available Techniques to reduce and prevent environmental pollution [Ecoaction 2023].

The Ukrainian government is preparing systemic solutions, which will help change the balance from the export of agricultural raw materials to the supply of products with a high degree of processing and environmental friendliness. These can be both ready-to-consume goods and extraction products and components for the production of final products. Of course, such productions already exist in Ukraine. But they are clearly not enough to process at least half of the exported raw materials.

CONCLUSIONS

The Russian invasion of Ukraine in 2022 started one of the largest and most destructive wars in the world since World War II. But Ukraine managed to avoid macro-financial destabilization and diversify the sources of financing expenses, which will keep the economy from further decline and have a positive impact on the prospects of post-war recovery.

The consequences of a full-scale war became catastrophic for the entire economy of the country, especially for agriculture due to the specifics of this industry. The main challenges for it during the Russian military aggression are colossal losses in the form of: annihilated equipment and buildings (including granaries), crops, irrigation facilities, processing enterprises, energy facilities, animals and livestock farms, grain stocks and

their theft; destructed port territory and infrastructure, reservoirs, biological resources; blockade of sea ports, what strongly inhibits the export of Ukrainian agricultural products.

These challenges create a number of problems for producers of agricultural products due to the lack of financial resources created by these challenges, the increase in prices for fertilizers, fodder and other technologically necessary materials; reduction of the area of the used areas due to their chemical pollution and mechanical destruction and difficulty of access to them due to their mining and to agricultural animals – due to the occupation of the territory; decrease in the number of farm animals; difficulty and increase in the cost of logistics. Damages to Ukrainian agriculture from Russia's military actions on its territory continue to grow, as the war is not over yet.

The challenges and related problems in the development of agriculture during the war in Ukraine have both domestic and global significance, since Ukrainian agricultural export forms almost half of the country's foreign exchange earnings and occupies a significant place in the world export of agricultural products, and the decrease in the volume of this export has a strong influence on the deterioration of the financial condition of agricultural producers, and, accordingly, of food products in the country and the state of food security in the world, and, accordingly, exacerbates the problems of hunger for a large part of the world's population.

The reaction of the agrarian economy of Ukraine to the mentioned challenges and related problems is the search for new possibilities for solving logistical problems, changing the structure of production and diversifying areas of specialization, including at the expense of their high-margin nicheization, activation of organic and bioenergy areas of specialization, which, accordingly, will change the structure of exports, intensive development of the processing industry with the aim of increasing the share of finished products with high added value in the export structure of these products.

The role of small producers of agricultural products, who showed greater mobility and reactive adaptability during the war, is expected to grow, which is facilitated by the structure of aid from foreign partners, which is specifically aimed at this sector of producers. This, accordingly, increases the role of the development of cooperation in all spheres of the agrarian economy.

Despite the war, Ukraine managed to preserve its agriculture and remain a global supplier of agricultural products, primarily of grain. The restoration and further development of the agricultural sector of the Ukrainian economy should be based not only on the goals of increasing production and exports, but also on ensuring the long-term sustainable development of Ukraine on the way to EU membership, taking into account its requirements and the need for a qualitatively new level of this development.

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WYZWANIA DLA ROLNICTWA UKRAINY W CZASIE WOJNY I KIERUNKI JEGO ROZWOJU

Słowa kluczowe: Ukraina, wojna, rolnictwo, bezpieczeństwo żywnościowe, wyzwania, straty, kierunki rozwoju

ABSTRAKT. Celem badań było usystematyzowanie wiedzy o skutkach rosyjskiej agresji militarnej, jako olbrzymiego wyzwania dla rolnictwa Ukrainy oraz nakreślenie perspektyw i kierunków rozwoju tej branży w czasie wojny i okresie powojennym. Przedmiotem badania były zjawiska zachodzące w Ukrainie w okresie rosyjskiej agresji militarnej, powodujące wiele negatywnych konsekwencji, m.in. dla rolnictwa, którego produkcja stanowi główny udział w eksporcie żywności. Zastosowano metody opisowo-analityczne, indukcji i dedukcji, a także dokonano syntezy uzyskanych wyników. W efekcie przeprowadzonych badań usystematyzowano wiedzę nt. skutków rosyjskiej inwazji na Ukrainę dla rolnego sektora gospodarki, określono wyzwania dla producentów produktów rolnych, zidentyfikowano także rozmiar tych skutków i ustalono trendy w rozwoju branży. Główne skutki rosyjskiej agresji militarnej dla rolnictwa, to przede wszystkim: zniszczenie sprzętu, budynków, przedsiębiorstw przetwórczych, obiektów energetycznych, zapasów produktów, plonów, zwierząt, a także ich kradzież. Poza tym ogromnym wyzwaniem są zanieczyszczenia obszarów rolniczych, zrujnowanie infrastruktury portowej i zbiorników wodnych oraz blokowanie portów morskich. Skutki wojny stwarzają wiele problemów dla producentów rolnych, m.in. ze względu na: brak środków finansowych, rosnące ceny nawozów, pasz i innych materiałów, zmniejszenie powierzchni użytków rolnych w związku z ich zanieczyszczeniem chemicznym i mechanicznym oraz utrudniony dostęp do pól i zwierząt gospodarskich – w związku z okupacją terenu, a także zmniejszenie liczby zwierząt gospodarskich, komplikacja i wzrost kosztów logistyki.

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