The Impact of the Russian-Ukrainian War on Global Food and Environmental Security

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Abstract: - The global war has disrupted trade, production, and consumption, leading to increased commodity prices and a threat to global food security. The article examines the long-term consequences of the war on global food and environmental security, focusing on disruptions in food markets and infrastructure destruction. The study utilizes the FAOSTAT database and food security indicators to assess the state of food security in Russia and Ukraine from 2010 to 2021. The results reveal numerous negative direct and indirect effects on food and environmental security, with the Middle East and North Africa (MENA) being among the most affected regions. Prior to the Russian invasion in February 2022, Ukraine was a major grain exporter to the MENA region. However, the war caused extreme volatility in food insecurity. Among the key consequences of the war, it should be mentioned about the decrease in the volume of production of agricultural products in Ukraine due to the reduction of cultivated areas as a result of blockades and destruction, which led to export restrictions, and loss of producers' income. The countries of the Global South are most vulnerable to the food crisis (Turkey, Egypt, Georgia, Tunisia, Morocco, Libya), given the significant import dependence on Ukraine and the significant increase in product prices. The war has also resulted in pollution of water and land resources, air contamination, supply and sewage problems, and deteriorating sanitary conditions.

Key-Words: - food security, environmental security, Russian-Ukrainian war, food crisis, environmental disaster

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1 Introduction

The war has affected global trade dynamics, production volumes, and consumption patterns, causing commodity prices to rise in 2022-2023 and threatening global food security. The destruction of infrastructure and hostilities also harm the environment, biodiversity, and land resources. Environmental safety has been compromised in the frontline and adjacent areas, and Russia's terrorist actions have led to air and water pollution and soil degradation, [1]. Thus, food and environmental security are closely linked, especially in the context of food production and consumption of natural resources. According to preliminary estimates, the war has resulted in total losses to agriculture of USD 2.2 billion, with cumulative losses amounting to USD 28.3 billion, [2]. Among the consequences are the complete or partial destruction of warehouses, machinery and equipment, livestock and perennial plantations, theft of material and technical products, and the need for reclamation of agricultural land, [3]. Among the losses are production losses, including unharvested crops and winter crops, as well as an increase in the cost of agricultural production, which negatively affects Ukraine's agricultural exports.

To understand the overall impact of military operations on food security, it is advisable to analyze the long-term consequences of disruptions in global food markets and the destruction of infrastructure on global food and environmental security.

The purpose of the present academic paper is to identify the key consequences of the impact of the Russian-Ukrainian war on global food and environmental security. The study systematizes the major negative consequences of the Russian-Ukrainian war on global food security, in particular, it confirms the growing vulnerability of the food system.

2 Literature Review

Ukraine – Russia war impact on food security

The Russian-Ukrainian war has harmed the socioeconomic system at the international level, in particular, causing a food crisis, creating challenges for various countries, especially those dependent on food imports (countries of the Middle East and North Africa (MENA), [4]. The total world wheat production of Ukraine and Russia is about 30%, [5]. African countries import all their wheat from Ukraine and Russia: Lebanon, Egypt, and Tunisia import significant volumes of wheat from Ukraine (81%, 85%, and 50% of total wheat imports, respectively), [5]. Some of the world's most food-insecure countries, such as Yemen, Sudan, and Bangladesh, are heavily dependent on wheat imports from Russia and Ukraine. This leads to social and economic problems in terms of short-, medium- and long-term food security, [6]. The rapid development of the global market for organic products provides new opportunities for Ukraine, [7]. Machine-building enterprises also suffer from military actions, so management with a spatial approach was introduced, [8]. With the help of strategic planning in national security, it is possible to improve the state system in the conditions of informatization of society, [9], as well as the financial and economic security of financial markets at the stage of European integration, [10]. When forming strategic issues, one should not forget about the environmental issues of globalization, [11], and atmospheric air pollution, [12]. Prices in food markets are rising due to disruptions in the supply chain, and in some countries, yields have declined with high global demand, [4]. Among the direct consequences of the war are the following: reduction of Ukrainian exports, labor shortages due to migration from Ukraine, the uncertainty of future yields, [4], reduction of grain exports from countries, changes in the volume of global fertilizer supplies from Belarus and the Russian Federation, and rising food prices, volatility of basic foodstuffs and fertilizers, growing uncertainty in various markets, intensification of competition in the global food market due to the actions of two key players (China and India), whose foreign demand for food is growing, [6], [13], [14]. In, [15], authors identified the effects of the war on the area and the expected yield of winter crops based on data from 10,125 village councils in Ukraine and satellite imagery. Under the war, the area under winter crops decreased from 9.35 million hectares to 8.38 million hectares, only 14% of which can be attributed to the direct effects of the conflict. The combined reduction in area and yields due to the war will lead to losses of up to 17% of the winter wheat harvest, assuming that the 2022 winter wheat crop is fully harvested, [15].

The Food and Agriculture Organization of the United Nations (FAO), [16], believes that food security is achieved when all people have consistent

physical and economic access to sufficient, safe, and nutritious food at all times. This allows them to meet their dietary needs and taste preferences for an active and healthy lifestyle. The four pillars of food security are availability, accessibility, utilization, and sustainability (Figure 1). That is, FAO identifies four factors that affect food security. The first factor is food availability - the availability of sufficient quantities of food of adequate quality supplied by national or imported producers (including humanitarian aid). The next factor is the affordability of food. It means that individuals have access to resources necessary and sufficient to obtain food for a balanced diet. An equally important factor is the rational use of food. It means meeting all the physiological needs of the body through a balanced diet. The last factor is stability - the absence of risks of losing access to food in the foreseeable future, [17].

Ukraine – Russia war impact on ecology security

The destruction of commercial, industrial, and private infrastructure during the war has led to the pollution of water and land resources, which is dangerous for human health and the ecosystem, [18], [19]. As a result of the hostilities, power outages, and the destruction of civilian homes in Ukraine, there are problems with the water supply and sewage, and sanitary conditions have deteriorated. Constant bombardment and troop movements harm air quality and land resources. This, in turn, makes it impossible for the civilian population to grow agricultural products, [20], [21]. The terrorist actions of Russian troops increase the risks and probability of radiation leaks from nuclear facilities. For instance, military operations near Zaporizhzhia Nuclear Power Plannt and Chornobyl have increased the threat of radiation leakage, [22]. The chemical, biological, and physical characteristics of the soil were also affected by the explosions and shelling. Consequently, agriculture, industrial production, and logistics have been negatively affected. The hostilities have caused large-scale forest fires and forest destruction, [20]. Biodiversity is negatively impacted by intensive deforestation and the destruction of natural habitats with potential consequences for wildlife. Studying plant defensiveness through structuralism could reduce the negative impact, [23]. Bombing, trenching, and tunneling are likely to negatively impact soil degradation and landscape morphology, [22]. In the long term, there are risks of biodiversity loss and species extinction, especially in the Askania Nova nature reserve, which was occupied on March 20, 2022. The war hinders the implementation of environmental protection and pollution control measures at the local and global levels, [20]. Continuation of intense hostilities could lead to catastrophic environmental consequences, spreading to other countries, such as Moldova and Russia. The literature has published evidence of severe air pollution and greenhouse gas emissions as a result of hostilities, [22].

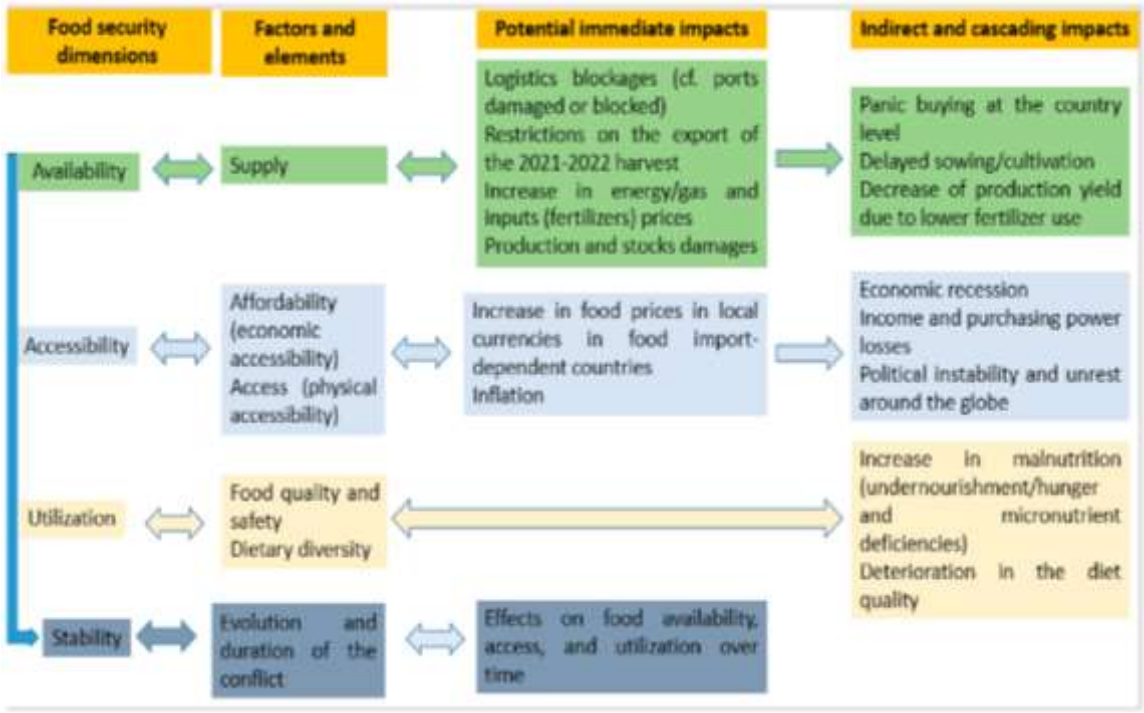

Fig. 1: Impacts of Russia–Ukraine War on global food security
Source: [4], [16], [17].

3 Methodology

A systematic approach to determining the consequences of the Russian-Ukrainian war on global food and environmental security is applied in the academic paper. At the first stage, the authors conduct a literature review to systematize the available studies on direct and indirect losses caused by the war. Particular attention in the systematization is paid to the influence of the conflict on environmental security, given the lack of quantitative data and assessments that would allow for a more accurate analysis of the consequences. In the second stage, a statistical analysis of the state of food security in Russia and Ukraine was conducted using quantitative data. The analysis contributed to understanding which countries will be most affected by the food crisis, given their dependence on food imports from Ukraine.

In the study, the FAOSTAT database and the system of food security indicators by the following dimensions were used: Stability, Feature indicator / Access. These dimensions made it possible to assess the state of food security in the Russian Federation and Ukraine for the period 2010-2021, which affected the situation with food supply in the context of war. Thus, the coefficient of dependence on grain imports made it possible to estimate the import of available domestic food stocks of grain and the volume of the country's production. The coefficient is calculated as grain imports – grain exports)/(grain production + grain imports – grain exports) * 100. The indicator of variability of food supply per capita made it possible to compare the variation of food supply in the world, the Russian Federation, and Ukraine for 2010-2021. Besides, the indicator of the total volume of Ukraine's foreign trade turnover with different countries of the world in 2017-2021, the volume of agricultural production in Russia and Ukraine were estimated, and the dynamics of food price variability for the period 01/01/2018 - 04/06/2023 were presented.

Food security indicators are systematized by the following dimensions:

1. Stability: Cereal import dependency ratio (percent) (3-year average), Per capita food production variability (constant 2014-2016 thousand int$ per capita), Per capita food supply variability (kcal/cap/day), Political stability and absence of violence/terrorism (index), Value of food imports in total merchandise exports (percent) (3-year average).

2. Feature indicator: Prevalence of moderate or severe food insecurity in the total population (percent) (3-year average), Number of moderately or severely food insecure people (million) (3-year average), Number of severely food insecure people (million) (3-year average).

In the third stage of the research, the authors discuss the impact of the war with similar studies, which have confirmed the vulnerability of the global food system, especially in countries dependent on Ukrainian food imports.

4 Results and Discussion

Food security in Ukraine and Russia

Food security is one of the most important components of any state's national security. In 2021, almost 400 million people in the world received food provided by the export of agricultural products from Ukraine to the world market. The war provoked by the Russian Federation in Ukraine has led to the destruction of the systems of production, processing, and supply of agricultural products to the international market, [24].

The war in Ukraine has shocked not only all countries of the world but also negatively affected the economies of most of them. With the outbreak of hostilities, a large number of companies suspended their operations, which in turn led to the destruction of logistics. One of the main logistical challenges is the blocking of agricultural transportation across the Black Sea from Ukrainian ports in Odesa, Mykolaiv, and Kherson, which were previously used by Ukraine for almost all of its food exports.

Currently, Ukraine is one of the world's most important exporters of grains, namely wheat, barley, and corn, and is also the largest exporter of sunflower oil. Some countries in the world are more dependent on Ukraine than others: imports of Ukrainian wheat are crucial for countries in the Middle East, such as Egypt; Ukraine's share of total world imports of wheat flour to this country is 44%, corn - 55%, and sunflower oil - 59%. Ukraine's key trading partners include China, India, the Netherlands, Turkey, Egypt, Poland, and Spain (Table 1, Appendix).

According to the UN Food and Agriculture Organization (FAO), in 2021 Ukraine became the world's largest exporter of sunflower oil (almost 35%), ranked second in barley exports (14%), third in corn exports (11%), as well as fourth in rapeseed

exports (over 10%) and fifth in wheat exports (almost 10% of world exports), [25].

According to the Global Food Security Index, Ukraine, having received a record harvest of grains and oilseeds in 2021 (107 million tons), ranked only 58th, [25]. Although Ukraine has high indicators of food availability, quality, and safety, its indicators of resources and sustainable development are significantly lower than those of other countries. These indicators did not allow Ukraine to rank higher on the Global Food Security Index. Before the war, the Russian Federation had a negative coefficient of dependence on grain imports, which amounted to -59.2% for the period from 2010 to 2021. At the same time, in Ukraine, this coefficient was -174.10%, [25], which indicates a high dependence of other countries on grain imports from Ukraine.

Meanwhile, the number of people with moderate or acute food insecurity is high in Russia and Ukraine: 9.66 million and 9.10 million people in 2016-2021, [25]. War conditions have significantly worsened the food security situation, increasing the number of food-insecure people. As the authors of the study, [26], show, at the lowest level of war duration and sanctions, the direct and indirect effects could lead to 67.3 million people being undernourished (which is close to the total population of France). 316.7 million people could suffer from extreme food insecurity (close to the total population of Bangladesh and Russia). Among the affected population, almost 95% come from developing countries, which indicates the risks to the food supply in these countries, [26]. Ukraine has a much higher indicator of variability in food production per capita - 43.08 thousand dollars per capita, while in the Russian Federation, it is 20.48 thousand dollars per capita, [17]. The Russian Federation and Ukraine also have different indicators of the variability of food supply per capita, 28.8 kcal/person/day and 21.6 kcal/person/day, respectively. Ukraine has a much lower indicator of political stability and the absence of violence/terrorism - -1.28 for 2010-2021, while the Russian Federation - -0.69 for the same period, [17]. Ukraine has a much higher prevalence of moderate or severe food insecurity among the population - 20.61%, while in the Russian Federation, it is 6.62%, [17]. The value of food imports in Ukraine's total merchandise exports amounted to 7.75%, while in the Russian Federation, it was 6.25%, [17]. Thus, Ukraine has significantly higher food security indicators, especially in terms of grain availability, food production, and supply. Meanwhile, the high level of instability has harmed Ukraine's food security indicators and, accordingly, has affected countries dependent on imports of grain and other food products. The Food Security Indicators in Ukraine and Russia 2010–2021 are presented in Table 2 (Appendix).

The volume of agricultural production in the Russian Federation grew annually by 6.36% on average in 2017-2021, in Ukraine - by 18.51% over the past five years, and in the world as a whole - by 4.89%, [16], (Table 3, Appendix). Herewith, the share of agricultural production in Ukraine amounted to 0.79% on average for 2017-2021, gradually increasing, [16]. The Russian Federation's figure was 2.04% on average for the same period, which, given the territory of both countries, indicates Ukraine's significant agricultural advantages in providing food to other countries.

Over the period 2011-2021, the Agricultural Production Index grew both globally and in Russia and Ukraine (Figure 2). According to a study by the European Commission, the war harmed production in one quarter (25%) of the surveyed farms, [3]. Every fourth respondent reported a reduction or cessation of production, and this trend is more pronounced in the frontline regions, where every third respondent reported a reduction in activity (38%).

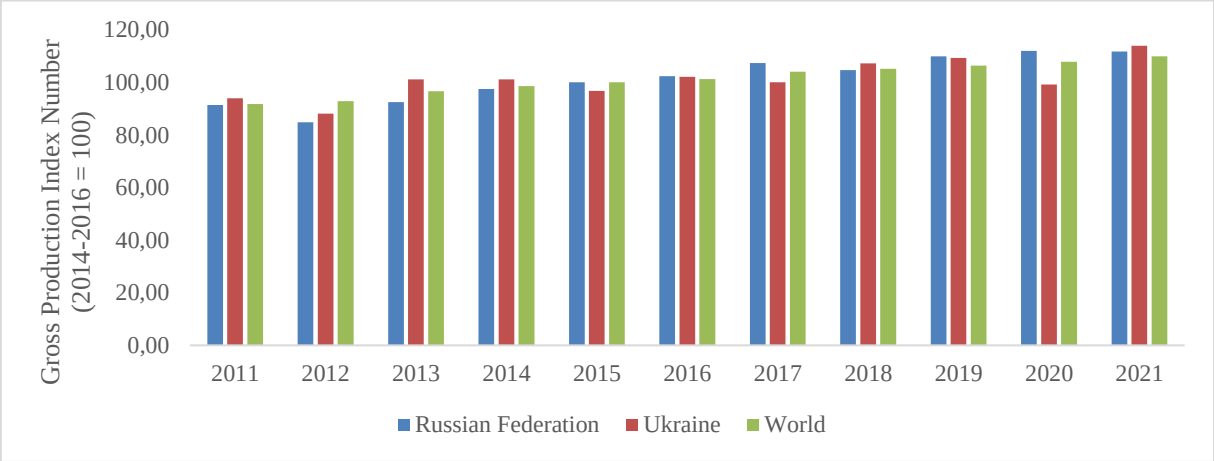

Fig. 2: Production Indices of agriculture in Russia, Ukraine, world, 2017-2021,
Source: [27].

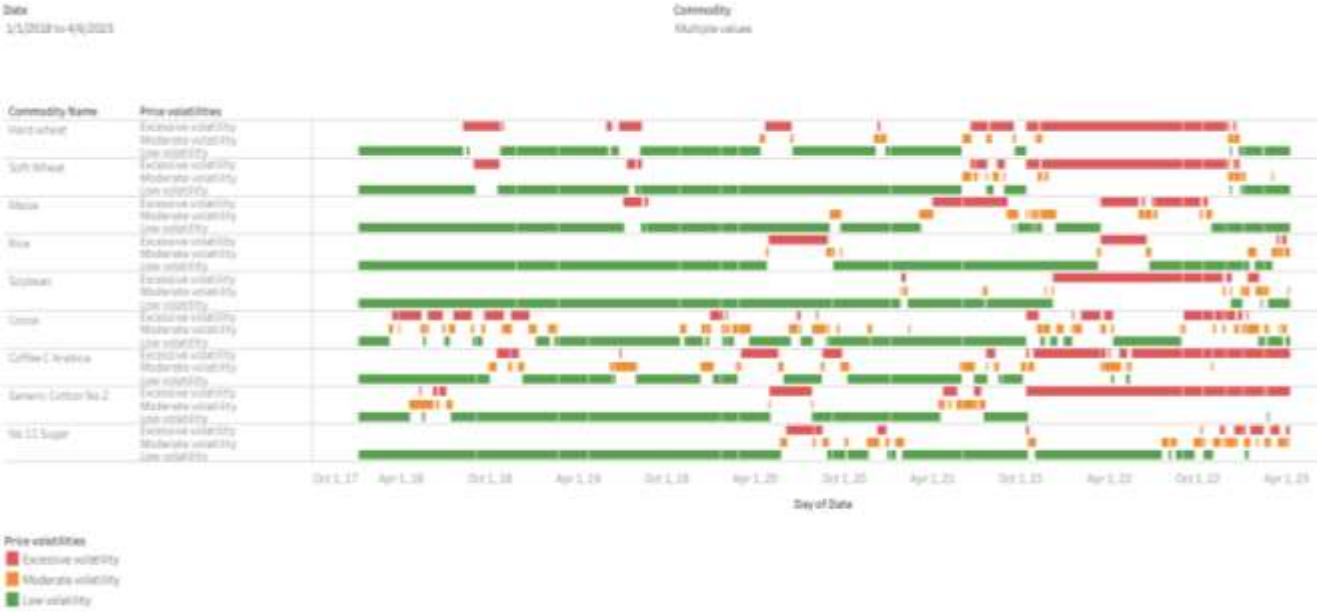

Fig. 3: Excessive food price variability early warning system 01/01/2018 – 04/06/2023
Source: [30].

The decline in agricultural production is indirectly evidenced by the reduction in the area under crops in 2022 by -5377 thousand hectares (-22%) in Ukraine. At the same time, in 2018-2021, this indicator increased by 2% on average per year, [28]. In addition, the production of basic livestock products decreased in Ukraine in 2022, namely: meat (in slaughter weight) -231,6 thsd. tons; milk -946,2 thsd. tons; eggs -2149,5 mln. pieces; wool -260,0 tons. According to data from the State Statistics Service of Ukraine, the agricultural production index in 2022 was 75% to the previous year, [29]. Accordingly, this situation affected producers' incomes and increased their expenses for crop production and livestock breeding. More than a third of households reported a sharp or significant decrease in income: 53% of respondents reported a decrease in June-September 2022. 72% of respondents engaged in crop production and 64% of respondents engaged in livestock production report an increase in production costs, [3].

Total losses and damages to rural households in the first six months of the war were estimated at USD 2.25 billion, of which USD 1.26 billion was in crop production and USD 0.98 billion in livestock production. The largest losses were recorded in the

cattle sector, which accounted for more than 64% of the total value of losses in the livestock sector. The grains and oilseeds sub-sector lost more than 67% of the total value loss in the crop sector, [3]. Volatility in grain prices is also growing significantly (Figure 3), which increases the risks of a decline in global trade and a food crisis. The war unleashed by the Russian invaders against Ukraine has caused a sharp rise in wheat and corn prices on the world market, which have already increased by more than 20%. This, in turn, has led to an increase in the cost of basic foodstuffs, especially in third-world countries, [24]. The results of the study, [31], show that, on average, a 1% decrease in global wheat trade can lead to a 1.1% increase in wheat producer prices. At the same time, a 1% increase in producer prices could lead to a 0.59% reduction in annual per capita wheat consumption, a 0.54% reduction in daily calorie consumption, and a 0.64% reduction in protein consumption. In general, in the context of war, a 50% reduction in wheat exports by Russia and Ukraine could lead to a 15% increase in producer prices for wheat, which would result in a reduction in wheat consumption and food energy consumption by at least 8%, [31]. Another scientific work reveals the acute tangible impact of the Ukrainian-Russian war in 2022 on the global food system, [32]. The vulnerability of the food system was manifested in significant disruptions in the supply chain of fertilizers and food products, especially grains. As a result, the poorest people in the Global South have suffered more than others, [32]. As the results of this research show, this vulnerability is caused by the blockade of seaports in the South and restrictions on exports from Ukraine. In particular, according to satellite observations, the restrictions and reduction in exports are due to a decrease in wheat production in Ukraine in the 2021-2022 season, [33]. Thus, the study, [34], also concludes that the most negative impact of the war-related food crisis is on the Global South because of the pressure on grain supplies and food prices, [35]. The war will potentially lead to a reduction in trade (60%), an increase in wheat prices (50%), and a food security crisis with a decrease in purchasing capacity (above 30%), especially for countries dependent on grain imports from Ukraine (Egypt, Mongolia, Turkey, Georgia, and Azerbaijan), [33]. This opinion can be confirmed given the sharp/substantial decline (53%) in the incomes of one-third of households in June-September 2022. Moreover, the authors of a recent study, [36], also revealed that the most negative consequences of war are traced to countries with low economic scale and political status, leading to a reduction in significant trade flows.

5 Conclusion

The Russian-Ukrainian war has negative direct and indirect effects on food and environmental security. Among the countries that will suffer the most are the Middle East and North African countries. Ukraine remains one of the world's most important grain exporters (Egypt, Libya, Syria, etc.). Before Russia's invasion in February 2022, Ukraine had significantly higher food security indicators, especially in terms of grain availability, food production, and food supply. The political instability caused by the war has negatively affected food security indicators in Ukraine and led to a decline in global food security. This situation particularly affects countries that depend on imports of grains and other food products. At the lowest level, the duration of the war and the imposition of sanctions could result in 67.3 million people becoming malnourished. Moreover, 316.7 million people may suffer from extreme food insecurity.

Among the negative consequences of the war are the pollution of water land resources, and air, which is dangerous for human health and the ecosystem, problems with the water supply and sewage, and deteriorating sanitary conditions. The war has harmed the state of land resources, making it impossible for civilians to grow agricultural products. Thus, it was found that more than a third of households in the frontline areas reported a sharp or significant reduction in income: 53% of respondents reported a decrease between June and September 2022. 72% of crop farmers and 64% of livestock farmers reported an increase in production costs. The total losses, including losses of agricultural enterprises in the first six months of the war, are estimated at USD 2.25 billion.

Ensuring global food security is possible only if the war unleashed by the aggressive Russian Federation against Ukraine ends and the occupied territories are liberated. To do this, the world must guarantee the security and integrity of Ukraine, to provide global assistance in demining and reclaiming fertile land in the de-occupied territories. In addition, it is necessary to provide preferential loans to farmers to restore equipment and production facilities damaged or destroyed as a result of the hostilities. It is also necessary to provide foreign investors with preferential loans to restore the infrastructure for the storage, transportation, and processing of crop and livestock

products. It is equally important to introduce the latest advanced technologies for growing and processing agricultural products to promote high-value-added exports, particularly in the meat and dairy sector, products of small agricultural enterprises, producers of craft products, and niche crops. To ensure the uninterrupted and safe export of agricultural products by sea, it is necessary to engage the international community and modernize logistics routes, in particular, to bring the width of the Ukrainian railway gauge to European standards with the involvement of foreign capital. With the support of the international community, it is essential to create conditions for constant, uninterrupted, and safe exports of agricultural products by sea, protecting against the possible blocking of ports by aggressive countries.

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Appendix

Table 1. The total volume of foreign trade turnover of Ukraine with different countries of the world in 2017-2021, thousand USD

Partner Countries	2017	2018	2019	2020	2021	Average 2017-2021	Average share, %
China, mainland	1106832	1292270	2075357	3720102	4383063	2515524,8	9,60
India	2043273	1966632	1636045	1590762	2047420	1856826,4	7,09
Netherlands	1441358	1349473	1700492	1674919	1936293	1620507	6,18
Türkiye	1193389	1157298	1926344	1515615	1846855	1527900,2	5,83
Egypt	1282430	924049	1715690	1414257	1610785	1389442,2	5,30
Poland	886481	1024161	1247694	1484295	1706255	1269777,2	4,85
Spain	1115930	1138485	1341380	1147454	1348545	1218358,8	4,65
Germany	762013	1073288	1284991	985927	1254624	1072168,6	4,09
Italy	910845	940898	1047381	1027179	1223110	1029882,6	3,93
Indonesia	505205	655377	715937	728732	979130	716876,2	2,74
Belarus	505591	590869	660543	581475	617445	591184,6	2,26
France	439593	542860	603637	601987	750513	587718	2,24
Belgium	382201	505882	584616	460012	515724	489687	1,87
Saudi Arabia	356582	586729	386249	396535	616273	468473,6	1,79
Iran	542311	437181	226455	279714	617648	420661,8	1,61
Israel	417304	346371	467916	389651	458916	416031,6	1,59
United Kingdom	250007	284814	353100	455357	653057	399267	1,52
Iraq	184325	355202	337042	398866	469101	348907,2	1,33
Bangladesh	364374	203011	442139	348546	240111	319636,2	1,22
Georgia	297523	352460	310462	290185	330091	316144,2	1,21
Tunisia	271006	305366	310191	358747	315258	312113,6	1,19
Morocco	208642	342077	269897	339283	392547	310489,2	1,18
Libya	202540	301093	263027	297403	372021	287216,8	1,10
United States of America	187839	230088	281305	303360	333669	267252,2	1,02
Republic of Moldova	235601	247114	242729	242475	288352	251254,2	0,96

Source: [25].

Table 2. Food Security Indicators in Ukraine and Russia 2010–2021

Country	Food security dimension	Indicator	2010-2012	2016-2018	2017-2019	2018-2020	2019-2021	Average 2010-2021
Russian Federation	Stability	Cereal import dependency ratio (percent) (3-year average)	-36,90	-68,10	-72,60	-	-	-59,20
	Feature indicator / Access	Number of moderately or severely food insecure people (million) (3-year average)	-	11,53	10,27	8,80	8,03	9,66
	Feature indicator / Access	Number of severely food insecure people (million) (3-year average)	-	0,87	0,67	0,40	0,43	0,59
	Stability	Per capita food production variability (constant 2014-2016 thousand int$ per capita)	43,60	18,20	8,40	11,70		20,48
	Stability	Per capita food supply variability (kcal/cap/day)	44,00	19,00	14,00	14,00	17,00	21,60
	Stability	Political stability and absence of violence/terrorism (index)	-1,00	-0,64	-0,54	-0,56	-0,73	-0,69
	Feature indicator	Prevalence of moderate or severe food insecurity in the total population (percent) (3-year average)	-	7,90	7,07	6,00	5,50	6,62
	Stability	Value of food imports in total merchandise exports (percent) (3-year average)	7,00	6,00	6,00	6,00	-	6,25
Ukraine	Stability	Cereal import dependency ratio (percent) (3-year average)	-79,20	-201,20	-241,90	-	-	-174,10
	Feature indicator / Access	Number of moderately or severely food insecure people (million) (3-year average)	-	9,60	8,13	8,73	9,93	9,10
	Feature indicator / Access	Number of severely food insecure people (million) (3-year average)	-	0,90	0,73	1,07	1,40	1,03
	Stability	Per capita food production variability (constant 2014-2016 thousand int$ per capita)	55,30	43,00	40,90	33,10	-	43,08
	Stability	Per capita food supply variability (kcal/cap/day)	76,00	17,00	17,00	14,00	20,00	28,80
	Stability	Political stability and absence of violence/terrorism (index)	-0,07	-1,87	-1,87	-1,42	-1,16	-1,28
	Feature indicator	Prevalence of moderate or severe food insecurity in the total population (percent) (3-year average)	-	21,50	18,30	19,90	22,73	20,61
	Feature indicator	Prevalence of severe food insecurity in the total population (percent) (3-year average)	-	2,00	1,60	2,50	3,17	2,32

	Stability	Value of food imports in total merchandise exports (percent) (3-year average)	7,00	7,00	8,00	9,00	-	7,75

Source: [17].

Table 3. Value of Agricultural Production in Russia, Ukraine, world, 2017-2021, million US dollars

Area	2017	2018	2019	2020	2021	Total Value	Average Growth rate, %
Russian Federation	77614,90	75053,57	81876,84	81604,84	97898,05	414048,20	6,36
Ukraine	24646,98	28688,11	30319,74	30309,04	46063,82	160027,68	18,51
World	3684101,79	3738234,65	4151990,59	4227958,85	4447470,31	20249756,18	4,89
Russian Federation share, %	2,11	2,01	1,97	1,93	2,20	2,04	-
Ukraine share, %	0,67	0,77	0,73	0,72	1,04	0,79	-
Growth rate, %							
Russian Federation	-	-3,30	9,09	-0,33	19,97	-	-
Ukraine	-	16,40	5,69	-0,04	51,98	-	-
World	-	1,47	11,07	1,83	5,19	-	-

Source: [16].

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IK conceived of the presented idea. AK developed the theoretical formalism, VS performed the analytic calculations and VD performed the numerical simulations.

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Conflict of Interest

The authors have no conflict of interest to declare.