DEVELOPMENT OF AGRIBUSINESS IN THE POST-WAR RECONSTRUCTION OF UKRAINE

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The agricultural sector of Ukraine is traditionally one of the key structural elements of the national economy. However, the full-scale invasion of the Russian Federation in February 2022 formed an unprecedented complex of structural shocks, simultaneously hitting the land fund, production infrastructure, logistics chains, personnel potential and foreign trade positions of the sector. Thus, the problem of the development of agribusiness takes on not only an economic, but also a geopolitical dimension: both the country's food security and its place in the global food system depend on the ability of the agricultural complex to recover and modernize.

So, agribusiness occupies a special place in the structure of the national economy of Ukraine, determining not only domestic food security, but also the position of the state in global markets. Agricultural production forms about 7% of the country's GDP, and agricultural exports account for almost 60% of all foreign trade. These indicators are not static - they reflect the long-term structural transformation of the industry, which over the past decade has turned from a traditional sector of the agricultural economy into a full-fledged competitive industry integrated into global value chains.

The strategic role of agribusiness for Ukraine is due to several interrelated factors:

- favorable natural and climatic conditions - more than 40 million hectares of agricultural land, a third of which falls on fertile chernozems of the world - form a powerful natural resource potential;
- the existing production and processing infrastructure, formed over decades, provides opportunities for increasing volumes and diversifying the range of products;
- the growing international importance of Ukraine as a guarantor of food security for a number of regions - from the Middle East to Africa - turns the agricultural sector into an instrument of geopolitical influence [1].

Therefore, understanding the dynamics of agribusiness development in modern conditions acquires not only economic, but also strategic importance.

To analyze structural shifts in the domestic agricultural sector, it is necessary to consider the key macroeconomic indicators of the industry in dynamics. Comparison of 2020 and 2024 indicators makes it possible to establish the nature and directions of transformation processes, identify stable trends and identify factors that determine the competitiveness of the domestic agro-industrial complex (Table 1).

Table 1. Agribusiness performance

Indicator	2020, billion (UAH/dollar) USA	2020,%	2024, billion (UAH/dollar) USA	2024,%
Share of agricultural products in the country's GDP	318,0	8,3	464,0	6,8
Share of agricultural exports in the country's exports, billion dollars USA	22,2	45,0	24,7	59,0
The share of the agro-industrial complex in loans to all sectors of the economy	130,0	18,0	190,0	24,0

Source: compiled by the author based on [1; 17; 27]

These data indicate a contradictory, but generally positive dynamics of the development of the agricultural sector in the context of the national economy. On the one hand, the share of agricultural products in the country's GDP decreased from 8.3% in 2020 to 6.8% in 2024, which, however, is explained not by an absolute drop in the industry, but by a faster growth in nominal GDP at current prices compared to agricultural production. The absolute indicator of production volume increased from 318 to 464 billion UAH, that is, increased by 46%.

The dynamics of export indicators is indicative: the share of the agricultural sector in the total volume of Ukrainian exports increased from 45% in 2020 to 59% in 2024, while the absolute volume of agricultural exports increased from $22.2 to $24.7 billion. USA. This means that in the face of shrinking industrial and

other sectors due to military destruction, agribusiness has become the main sector of the national economy generating foreign exchange earnings, bearing a disproportionate burden of ensuring the country's balance of payments. In general, it can be stated that the agricultural sector has shown itself to be the most stable component of the Ukrainian economy in the face of unprecedented military and humanitarian challenges.

The dynamics of lending also deserves attention: the share of the agro-industrial complex in the total loan portfolio of the banking system increased from 18% to 24%, and the absolute volume of loans to the industry increased from UAH 130 to 190 billion. This indicates a growing financial interest in the agricultural sector from institutional investors and the banking system, reflecting its perception as a relatively reliable borrower even in wartime conditions.

The full-scale invasion of the Russian Federation in Ukraine, begun on February 24, 2022, caused enormous damage to the country's agro-industrial complex, which are both direct - material and indirect - operational and profitable.

Thus, analytical studies of the Kyiv School of Economics, the Ministry of Agricultural Policy and international analytical centers (FAO, OECD, World Bank) make it possible to systematize these losses into six key categories, which is reflected in Table 2.

Table 2. Main categories of losses of Ukrainian agribusiness due to full-scale invasion

Loss category	Volume/Metric	Main regions of defeat	Impact on production
Agricultural land (de-occupied/war zones)	~ 5.0 million hectares withdrawn from circulation	Kherson, Zaporizhzhya, Donetsk, Lugansk regions.	Reduction of sown areas by 25-30%
Machinery and equipment	More than 100 thousand units destroyed or damaged	Front-line and front-line zones	Mechanization reduction to 60% of pre-war level
Grain infrastructure (elevators, warehouses)	~ 30% of capacity is damaged	South and East of Ukraine	Storage deficit - 10-15 million tons
Irrigation systems	Kakhovskaya system - 584 thousand hectares of irrigation lost	Kherson, Nikolaev regions	Threat of desertification of southern agrozones
Human capital (mobilization + migration)	Up to 3 million employed in the sector left the country or mobilized	Nationwide scale	Personnel deficit 35-45% in crop production
Logistics corridors and ports	Black Sea exports blocked for ~ 18 months	Odessa, Nikolaev region	Overloading of land and river routes

Source: compiled by the author based on [1; 4; 11; 19]

The analytical data presented indicate that the most critical are not so much direct material losses as systemic failures in the functioning of the production and logistics chain. The withdrawal from circulation of about 5 million hectares of agricultural land - primarily due to mine pollution, physical destruction and occupation - means a long-term reduction in production potential even in the conditions of the complete liberation of these territories. The destruction of the Kakhovsky reservoir in June 2023 dealt a particularly heavy blow to the irrigated agriculture of the South, where irrigation is not an option, but a necessary condition for a stable harvest. Summarizing the above indicators, it can be stated that the cumulative regressive impact on industry productivity is estimated at 25-40% relative to the pre-war baseline.

A comprehensive assessment of these losses is crucial for understanding the real state of the industry and justifying its recovery strategy [1; 19]. Structured accounting of direct losses of the agro-industrial complex for the period from February 24, 2022 to December 31, 2024 is shown in Table 3.

Table 3. Losses of the Ukrainian agro-industrial complex during the war, (from February 24, 2022 to December 31, 2024)

Group	Amount, billion dollars USA	In% of total
Volume of losses, total billion dollars USA:	**11,2**	**100,0**
incl. damage to machinery and equipment	6,5	58,0
- damage to storage facilities	1,9	17,0
- theft of material and technical resources and products	1,9	17,0
- other	0,9	8,0

Source: compiled by the author based on [1; 19]

The total volume of direct losses of the agro-industrial complex for the analyzed period amounted to $11.2 billion. USA. The largest share is 58%, or $6.5 billion. USA - make up losses from damage to agricultural machinery and equipment. This position is critical due to the fact that the complete or partial loss of technical fleet directly limits the production potential of the industry and is the first condition for the restoration of normal functioning of farms. Firstly, destroyed or disabled tractors, combines, seeders and other equipment make it impossible to comply with agrotechnical deadlines critical for preserving yields. Secondly, the restoration of the technical base requires significant investments and time, because there is a shortage of equipment on the market due to pan-European demand and disruptions in supply chains.

Equal shares - 17% each, or $1.9 billion each. USA each - distributed losses from damage to warehouse facilities and from theft of material and technical resources and products. The first component reflects the destruction of elevators, granaries, refrigeration facilities and processing plants, which directly complicates the storage and sale of crops. The second component - kidnapping - is a special form of losses associated with the occupation of agricultural land and production facilities, where large-scale thefts of equipment, fertilizers, fuel resources and finished products have been recorded. The rest - 8%, or 0.9 billion dollars. USA - accounts for other categories of losses, including damage to irrigation systems, drainage infrastructure and agricultural buildings. As of December 2024, the volume of losses in the sector increased by 9.2% compared to December 2023, which indicates the continuing impact of hostilities on the material base of the industry.

Along with direct losses subject to direct value measurement, agribusiness suffered significant indirect losses, which cover lost revenues of producers due to production cuts, unfavorable price conditions and rising costs. The cumulative picture of indirect losses is reflected in Table 4.

Table 4. Volume of indirect losses (from February 24, 2022 to December 31, 2024)

Group	Amount, billion dollars USA	In% of total
Volume of indirect losses, total billion dollars USA:	**72,8**	**100,0**
including production reduction - annual crops	37,1	51,0
- perennial	1,5	2,0
- animal husbandry	3,6	5,0
Decrease in purchase prices	24,7	34,0
Increase in production costs	4,4	6,0
Other	1,5	2,0

Source: compiled by the author based on [1; 19]

The total volume of indirect losses amounted to $72.8 billion. The United States is more than six times higher than direct losses and clearly illustrates how destructive the impact of armed conflict is on the operations and income of agricultural producers. Indirect losses are the difference between the actual revenues and the revenues that agricultural producers would have received in the absence of invasion. It is fundamentally important that these losses will be incurred by farmers throughout the country, and not just in areas of active hostilities.

The dominant item of indirect losses is the reduction in the production of annual crops - $37.1 billion. USA, or 51% of the total. This reflects the combined impact of the removal of significant areas from cultivation in war zones, mass mining of farmland, labor shortages through mobilization and migration, and the destruction of irrigation systems. The second most significant article is a decrease in purchase prices - $24.7

billion. USA, or 34%. The blockade of the Black Sea ports during the initial stage of the invasion, disruption of logistics routes and general instability led to a significant depreciation of agricultural products in the domestic market. The increase in production costs amounted to 4.4 billion dollars. US (6%), reflecting increases in fuel, fertilizer, plant protection and insurance costs. The greatest indirect losses were recorded in the Kherson, Zaporizhzhya, Kharkov and Donetsk regions, which is a natural consequence of active hostilities in these regions.

Analysis of structural shifts in the production base of the agricultural sector is a prerequisite for understanding the long-term consequences of armed conflict and assessing the adaptation capabilities of the industry. Comparison of the production volumes of the main product groups at constant prices in 2021 for 2018 and 2024 makes it possible to separate cyclical fluctuations from structural transformations (Table 5).

Table 5. Agricultural products, UAH billion (at constant prices in 2021)

Commodity goods	Year		In dynamics
	2018	2024	
Cereals and legumes	413,0	353,0	–60,0
Technical cultures	387,0	373,0	–14,0
Fruits and vegetables	211,0	133,0	–78,0
Livestock products	256,0	211,0	–45,0
Total, UAH billion	**1267,0**	**1070,0**	**–197,0**

Source: compiled by the author based on [1; 27]

The total volume of agricultural production decreased from UAH 1267.0 billion in 2018 to UAH 1070.0 billion in 2024 - that is, by UAH 197.0 billion, or 15.5%. This decline reflects not only the immediate consequences of hostilities in 2022-2024, but also the gradual erosion of production capacity due to systemic imbalances that accumulated even before the start of the active phase of the conflict.

Firstly, most of all, in absolute terms, reductions were recorded in the production of grain and legumes - from 413.0 to 353.0 billion UAH (-60.0 billion UAH, or -14.5%). Cereals remain the basis of crop production, so their reduction has a multiplicative negative impact on the entire industry - from the feed base of animal husbandry to the workload of processing facilities. In 2024, grain production in Ukraine fell to the lowest level in a decade, which is primarily due to the low yield of spring crops, in particular corn, due to unfavorable weather in the summer of 2024.

Consequently, the production structure has undergone internal shifts: farmers have reoriented sown areas to soybeans and other oilseeds because of their higher profitability. The production of industrial crops decreased relatively less - only by UAH 14.0 billion (-3.6%), which reflects the higher adaptability of this segment. The largest relative drop was in the production of fruits and vegetables - from 211.0 to 133.0 billion UAH (-37%), which is explained by the occupation of the main production zones in the southern regions (Kherson region, Zaporozhye) and logistical restrictions that make it difficult to supply to sales markets. The livestock industry reduced production from UAH 256.0 billion to UAH 211.0 billion (-17.6%), although poultry production partially compensated for the drop in other subsectors due to the growth of industrial poultry farming [1].

Summarizing the industry dynamics, it should be noted that despite significant challenges, the agricultural sector has shown relative stability, retaining 84.5% of the pre-war production potential. A key feature of the current transformation is the geographical movement of production centers: occupation and hostilities in the traditional agrarian regions of the South and East led to a reorientation of production to the central and western regions.

Despite significant internal challenges, Ukraine retains a significant position in the global agricultural market.

It is advisable to start the analysis of the development of foreign trade in agri-food products by assessing the overall dynamics of the main indicators of the trade balance, which reflects structural shifts in the production chains of the domestic agricultural sector. The formation of a positive balance of foreign trade is one of the key indicators of the competitiveness of the industry, while the dynamics of imports and exports makes it possible to identify trends in attracting enterprises in cooperation chains for the production of value-added products [1; 17].

The data below illustrate the dynamics of Ukraine's trade balance in the agri-food sector during 2023-2025 (Chart 1).

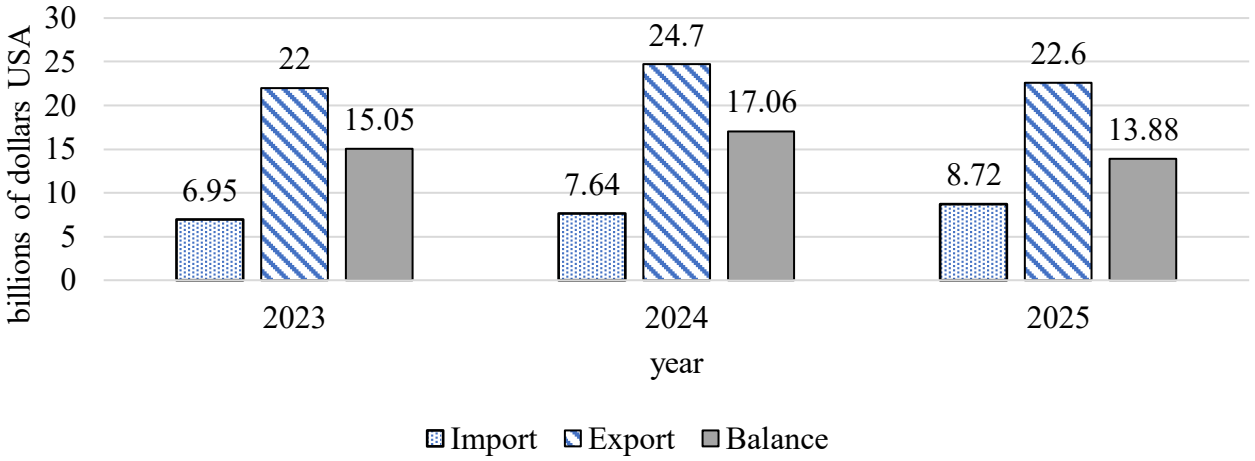

Figure 1. *Indicators of foreign trade in agri-food products of Ukraine, billion dollars USA*
Source: built by the author based on [1; 17]

Analytical data indicate a contradictory nature of trends in foreign trade in agri-food products. On the one hand, imports show stable growth: from $6.95 billion. USA in 2023 to $8.72 billion in 2025, which corresponds to an increase of $1.77 billion or 25.5%. This growth is primarily due to an increase in the needs of the processing industry for raw materials and ingredients that are not produced domestically, as well as the revival of domestic consumer demand in the context of a partial normalization of economic life.

On the other hand, the dynamics of exports is less unambiguous. After growing from $22.0 billion in 2023 to a record $24.7 billion in 2024, in 2025 there is a decrease to $22.6 billion, which ultimately gives only a slight increase (+ $0.6 billion) compared to the base year. Consequently, the corresponding reduction in the positive trade balance - from $17.06 billion in 2024 to $13.88 billion in 2025 - indicates an increase in pressure on Ukraine's foreign trade positions. At the same time, a decrease in the balance is not an exclusively negative signal: it may reflect structural transformations in the direction of increasing imports of means of production and technologies necessary for the production of products with higher added value.

Summarizing the analysis of the dynamics of the trade balance, it can be stated that the preservation of a positive balance with a simultaneous increase in imports indicates the preservation of competitive positions of domestic agricultural exports, however, the lack of stable growth in export indicators indicates the need for qualitative changes in the commodity structure of supplies.

The assessment of Ukraine's share in global agricultural exports is fundamental for understanding the international dimension of domestic agribusiness and its importance for global food security (Figure 2).

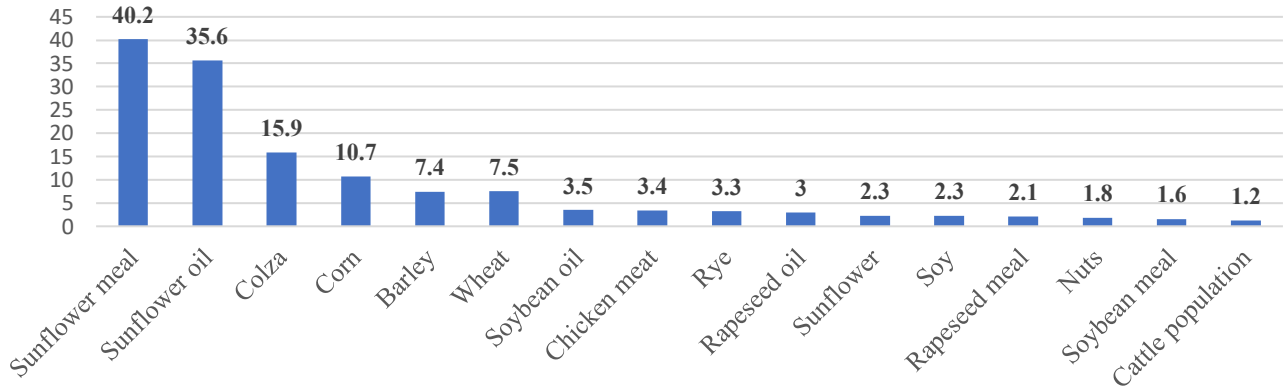

Figure 2. *Ukraine's share in global exports of basic agricultural products,% (2024/25 MY)*
Source: built by the author based on [1]

These data indicate an exceptional concentration of competitive advantages of the domestic agricultural sector in individual product niches. The undisputed leader is the production and processing of sunflower: Ukraine controls 40.2% of the world sunflower meal market and 35.6% of the sunflower oil market. This means that more than a third of the world's supplies of key oil and protein products are formed by Ukraine, which gives it the status of an indispensable player in the respective markets.

The second strategic direction is grain crops: Ukraine's share is 10.7% in world corn exports, 7.5% in wheat and 7.4% in barley. These indicators are significant in absolute terms, but they have decreased compared to pre-war years due to production cuts and time logistical constraints. The resumption of the work of grain corridors - first within the framework of the "Grain Initiative," and then through the Danube and railway routes - contributed to the preservation of market share, but did not fully compensate for the losses caused by the fall in yields.

The position of Ukraine in the rapeseed market is also indicative - 15.9% of the world market, which reflects the rapid growth of domestic rapeseed. Firstly, rapeseed is becoming increasingly important as a raw material for biodiesel production in the European Union, which forms a stable demand from European buyers. Secondly, the expansion of rapeseed areas is part of the overall strategy of diversification of sown areas, which is carried out by domestic farmers in the face of price volatility in the wheat and corn markets. The share of Ukraine in the chicken market is also noteworthy - 3.4%, which indicates the competitiveness of the domestic industrial poultry industry at the international level.

Summarizing the competitive profile of the domestic agricultural sector, it can be argued that Ukraine occupies a leading position mainly in the production and processing of oilseeds, while in the markets of grain and livestock products its share, although it remains significant, is inferior to individual competitors. Consequently, the agribusiness development strategy should take into account the need to protect existing competitive niches, primarily sunflower processing, and to purposefully increase its presence in promising segments.

Ensuring sustainable economic development in wartime and post-war reconstruction of Ukraine requires fundamentally new approaches to organizing production and creating competitive advantages in foreign markets. The agricultural sector is faced with a paradox of commodity orientation: despite significant export volumes, the level of added value in domestic products remains significantly lower than potentially possible. This contradiction determines the relevance of the study of mechanisms of inter-business cooperation as a tool to increase the degree of product processing and increase profitability along the entire production chain [23].

Cooperation of enterprises in its various forms - vertical integration, horizontal alliances, contract production, cluster associations - allows you to concentrate the resources and competencies necessary for the manufacture of products with higher added value. Therefore, the question of how organizational interaction between the subjects of the agricultural market affects the structure and competitiveness of Ukrainian agricultural exports acquires not only theoretical, but also purely practical significance in the context of European integration aspirations and the need to diversify foreign trade relations [21-25].

This problem becomes especially acute given the instability of global food markets, volatility in commodity prices and increased competition from other agricultural exporters. With commodity margins declining and demand for deep processing products growing, the survival and development of domestic enterprises directly depend on the ability to form effective cooperative ties and integrate into global value chains.

The problems of cooperation between enterprises and the formation of added value in production chains are being developed by a wide range of domestic and foreign scientists. The conceptual foundations of the theory of value chains are laid in the writings of M. Porter [10], who substantiated the importance of vertical integration and specialization in ensuring the competitive advantages of enterprises. These ideas were further developed within the framework of the Global Value Chains approach, which was formed thanks to the research of G. Gereffi, J. Humphrey, T. Sturgeon [5-6], K. Fernandez-Stark [5] and their followers, who proved that participation in global chains is a key factor in technological and institutional upgrade for enterprises in developing countries.

In the national scientific literature, a significant contribution to the study of cooperation in the agricultural sector was made in the works of V. Andriichuk [12], Yu. Lupenko, M. Malik, A. Shpykuliak [22], L. Moldavan [24]. In particular, the researchers focus on the need to move from primary production to deep processing as a condition for increasing the profitability of agricultural enterprises. The issues of forming clusters in the agri-food sector of Ukraine are covered in the works of M. Kropyvko [21], I. Kaitanskyi et al. [18], which consider clustering as an effective tool for increasing the competitiveness of regional agri-food systems.

The results of the analysis of the commodity structure reveal the dominance of two commodity items, which together form more than 54% of agricultural exports: corn (29.5%) and sunflower oil (25.0%). It is necessary to note the fundamentally different degree of processing of these products. Maize is predominantly a primary raw material with a minimum degree of processing and, accordingly, a low level of added value. But sunflower oil is a product of industrial processing of oilseeds, the production of which provides for the use of complex technological chains and the participation of several business entities - seed producers, elevator enterprises, oil and fat factories, logistics operators (Figure 3).

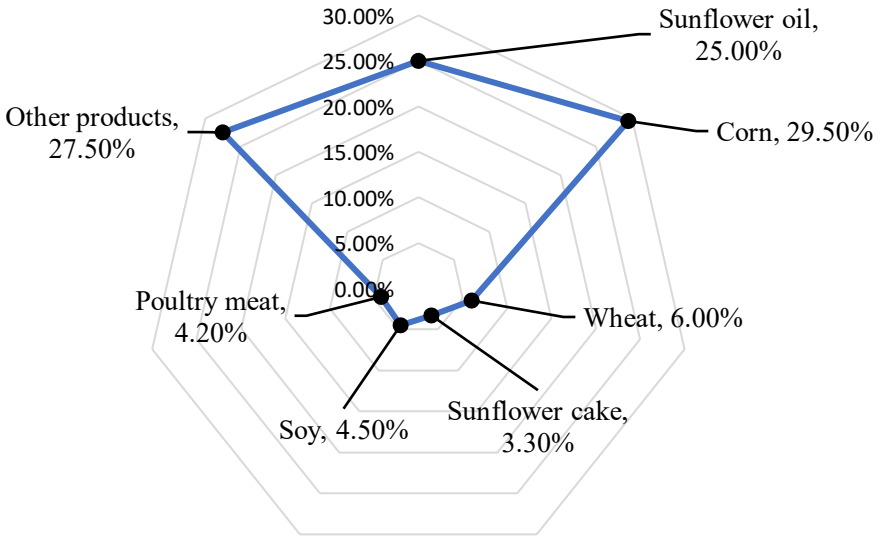

Figure 3. *Commodity structure of agricultural exports, as of January 2026*
Source: built by the author based on [17]

We can state that a high share of vegetable oil (25%) indicates the presence of effective production cooperation in the processing sector, because the production of this product requires coordinated interaction between different levels of the production chain. It should also be noted that the participation in the structure of products such as poultry meat (4.2%), sunflower cake (3.3%) and soybeans (4.5%) indicates an increase in the level of processing in the livestock and crop segments. Consequently, even despite the dominance of grain, the structure of domestic agricultural exports is gradually acquiring the features inherent in more diversified and technologically saturated value chains. The presence of 27.5% of "other goods" in the structure additionally indicates an expansion of the range of products produced and sold in foreign markets.

A more detailed analysis of foreign trade flows by individual product groups allows us to identify specific points of growth and decline associated with the effectiveness of cooperation relations in the relevant industries of the processing industry. To quantify these trends, we turn to actual data, which reflect the comparative dynamics of exports and imports in the context of commodity groups (as of January 2026) relative to the same period in 2025 (Table 6).

The presented actual export and import indicators reveal a significant differentiation of growth rates among different commodity groups, directly correlates with the degree of involvement of enterprises in processing cooperation chains. The most noticeable trend is the outstripping growth of vegetable oil exports (+ 27.5%) - to $601.1 million - against the background of a slight decrease in the volume of exports of grain crops (-1.0%) and primary oilseeds (-2.8%). This asymmetry is a significant evidence that cooperation between farmers, elevators and processing enterprises can effectively convert primary plant raw materials into processed products, which are distinguished by significantly higher price competitiveness and more stable demand in international markets.

So, it should be noted that the oil and fat complex of Ukraine occupies one of the key places in the structure of the national economy, providing a significant share of foreign exchange earnings and forming the basis for the development of related industries. At the same time, despite the strong production potential and favorable agroclimatic conditions, the domestic industry still remains predominantly focused on the export of raw materials and oil with a minimum degree of processing. This situation leads to inefficient use of resource

potential and leads to significant losses of added value, which is realized not in Ukraine, but in importing countries, where further advanced processing is carried out [28].

Table 6. Dynamics of exports and imports of agricultural products in January 2026 relative to January 2025

Merchandise category	Export		Import	
	Cost, million U.S. dollars	Changes: January 2026 to January 2025	Cost, million U.S. dollars	Changes: January 2026 to January 2025
Cereals	712,5	-1,00%	12,6	-9,90%
Oilseeds	158,9	-2,80%	39,4	+20,20%
Vegetable oil	601,1	+27,50%	9,39	+30,30%
Meat and meat products	92,7	+11,10%	13,7	+83,20%
Milk and milk products	18,2	-6,10%	22,4	-1,20%
Fish and fish products	2,45	-24,20%	86	+16,40%
Fresh vegetables	1,13	-5%	26,8	-36,40%
Fresh fruits and berries	2,24	+32,40%	98,1	+4,80%
Honey, sugar and products from it	51,9	+0,80%	6,89	-26,10%

Source: Author based [17]

Analysis of the structure of the value chain of oilseeds reveals a systemic problem: individual participants in the chain - producers of raw materials, processing enterprises, logistics operators, research institutions - function in fragments, without proper coordination and institutional interaction. The lack of integrated cooperation mechanisms leads to unjustified losses at the stages of storage, underuse of by-products of processing, which contain valuable components - lecithin, tocopherols, phytosterols, protein fractions - and can serve as raw materials for the pharmaceutical, food and cosmetic industries. Technological backwardness and low level of innovation activity of enterprises in the industry further limit the possibilities of diversifying the product portfolio and entering markets with higher margins.

In this context, the question of which model of organization of interaction between participants in the oil market can comprehensively solve these problems and become an effective tool for the transition from a raw material to an innovative technological model of sectoral development acquires particular scientific and practical relevance. The concept of a cluster approach offers an answer to this request through the synergistic integration of producers, processors, scientists and institutional actors within a single spatial cooperation system. Wartime provides additional urgency to the problem: the destruction of the logistics and processing infrastructure, the reorientation of export flows and the change in market conditions form new challenges, but at the same time new windows of opportunity for the structural restructuring of the industry on a cluster basis in the process of post-war recovery [29].

The problems of forming clusters and value chains in the agricultural sector cover a wide range of scientific areas. Yes, Bartolucci S. et al.. [2] examine the correlation between upstream and downstream positions of enterprises in global value chains, which is the theoretical basis for assessing Ukraine's place in the international division of labor in the field of oilseeds. Michael E. Porter [10] laid the conceptual foundations of the cluster approach through the prism of competitive advantages of countries, which remains the basic theoretical framework for all further research in this area. Mario Davide Parrilli [8] develops cluster theory regarding the challenges of the 2020s, focusing on the transformation of cluster politics in the face of global change. K.V. Zheludenko [16] considers clusters as an innovative tool to ensure the competitiveness of agricultural enterprises, emphasizing their potential for the modernization of agribusiness. I. Kaitanskyi, K. Harbazhii and I. Hladkyi [18] systematize theoretical approaches to the management of agrarian clusters, which is important for developing practical recommendations for organizing cluster structures in an oil subsequence. I. Chekhova [28] examines the regional aspect of oilseed production in Ukraine, forming an analytical base for assessing the clustering potential of the industry. The materials of the European Cluster Platform [3, 9] and the European Commission [15] outline the best EU practices for supporting clusters.

The cluster approach, as a paradigm for the organization of economic activity, is based on the recognition of the fundamental role of geographical proximity, specialization and networking in the formation of competitive advantages. The basic concept formulated by Michael Porter defines a cluster as a geographic concentration of interconnected companies, specialized providers, service providers, firms in related industries, and related institutions in certain industries that compete but also collaborate. Unlike traditional industrial areas or simply sectoral agglomerations, clusters are characterized by the presence of complex vertical and horizontal connections, institutional support infrastructure, and a culture of cooperation that promotes knowledge exchange and collective learning.

In the context of the agro-industrial sector, the cluster approach takes on specific characteristics related to the nature of agricultural production. Agro-industrial clusters bring together not only processing enterprises and producers of raw materials, but also suppliers of seeds, fertilizers, plant protection products, agricultural machinery, logistics companies, research institutions in the field of agronomy and food technology, financial institutions specializing in agricultural lending, as well as local governments and industry associations. A feature of agro-industrial clusters is their close relationship with the natural and climatic conditions of a certain territory, which determines the possibilities of specialization and differentiation of products. Studies by the European Commission show that successful agro-industrial clusters contribute to 15-25% higher productivity compared to isolated enterprises through effects of scale, specialization and knowledge sharing [3; 9; 15].

The concept of value chains, which derives from Michael Porter's work on enterprise-level value chains and has been developed by researchers of global production networks, focuses on the sequence of activities through which a product or service is created, distributed, and delivered to the final consumer. Each link in this chain adds a certain value to the final product, and the overall efficiency of the chain is determined not only by the performance of individual participants, but also by the quality of coordination and integration between them [10; 18].

In the case of oilseeds, the value chain includes the production of seeds and other raw materials, the cultivation of oilseeds, storage and logistics, primary processing, oil refining and fractionation, food production and technical applications, and marketing and distribution of final products [28].

For Ukraine, which seeks to move from exporting raw materials to creating high value-added products and integrating into global production networks on more favorable terms, the development of an effective oil cluster model can become a strategic lever for regional economic development and strengthening food security (Table 7).

Table 7. Dynamics of exports of oilseeds from Ukraine for 2022-2025, million dollars USA

Culture	2022		2025*		In dynamics	
	Seeds	Oil	Seeds	Oil	Seeds	Oil
Soy	863,1	304,7	1002,4	434,2	139,3	129,5
Sunflower	1256,2	5464,2	36,5	3703,2	-1219,7	-1761
Colza	1540,5	83,6	619,7	169,4	-920,8	85,8
Others	61,3	8,77	46,8	3,83	-14,5	-4,94
Together:	3721,1	5861,3	1705,4	4310,6	-2015,7	-1550,6
Ratio of oil export to seed export,%	157,5		252,8		-	

* Note: As of September 2025

Source: Author based [17]

Particularly promising is the development of areas related to the advanced processing of oilseeds, including the production of functional food ingredients, biofuels, biopolymers and other products with high added value. Studies show that deep processing can significantly increase value added compared to crude oil exports (Table 7) and (Figure 4).

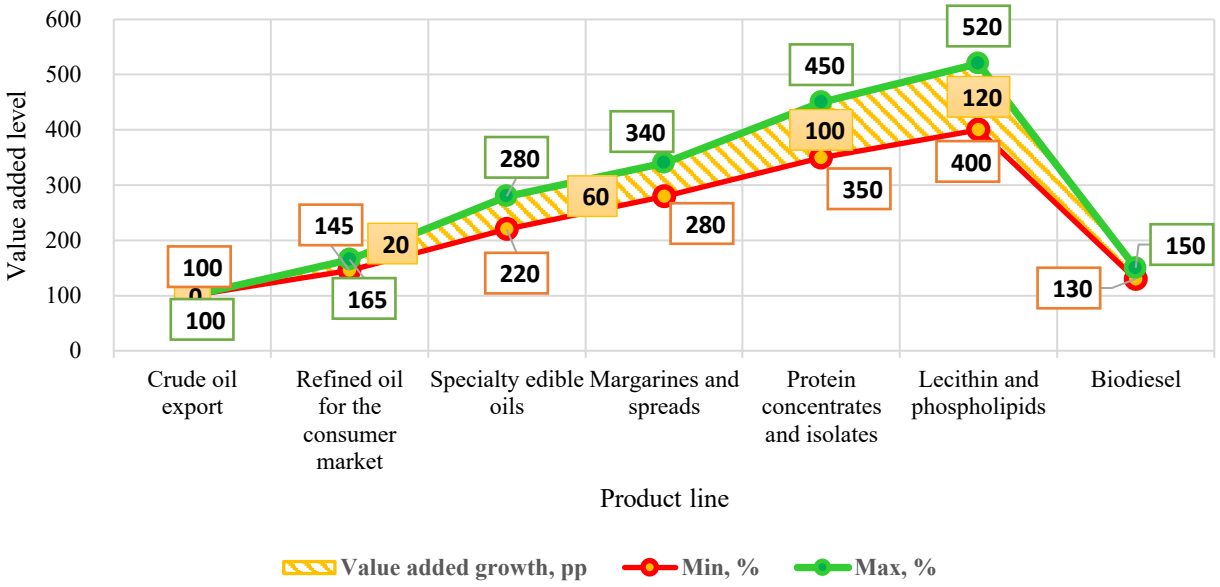

Figure 4. *Level of added value in relation to raw materials,%*
Source: built by the author based on [8; 13; 20]

Thus, protein concentrates, lecithin and specialized food ingredients demonstrate the highest level of added value, but these areas require significant technological competencies and investments in specialized equipment. The cluster model can facilitate the development of these high-margin directions through the creation of a joint research infrastructure, the exchange of technologies and the coordination of investments between cluster participants.

The choice of the optimal model of the oil cluster for Ukraine requires taking into account the specific conditions of the national economy, industry characteristics and strategic development goals. In international practice, several basic cluster models are distinguished, each of which has its own advantages and limitations in various contexts:

- a regional cluster is characterized by a geographical concentration of interconnected enterprises within a certain region, which ensures maximum use of the advantages of spatial proximity;
- industry cluster unites enterprises of a certain industry regardless of their geographical location, focusing on common technological and market challenges;
- the innovation cluster focuses primarily on the creation and commercialization of new knowledge and technologies through intensive cooperation between business, scientific institutions and educational institutions [16; 21; 29].

The analysis of the Ukrainian context indicates the advisability of using a hybrid model that combines elements of regional and innovative approaches. Such a model provides for the formation of several regional oil clusters in the most suitable areas for this, while creating a nationwide innovation network that will provide technology transfer, coordination of scientific research and the exchange of best practices between regional clusters. The regional component is critical for the fat and oil industry due to the significant role of logistics and the need for close coordination between raw material producers and processing plants [28]. At the same time, an innovative component is needed to ensure long-term competitiveness through the constant updating of technologies, the introduction of new products and adaptation to changes in global value chains.

The structure of the regional oil cluster for Ukrainian conditions should include three main groups of participants. The core of the cluster is formed by enterprises for the production and processing of oilseeds, including agricultural enterprises, elevators, oil extraction plants, refineries and manufacturers of food products based on vegetable oils. The supporting infrastructure covers suppliers of seeds, fertilizers, plant protection products, agricultural machinery and equipment for processing, logistics companies, financial institutions, consulting and engineering firms. The institutional component includes research institutions, educational institutions, standardization and certification laboratories, industry associations, local governments and regional development agencies (Figure 5).

A key element of a successful cluster model is a management and coordination mechanism that ensures effective communication between heterogeneous participants. International experience demonstrates the effectiveness of creating a specialized cluster organization or agency that acts as a coordinator, facilitator of cooperation, representative of the interests of the cluster in relations with authorities and external partners, organizer of joint projects and initiatives. Such an organization can function as an independent non-profit structure funded by membership fees of cluster members, government support and income from joint projects. It is important for Ukrainian conditions to ensure a balance between private initiative and state support in the formation of a cluster organization, avoiding both complete dependence on state funding and insufficient institutional capacity due to limited resource attraction [16, p. 104; 18].

The innovative component of the cluster model provides for the creation of mechanisms for systematic interaction between business and research institutions. This may include joint research projects, internship programs for scientists in enterprises, the creation of technology platforms for the exchange of knowledge, support for startups in the field of agrotechnology and food innovation.

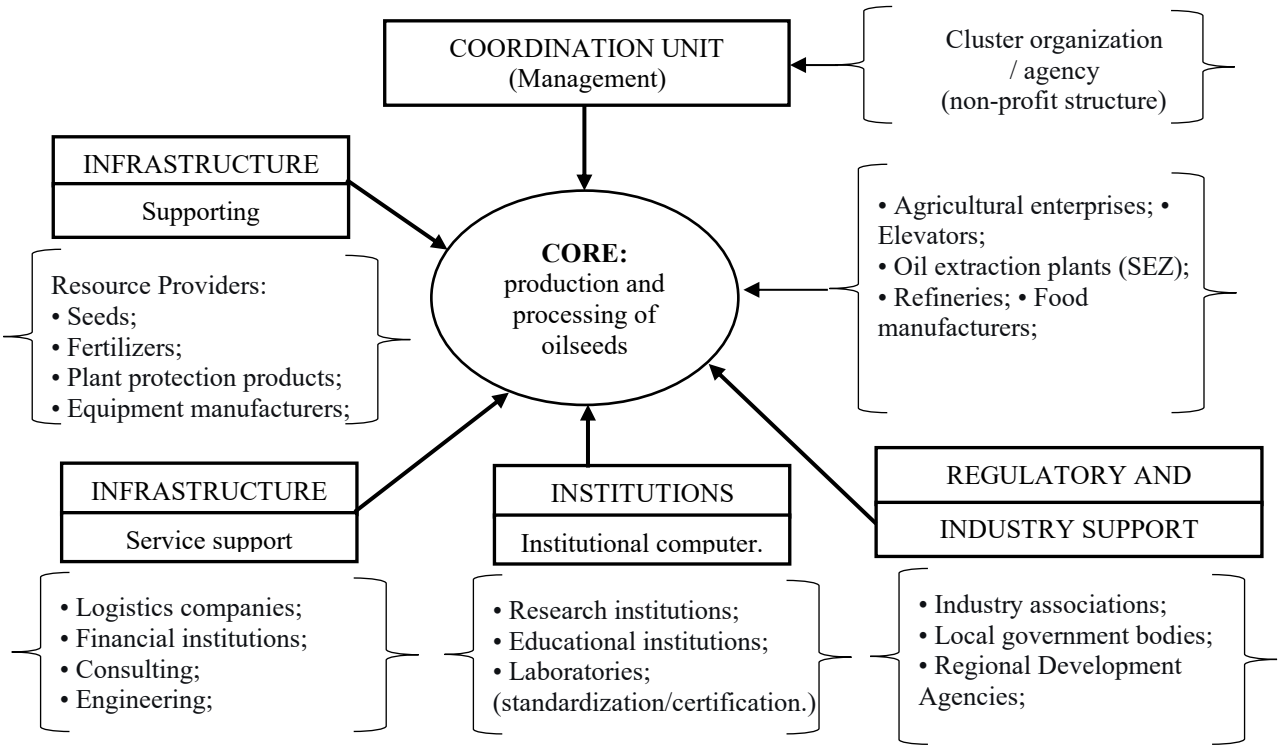

Figure 5. *Regional oilseed cluster structure*
Source: built by the author

A cluster organization creates specific opportunities to add value at each stage of the chain from growing oilseeds to selling the final product to consumers. During the growing phase, the cluster approach allows for increased productivity and raw material quality through better access to innovation, specialized consulting services and quality seed material. Concentration of production creates economic incentives for suppliers of seeds, fertilizers and plant protection products to invest in the development of products adapted to the specific soil and climatic conditions of the region.

The organization of collective storage and logistics systems within the cluster can significantly reduce product losses and transportation costs. Investments in modern elevator capacities with controlled environment, active ventilation and quality monitoring systems can significantly reduce these losses. A cluster organization makes such investments economically viable because of the ability to ensure stable capacity utilization and the distribution of fixed costs among a large number of participants. The creation of a common logistics infrastructure, including railway access roads, vehicles and transshipment terminals, makes it possible to realize economies of scale and reduce transportation costs [16, p. 106; 18].

In the downstream phase, the cluster approach opens up opportunities for technological modernization, product diversification, and increased utilization of by-products. Conventional seed oil extraction technology

involves the production of crude oil and meal as primary products, while other seed components such as lecithin, tocopherols, phytosterols, and other valuable compounds are often lost or underutilized. The introduction of advanced processing technologies makes it possible to extract these expensive components and create products for specialized markets, such as functional food ingredients, dietary supplements, cosmetic ingredients and pharmaceutical applications.

The key advantage of a cluster organization is the ability to implement the concept of industrial symbiosis, in which by-products or waste from one enterprise become the raw material for another. In the context of the fat and oil industry, this may include:

- the use of sunflower seed husks for the production of pellets as fuel or raw material for the production of furfural;
- processing of glycerol formed during biodiesel production into chemical products or feed;
- use of protein fractions for the production of animal feed or food ingredients.

The geographical proximity of businesses in the cluster reduces the transport costs of moving by-products and facilitates coordination between members of the symbiotic network.

The marketing and sales phase also benefits the cluster organization through collective branding opportunities, co-marketing products in international markets and building the region's reputation as a producer of high-quality oilseeds. Creating a regional brand or geographical indication can be a powerful tool for differentiating products and getting a premium to the price. Successful examples of this approach include the French Appellation d'Origine Contrôlée system for olive oil, Italian regional brands of oils and other forms of collective trademarks [14]. For Ukraine, the development of brands of organic sunflower oil, premium rapeseed oil or specialized products with a high content of oleic acid or other functional components may be promising.

A systematic analysis of the potential for value addition at different stages of the chain through a cluster organization is presented in a summary table (Table 8).

Table 8. Mechanisms to add value at oilseed chain stages through cluster approach

Chain stage	Traditional approach	Cluster approach	Value increase potential,%	Key mechanisms
Cultivation	Standard agronomy	Precision farming, breeding	15-25	Access to innovation, consulting
Storage	Basic elevators	Modern grain terminals	8-12	Loss reduction, quality
Logistics	Retail delivery	Overall Logistics System	20-30	Economies of scale
Primary processing	Oil extraction	Complex processing	40-60	Getting expensive components
Refinement	Basic refining	Fractionation, modification	30-45	Specialty Products
Production of products	Standard products	Functional foods	50-80	Innovation, Premiumization
Marketing	Individual sales	Collective brand	15-25	Reputation of the region

Source: developed by the author based on the analysis of international practices and expert assessments

It should be noted that the presented estimates of the potential for cost increase are approximate and may vary depending on the specific conditions for implementing the cluster approach. It is important to understand that the maximum effect is achieved not through individual initiatives at certain stages of the chain, but through system integration and coordination of activities at all stages, which allows you to realize synergistic effects and optimize the value chain as a holistic system.

In general, based on the study, it can be argued that the cluster approach is one of the most promising organizational and economic tools for the systemic transformation of the oil and fat complex of Ukraine - the transition from a model of raw material exports to the creation of products with high added value and integration into global value chains on more favorable terms. The study confirmed that fragmentation of production links, technological backwardness of individual links in the processing chain and insufficient level of institutional coordination between industry participants are the main structural shortcomings that hinder the realization of the potential of oilseeds as a strategic resource of the national economy. The cluster model is able to address these deficiencies through the formation of an integrated environment where geographic proximity, shared infrastructure, and networking among producers, processors, scientists, and institutional actors generate synergistic effects unattainable for isolated businesses.

So, we can state that the traditional raw material model of agricultural exports of Ukraine, which is based on the mass export of grain and sunflower oil in unprocessed or primarily processed form, demonstrates systemic restrictions in terms of both income generation and resistance to external shocks. Analysis of global trends shows that each dollar of added value in the processing chain generates 2.5-3.5 times more GDP and provides 4-6 times more jobs compared to raw materials sales of a similar volume of agricultural products. Firstly, this means that the shift in emphasis from "selling grain" to "selling flour, cereals, pasta, feed mixtures, food ingredients" is not just desirable, but a strategically imperative transformation.

Critical tools for increasing added value are: development of capacities for deep processing of grain (flour, starch, glucose-fructose syrups, bioethanol); expansion of oil and fat processing from raw oil to margarines, mayonnaise and specialized fats; development of production of organic and functional products (the market of which is growing in the EU by 8-10% annually); promotion of niche crops - flax, buckwheat, hemp, echinacea, spelts - with direct contracts for the markets of Central and Western Europe. A special role is played by the strategy of geographical designations (GI) on the model of the EU, which allows you to monetize the uniqueness of the regional origin of the product, adding from 15 to 80% of the price premium compared to unmarked counterparts.

The dynamics in the meat products segment is also indicative (Table 6). The growth of meat and meat products exports by 11.1% - to $92.7 million - testifies to the gradual strengthening of cooperation ties in the livestock industry, where feed producers, farms, slaughterhouses and meat production enterprises form a relatively closed value chain. At the same time, a sharp increase in imports of meat products (+ 83.2%) indicates unsecured domestic demand and insufficient capacity of cooperation ties in this segment, which signals a significant potential for the development of intra-industry cooperation.

At the same time, the negative dynamics in certain product groups - milk and milk products (-6.1%), fish and fish products (-24.2%), fresh vegetables (-5%) - indicates the fragmentation of cooperation chains in the relevant sub-sectors and the insufficient level of their integration. But the positive dynamics of fruits and berries (+ 32.4%), as well as honey, sugar and products from it (+ 0.8%), indicates the formation of new niches for cooperative specialization (Table 6).

Geographical diversification of sales markets is one of the key indicators of the maturity of cooperation structures and their ability to produce products in accordance with the requirements of various international markets. The study of the geographical distribution of agricultural exports reveals both established partnerships and new strategic directions reflecting the growing competitiveness of processed products [1; 17].

Analytical data indicate a significant differentiation of dynamics between individual geographical sales markets, which directly reflects changes in the competitive position of Ukrainian manufacturers and the success of cooperation strategies aimed at meeting the requirements of specific markets. The most significant result is the rapid growth in supplies to Turkey - from 116.5 to 235.7 million dollars. USA, or almost twice (+ $119.2 million). This growth reflects the effectiveness of interaction between Ukrainian oil and grain producers and Turkish trading partners, which act not only as end consumers, but also as re-exporters of processed products (Figure 6).

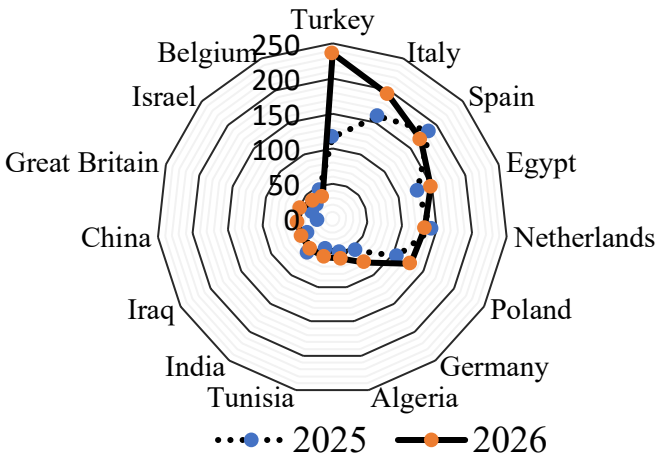

Figure 6. *Rating of countries for the export of Ukrainian agricultural products (as of January 2026)*
Source: built by the author based on [17]

A significant increase in supply volumes is also recorded in China (+ $28.8 million, or + 137%), which is evidence of the development of a new strategic market, access to which is possible only if there are certified, technologically mature cooperation chains capable of providing quality standards and volumes that meet the requirements of Chinese importers. Significant growth was also recorded in Poland (+ $22.1 million), Germany (+ $21.2 million) and the UK (+ $17.3 million), which indicates the gradual penetration of processed products into the demanding markets of the EU and the UK with their strict standards of quality and food safety.

At the same time, the decrease in supplies to Spain (-17.2 million dollars), the Netherlands (-9.63 million dollars) and Belgium (-10.8 million dollars) is due to competitive pressure from other suppliers and a partial reorientation of resources to markets showing higher demand. This trend indicates the need to strengthen cooperation specialization on products with specific competitive advantages that can withstand competition in the most saturated markets. Consequently, the geographical structure of agricultural exports in 2026 reflects both successes and challenges for the domestic system of inter-entrepreneurial cooperation in the field of agricultural processing.

Summarizing, it can be argued that cooperation between enterprises is not only an organizational, but also an economic phenomenon that directly affects the profitability and competitiveness of participants in agricultural chains.

The scale of the damage caused and the volume of indirect losses naturally raise the question of the formation of a comprehensive strategy for the recovery of the agricultural sector. Realistic planning for redevelopment requires a detailed consideration of funding needs by focus area and time horizon. Table 9 summarizes the recovery needs for 2025-2035.

Table 9. Recovery needs, billion dollars United States (2025-2035)

Direction	Amount, billion dollars USA	In% of total
Service recovery, total	38,9	100,0
Promoting climate-oriented technologies	15,0	38,6
Value chain development	10,0	25,7
Investment grants	10,0	25,7
Support for agricultural institutions	3,0	7,7
Other	0,9	2,3
Recovery, total	10,5	100
Agricultural equipment and machinery	7,2	68,6
Warehouse facilities	2,3	21,9
Perennial, animal husbandry, fish farming	1,0	9,5
Production support, total	6,0	100
Program 5-7-9%	3,1	52
Grants for small FGs	1,1	18
Recultivation	1,1	18
Other	0,7	12
Total, billion dollars USA	55,4	–

Source: compiled by the author based on [1; 19]

The total need to restore the agricultural sector over the ten-year horizon is $55.4 billion. US, which is structured in three main components: restoration of services ($38.9 billion USA), physical recovery ($10.5 billion US) and production support ($6.0 billion USA).

The largest share is $38.9 billion. The United States, or 70% of the total, falls on the restoration of services. The leading article of this component is the promotion of climate-oriented technologies - $15.0 billion. USA (38.6% of service recovery). This figure reflects the recognition that simply restoring the pre-war production model is insufficient: the agricultural sector needs to be structurally modernized to address increasing climate risks. Sunflower production in 2024 decreased significantly due to drought - a fact that clearly illustrates the vulnerability of production systems without appropriate climatic adaptation. $10.0 billion each The United States (25.7% each) is provided for the development of value chains and investment grants.

Restoration of the material and technical base requires $10.5 billion. USA. The dominant item is the restoration of agricultural equipment and machinery - $7.2 billion. USA (68.6%), which directly corresponds to the structure of direct losses, where damage to equipment accounted for the largest share. Therefore,

restoration of the technical fleet is a critical priority, as without it any other restoration measures will have limited effect. $2.3 billion is provided for the restoration of warehouse facilities. USA (21.9%), for the revival of perennial plantings, animal husbandry and fish farming - $1.0 billion. USA (9.5%).

Production support is estimated at $6.0 billion. USA. Half of this volume is $3.1 billion. USA (52%) - provided for the program of cheaper loans "5-7-9%," which is the main financial instrument to support agricultural production in Ukraine. Equal shares - $1.1 billion each. USA (18%) each - planned for grants for small farms and for the reclamation of contaminated and mined land. Reclamation is a particularly important article, given the scale of mine pollution: according to various estimates, from 174 to 250 thousand square kilometers of Ukrainian land need demining, which directly limits the restoration of processing.

It should be noted that the recovery of the industry has already begun: in 2022-2024, the state budget and donors allocated $873 million. USA, mainly for interest rate compensation (49%) and grants for small producers (22%). However, this amount is only 1.6% of the total need, which indicates the need to attract significant amounts of private capital and international funding. In particular, private investment has significant potential to become an engine of recovery, which requires the formation of an appropriate investment climate.

The question of the optimal structure of agricultural production in the post-war conditions is one of the most controversial in the professional environment. Researchers disagree on whether large agricultural holdings retain a dominant position, or whether the crisis opens a window of opportunity for restructuring in favor of small and medium-sized entities. The answer to this question is not unambiguous, since different models show a different stability profile depending on the specific operating conditions, which is summarized in Table 10.

Table 10. Comparative resilience of post-war agribusiness patterns

Model	Resilience in Crisis	Benefits for recovery	Risks and limitations
Large agricultural holdings (> 50 thousand ha)	Average	Access to capital, technology scaling, international certification	High vulnerability to assets in the war zone, dependence on foreign markets
Medium farms (500-5000 ha)	High	Flexibility, rapid reorientation of cultures, local employment	Limited access to credit resources, lack of agro-consulting
Cooperatives and associations of small farmers (<500 ha)	High (in a well-developed network)	Food security of the region, preservation of rural communities, diversification of products	Need for government support, low capitalization
Mixed partnerships (holding + cooperative), clusters	High	Synergy of capital and local knowledge, risk allocation	Management complexity, need for legal settlement

Source: compiled by the author based on [20-25; 29]

These data strongly suggest that medium-sized farms and cooperative or cluster structures demonstrate higher operational resilience in crisis conditions compared to large holdings. This is due to their ability to quickly reorient to alternative crops, a smaller share of assets in high-risk zones and an organic connection with local food systems. At the same time, large agricultural holdings remain indispensable in terms of access to international capital and technology, which is critical for the implementation of large-scale investment recovery projects. Therefore, the optimal structure of the post-war agricultural sector does not provide for the dominance of one model, but a synergistic combination of all three forms within a regulated system with clear government incentives for each segment.

The blockade of the Black Sea ports in 2022-2023 exposed the key structural vulnerability of Ukraine's agricultural exports - its critical concentration in one geographical node. Before the invasion, about 75-80% of grain and oilseed exports passed through the Odessa, Black Sea and Nikolaev ports. But in wartime conditions, there was an urgent need for operational diversification, which is also a strategic task for the post-war period. A comparative analysis of alternative logistics routes is presented in Table 11.

Table 11. Alternative logistics routes and tools for diversification of agricultural exports

Route/tool	Current throughput	Development potential	Priority actions
Danube ports (Izmail, Reni, Kilia)	Up to 3-4 mln t/month	Expansion to 8-10 million tons/month. for overload investments	Deepening of the fairway, new terminals, railway communication
EU rail corridor (broad/narrow gauge)	~ 30-35 million tons per year (2023 estimate)	Up to 50-60 million tons/year when upgrading gauge transfers	Acceleration of gauge conversion, simplification of customs procedures
Black Sea Grain Corridor (restored)	Temporarily restored in 2022-2023, suspended	Full de-escalation recovery	International guarantees, insurance, demining
Baltic routes (via Poland, Lithuania)	Limited (~ 5-8 million tons per year)	Growth in Polish port infrastructure	Coordination of tariffs, compatibility of standards
Direct contracts with Asian and African countries (without intermediaries)	Develops	Formation of stable bilateral agreements for 3-5 years	Diplomatic support, digital trading platforms

Source: Author based [19]

The results of the study of alternative logistics routes demonstrate that no single route can completely replace the Black Sea corridor in conditions of hostilities or constant threats. Danube ports, despite a significant expansion of capacity in 2022-2024, are limited by the depth of the fairway and the throughput potential of the river itself. Rail corridors across the EU are promising, but require a solution to the problem of gauge differences and harmonization of customs procedures. In general, the diversification strategy should be based on the principle of a "portfolio approach": the simultaneous development of several routes of various modalities ensures geopolitical resilience regardless of the development of specific regional conflicts or protectionist trends of individual countries.

Digitalization of the agricultural sector acquires a fundamentally new meaning in the context of post-war recovery, when there are two critical deficits at the same time: personnel (through mobilization and forced migration) and financial (due to the need to effectively use limited resources). A comparative analysis of the main digital technologies and their impact on production indicators is systematized in Table 12.

Table 12. Agribusiness Digital: Functionality, Efficiency, and Barriers to Adoption

Technology/Tool	Functional purpose	Effect on performance	Barriers to implementation
Precision farming (GPS, IoT sensors, drones)	Crop monitoring, differentiated fertilization	15-25% reduction in resource costs, 10-20% increase in yield	High initial cost of equipment, need for trained operators
Remote sensing of the Earth (satellites, UAVs)	Mapping of damaged land, mine pollution assessment	3-5 times faster land inventory	Dependence on cloud services, the question of data sovereignty
Electronic document management (USRP, agro-ERP)	Digital land registration, subsidies, reporting	30-40% reduction in administrative costs	Digital divide in small communities, cybersecurity
Agro-information platforms and marketplaces	Connecting manufacturers with buyers, insurance companies	12-18% increase in income for small farmers	Distrust of platforms, the need for a legal framework
Automated farming (robots, autopilot technology)	Compensation for personnel shortages in the fields	40-60% reduction in manual labor in some operations	Critical dependence on power supply and service

Source: Author based [26]

These data allow us to draw several fundamental conclusions. First, digital technologies are able to compensate for 30 to 60% of the personnel deficit in individual operational processes - in particular, automated agriculture and remote monitoring of crops. Secondly, the systemic effect of the integrated implementation of digital solutions exceeds the simple sum of individual effects: the integration of satellite monitoring with

precision fertilization and automated technology allows achieving synergistic productivity growth by 25-35%. Third, the key barrier is not technological accessibility, but the digital divide between large farms and small farmers, which requires targeted government support in the form of subsidized access to digital platforms and operator training programs.

Ukraine's food security is an integral part of its national security and an important factor of stability in global markets. We have summarized the key factors that form the contour of food security in Ukraine in war conditions (Table 13).

Table 13. Key Factors Affecting Ukraine's Food Security (2022-2025)

Category	Indicator/Impact factor	Quantification/Trend
Production potential	Change in total output of agricultural products	Reduction by 15.5% (from 1267 to 1070 billion UAH per post. prices 2021)
	Reduction of acreage	Withdrawn from circulation ~ 5 million hectares of agricultural land
	Losses of irrigation systems	Lost Kakhovskaya irrigation system for 584 thousand hectares
Key Product Groups	Production of cereals and legumes	Reduction by 14.5% (from 413 to 353 billion UAH)
	Fruit and vegetable production	Reduction by 37% (from 211 to 133 billion UAH) - the largest relative drop
	Production of livestock products	Reduction by 17.6% (from 256 to 211 billion UAH)
Export potential (ability to generate revenues)	Share of agricultural exports in the country's total exports	Increased from 45% (2020) to 59% (2024)
	Share in global exports (sunflower oil)	35.6% - critical role in the global food system
	Dynamics of vegetable oil export	+ 27.5% growth (Jan 2026 vs Jan 2025)
Logistics and market access	Logistical constraints	Blockade of Black Sea ports for the ~ 18 months, reorientation to land and river routes
Industry losses	Direct losses of the agro-industrial complex	$11.2 billion USA (58% - destroyed equipment)
	Indirect losses (lost revenue)	$72.8 billion USA (51% - due to a decrease in the production of annual crops)
Resilience to crises	Comparative stability of business models	Medium-sized farms and cooperatives show higher sustainability than large agricultural holdings

Source: compiled by the author based on [1; 17; 19]

The war caused not point, but systemic defeats of the agricultural sector, which simultaneously covered the production base, logistics, personnel potential and sales markets. The most long-term effects are land mine pollution and loss of irrigation systems, which will take decades to recover. Despite colossal losses (total direct and indirect losses exceed $84 billion. USA), the agricultural sector not only survived, but also increased its share in the country's economy, becoming the main source of foreign exchange earnings. This indicates the high adaptation potential of the industry, but at the same time indicates its critical importance for macroeconomic stability. Successful restoration and strengthening of food security in Ukraine is impossible without significant amounts of external funding (the need is estimated at $55.4 billion. USA), technological support and security guarantees to restore the full operation of marine export corridors.

The speed of recovery of destroyed agricultural enterprises and their long-term competitiveness directly depend on how much the recovery process integrates innovative solutions, and not just reproduces the pre-war technical and technological base. This thesis is confirmed by international experience in the post-war recovery of agricultural sectors: In particular, the experience of Rwanda after the 1994 genocide and Vietnam after 1975 indicates that enterprises that combined recovery with the introduction of new technologies, after 7-10 years exceeded pre-war productivity indicators by 1.5-2 times.

The climatic measurement is gaining special weight due to the fact that the average annual temperature in Ukraine over the past 30 years has grown by about 1.2 ° C, and droughts in the South and East have become more frequent and prolonged. Therefore, the restoration of agricultural enterprises without taking into account climate adaptation will mean their repeated vulnerability in 10-15 years. Key innovation areas include: introducing drought-resistant and heat-resistant varieties; transition to water-saving irrigation technologies (drip irrigation); development

of agroforestry and restoration of forest belts destroyed over decades of agricultural plowing; using AI-based predictive analytics systems to make crop rotation and risk management decisions.

The agricultural sector is traditionally considered mainly in the production and economic dimension. However, in conditions of de-occupation of significant rural areas, it is able to play the role of a systemic "anchor" for the restoration of all social and physical infrastructure. This phenomenon can be described through the concept of an "agrarian multiplier": each stably functioning agricultural enterprise in a de-occupied territory generates demand for transport infrastructure (roads, bridges), energy, telecommunications, housing services for staff, education and medicine for families employed. World Bank research shows that every dollar invested in rural agribusiness in post-conflict economies generates $2.0-3.2 of growth in related industries [11].

Practical mechanisms for realizing this synergy include: the tool of "agro-infrastructure packages," under which large agricultural holdings receive benefits (subsidies, land concessions) in exchange for commitments to invest in the restoration of local roads, schools and medical facilities; corporate social responsibility programs supported by tax incentives for investments in the social infrastructure of the communities of presence; model of "agricultural parks" - integrated complexes that combine production, processing and logistics functions with housing and educational infrastructure, creating self-sufficient centers for the revival of rural communities.

The global food system is in a state of structural turbulence caused by a combination of factors: increased protectionist trends among key importers, restructuring of supply chains after COVID-19, growing climate risks in traditional production regions and geopolitical fragmentation. In this context, Ukraine has a unique "window of opportunity" associated with its natural production potential, but it is possible to use it only if it is actively strategic positioning, and not passive expectation of a recovery in demand.

The grain sector remains the foundation, but requires a transition from the sale of raw materials to contract trade with fixed supplies, which ensures price stability and long-term relations with importers. The oilseed sector - due to the preserved processing potential - may occupy a niche of premium oils (cold-pressed sunflower, linseed, rapeseed) in the EU and Asian markets. Niche and organic crops are the segment with the highest growth rate of value: the demand for organic products in the EU is growing by 8-10% annually, while Ukraine is already one of the ten world producers of organic grain. Therefore, the positioning strategy should be based on a three-tier model: mass crops and oilseeds - as a stable base; deep processing - as the main generator of added value; organic and niche products - as a premium growth segment.

A comparative analysis of three fundamentally different conceptual approaches to post-war reconstruction - the reproduction of the pre-war model, forced modernization and the construction of a fundamentally new agrarian architecture - is the central theoretical and analytical task of this study. Each approach has its own benefit and risk profile, which is summarized in Table 14.

Table 14. Comparative analysis of conceptual models of post-war agribusiness recovery

Evaluation criterion	Restoring a pre-war model	Forced modernization	New agrarian architecture
Production recovery rate	High (3-4 years)	Average (5-7 years)	Inferior (7-10 years)
Food security (short-term)	High	Average	Low
Competitiveness in 2035-2040.	Low	Average-high	High
Climate resilience	Low	Average	High
Value added and diversification	Low (feed model)	Average	High (processing, niche crops)
Need for external financing	Moderate	High	Very high
Social effect (employment, communities)	Moderate	Moderate	High
Integral score (score 1-10)	**5,5**	**7,0**	**8,5***

* Evaluation in conditions of sufficient external funding and consistent public policy.

Source: compiled by the author

The benchmarking results demonstrate the undoubted advantage of the "new agrarian architecture" model in most strategic criteria, despite its lower performance in the short term. This model provides for simultaneous action in three planes: structural (restructuring of land relations and the ownership system in favor of a diversified farm structure); technological (large-scale implementation of digital, precision and biological technologies as a standard, not an exception); institutional (building a new system of agrarian

education, meeting, financial intermediation and market infrastructure). Therefore, the key issue is not the choice between these three models in its pure form, but the determination of the correct balance between them in different time horizons: in the first 2-3 years, priority should be given to elements of "forced modernization" to ensure food security, while at the same time the institutional foundations of the "new architecture" are being laid, the results of which will manifest themselves in a 7-15-year perspective.

Conclusions. The study suggests that the agribusiness of Ukraine, despite the unprecedented challenges caused by the full-scale invasion, has retained the status of a backbone element of the national economy. The analysis showed a contradictory, but generally stable dynamics of the industry: despite the reduction in the share of GDP to 6.8% in 2024, absolute production volumes increased by 46%, and the share of agricultural exports in total foreign trade reached 59%. This testifies to the transformation of the agricultural sector into a key guarantor of foreign exchange earnings and a balancer of the country's balance of payments in a military economy.

At the same time, the study revealed that this sustainability is achieved at the cost of colossal structural losses. The total volume of direct losses of the agro-industrial complex reached $11.2 billion. USA, with the greatest damage caused to the technical park (58% of total losses). Indirect losses, which are estimated at $72.8 billion, turned out to be even more destructive. The United States, which is six times more than direct losses and indicates a deep operational decline, especially in the production of annual crops. The production potential of the industry decreased by 15.5% compared to 2018, with the most critical drop recorded in sectors tied to the occupied southern regions, in particular in the production of fruits and vegetables (a drop of 37%).

The key conclusion of the study is the confirmation that the raw material model of agricultural exports has exhausted itself. Despite maintaining a leading position in global exports of sunflower oil (35.6%) and meal (40.2%), the commodity structure of exports demonstrates a high concentration on products with a low degree of processing (corn - 29.5%). A direct correlation was revealed between the development of cooperation ties and the growth of exports of products with higher added value. In particular, the outstripping growth in the export of vegetable oil (+ 27.5%) against the background of a decrease in the export of oilseeds is an empirical confirmation of the effectiveness of vertical cooperation in the oil and fat complex. But the fragmentation of ties in the livestock and dairy sectors leads to the loss of markets and an increase in imports, which indicates reserves for the development of intra-industry integration.

It has been proven that a cluster model of production organization is an optimal tool for overcoming structural imbalances. A hybrid model combining regional concentration (to optimize logistics and use natural advantages) with an innovative component (for technology transfer and deep processing) can provide a synergistic effect. Calculations show that the introduction of the cluster approach allows to increase the added value at different stages of the production chain: from 15-25% at the stage of cultivation (thanks to precision technologies) to 50-80% at the stage of production of functional food products. This confirms the thesis that the strategic transition from the export of raw materials to the export of deep processing products is not only desirable, but also an economically justified vector of development.

Summary of recovery needs ($55.4 billion) US 2025-2035) and comparative analysis of agribusiness patterns demonstrate that simple reproduction of the pre-war structure is the least effective in the long term. The highest integral assessment (8.5 points) was received by the model of the "new agrarian architecture," which provides not just physical restoration, but high-quality modernization based on climate adaptation, digitalization and cooperation development. It was revealed that medium-sized farms and cluster structures demonstrate higher operational stability in crisis conditions compared to large holdings, which actualizes the issue of revising the state support policy in favor of a more balanced structure of the agricultural sector.

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