

Міжнародні економічні відносини

UDC 338.14

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## **THE AGRICULTURAL SECTOR OF UKRAINE DURING A FULL- SCALE WAR АГРАРНИЙ СЕКТОР УКРАЇНИ ПІД ЧАС ПОВНОМАСШТАБНОЇ ВІЙНИ**

**Summary.** *The agricultural sector is one of the most important branches of Ukraine's economy, which provides a significant part of the country's gross domestic product and is a key element in ensuring the nation's food security. It also provides the production of raw materials for industry and energy, which*

*helps ensure the country's economic stability. However, with the start of a full-scale war in 2022, the agricultural sector became one of the most affected sectors of the Ukrainian economy. The purpose of the study is to study the impact of the war on the agricultural sector of Ukraine, in particular on the production and export of agricultural products, the state of the industry and the prospects for its development in the conditions of the war. The consequences of the war on the agricultural sector, in particular, a decrease in production and exports, an increase in production costs, a decrease in the availability of credit, and other negative effects were studied. The article carries out a SWOT analysis of the agricultural sector in the conditions of war, identifies the main problems and prospects for the development of the industry. In particular, positive dynamics in the development of certain categories of agricultural products in 2022 were revealed, but the general state of the industry remains at risk due to the negative consequences of the war. The results of the study can be useful for specialists in the agricultural sector, government bodies, as well as for everyone who is interested in the development of the Ukrainian economy in wartime conditions.*

*In addition to the analysis of the negative consequences of the war on the agricultural sector, the article examines the impact of the war on the socio-economic indicators of Ukraine in general, in particular on inflation, on the world and regional markets of agricultural products and how it affects Ukraine's export opportunities. Since the agricultural sector is one of the most important sectors of the Ukrainian economy, understanding the impact of the war on this sector will allow us to draw conclusions about the general impact of the war on the economy of Ukraine and the appropriateness of production and social mechanisms under the influence of the conflict.*

*The article also draws attention to the role of state policy in supporting the agricultural sector in wartime conditions. The study notes the need for the effective use of state support tools, such as subsidies, lending, investment incentives, etc., to preserve and increase the production of agricultural products.*

**Key words:** *Ukraine, Agricultural production, Agrarian sector, War, Markets, Infrastructure, Economy, Economic consequences, Consequences of war, Farming.*

**Анотація.** *Аграрний сектор є однією з найважливіших галузей економіки України, яка забезпечує значну частину валового внутрішнього продукту країни та є ключовим елементом забезпечення продовольчої безпеки нації. Він також забезпечує виробництво сировини для промисловості та енергетики, що допомагає забезпечувати економічну стабільність країни. Проте, з початком повномасштабної війни в 2022 році, аграрний сектор став одним з найбільш постраждалих галузей економіки України. Метою дослідження є вивчення впливу війни на аграрний сектор України, зокрема на виробництво та експорт аграрної продукції, стан галузі та перспективи її розвитку в умовах війни. Досліджено наслідки війни на аграрний сектор, зокрема зменшення виробництва та експорту, збільшення витрат на виробництво, зменшення доступності кредитування та інші негативні впливи. У статті проведено SWOT аналіз аграрного сектору в умовах війни, визначено основні проблеми та перспективи розвитку галузі. Зокрема, виявлено позитивну динаміку у розвитку певних категорій аграрної продукції в 2022 році, проте загальний стан галузі залишається під загрозою через негативні наслідки війни. Результати дослідження можуть бути корисні для фахівців у галузі аграрного сектору, державних органів, а також для всіх, хто цікавиться розвитком української економіки в умовах війни.*

*Додатково до аналізу негативних наслідків війни на аграрний сектор, у статті розглядається імпакт війни на соціально-економічні показники України загалом, зокрема на інфляцію, на світові та регіональні ринки сільськогосподарської продукції та як це впливає на експортні можливості України. Оскільки аграрний сектор є одним з найважливіших галузей*

*економіки України, розуміння впливу війни на цю галузь дозволить зробити висновки про загальний вплив війни на економіку України та належність виробничих та соціальних механізмів під впливом конфлікту.*

*Також у статті звертається увага на роль державної політики в підтримці аграрного сектору в умовах війни. Дослідження відзначає необхідність ефективного застосування інструментів державної підтримки, таких як субсидії, кредитування, стимулювання інвестицій тощо, для збереження та підвищення виробництва аграрної продукції.*

**Ключові слова:** *Україна, Сільськогосподарське виробництво, Аграрний сектор, Війна, Ринки, Інфраструктура, Економіка, Економічні наслідки, Наслідки війни, Фермерство.*

**Formulation of the problem.** The agricultural sector of Ukraine is an important component of the national economy and ensures not only the country's food security, but is also a key export industry. The conditions of a full-scale war significantly complicate the functioning of agriculture and complicate the work of farmers and enterprises in the agrarian sector.

The war in Ukraine has had a significant impact on the country's agricultural production. Despite challenges such as disruption of supply chains, loss of access to markets, and damage to infrastructure, the sector has shown resilience and continued to contribute to the country's economy. The government has implemented measures to support farmers, including subsidies and loan programs, and has also encouraged the development of alternative markets and export routes. However, ongoing war and political instability continue to pose challenges to the agricultural sector's long-term growth and sustainability.

Despite this, the agricultural sector of Ukraine has the potential to overcome the challenges that arise in the conditions of war. One of the ways is the transition to more efficient production methods, the use of the latest technologies and mechanisms that can help increase productivity and work

efficiency. In addition, it is important to interact with other players in the market, look for new sales markets and invest in the development of agriculture.

**Analysis of recent research and publications.** Regarding the problematic issues of the functioning and development of the domestic agro-industrial complex, considerable attention was paid to the work of such domestic scientists as: V. Andriychuk, V. Bogdar, A. Gayuduky, B. Gubskiy, M. Demyanenko, T. Dudar, V. Zbarskiy, S. Kvasha, V. Messel-Veselyak, Y. Nesterchuk, Ya. Oliynyk, B. Paskhaver, P. Sabluk, O. Shpychak and others.

**Formulation of the objectives of the article (statement of the problem).**

The objective of this article is to analyze the impact of a full-scale war on the agrarian sector of Ukraine. Specifically, the article aims to:

- 1) Identify the main challenges and risks that the agrarian sector faces during times of war, including production, distribution, and export issues, as well as the impact on the workforce, infrastructure, and investment.
- 2) Evaluate the effectiveness of the policies and measures implemented by the Ukrainian government and other stakeholders to mitigate the negative effects of war on the agrarian sector.
- 3) Examine the opportunities and potential for growth and development of the agrarian sector in the context of a full-scale war, including alternative markets, new technologies, and innovation.
- 4) Provide recommendations for the Ukrainian government and other stakeholders to strengthen the resilience of the agrarian sector and maximize its contribution to the overall economy during and after the war.

**Presentation of the main material.** The war in Ukraine that began in 2014 has had a significant impact on the country's agricultural production. Prior to the war, Ukraine was one of the largest grain producers and exporters in the world, with a diverse agricultural sector that included livestock, dairy, and horticulture.

Despite these challenges, Ukraine's agricultural sector has shown remarkable resilience in the face of the war. The government has implemented

measures to support farmers, including subsidies and loan programs, to help them cope with the impact of the war. These measures have helped to stabilize the sector and maintain agricultural production levels.

Moreover, the Ukrainian government has encouraged the development of alternative markets and export routes to mitigate the impact of lost access to traditional markets in Russia and other neighboring countries. This has included expanding trade with countries such as China, Turkey, and the European Union.

However, ongoing war and political instability continue to pose challenges to the agricultural sector's long-term growth and sustainability. The war has caused population displacement, which has had a direct impact on the agricultural labor force.

The occupied parts of Luhansk, Donetsk, Zaporizhzhia and Kherson regions are among the most productive agricultural areas in Ukraine, with significant production of grain, vegetables, and fruits. The loss of these areas to occupation has led to a sharp decline in agricultural output, reducing the country's food production capacity, and potentially leading to food shortages and higher prices.

The occupation of these regions has led to the displacement of farmers and other agricultural workers, further impacting the agricultural sector's productivity. The occupying forces have seized land and resources, and have deliberately destroyed crops and livestock, causing further losses for the local farmers and communities.

The ongoing missile attacks on energy facilities in the remaining regions have disrupted the country's energy supply, leading to blackouts and power outages. This has severely impacted the functioning of agricultural machinery and irrigation systems, which rely heavily on electricity, and has led to significant crop losses.

The war has also led to disruptions in transportation networks, making it difficult to transport agricultural products to markets both domestically and



internationally. This has further impacted the agricultural sector's profitability, as well as limited the availability of food for the population [1].

The agricultural sector of Ukraine has suffered significant economic losses and actual food shortages for the population due to the ongoing war and the occupation of vital agricultural regions.

Agricultural machinery and irrigation systems rely heavily on electricity, and power outages caused by energy supply disruptions have led to significant crop losses. Without power, irrigation systems have been unable to provide the necessary water for crops, causing them to wilt or die. Harvesting and processing equipment also require electricity to function, so power outages have led to delays in harvesting and processing crops, further reducing agricultural output.

Energy supply disruptions have also impacted the transportation of agricultural products to markets. Without electricity, refrigerated storage facilities and transportation networks have been unable to function properly, leading to spoilage and loss of crops. This has further impacted the agricultural sector's profitability and limited the availability of food for the population.

Moreover, the impact of energy supply disruptions on the agricultural sector has extended beyond the short-term effects of the war. Power outages and the destruction of energy infrastructure will take months or even years to fully recover, resulting in long-term impacts on the productivity and profitability of the agricultural sector [2].

The agricultural sector in Ukraine has been significantly affected by the ongoing missile attacks on energy facilities, resulting in the disruption of energy supply and causing a range of negative impacts such as substantial crop losses, spoiled food, and reduced profitability.

Transportation networks are essential for moving agricultural products from farms to markets, both domestically and internationally. Disruptions in transportation have led to delays, spoilage, and even the loss of crops. The war

has led to damage and destruction of roads, bridges, and other transportation infrastructure, making it difficult to move agricultural products to markets.

Moreover, the war and occupation have led to the imposition of trade barriers, making it difficult to export agricultural products and limiting the market opportunities for Ukrainian farmers. This has led to oversupply of agricultural products in the domestic market, lowering prices and reducing farmers' profitability.

Furthermore, transportation disruptions have led to increased transportation costs, which have further impacted farmers' profitability. The costs of fuel, labor, and other transportation-related expenses have increased significantly during times of conflict, making it difficult for farmers to transport their products to markets profitably.

Finally, transportation disruptions have also impacted the availability of agricultural inputs, such as fertilizers, seeds, and pesticides, which are essential for crop production. Disruptions in transportation have made it difficult for farmers to access these inputs, leading to reduced yields and lower productivity.

The agricultural sector in Ukraine has been significantly affected by the disruption of transportation networks caused by the ongoing war and occupation, resulting in decreased profitability, surplus of agricultural products in the domestic market, and decreased productivity.

Agriculture is a labor-intensive sector, and the availability of labor is critical to crop production and farm operations. The ongoing war and occupation have led to the disruption of labor markets. This has resulted in a shortage of available labor, making it difficult for farmers to carry out essential farming activities such as planting, harvesting, and processing crops. As a result, there has been an increase in labor costs, as farmers need to pay higher wages to attract available workers. This has impacted farmers' profitability and led to higher prices for agricultural products.



The shortage of labor has also caused delays in crop production and harvesting, leading to reduced agricultural output. This has further impacted the agricultural sector's productivity and profitability, as well as limited the availability of food for the population.

Additionally, the shortage of labor has impacted the implementation of good agricultural practices, such as pest control and disease management, which require significant labor inputs. Without adequate labor, these practices have become difficult to implement, leading to reduced crop yields and increased crop losses.

The agricultural sector has been negatively impacted by the ongoing war and occupation in Ukraine, resulting in a substantial shortage of labor. This has caused reduced productivity, increased labor costs, and the possibility of food shortages for the population.

Export markets for Ukrainian agricultural products are impacted in several ways, including:

- water blockade in the Black and Azov seas by the Russian fleet. This has led to reduced export opportunities for farmers and a reduction in the country's agricultural exports [3];
- transportation disruptions have made it difficult for farmers to transport their agricultural products to export markets. This has led to delays, spoilage, and even the loss of crops, impacting farmers' profitability and reducing the availability of agricultural products in international markets;
- significant crop losses and reduced agricultural output in key agricultural regions. This has resulted in reduced availability of agricultural products for export, impacting Ukrainian farmers' ability to meet the demand from international markets;
- perception of risk among foreign buyers, leading to reduced demand for Ukrainian agricultural products. This has limited the country's ability to generate revenue from agricultural exports.

The continuous war and occupation in Ukraine have had a noteworthy adverse effect on the nation's agricultural exports, which has restricted possibilities for Ukrainian farmers and lead to a decrease in the country's income from agricultural exports.

Trade barriers, disruption of transportation networks, currency devaluation, and supply chain disruptions have all contributed to reduced availability and increased costs of essential inputs for Ukrainian farmers. This has resulted in serious consequences for farmers, including reduced yields, lower productivity, and challenges in maintaining viable businesses. The situation highlights the importance of stable political environments and strong international relationships for the agricultural sector's success, and it will require a concerted effort to address the challenges facing Ukrainian farmers and rebuild their agricultural supply chains.

The war leads to a potential grain crisis in the country and impacting global grain markets. The severity of the crisis will depend on how long the war lasts and the ability of farmers to adapt to changing conditions. Disruption in farming operations, led to a reduction in the area of land planted with crops and lower yields. Farmers are unable to access their fields due to fighting or have been forced to abandon their crops due to the occupation or destruction of infrastructure such as irrigation systems or storage facilities [4].

*Table 1*

**SWOT analysis of Ukraine's economy**

Strengths	Weaknesses
1. Soils (Ukrainian agricultural lands are chernozems with the highest humus content in the world) 2. Climate (a large part of the territory of Ukraine is located in climatic zones that facilitate farming with minimal risks of damage from various natural disasters) 3. Advantageous geographical location in the center of Europe at the intersection of the	1. Weak self-organization of the market (medium and small businesses do not actively participate in trade unions for political lobbying of their interests) 2. Lack of sources of funding for the sector (expensive loans), underfunding of the sector 3. Deterioration of the quality of chernozem (about 20% of Ukrainian chernozems degraded over 28 years due to an ill-

<p>main logistics hubs, namely the passage through Ukraine of the routes of the New Silk Road and the Baltic-Black Sea transport corridor</p> <p>4. Culture and knowledge (farmers actively learn from colleagues from all over the world)</p> <p>5. Business is represented in the government through its lobbyists from industry associations</p> <p>6. The landscape is ideal for large-scale commercial farming</p> <p>7. High share of exports in the economy</p> <p>8. IT industry (the use of drones in farming and agriculture in general is one of the most promising areas of application of this technology)</p> <p>9. Human capital. It is not so much about the fact that Ukrainian labor migrants are in demand abroad, as about the presence in Ukraine of a good system of technical education and scientific base in general, which, however, require additional investments.</p> <p>10. A developed energy complex, which includes facilities for extraction, generation, transportation, and storage of resources.</p>	<p>conceived policy of soil cultivation and uncontrolled application of fertilizers, which led to losses of up to 10-15 billion UAH)</p> <p>4. High cost of credit resources</p> <p>5. Large-scale destruction of agricultural infrastructure</p> <p>6. Military actions and occupation of some regions of Ukraine. More than 500,000 tons of grain were stolen by Russia in the occupied territories. 400,000 livestock died as a result of hostilities.</p> <p>7. Reduction of production volumes</p> <p>8. Complication of logistic operations.</p>
Opportunities	Threats
<p>1. Lifting of the moratorium on the sale of land (up to \$50 billions of investments over 10 years)</p> <p>2. Entering new markets with new products (for example, hemp, flax, linen fabrics, halal meat, Ukrainian-made jamon, goat cheese, organic honey, organic chicken, etc.)</p> <p>3. Digitalization of agriculture</p> <p>4. Investment attraction in the sector</p> <p>5. Support from international financial organizations</p> <p>6. Growth of exports and, as a result, foreign currency inflows to the country</p>	<p>1. War, political and economic crisis in Ukraine</p> <p>2. Miscalculations in industry regulation</p> <p>3. Deterioration of land quality</p> <p>4. Degradation of the sector</p> <p>5. Loss of part of the yield potential due to soil degradation</p> <p>6. Labor migration</p> <p>7. Climate change</p> <p>8. Raiding, "gray" grain market, fraudulent schemes, counterfeit products, pressure from law enforcement agencies</p>

7. Formation of the "20-40-40" model (according to the size of farms, 20% - large agribusiness, 40% - medium, 40% - small)	
8. Ability to format the industry (choose a unique "Ukrainian" path of development)	

*Source:* author's research

It is crucial for the international community to come together and support Ukraine in this time of crisis. Providing aid and support to Ukrainian farmers can help alleviate the impact of the war and occupation on the country's grain production. This will ultimately benefit not just Ukraine but also the global grain markets.

The war and occupation are leading to reduced investment in the agricultural sector, as investors are hesitant to invest in an uncertain and unstable environment.

The following are specific ways in which the reduced investment is impacting the agricultural sector:

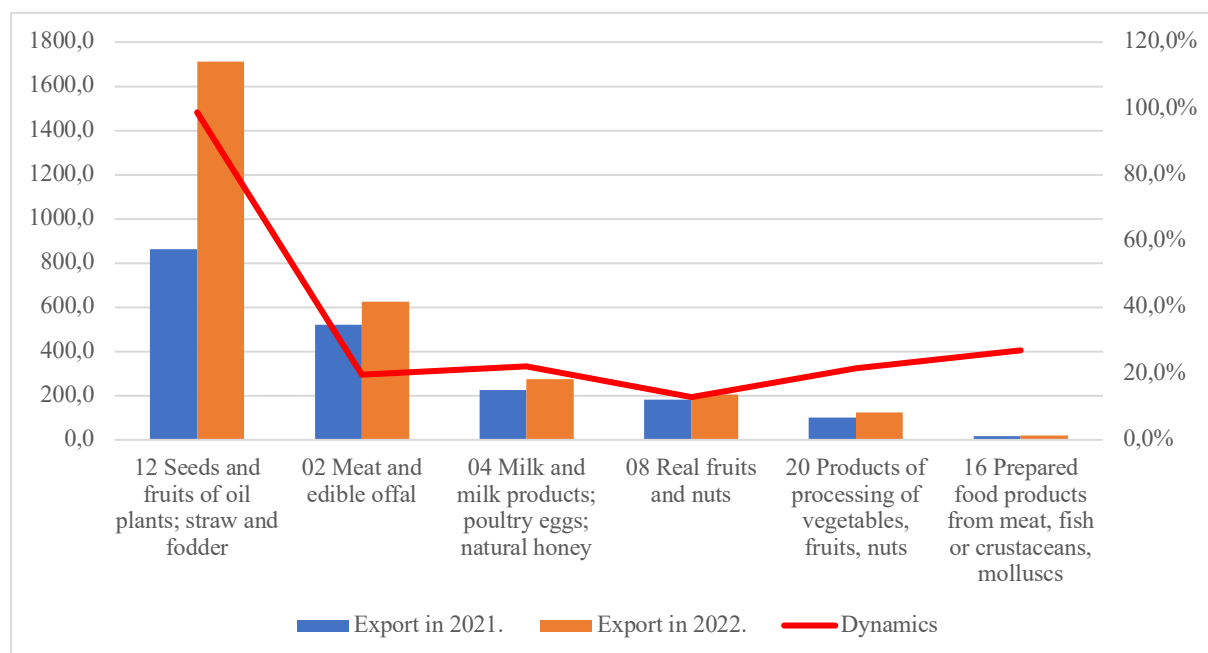
- the agricultural sector is finding it difficult to adopt new technologies and farming practices due to the reduced investment in the sector. For instance, farmers are unable to afford new equipment or irrigation systems that could enhance productivity or reduce water usage;
- due to the reduced investment, the amount of research and development taking place in the agricultural sector is limited. This is limiting the sector's ability to develop new crop varieties that are resistant to pests and diseases or that are more productive in local growing conditions [5];
- the reduced investment is also leading to limited access to credit for farmers and businesses in the agricultural sector, which is limiting their ability to finance new projects, expand production, or invest in new technologies or inputs;
- the inability of the agricultural sector to modernize and innovate due to reduced investment is making it less competitive on the global market. This is

impacting the sector's ability to export its products and generate income for farmers and businesses [6];

– the reduced investment is leading to higher costs for farmers and businesses in the agricultural sector. For instance, if there is limited investment in irrigation systems, farmers may have to rely on more expensive sources of water to irrigate their crops.

At the beginning of the enemy's full-scale invasion of our lands, all logistics practically stopped. Because the Ukrainian seaports, through which the largest volumes of exports were sent, remained under occupation or were blocked by Russia. Therefore, the western borders became almost the only option for trade with other countries.

In order to increase export volumes of agricultural products, in May the European Union launched the "Paths of Solidarity" program. These routes made it possible to speed up exports and the work of customs between Ukraine and EU countries. As a result, according to the Ministry of Agriculture, during the 9 months of the war, Ukraine managed to export 19 million tons of agricultural products through these alternative routes.



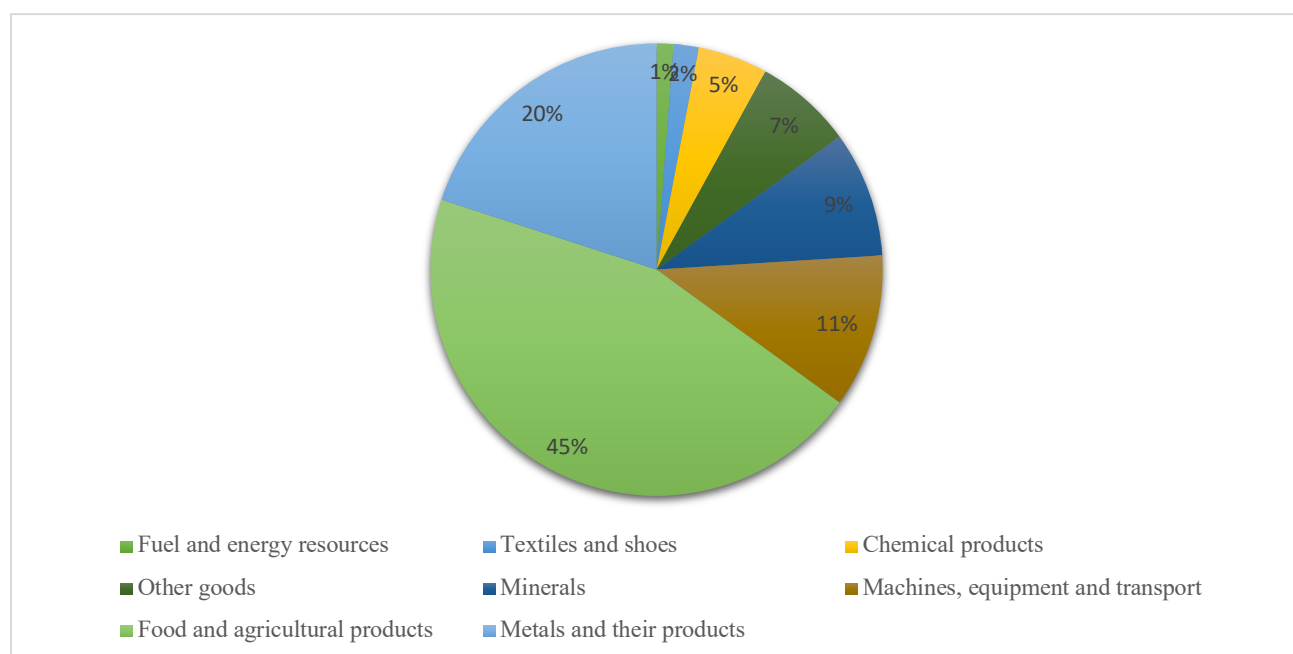
**Fig. 1. Exports of Ukraine of certain categories with positive dynamics**

*Source:* calculated by the author based on [7]

In addition, thanks to the efforts of Ukrainian diplomats, with the mediation of the UN and Turkey, the three Black Sea ports "Odesa", "Chornomorsk" and "Pivdenny" resumed their work for the transportation of food from August 1. And despite the constant obstacles from the Russian side, at the end of the year, as reported by the head of state Volodymyr Zelenskyi, Ukraine managed to export more than 15 million tons of food - primarily grain - to more than 40 countries of the world [8].

Also, at the end of November, on the initiative of the president, the Grain from Ukraine program was launched, within the framework of which Ukrainian grain is exported to countries in Africa and Asia, which suffer the most from the food crisis and need urgent assistance. More than 30 donor states have already joined this program and almost 200 million dollars have been involved [9].

In addition, our state was able to return to the world food market and thereby proved that it is a reliable partner for many countries. In 2023, our diplomats will still have to fight for the continuation of the "grain agreement" on the export of Ukrainian grain and to extend it to the ports of Mykolaiv [10].



**Fig. 2. The ratio of export revenues of the main industries, %**

*Source:* calculated by the author based on [10]



This is important, because before the war, agricultural exports brought the country more than 45 percent of all export revenues (figure 2). And we all understand that stable export supplies provide stability to our national currency - the hryvnia. There is another important aspect - social: before the war, money from the sale of food products, including the sale of grain crops abroad, provided income for 7.5 million Ukrainians who worked in the agricultural sector.

**Conclusion.** While the war in Ukraine has had a significant impact on the country's agricultural production, the sector has shown remarkable resilience in the face of these challenges. The government's support measures and efforts to develop alternative markets have helped to mitigate the impact of the war. However, ongoing political instability and the challenges of population displacement and damage to farmland continue to pose obstacles to the sector's long-term growth and sustainability.

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