

ANALYSIS OF MODERN TRENDS IN THE TRANSFORMATION OF THE AGRICULTURAL SECTOR OF UKRAINE: A CASE STUDY OF A REGIONAL SURVEYOR

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Abstract

The article analyses the current state of the process of transformation of the agro-industrial sector of the economy of Ukraine in the context of existing challenges and prospects and the formation of the country's food security in the system of existing risks in the agricultural sector of the economy that have arisen in the realities of modern times. Possible ways of solving problematic issues are also proposed. The results of the grouping of the regions of Ukraine according to the indicator of the shortage of elevator capacities are presented. An assessment of the impact of factors that slow down agribusiness development in Ukraine in 2016-2021 is provided. The study results confirm that Ukraine's agricultural business is an essential component of the economy, generating more than 1/10 of the country's GDP annually. The analysis results prove the constant trends in the development of the agricultural market of Ukraine, especially in the part of large businesses operating here.

Key words: agricultural sector, transformation trends, agro-industrial complex, agricultural production, food security, the association between Ukraine and the European Union

INTRODUCTION

The agricultural sector was and remains one of the leading contributors to Ukraine's budget and is the basis of its food security. It should be noted that in modern realities, the "Center for Food and Land Use Research (KSE Agrocenter)" is engaged in constant monitoring of food security and agricultural policy in Ukraine together with the "Ministry of Agrarian Policy and Food of Ukraine". Before the development of transformational phenomena in the agricultural sector of Ukraine, caused by external geopolitical influence, almost 400 million people in the world were provided with food and agricultural products due to their exports from Ukraine to the world market. According to USDA data, before the transformation processes, Ukraine supplied 46% of the world's sunflower oil exports, 9% of wheat exports, 17% of barley exports, and 12% of corn exports on international markets [23]. Thus, today, Ukraine is among the largest suppliers of agricultural products in the EU and occupies an equally significant place in the world trade of farm products.

Modern studies of the processes of transformation of the agricultural sector emphasize the regional features of the development of the agrarian sphere. The main trends include the introduction of innovative technologies, adaptation to climate change, and the role of state support for agriculture. At the same time, at the regional level, studies note significant differences in production indicators, which is caused by different availability of labor resources and management efficiency. The main studies of this issue are presented in the works of such scientists as N. Antoniuk [2], I. Arakelova [3], V. Boiko [4], M. Dziemulych [7-15], N. Khomiuk [18], V. Kostyuk [19], I. Mazniev [21], A. Popescu [24-33], M. Rudenko [34], T. Shmatkovska [35-40], R. Sodoma [41], A. Verzun [46] and others.

The existing trends in the development of Ukraine's agricultural sector, the level of its efficiency, the market balance of the leading indicators, and attractiveness factors for investors prove the relevance of the research topic. Thus, the issue of food security and the importance of the agricultural sector of Ukraine's economy have always been, are and will be relevant, especially against the

background of the latest geopolitical events in the world.

In this context, The purpose of the study is to analyze the current state of the transformation process of the agro-industrial sector of Ukraine's economy in the context of existing challenges and prospects, the formation of the country's food security in the system of existing risks in the agricultural sector of the economy that have arisen in the realities of modern times, and possible ways to solve problematic issues.

MATERIALS AND METHODS

We used analysis and synthesis, induction and deduction, analytical and statistical methods, and graphic methods to visualize the presented research results during the research.

RESULTS AND DISCUSSIONS

Food security is one of the most critical components of the national security of any state. Ukraine plays an integral part in global agrarian geopolitics. That is why complications in global geopolitics involving Ukraine are a critical negative factor in many countries' deterioration of food security. In addition, it is worth noting that other factors, in particular, also influenced the functioning of the global agro-food system:

- price disparity for agricultural products;
- low quality and unsatisfactory quantity of material and technical means for agricultural production (including plant protection means and fertilizers);
- negative socio-economic consequences caused by the COVID-19 pandemic;
- change in climatic conditions on Earth [4].

The negative impact of geopolitical problems involving Ukraine on the economy of most countries is noted at world economic forums. Many Ukrainian agricultural enterprises suspended their activities during the crisis, suffering significant destruction. Some were forced to evacuate their facilities to safer places. Still, the peculiarity of agribusiness is that extensive stationary-type facilities cannot be moved and are tied to land, which, in turn, destroys the logistical ways of exporting products of agricultural enterprises, agricultural holdings, and farms.

It is worth noting that last year, 2021, Ukraine entered the agricultural history as an absolute record - more than 106 million tons of grain and oil crops were harvested, the absolute maximum in the state's history. Ukrainian farmers harvested more than 84 million tons of grain and legumes, of which a significant share is accounted for by corn, wheat, and barley (40, 32.4, and 10.4 million tons, respectively). As for oil crops, according to the results of 2021, 22.6 million tons of them were collected [16]. This shows that during the implementation of most export contracts in the agricultural sector, elevators and warehouses of Ukraine are, in most cases, wholly filled with farm products to be exported. Accordingly, the destroyed sea logistics routes and the establishment of new land routes, which are far from being able to ensure the export of the necessary volumes, negatively affected the activity of the agricultural sector. Before the "grain corridor" opening, the prospect of exporting surplus grain of corn, wheat and sunflower for the 2021 harvest was unlikely since the carrying capacity through the Danube River and the western borders was relatively low. The cost of logistics was also added, which, in turn, made the export of agricultural products from most of the country unprofitable. An additional negative factor for exporters, especially those who did not work with the countries of the European Union, was the requirement for the quality of exported products, particularly regarding the residues of pollutants, diseases, pests, and toxicity. Most exporters needed to gain experience and knowledge of EU legislation. Therefore, this logistics path did not give a 100% guarantee that the products would not be returned due to non-compliance with the requirements.

In turn, there were many concerns about the quality of grain, which had been stored and "overstayed" in warehouses and elevators for quite a long time. But, as the results of the "grain corridor" showed, the fears of sceptics about grain quality were not justified. Ukraine confirms its status as a producer of quality grain and a reliable partner in its supply to fight the world's food crisis.

At the same time, exporters faced problems such as grain processing. In particular, this problem in 2021 concerned corn, which had been stored in elevators for a long time. The main reason was the uncontrolled use of

pesticides during the post-harvest treatment of grain from pests. It is worth paying attention; before using any drug on your own or treating grain with it, you need to consult with the manufacturer or supplier of drugs. To minimize such risks, it is better to involve fumigation experts and treat them with phosphine-based preparations to avoid problems with exceeding the limits of residual substances when exporting products yourself or supplying the exporter. Also, in some cases, issues with the presence of storage mycotoxins could arise, but such cases, as a rule, occur only when conditions are not met during storage.

The "Grain Corridor" remained the main logistics route for exporting the 2022 harvest. In particular, as of October 2022, about 32.7 million tons of grain and oil crops were collected from about 9.5 million hectares of cultivated areas, and 7.38 million tons of new and old crops were exported through the "grain corridor".

According to the results of the already exported products of the 2022 harvest, namely, corn, wheat, barley and rapeseed, it is possible to assess their current quality and provide a comparative characteristic with the indicators of the past year 2021.

The main problem in exporting corn is the control of mycotoxins. It is important to remember that all countries that import Ukrainian corn control mycotoxins, regardless of the purpose of the products. The level of mycotoxins increases because producers and direct elevators can accept products without drying them and without bringing them to the proper condition for long-term storage.

Several hundred different mycotoxins have been identified in the world, but the most common and dangerous to human and animal health are such mycotoxins as:

- Aflatoxins (products of *Aspergillus* genus);
- Ochratoxin A (OTA) (products of the *Penicillium* genus);
- Fumonisin, Zearalenone (ZEA) (DON) (produced, in particular, by the genus *Fusarium*).

At the same time, fungi that affect grains can be divided into two groups:

- fungi affecting plants in the field, that is, during its growing season (species of plant pathogenic fungi, namely the genus *Fusarium*);

– fungi that develop during storage (fungi of the genus *Aspergillus* and *Penicillium*) can also infect products in the field.

Deoxynivalenol, Fumonisin, Zearalenone and T2/HT2 are the most common mycotoxins for Ukrainian corn. It is also worth noting the increased content of benzo(a)pyrene, RAN4 and dioxins in corn because corn is most susceptible to drying, depending on weather conditions during harvesting, and oil crops such as soybeans, rapeseed, and sunflower, because dioxins, benzo(a) pyrene, RAN4 is a fat-soluble product, i.e., in its central mass, it passes from the seed into oil.

The increased gas price can encourage producers and those who store corn to save on dryer burning agents, using low-quality fuel, fuel oil, etc., instead of gas. Therefore, when buying and immediately before exporting corn, it is worth paying attention to a set of indicators (Table 1) and discussing with corn suppliers what types of dryers and fuel they use. It is possible to conduct sampling by an independent surveyor directly at storage locations before purchase or shipping to the port.

Table 1. Basic indicators of the export quality of corn in Ukraine

Parameters according to EN, ISO	Harvest 2021	Harvest 2022
Moisture, %	14.41	14.17
Nature, kg/hl	73.0	73.75
Beats, %	3.47	3.26
Damaged, %	1.5	0.61

Source: Generalized based on [45].

As for the quality of wheat in 2022, a significantly higher index of nature compared to last year is observed throughout Ukraine, but at the same time, a significant decrease in the index of protein and, accordingly, gluten; according to other indicators, the quality of wheat is at the level of the previous season.

In the new season, there are no significant problems for wheat concerning the presence of harmful fungi that affect quality indicators during export, namely *Tilletia controversa*, *Tilletia laevis*, and *Tilletia tritici*, which cannot please, since this indicator is increasingly one of the main requirements of importing countries and buyers are interested in buying batches completely clean of the genus *Tilletia* mushrooms.

According to the results provided by the surveying companies of the Ukrainian Grain Association members, the quality of the wheat baking indicators for some of them improved in 2022 (Table 2).

Table 2. Bakery indicators of wheat export quality in Ukraine

Parameters according to EN, ISO	Harvest 2021	Harvest 2022
Protein on dry matter, %	12.58	11.75
Nature, kg/hl	77.1	79.0
The number of falls, sec	345	351
Gluten, % (mechanical washing)	25.9	21.4
W, 10-4 J	217	186

Source: Generalized based on [45].

In particular, we can see that the grain's nature has grown significantly. This means a greater yield of flour and groats will be obtained during processing because nature characterizes the grain's flour and excellent quality.

It should be noted that the main problems for barley in 2022, as in previous years, remain the presence of quarantine objects, such as *Avena ludoviciana* Durien and *Aegilops cylindrica*, which are prohibited quarantine objects for export to China.

For the European Union, *Avena ludoviciana* Durien and *Aegilops cylindrica*, fortunately, are not a quarantine object and are therefore limited only by % litter admixture according to the contract (Table 3).

Table 3. Indicators of export quality of barley grain in Ukraine

Parameters according to EN, ISO	Harvest 2021	Harvest 2022
Protein on dry matter, %	11.25	11.70
Nature, kg/hl	62.9	62.7

Source: Generalized based on [45].

Different from wheat, according to the results of the 2022 harvest, the quality indicators for barley have mostly stayed the same from last year.

The 2022 harvest of rapeseed greatly pleased the producers with oiliness indicators that are 2% higher than last year. Also, the quality of rapeseed is accompanied by the absence of problems with erucic acid and glucosinolates, the high content of which is an indicator of technical rapeseed (Table 4).

Table 4. Indicators of export quality of rapeseed in Ukraine

Parameters according to EN, ISO	Harvest 2021	Harvest 2022
Oiliness (as is), %	42.50	44.5
Erucic acid, %	0.15	0.05
Glucosinolates, $\mu\text{mol/g}$	9.7	9.9

Source: Generalized based on [45].

An equally important export component is sunflower and sunflower oil. Sunflower yield in Ukraine in 2022 was 2.19 tons per hectare [22]. This year, the area under sunflowers is the lowest in the last ten years – 4.75 million hectares [20]. In particular, in connection with the deterioration of weather and climate conditions, namely prolonged rains in September, in addition to the shift of the harvest campaign, significant areas of sunflowers are affected by diseases, which affects their quality. In particular, 16% of the examined crops were affected by fomosis. The highest damage is observed in the Kirovohrad region – 40% of the area. Other common diseases include white and grey rot. In particular, white rot affects 6-32% of areas and 2-20% of plants, with the development of the disease 1-10% (Ternopil, Vinnytsia, Dnipropetrovsk, Kirovohrad, Zaporizhzhya, Cherkasy regions), grey rot - 12-37% of areas, 1- 20% of plants with disease development 1-10% (Ternopil, Vinnytsia, Dnipropetrovsk, Kirovohrad, Zaporizhzhya, Zakarpattia, Cherkasy regions).

Peronosporosis affected 20% of sunflower areas, 3-6% of plants with the development of the disease, 0.2% (Khmelnyskyi region), rust – 4% of the areas, 8% of plants, and 5% with the development of the disease (Kirovohrad region).

Aphids also feed on sunflower crops. They colonised 10% of the areas at 1.0-8.0 specimens/plant and damaged 1% of the plants (Khmelnyskyi region). In addition, bugs, which infested 50% of the areas at the rate of 2.0-4.0 specimens/plant, damaged 6-8% of the plants (Khmelnyskyi region), cotton bollworm – 4% of the areas at the rate of 0.5 specimens/m², 8% of plants were damaged (Kirovohrad region) [17]. We must admit that under such conditions and with the reduction of sunflower areas in Ukraine, significantly less grain and oil were exported from it in 2022 (Table 5).

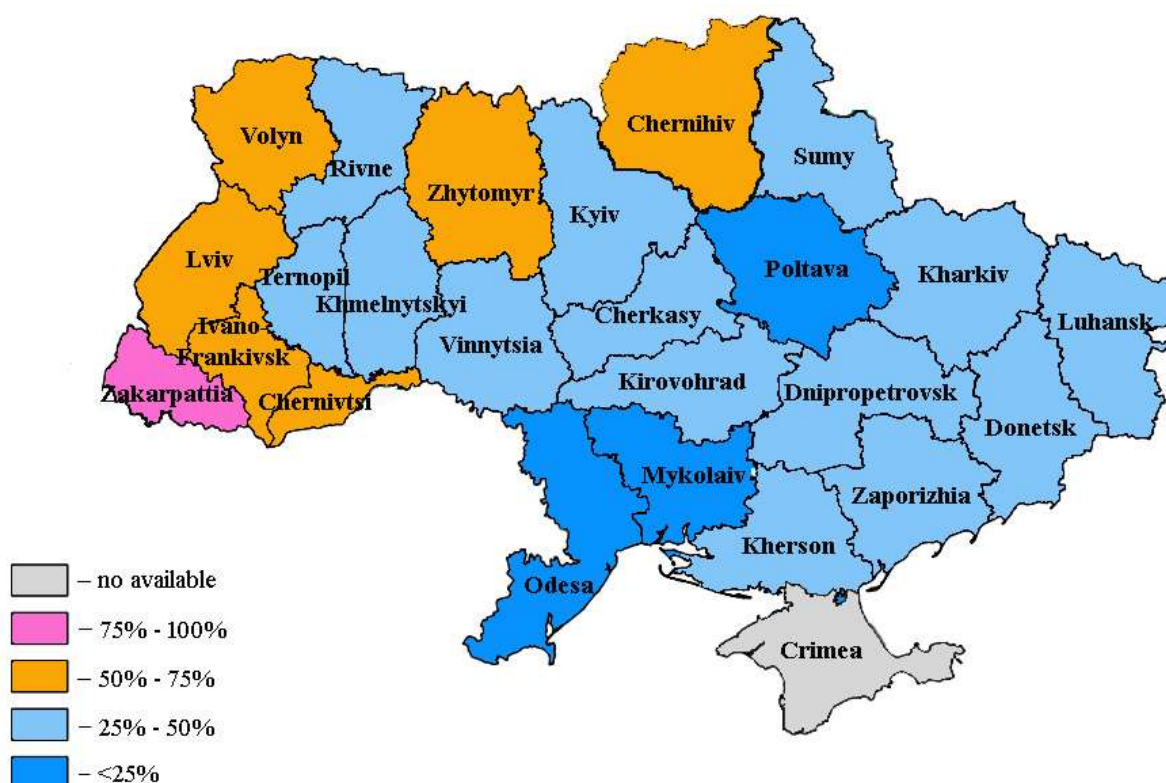
Table 5. Yield Indicators of Ukraine in 2022

Agricultural culture	Area, million ha-thousands ha	Share of the total sowing area, %	Yield, t/ha	Threshed, million t-thousand t
Wheat	4.7	100	4.12	19.4
Barley	1.6	100	3.51	5.6
Pea	111.5	100	2.34	261
Turnip	1.1	100	2.89	3.2
Millet	42	93	2.33	97
Buckwheat	104	88	1.36	141
Sunflower	3.2	68	2.19	7.0
Soy	798	52	2.36	1.9
Sugar beet	89	49	47.8	4.2
Corn	528	12	5.07	2.7

Source: [22].

Understanding the key trends of the agricultural market is necessary for correct and practical decisions made by information users. Such an understanding is provided through qualitative analysis and assessment of information as the primary tools for ensuring trust in the Ukrainian agricultural market.

It is important to emphasize that the current state of the elevator, transport, and irrigation infrastructure forms the prerequisites for the further development of Ukraine's agricultural sector. In particular, based on the study results, we grouped the regions of Ukraine according to the indicator of the shortage of elevator capacities (Map 1).



Map 1. Cartogram of the results of the grouping of the regions of Ukraine according to the indicator of the shortage of elevator capacities, %

Source: own generalisations based on [42].

It was found that the most significant shortage of elevator capacities is observed in the Zakarpattia region (Map 1). In addition, there

is a relatively high deficit in most of the western border regions of Ukraine, particularly in the Volyn, Lviv, Ivano-Frankivsk and

Chernivtsi regions. The most minor shortage of elevator capacities in Ukraine is observed in the Poltava, Odesa and Mykolaiv regions, which are located in the south and centre of the country. It is important to note that the

Ukrainian agricultural market developed and continues to develop under certain restrictions and the influence of negative factors (Fig. 1). We consider all limits directly from the point of view of Ukrainian farmers.

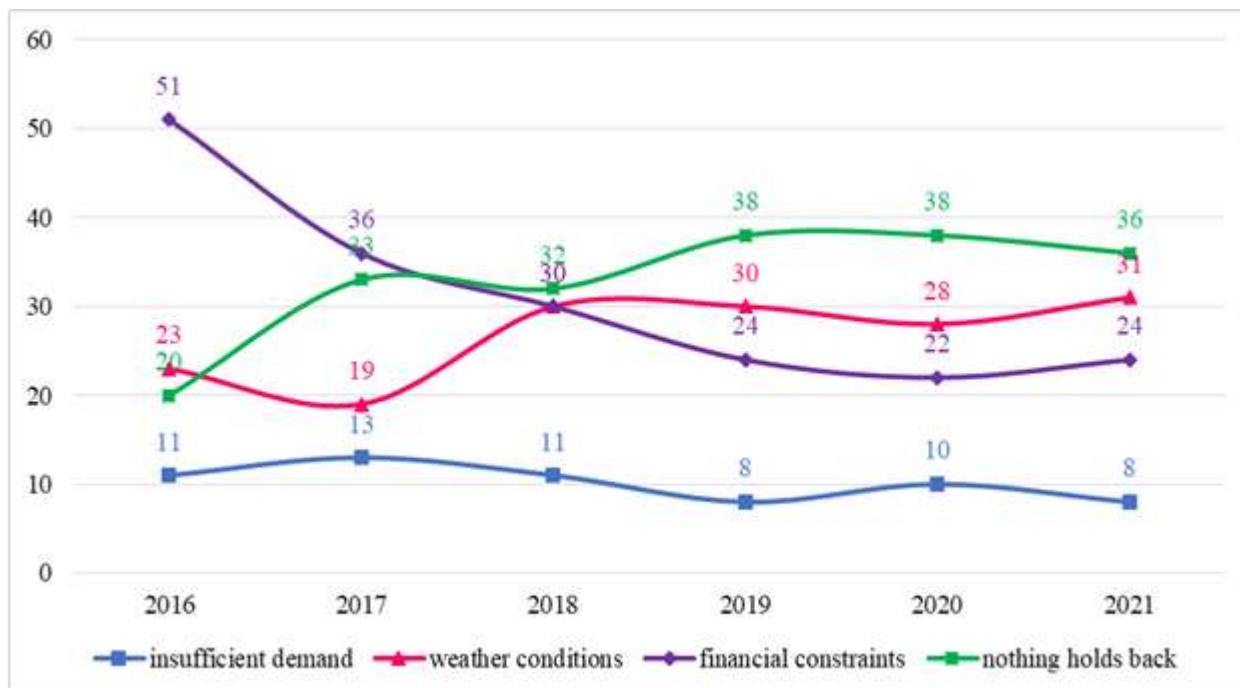


Fig. 1. Assessment of the impact of factors that slow down the development of agribusiness in Ukraine, 2016-2021, %

Source: own development based on [42].

In particular, when assessing the expectations of agrarians regarding the significance of factors restraining the development of agribusiness in Ukraine, the following was found:

1. insufficient demand (11% of respondents chose it as essential in the 3rd quarter of 2016, and only 8% in the 3rd quarter of 2021);
2. weather conditions (19-30% of respondents during 2016-2021 considered it a significant influencing factor).
3. labour shortage (the least important factor for agribusiness – only 1-4% of respondents in different years paid attention to its negative impact);
4. lack of materials and equipment (8% of respondents considered this a problematic issue in the 3rd quarter of 2016, but at the end of the 3rd quarter of 2021, only 2% of them held this opinion);
5. financial constraints (51% of respondents were concerned about this factor in the 3rd quarter of 2016, and only 22% in the same period of 2021).

Agribusinesses often need more financing than is available. In this case, cheap and long-term financing is considered available. Ukrainian banks could not ensure the fulfilment of these criteria, especially during the “bank collapse” period, since the financing of national banks and investors was expensive and short-lived, especially in 2016.

However, some Ukrainian banks now offer affordable financing tools. In addition, instruments of international financing have gained popularity. First, this concerns the European Bank for Reconstruction and Development (EBRD) [1]. Therefore, in 2021, the availability of cheap and long-term financing for farmers is much higher than in 2016.

Thus, it is worth emphasising that since 2016, agribusiness has been developing under conditions of significant financial restrictions, which were eliminated by 2021. Weather conditions, which, according to the specifics of the industry, are a normal phenomenon, have become the predominant negative factor for

agribusiness this year. At the same time, in 2021, the agricultural market feels that the factors restraining development have become weaker. The absence of a significant impact of financial restrictions, lack of materials, equipment and labour, and insufficient demand allowed farmers to be included in the list of those least affected by the quarantine restrictions introduced during the spread of COVID-19 [44].

The process of Ukraine's association with the European Community must involve implementing the provisions of the Agreement in Ukraine's legislative field and harmonising the Ukrainian legal framework. It was established that by the end of 2022, the overall progress in implementing the document was estimated at 72%, in particular, in humanitarian policy – 91%, in entrepreneurship – 88%, and in agriculture – 63% (Fig. 2).

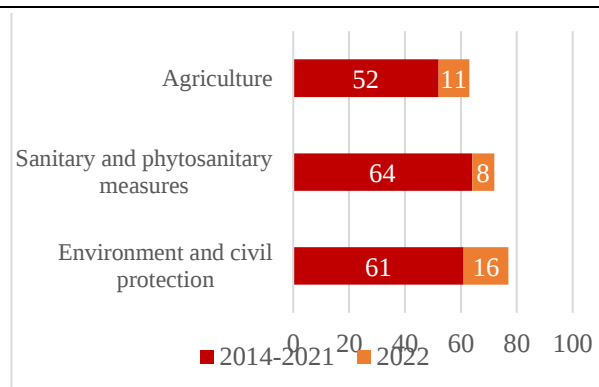


Fig. 2. Overall progress in the implementation of the association agreement between Ukraine and the European Union by spheres of activity, %
Source: own development based on [5; 43].

Ukraine has partially harmonised its own regulatory and legal environment with the requirements of the European Union. However, there are still areas of activity for which the legislation needs significant improvement, including the development of implementation mechanisms.

	No. Chapters	Ukraine	Moldova	Georgia	Turkey	Serbia	N. Macedonia	Montenegro	Albania	Bosnia	Kosovo
Total score (without chapter 23)		69	55	67	94	98	97	99.5	84.5	52	56
Basic sections											
Judicial system and fundamental rights 23		n/a	n/a	n/a	1	2	2.5	3	2.5	2	n/a
Justice, freedom, security 24		2	2	2	3	2	3	3	2.5	2	1.5
Public procurement 5		2	1	2	3	3	3	3	3	2	2.5
Statistics 18		2	2	2	3	3	3	3	3	1	2
Financial control 32		1	1	2	4	3	3	3	3	2	2
Green agenda and sustainable connectivity											
Transport policy 14		2	2	2	3	4	3	3.5	2	2	1
Energy 15		4	2	2	3	3	3	4	3	1	2
Trans-European networks 21		2	2	2	5	3	4	3.5	2	2	2
Environment and climate change 27		1	1	1	2	2	2	2	2	1	1
Resources, agriculture and cohesion											
Agrarian industry and rural development 11		1	1	1	2	2	3	3	2	1	2
Food safety, veterinary medicine, phytosan 12		3	2	2	2	3	4	3	2	2	2
Fishing 13		1	1	2	3	3	3	2	2.5	1	1
Region. policy, structure tools 22		2	1	1	2	3	3	3	3	1	1
Financial and budgetary provisions 33		1	1	1	2	2	1	2	2	1	n/a

Fig. 3. Evaluation of Ukraine as an EU candidate state in terms of approximation to European law and practice
Note:

1	basic level	2	is some approximation	3	medium level	4	good level	5	advanced level of approximation
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Source: own development based on [6; 43].

According to the materials of the analytical report of the European Commission on the level of convergence of Ukrainian legislation with current EU law (February 2023), Ukraine

demonstrates an initial level of training in the field of environment and climate change in the field of agriculture and development of rural

areas, as well as a certain level of training in the field of regional policy (Fig. 3).

This provides grounds for concluding that there is a need not only to create an appropriate legal environment but also to create a system of administratively capable institutions, the functional purpose of which should be the regulation of agricultural and rural development, the protection of the natural environment, the development of mechanisms for the implementation of the provisions of European regulatory documents, the provision of systematic monitoring and control of relevant processes, etc.

CONCLUSIONS

Understanding the key trends in the development and transformation of Ukraine's agricultural sector is necessary for correct and practical decisions made by users of such information.

The study results confirm that Ukraine's agricultural business is an essential component of the economy, generating more than 1/10 of the country's GDP annually. The analysis results prove the constant trends in the development of the agricultural market, especially in the part of large businesses operating here. For example, 14% of the largest business entities in Ukraine, regardless of size and form of ownership, are agribusinesses.

The world market has recently seen a significant increase in agricultural products; in particular, the price policy for wheat and corn has increased by 20%. Many factors contributed to these processes, including crop failures in agricultural production countries due to adverse climatic conditions (droughts, fires, floods). The outlined trends in the future will lead to an increase in the cost of essential food products, especially in third-world countries. Reducing the price tension in the world market of agricultural products is possible by assisting Ukraine's leading world leaders. It should also be emphasised that agribusiness was slightly affected by quarantine restrictions and the economic crisis caused by the COVID-19 pandemic. This makes it attractive for foreign investment, which is refocusing on a more substantial

business in a period of increasing number of liquidations of market entities.

In particular, the domestic agricultural market should implement a policy aimed at:

- provision of preferential loans to farmers for the restoration of equipment and production facilities;
- provision of preferential loans by foreign investors for the restoration of the infrastructure of storage, transportation and processing of plant and animal products;
- introduction of the latest advanced technologies for growing and processing agricultural products to promote their export with high added value;
- modernisation of logistics routes, namely bringing the width of the Ukrainian railway track to European standards with the involvement of foreign capital.

It is equally important to create conditions for the permanent, uninterrupted, and safe export of agricultural products by the sea with the world community's support.

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