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# Forecasting regional development of the agricultural sector in the context of economic instability

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▶ Abstract. The purpose of the study was to assess the impact of economic factors on the agricultural sector of the Dnipropetrovsk Oblast for the period 2021-2024, identify key trends and develop approaches to improving the economic stability of the region. Within the framework of the study, methods of regression analysis, econometric modelling, and scenario approach were applied to assess the dynamics of yield, the structure of acreage, investment activity, and the share of the agricultural sector in the gross regional product. The results of the study showed that the share of the agricultural sector in the gross regional product ranged from 7.5-8.76% during the analysed period. The highest rate of 8.76% was recorded in 2022 due to a 46% reduction in the total gross regional product compared to 2021. The volume of agricultural production decreased by 33.9% in 2022, but partially recovered in 2023, reaching UAH 32.5 billion. The regression analysis showed that an increase in the fuel price by 1 UAH/l reduces the wheat yield by 0.2 cwt/ha, and an increase in the inflation rate by 1% leads to a decrease in the yield by 0.3 cwt/ha. Scenario analysis showed possible consequences of changes in economic conditions: in a pessimistic scenario, wheat yields may fall to 36.08 cwt/ha by 2028. The significance of the results obtained lies in the possibility of using them to form strategies for the recovery

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and development of the agricultural sector in conditions of economic instability. It was proposed to focus on attracting foreign investment, diversifying crops and introducing energy-efficient technologies to increase the sustainability of the region. The results of the study also highlighted the importance of government support, which accounted for 25% of total investment in 2023, which contributed to a partial recovery in economic activity in the agricultural sector

Keywords: gross output; investment activity; crop diversification; crop insurance; crop structure

### Introduction

The relevance of this study is conditioned by the need to ensure the stable development of the agricultural sector of Ukraine in the context of economic instability, which is caused by the impact of global and internal crisis phenomena, such as war, inflation, rising resource prices, and changes in international trade relations. The agricultural sector is a strategically important sector that ensures food security, creates a significant share of gross domestic product, and acts as a key source of income for a significant number of the population.

However, the instability of the economic environment affects the efficiency of agricultural enterprises, reduces their competitiveness, and creates risks for investment activities (Berxolli *et al.*, 2023). Under these conditions, there is a need to develop scientifically based approaches to forecasting the development of the agricultural sector, which would consider the specifics of regional features and the influence of macroeconomic factors.

The problems of optimising the structure of assets and capital of Ukrainian agricultural enterprises caused by macroeconomic instability, low investment attractiveness and lack of transparent market rules after the cancellation of the moratorium on land sales were discussed in the study by N. Barabash & T. Pashkuda (2021). The researchers, using models of correlation of financial indicators, found that the agricultural sector provides 15-20% of the gross domestic product of Ukraine annually, but its development was limited by financial risks and lack of innovative management mechanisms. Risk management methods, the introduction of modern financial instruments, and the impact of technology investment on industry stabilisation remain insufficiently studied.

Ukraine's integration into the European market and the challenges of war significantly complicate ensuring the competitiveness of the agricultural sector (Shebanin *et al.*, 2024). S. Kozlovskyi *et al.* (2023) investigated these aspects by developing an economic and mathematical model based on fuzzy set theory, which allowed assessing competitiveness considering quantitative and qualitative factors. The results of their study included a forecast of competitiveness until 2026, which showed an increase in efficiency in the context of European integration. Gaps that require additional research include improvements in the methodology for assessing military factors such as logistics, energy, and fertiliser delivery.

The impact of wartime and instability on the agricultural sector significantly complicates its development. S. Moshenskyi *et al.* (2024) focused on the stagnation of livestock production and the decline in crop growth rates caused by political and economic instability, in particular, the events of 2014 and 2022. The researchers developed recommendations for minimising the negative impact of corruption, developing innovation, and attracting investment to support the agricultural sector. Gaps that require further study include improved wartime support policies and effective resource management to address the effects of economic instability.

Martial law and economic instability significantly affect the financial support of the agricultural sector, which creates numerous challenges for its functioning and development (Pylypenko *et al.*, 2025). D. Titov & V. Oleksienko (2024) focused on changing conventional financing mechanisms, in particular lending, due to high risks and uncertainty. The researchers highlighted the importance of new financial instruments, such as international aid, grants, risk insurance, and crowdfunding, which could contribute to the stability of the agricultural sector. However, gaps that required additional research included adapting these tools to the specific conditions of Ukraine and implementing insurance mechanisms, considering the risks of military operations.

The unstable state of agricultural entrepreneurship in Ukraine, in particular during martial law, significantly complicated the strategic development of this industry. O. Kovbasa (2024) studied the components of the strategic development of agricultural entrepreneurship, paying attention to the disparities in the structure of production, technological support, regional differences, and the problems of adaptation of enterprises to modern challenges. The researcher emphasised the need to improve the risk management system through the introduction of digital technologies, diversification of risk management tools, and strengthening cooperation with stakeholders. The gaps that required further research included the impact of digitalisation on the effectiveness of strategic management and the integration of environmental aspects into the development of agricultural entrepreneurship.

Current economic trends, in particular, globalisation, climate change, and market instability, have significantly complicated the management of the development of the agricultural sector (Wang *et al.*, 2024). N. Petrukha & V. Karashko (2024) focused on the need to introduce innovative technologies that would help to improve the efficiency and sustainability of production. The researchers developed an algorithm for implementing innovative technologies and a model for adopting technologies in conditions of uncertainty. The importance of ensuring adequate funding and support from the state and international organisations was also emphasised. Further research requires adapting technologies to the specific conditions of different regions, and integrating innovations into a single production process.

Regional differentiation and economic instability created significant challenges for the agricultural sector (Boiko *et al.*, 2024). H. Syrotiuk (2022) investigated the features of the development of the agricultural sector of the

Lviv Oblast, drawing attention to the imbalance between crop production and animal husbandry, which negatively affects food security and employment of the population. The researcher proposed approaches to improving state support, in particular, through compensation for the costs of machinery, seeds, and livestock maintenance. Further analysis requires the integration of innovative technologies into production processes and increasing the effectiveness of agricultural policy at the regional level.

The purpose of the study was to develop econometric models for predicting the development of the agricultural sector of Ukraine in conditions of economic instability, considering the influence of macroeconomic and regional factors. To achieve this goal, the following tasks were defined: to analyse the dynamics of the main indicators of the agricultural sector, such as yield, production structure and investment activity; to assess the impact of economic instability on the sustainability and efficiency of agricultural enterprises.

#### Materials and methods

This study represented an applied, analytical research aimed at assessing the impact of economic factors on the agricultural sector of the Dnipropetrovsk Oblast. The time frame covered the period from 2021 to 2024, as 2021 was the base period for analysis, reflecting stable economic conditions before the start of significant challenges related to military operations and economic instability. This allowed comparing indicators before and during the crisis conditions, identifying key trends and the impact of external factors on the agricultural sector. Dnipropetrovsk Oblast was selected for the study because of its strategic role in Ukraine's agricultural sector, its significant contribution to the country's gross agricultural output, and the high level of impact of economic and social challenges on regional development. This helped to investigate the adaptive capabilities of the region in the context of macroeconomic changes.

The main sources of information were official statistics (Dnipro Agro Group, n.d.; Bayer, 2021; Latifundist, 2023; Main Department of Statistics in the Dnipropetrovsk Oblast, 2023), economic forecasts (State Statistics Service of Ukraine, 2022; 2023), data from the National Bank of Ukraine (2022; 2023; 2024), and information obtained in the process of econometric modelling (Fuel prices: how..., 2022; Kudynenko, 2022; How the average..., 2023). The study focused on key indicators such as agricultural output, gross regional product, investment activity, crop vields, and structural changes in acreage (Ministry of Economy of Ukraine, 2020; National Institute for Strategic Studies, 2024). The analysis included an assessment of economic and social changes affecting the agricultural sector. As part of the study, the share of the agricultural sector in the gross regional product of the Dnipropetrovsk Oblast for 2021-2023 was analysed (1):

$$S = \frac{agricultural \ products}{gross \ regional \ product} \cdot 100\%,\tag{1}$$

where *S* – share of the agricultural sector in the gross regional product, expressed as a percentage; *agricultur-al products* – total volume of products produced in the agricultural sector (in monetary terms); *gross regional* 

*product* – total volume of products and services produced in the region (in monetary terms).

This analysis allowed assessing the dynamics of the contribution of the agricultural sector to the economic stability of the region and its adaptive capabilities in conditions of economic instability. The results of the analysis of the share of the agricultural sector in the gross regional product determined its role in ensuring the economic factors on the development of agriculture. This contributes to the achievement of the research goal, as it provides sound data for developing effective strategies for the recovery and development of the agricultural sector in conditions of economic instability. To analyse the influence of individual factors on wheat yield, a regression model was used, which considered changes in yield depending on variables such as fuel price and inflation rate (2):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon, \tag{2}$$

where *Y* – projected wheat yield (cwt/ha); *X*<sub>1</sub> – fuel price (UAH/l); *X*<sub>2</sub> – inflation rate (%);  $\beta_0$ ,  $\beta_1$ ,  $\beta_2$  – regression coefficients that determine the effect of independent variables on the dependent one;  $\varepsilon$  – random error.

The model calculated how changes in each of these indicators affect yield, helping to predict the dynamics of the indicator depending on economic conditions. This provided a more accurate forecast based on changes in key macroeconomic indicators. To analyse the dynamics of wheat yield in the Dnipropetrovsk Oblast, the average value formula was used, which allowed calculating the average yield value for the projected period (3):

$$Average = \frac{\Sigma Yi}{V}.$$
 (3)

The study also used scenario analysis to assess the possible impact of economic factors on agricultural production. Three scenarios were identified: optimistic, baseline, and pessimistic, which considered various possible changes in fuel costs, inflation rates, and overall economic conditions (4):

$$D_{uvelage alg} = yields \cdot area \cdot price.$$
 (4)

The scenario approach allowed assessing the prospects for the development of the agricultural sector depending on the future dynamics of macroeconomic conditions. In addition, a comparative analysis of the investment structure was carried out, which helped to assess the impact of various types of investment - public, private, and foreign - on the development of the agricultural sector. This analysis identified key factors for the stability of the agricultural sector in the context of economic instability. For data processing and construction of econometric models, modern software tools were used, in particular Excel and SPSS, which provided the possibility of qualitative data analysis, building models and forecasts. The tools helped to accurately assess the impact of factors on economic indicators and identify opportunities for adapting the agricultural sector to modern challenges.

#### Results

Dnipropetrovsk Oblast is one of the leading regions of Ukraine in terms of agricultural production. Agricultural land of the region covers an area of about 2.54 million hectares, which is a significant part of its territory. According to this indicator, the Dnipropetrovsk Oblast is among the top 5 regions of Ukraine. The main areas of agricultural production in the region are the cultivation of cereals (wheat, barley, corn) and oilseeds (sunflower, rapeseed), which form the basis of the agricultural sector. The cultivation of grain and oilseeds in the Dnipropetrovsk Oblast covers significant areas of agricultural land, which makes this region one of the key producers in Ukraine. The main crops are wheat, barley, sunflower, and rapeseed, which provide a high level of production for both domestic consumption and export (Penkova & Kharenko, 2023).

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In 2021, the yield of the main crops was also high. Winter wheat provided 49.4 cwt/ha, sunflower and winter rapeseed - 28.6 cwt/ha each, and winter barley -37.8 cwt/ha. The total area of agricultural land in the region occupied for these crops allows maintaining the stability of the agricultural sector even in difficult conditions (Bayer, 2021). In 2022, despite economic difficulties, about 99 thous. t of grain and oilseeds were harvested. The yield of winter wheat was 48.6 cwt/ha, rapeseed - 39.3 cwt/ha, and barley - about 31.5 cwt/ha. These results indicate a stable level of production, even in difficult conditions. In 2023, the region showed high yield indicators. Sunflower had a yield of up to 26.3 cwt/ha in some plots, and the area of its sowing amounted to more than 12 thous. ha. Winter wheat provided a yield of 52.4 cwt/ha, harvested from more than 12 thous. ha. Rapeseed showed an average yield of 35.7 cwt/ ha on an area of about 578 ha (Dnipro Agro Group, n.d.).

In 2024, farmers of the Dnipropetrovsk Oblast achieved significant success in harvesting. More than 60 thous. t of winter barley was harvested from 21 thous. ha, with an average yield of 29 cwt/ha. Winter wheat provided even higher indicators: more than 109 thous. t from 35 thous. ha, with an average yield of 32.3 cwt/ha. In addition, more than 21 thous. t of winter rapeseed was harvested from more than 14 thous. ha, while the yield was 16 cwt/ha. Sunflower also showed a significant improvement: about 1.1 mln. t was harvested from the area with an average yield of 21 cwt/ha, which exceeds the previous year's figure of 16 cwt/ha. In total, 1,808.6 thous. t of winter and spring wheat were harvested in 2024, with an average yield of 3.3 t/ha. These achievements demonstrate the stability and development of the region's agricultural sector (Poltorak et al., 2023: Shostak, 2024).

During 2021-2023, the volume of agricultural production in the Dnipropetrovsk Oblast showed significant fluctuations, reflecting the impact of both positive and negative factors on the agricultural sector. In 2021, the volume of production amounted to UAH 41.6 billion, which indicates stability in the region's agriculture. This indicator highlights the important role of the agricultural sector as one of the key sources of economic growth in the region. In 2022, there was a significant reduction in production volumes, which decreased to UAH 27.5 billion. The decrease of 33.9% compared to the previous year was caused by a number of negative factors, in particular, military operations, economic instability, and disruption of logistics chains. These circumstances significantly affected the productivity of the agricultural sector, reducing its efficiency. In 2023, according to expectations, the volume of agricultural production increased to UAH 32.5 billion, which reflects a partial recovery of the sector after previous losses. Despite this, the indicators remained below the level of 2021, which indicates the need for further stabilisation and adaptation of the agricultural sector to new conditions. Recovery was made possible by improved production conditions, well-coordinated work of enterprises, and a gradual return on investment in the industry (Main Department of Statistics in the Dnipropetrovsk Oblast, 2023).

During 2021-2024, the Dnipropetrovsk Oblast experienced significant changes in the structure of yields of the main agricultural crops, which were conditioned by economic challenges and the impact of military operations. In 2021, winter wheat occupied 497 thous. ha, sunflower -601.3 thous. ha, winter rapeseed - 86.8 thous. ha, corn -303 thous. ha, and winter barley – 90 thous. ha. In 2022, the area under winter wheat decreased to 457.2 thous. ha, sunflower - to 541.5 thous. ha, corn - to 275.5 thous. ha, and under winter barley - to 75 thous. ha, while winter rapeseed increased to 104 thous. ha, which emphasises its growing attractiveness. In 2023, the area under winter wheat decreased even more, to 406.4 thous. ha, sunflower grew to 621.69 thous. ha, winter rapeseed also showed positive dynamics, reaching 125.2 thous. ha, and the area under corn and winter barley decreased to 218.06 thous. ha and 65 thous. ha, respectively. In 2024, the area under winter wheat increased to 455.2 thous. ha, which is 108.1% compared to 2023. Sunflower showed stable growth, reaching 702.7 thous. ha (113% by 2023), while the area under winter rapeseed increased to 248.69 thous. ha, which is 356.8% compared to the previous year. The area under corn also increased to 293.13 thous. ha, which is 108.3% compared to 2023. Such changes indicate the adaptation of the agricultural sector to new conditions and an emphasis on the most promising crops, such as sunflower and rapeseed (Main Department of Statistics in the Dnipropetrovsk Oblast, 2024). In general, these changes in the structure of crops indicate the need to adapt the agricultural sector to new realities, in particular, through crop diversification and optimisation of production processes. Sunflower and rapeseed proved to be the most promising crops that provide stable demand and profitability, while the area under wheat and corn was reduced due to economic and climate challenges (Latifundist, 2023).

The gross regional product of the Dnipropetrovsk Oblast showed significant fluctuations during 2021-2023. This was due to stable events in peacetime and problems caused by war and economic instability. As evidenced by the stable economic development of the region and its significant contribution to the gross regional product of Ukraine in 2021, the gross regional product of the region amounted to UAH 582.363 million. This indicator highlights the importance of the region as one of the most important economic centres of the country. However, in 2022, amid military operations and significant economic shocks, the gross regional product fell to UAH 313.83 million. This decline, which was about 46% compared to 2021, reflected the serious challenges facing the region's economy. The negative effects of the war affected all industries, including industry, agriculture, transport, and infrastructure (State Statistics Service of Ukraine, 2022). In 2023, there was a partial recovery of gross regional

product to the level of UAH 398.732 million (State Statistics Service of Ukraine, 2023). Despite this growth, the figures are still below the level of 2021. Figure 1 shows graphically how the gross regional product in the region changed during this period.



**Figure 1.** Indicators of gross regional product for the period 2021-2023 **Source:** compiled by the authors

This indicates a gradual improvement in the economic situation, which, however, requires additional efforts to stabilise and develop the regional economy. Dnipropetrovsk Oblast continued to play an important role in Ukraine's economy, demonstrating resilience and recovery potential. To assess the contribution of the agricultural sector to the gross regional product of the Dnipropetrovsk Oblast for the period 2021-2023, the method of calculating the share of agricultural products in the gross regional product based on equation (1) was used. This approach allows analysing the current dynamics and dependence of the development of the agricultural sector on the economic conditions of the region:

$$S2021 = \frac{41.6}{582.363} \cdot 100\% = 7.5\%.$$
 (5)

In 2021, the share of the agricultural sector in the gross regional product was 7.5%, which reflects the stable development of agriculture against the background of overall economic growth in the region:

$$S2022 = \frac{27.5}{313.830} \cdot 100\% = 8.76\%.$$
(6)

In 2022, the share of the agricultural sector increased to 8.76% due to a reduction in the total gross regional product due to military operations and the economic crisis. This highlights the sustainability of the agricultural sector as a key element of the regional economy in times of crisis:

$$S2023 = \frac{32.5}{398.732} \cdot 100\% = 8.15\%.$$
(7)

In 2023, the share of the agricultural sector was 8.15%. Despite the partial economic recovery, the indicator remained below the level of 2021, which indicates the need for additional investment, state support, and innovative solutions for the sustainable development of the industry. According to the results of the analysis, the share of the agricultural sector in the gross regional product of the Dnipropetrovsk Oblast during 2021-2023 underwent significant changes, reflecting the impact of economic and social factors on the development of the region. In 2021,

the share of the agricultural sector was about 7.5%, which indicates the stable development of agriculture against the background of the overall economic growth of the region. In 2022, as a result of military operations and the economic crisis, gross regional product declined significantly, but the agricultural sector showed relative resilience, increasing its share to 8.76%. This underlines the importance of the agricultural sector as one of the key elements of the regional economy in times of crisis. In 2023, against the background of a partial recovery in gross regional product, the share of the agricultural sector was 8.15%. Despite some improvement in indicators, the level remained lower than in prewar 2021. This shows that the agricultural sector continues to adapt to new conditions, but its stable development requires additional investment, state support and innovative solutions. Thus, the agricultural sector remained an important stabilising factor in the economy of the Dnipropetrovsk Oblast, providing a significant contribution to the gross regional product even in difficult conditions.

In the period 2021-2023, there was a gradual decrease in the number of people employed in agriculture in the Dnipropetrovsk Oblast, which indicates the impact of economic challenges and changes in working conditions in the region. In 2021, the agricultural sector employed about 87.6 thous. people, which accounted for approximately 9.5% of total employment, emphasising the importance of agriculture as an important source of jobs. In 2022, the number of employees decreased to 81 thous. people (8.9% of total employment) due to the negative consequences of the war, which significantly affected all aspects of agricultural activities, including labour resources. In 2023, this decline continued, and the number of employed people decreased to 75 thous. (8.5% of total employment), which indicates prolonged economic instability and the need to adapt to new realities. Figure 2 graphically shows the dynamics of the number of people employed in agriculture in the Dnipropetrovsk Oblast.



Figure 2. Number of people employed in agriculture in Dnipropetrovsk Oblast 2021-2023 Source: compiled by the authors

Investment activity also changed during this period. In 2021, the total volume of investment in the agricultural sector amounted to about UAH 8.5 billion, of which 20% was accounted for by public investment, 15% – by foreign investment, and 65% – by private investment, which indicated a significant role of the private sector. In 2022, investment decreased to UAH 5.2 billion, while the share of public investment increased to 25%, and foreign investment decreased to 10% due to instability. The private sector continued to provide 65% of funding, while maintaining its leading role. In 2023, the total volume of investments reached UAH 6 billion, reflecting a partial recovery of the industry. Public investment remained at 25%, foreign investment rose to 15%, and private investment accounted for 60%, demonstrating the sector's adaptation to new conditions. Thus, despite the challenges, agriculture in the Dnipropetrovsk Oblast continued to play an important role in the region's economy, but further development requires additional measures to support and stimulate investment (State Statistics Service of Ukraine, 2023).

In the period 2021-2023, the inflation rate in Ukraine experienced significant fluctuations, reflecting the influence of both internal and external factors. In 2021, inflation was 10% year-on-year, exceeding the target range defined by the National Bank of Ukraine (2022). The price increase was driven by global factors such as supply chain disruption due to the COVID-19 pandemic, rising energy and raw material prices, and domestic factors including rising consumer demand and rising production costs. Record harvests, the strengthening of the hryvnia, and the NBU's monetary policy, which raised its key policy rate from 6% to 9% to contain price pressures, had a positive impact on containing inflation.

In 2022, inflation rose sharply to 26.6% in annual terms, which was the result of a full-scale war. Infrastructure destruction, supply chain disruption, rising production costs, and exchange rate fluctuations have put significant pressure on prices. Despite the difficult conditions, the measures of the National Bank of Ukraine (2023), including fixing the hryvnia exchange rate and raising the discount rate to 25%, helped to contain inflationary processes. In addition, the government imposed a moratorium on raising tariffs for housing and communal services, which also helped to reduce price pressure. At the end of the year, the price growth rate stabilised due to the establishment of logistics and the expansion of food supply.

In 2023, inflation slowed significantly to 5.1% in annual terms, which was the result of comprehensive measures taken by the National Bank of Ukraine (2024), good harvests, and a stable situation in the foreign exchange market. The decline in price growth is explained by improved exchange rate expectations, curbing administrative prices, and reducing business costs. Core inflation fell to 4.9%, while non-food prices even fell by 0.1%. The slowdown in the growth of the cost of services and durable goods further contributed to the stabilisation of the price situation. Thus, in 2023, inflation in Ukraine returned to controlled levels due to the effective actions of the National Bank and the government, despite the difficult conditions of previous years.

The dynamics of the cost of wheat cultivation in the Dnipropetrovsk Oblast depended on macroeconomic factors, such as inflation, an increase in the cost of fuel and agricultural resources. In 2021, the average cost of one tonne of wheat was UAH 1,825. This level of spending remained stable due to moderate inflation (10%) and relatively low fuel prices. For example, the average price of diesel fuel was 21.18-22.6 UAH/l, which allowed farmers to maintain the profitability of production through effective cost management. In 2022, inflation reached 26.6%, and diesel fuel prices rose to a record 56.36 UAH/l in May, which led to an increase in the cost of wheat to

2,278.5 UAH/t, or 24.9% more than in the previous year (Fuel prices: How..., 2022; Kudynenko, 2022). The rise in the price of fuel used for the operation of agricultural machinery and transportation of products has become one of the key factors for rising costs. For example, a 150% increase in the cost of diesel fuel significantly increased the cost of field work. In addition, fertiliser prices increased by 40%, which increased the cost of growing crops by 18%. Military action and logistics disruptions have also contributed to additional pressure on manufacturers. In 2023, inflation slowed to 5.1%, while fuel prices stabilised at 43.4 UAH/l in June (Fig. 3). However, the cost of wheat remained high – 2,268.2 UAH/t (How the average..., 2023; National Institute for Strategic Studies, 2024).



#### **Figure 3.** Cost of wheat cultivation in Dnipropetrovsk Oblast in 2021-2023 **Source:** compiled by the authors

This suggests that previous economic shocks still affected farmers' spending. Low purchase prices for cereals forced producers to change the structure of crops in favour of more cost-effective crops, such as sunflower and rapeseed, but this also required additional investment and limited opportunities for reducing production costs. Rising fuel and fertiliser prices combined with high inflation in 2022 were a crucial factor in raising the cost of wheat. Even after the economic situation stabilised in 2023, the agricultural sector continued to operate in conditions of high costs, which requires further adaptation and state support to ensure the profitability of production.

The agricultural sector of Ukraine has undergone significant changes in tax policy and state support, which was the result of the need to adapt to economic challenges and instability. In 2021, agricultural producers worked under preferential taxation with a value-added tax rate of 20%, which provided budget revenues of UAH 60.7 billion. State support amounted to UAH 3.8 billion aimed at reimbursement of value-added tax, subsidies, and lending programmes, which contributed to the development of the industry and support for producers (Decision of the..., 2024). In 2022, the situation became more complicated due to the war. Although the value-added tax rate remained unchanged, farmers received benefits such as single tax exemptions and deferred tax payments. This allowed partially easing financial pressure, but tax revenues to the budget were reduced to UAH 45.8 billion. State support also decreased to UAH 2.5 billion, although the focus remained on reimbursement of value-added tax and direct subsidies, which helped farmers to maintain their activities in difficult conditions. In 2023, there were drastic changes aimed at stabilising and developing the

agricultural sector. The introduction of the minimum tax burden mechanism allowed legalising about 11 million hectares of agricultural land, providing additional revenues in the amount of UAH 1,500 per hectare. The volume of state support increased to UAH 10.5 billion, which was a significant step forward compared to previous years. Total tax revenues from the sector increased to UAH 52.8 billion, reflecting the positive impact of the new measures. Such changes have become important for ensuring the financial stability of the agricultural sector, supporting its legalisation and creating conditions for further development (Dovgal *et al.*, 2017; Ministry of Economy of Ukraine, 2020).

Analysis using a regression model to predict wheat yield in the Dnipropetrovsk Oblast for the next 5 years, considering the annual increase in fuel prices by 10%, the projected wheat yield (cwt/ha) for the period 2021-2023 was calculated based on equation (2):  $\beta_0 = 55.2$  (constant);  $\beta_1 = 0.2$  (impact of fuel prices);  $\beta_2 = 0.3$  (impact of inflation) if  $\beta_0$  (constant): the base value of the yield if  $X_1$  and  $X_2$  equal to  $\beta_1$  for each additional 1 UAH/l increase in the fuel price, the yield decreases by 0.2 cwt/ha.  $\beta_2$  for each 1% increase in inflation, the yield decreases by 0.3 cwt/ha. Fuel prices at the beginning of 2024 were 55 UAH/l. Considering the trends of previous years, growth of 10% was projected annually:

▶ in 2025: 60.5 · 1.1 = 66.55 UAH/l;

- ▶ in 2026: 66.55 · 1.1 = 73.205 UAH/l;
- ▶ in 2027: 73.205 · 1.1 = 80.5255 UAH/l;
- ▶ in 2028: 80.5255 · 1.1 = 88.57805 UAH/l;
- ▶ in 2029: 88.57805 · 1.1 = 97.435855 UAH/l.

A stable forecast for fuel price growth of 5% has been adopted, as this estimate considers a gradual decrease in inflationary pressure, stabilisation of energy prices, and the absence of significant factors that could cause sharp fluctuations:

$$Y = 55.2 - 0.2X_1 - 0.3X_2; \tag{8}$$

1. 2024:  $Y=55.2-0.2 \cdot 60.5 - 0.3 \cdot 5 = 55.2 - 12.1 - 1.5 = 41.6$  cwt/ha.

2. 2025:  $Y = 55.2 - 0.2 \cdot 66.55 - 0.3 \cdot 5 = 55.2 - 13.31 - 1.5 = 40.39$  cwt/ha.

3. 2026:  $Y = 55.2 - 0.2 \cdot 73.205 - 0.3 \cdot 5 = 55.2 - 14.641 - 1.5 = 39.059$  cwt/ha.

4. 2027: *Y*=55.2 – 0.2·80.5255 – 0.3·5=55.2 – 16.1051 – -1.5=37.5949 cwt/ha.

5. 2028:  $Y=55.2-0.2 \cdot 88.57805-0.3 \cdot 5=55.2-17.71561-$ -1.5=36.08439 cwt/ha.

Calculations show that the wheat yield in the Dnipropetrovsk Oblast is gradually decreasing from 41.6 cwt/ha in 2024 to 36.08 cwt/ha in 2028, which indicates a significant impact of the increase in fuel costs on the productivity of the agricultural sector. Based on equation (3), the average value of wheat yield in the Dnipropetrovsk Oblast in future years was calculated:

$$Average = \frac{41.6+40.39+39.059+37.5949+36.0839}{5} = 38.94 \text{ cwt/ha}.$$
 (9)

The results of the forecast show that the increase in fuel prices by 10% annually has a significant impact on the average wheat yield in the Dnipropetrovsk Oblast. The yield is gradually decreasing from 41.6 cwt/ha in 2024 to 36.08 cwt/ha in 2028, with an average of 38.95 cwt/ha for this period. This dynamic is conditioned by an increase in production costs, which directly affects the economic efficiency of agricultural activities. To stabilise yields in the face of rising fuel prices, innovative approaches to reducing production costs, introducing energy-efficient technologies and state support are needed, in particular, through cost compensation mechanisms and stimulating the use of alternative energy sources (Golub *et al.*, 2020). Scenario analysis is an important tool for assessing the possible performance of the agricultural sector in conditions of economic instability. Its goal is to model various situations based on variable economic factors, such as agricultural prices, yields, crop area, and access to government support.

For the Dnipropetrovsk Oblast, which is one of the leading regions in the production of grain crops, in particular wheat, scenario analysis allows assessing the impact of changes in market conditions on farm incomes. The calculations were based on the average yield, the area of agricultural land, and the selling price of products. Three scenarios - optimistic, baseline, and pessimistic allow understanding the possible risks and prospects for the development of the industry, depending on economic conditions. The prospects for the development of the industry depend on economic conditions. Given that the area of agricultural land is 104,756 hectares, and the wheat yield is 45 cwt/ha, the estimate of potential income varies depending on price scenarios. In the baseline scenario, at a sales price of UAH 8,000/t, a stable level of income is expected. In the case of an optimistic scenario, in which the selling price increases by 10% and amounts to UAH 8,800/t, a significant increase in profit is possible. But a pessimistic scenario, which provides for a 10% reduction in the price to UAH 7,200/t, can significantly reduce the yield, emphasising the dependence of economic indicators on market conditions. An optimistic scenario: it provides for an increase in state support, access to soft loans and improved market conditions, which increases the selling price to UAH 8,800/t. Data on the amount of additional potential for 3 scenarios were calculated based on equation (4):

$$D_{wholesale} = 45 \text{ cwt/ha} \cdot 104,756 \text{ ha} \cdot 8,800 \text{ UAH/t} = = 41,902,608 \text{ UAH.}$$
(10)

Baseline scenario. Maintaining the current economic situation unchanged. Sales price remains at the level of 8,000 UAH/t:

$$D_{basic} = 45 \text{ cwt/ha} \cdot 104,756 \text{ ha} \cdot 8,000 \text{ UAH/t} = = 38,012,160 \text{ UAH}.$$
(11)

Pessimistic scenario It is expected to further increase costs due to inflation and higher fuel prices, which reduces the selling price to UAH 7,200/t:

$$D_{pessimistic} = 45 \text{ cwt/ha} \cdot 104,756 \text{ ha} \cdot 7,200 \text{ UAH/t} = = 34,210,944 \text{ UAH}.$$
(12)

Scenario analysis of the profitability of the agricultural sector of the Dnipropetrovsk Oblast demonstrated the importance of considering changes in economic conditions for predicting the results of economic activity. In an optimistic scenario, which provides for increased state support and stability of market prices, income from wheat cultivation on an area of 104,756 hectares may increase significantly, creating favourable conditions for further development of farms. The baseline scenario, characterised by maintaining the current state, reflects stable but limited returns without significant improvements or risks. The pessimistic scenario, which considers the negative impact of inflation and rising costs, showed a significant decline in revenues, which could jeopardise the profitability of production.

Thus, the results of the analysis indicate the need to introduce effective mechanisms of state support, such as subsidies and concessional lending, to mitigate the impact of negative factors and stimulate the growth of the agricultural sector. This will ensure the stability of farm incomes and increase their competitiveness even in unfavourable conditions. The study will conduct an analysis for sunflower, considering the following data: the area of land - 104.756 ha, the yield - 26.3 cwt/ha, and the base selling price - 23,700 UAH/t. For the optimistic scenario, it is planned to increase the selling price by 10%, which is 26,070 UAH/t, and for the pessimistic scenario - a decrease in the price by 10%, to 21,330 UAH/t. Calculations of these indicators are based on equation (4), which determines the additional income potential by multiplying the yield, crop area, and selling price of products:

$$D_{wholesale} = 26.3 \text{ cwt/ha} \cdot 104,756 \text{ ha} \cdot 26,070 \text{ UAH/t} = 71.998,554 \text{ UAH}.$$
 (13)

$$D_{basic} = 26.3 \text{ cwt/ha} \cdot 104,756 \text{ ha} \cdot 23,700 \text{ UAH/t} = 65,453,772 \text{ UAH}.$$
(14)

$$D_{pessimistic} = 26.3 \text{ cwt/ha} \cdot 104,756 \text{ ha} \cdot 21,330 \text{ UAH/t} = 58,909,033 \text{ UAH}.$$
(15)

The results of the analysis showed that the income from growing sunflower seeds on an area of 104,756 hectares significantly depends on fluctuations in sales prices. The optimistic scenario, which provides for an increase in the selling price to 26,070 UAH/t, will provide an income of UAH 71,998,554, which is the most profitable option for farmers. In the baseline scenario, if the sales price level is maintained at 23,700 UAH/t, the income will amount to UAH 65,453,772. The least favourable scenario is a pessimistic one, in which the selling price will decrease to 21,330 UAH/t, which will lead to a reduction in income to UAH 58,909,033. These results demonstrate a significant impact of economic conditions on the financial stability of the agricultural sector. To minimise risks, it is recommended to diversify activities, use insurance mechanisms to protect income, and introduce effective agricultural technologies.

To adapt the agricultural sector of the Dnipropetrovsk Oblast to the current challenges caused by economic instability, it is important to implement comprehensive strategies aimed at improving production efficiency, reducing costs, and minimising risks. The first step should be to diversify crops. Increase the area under oilseeds such as sunflower and rapeseed. In 2023, the average sunflower yield in the region was 26.3 cwt/ha. If the area of sunflower crops is increased by 20% of the total area of cultivated land of 104,756 hectares, this can provide an additional yield of 5,505. tons. With an average selling price of 12,000 UAH/t, this will provide an additional income of UAH 66 million. This approach will not only increase profitability, but also reduce dependence on monocultural production, which is vulnerable to price fluctuations.

The second important measure is the use of local fertilisers to reduce dependence on imports. In 2022, the cost of imported fertilisers increased by more than 30%, which significantly increased the cost of production. If farmers switch to using local fertilisers, the cost of which is 20-25% lower than imported analogues, this will save about 400 UAH/ha on fertilisers. On an area of 104,756 hectares, this will provide a total savings of UAH 41.9 million in one season. The saved funds can be used to modernise equipment or purchase high-quality seeds.

The third key step should be the introduction of crop insurance. In 2022, farmers of the region lost about 20% of their crops due to adverse weather conditions and fighting. The introduction of crop insurance with coverage of at least 70% of losses will allow farmers to compensate for losses. For example, wheat insurance with an average yield of 50 cwt/ha and a price of 8,000 UAH/t on an area of 50 hectares will cost approximately UAH 20,000 per season, but in case of complete loss of the crop, it will provide compensation up to UAH 280,000. Such a mechanism will increase the financial stability of farms and reduce the risks of bankruptcy.

Additionally, it is worth considering the introduction of modern technologies, such as precision farming systems, that can optimise the use of resources and increase yields. For example, the use of drones to monitor the condition of crops can reduce the cost of processing fields with chemicals by 10%, which for an area with an average crop area of more than 100 hectares will provide savings of UAH 100-120 thousand per season. Thus, the comprehensive implementation of the proposed strategies will increase the economic stability of the agricultural sector of the Dnipropetrovsk Oblast. The use of local fertilisers, crop diversification, and crop insurance combined with modern technologies will contribute not only to reducing costs, but also to increasing profitability, ensuring the sustainable development of the agricultural sector even in difficult economic conditions.

The results of the analysis of acreage and yield of the main crops in the Dnipropetrovsk Oblast for 2021-2023 show a significant impact of economic and social challenges on the agricultural sector of the region. During this period, fluctuations in the structure of crops of the main crops were observed. The area under winter wheat was gradually reduced, which may indicate a change in the priorities of farmers. Sunflower and rapeseed showed an increase in acreage, confirming their economic attractiveness in conditions of instability. Despite the challenges, the yield of key crops remained stable, and in some cases even showed a recovery, which underscores the sustainability of the agricultural sector. However, to ensure longterm growth and sustainability of the regional agricultural

sector, new approaches to management are needed, in particular, crop diversification, introduction of innovative technologies, and active state support.

#### Discussion

The agricultural sector plays a key role in ensuring food security and economic stability, especially in the face of global challenges. Analysis of the impact of economic, environmental, and social factors on the development of agriculture allows identifying the main mechanisms for improving its sustainability and efficiency. The use of quantitative methods, such as modelling and regression analysis, helps to identify the relationships between key indicators and develop recommendations for sustainable development of the agricultural sector in various regional and international contexts.

The current study and the paper by Q. Yang et al. (2022) share common features and differences due to geographical and contextual conditions. Both focus on the sustainability of the agricultural sector, but with different accents. This study examined the impact of economic instability on the agricultural sector of Dnipropetrovsk Oblast, while Q. Yang et al. analysed the impact of fluctuations in international prices on China's agricultural regions. The analysis of the spatial and temporal dynamics of change and the role of public policy in strengthening sustainability is a common feature. This study highlights the importance of public investment, and Q. Yang et al. effectiveness of the policy of minimum purchase prices and subsidies in China. Comparison with the paper by F.S. Xolmurotov et al. (2024) identified common features and differences. Both studies focus on the role of agriculture in shaping the economic sustainability of regions. F.S. Xolmurotov et al. analysed in detail the impact of agriculture on gross domestic product, employment, income, and export potential, offering a universal approach that considers the relationship with industry and services. But the current study focuses on local features of the agricultural sector in Ukraine.

The current study and the paper by K. Kuipers et al. (2024) have common features and differences due to different approaches. K. Kuipers *et al.* focused on the political evolution of sustainable development in the province of Flevoland (Netherlands), including environmental, economic, and social aspects. This study analysed the economic indicators of 2021-2023, while K. Kuipers et al. conducted a long-term analysis (1986-2022) using interviews and policy documents. The environmental aspect in this study was related to attracting foreign investment, whereas K. Kuipers et al. emphasised changing political rhetoric. Social component in K. Kuipers et al. was limited to supporting agribusiness, whereas in this study it was considered through investment. K. Kuipers et al. focused on the difficulties of implementing the policy, and this study focused more on the results of the recovery of the agricultural sector.

Both the current study and V. Stehel *et al.* (2019) shared common features and differences that reflect different approaches to the analysis of the agricultural sector. Both studies focused on assessing the sustainability of agricultural enterprises. The general focus was on the economic sustainability of the agricultural sector.

V. Stehel *et al.* used cluster analysis based on neural networks to evaluate 4,201 agricultural enterprises in the Czech Republic. The results of both studies confirmed the importance of investment for improving agricultural efficiency, although the scope of the analysis varied: the current study focused on the regional level, while V. Stehel *et al.* covered the national context.

EU. Khan *et al.* (2024) examined financial constraints in agriculture in developing countries, focusing on barriers such as high rates, difficult credit conditions, and lack of infrastructure. Both studies recognised the importance of financial support and investment in improving the productivity of the agricultural sector. EU. Khan *et al.* focused on global systemic problems, while this study focused on the impact of investment on the economy of Dnipropetrovsk Oblast. The difference was the scale of the analysis: EU. Khan *et al.* investigated the global context, and the current study examined the local challenges of the region.

T.V. Kalashnikova *et al.* (2019) highlighted common aspects of the analysis of investment support in the agricultural sector and its impact on agricultural development, but there were also significant differences in research areas and accents. Both studies highlighted the importance of investment to improve agricultural productivity. T.V. Kalashnikova *et al.* explored investment security through a multi-factor approach, considering the impact of profitability, lending, government support and foreign direct investment on gross value added. Both studies also emphasised the importance of forecasting the development of the agricultural sector. T.V. Kalashnikova *et al.* offered forecasts based on optimistic, realistic, and pessimistic scenarios for the development of agriculture in Ukraine.

C. Harkness et al. (2023) and R. Berry et al. (2022) examined aspects of the stability and economic sustainability of agriculture in England and Wales. C. Harkness et al. analysed the impact of climate change, management practices and government subsidies on the stability of the agricultural sector in 2005-2017, emphasising the importance of adapting solutions to climatic conditions. Diversification, efficient use of agrochemical resources, and agroecological management were identified as the main factors of stability. R. Berry et al. created an agricultural sustainability index based on spatial analysis, considering financial stability, economic efficiency, income diversification, and crop diversity. Both studies approached sustainability analysis through multidimensional metrics. C. Harkness et al. focused on management and climate aspects, while R. Berry et al. emphasised financial stability and used a geographical approach to visualise sustainability by region. The main difference was in the scale: C. Harkness et al. analysed multidimensional aspects of management, whereas R. Berry et al. focused on the subnational level through spatial analysis. Both approaches are useful for understanding the stability of the agricultural sector in the face of changes.

Both the current study and the paper by I. Rumyk *et al.* (2021) analysed the financial aspects of supporting and forecasting the development of the agricultural sector, but each of them had its own unique features that reflect different accents in the approaches. Common to both

studies was the emphasis on the role of financial support in the development of the agricultural sector. I. Rumyk *et al.* emphasised that an effective financing system provides for the optimal use and distribution of various sources of funding. The study by I. Rumyk *et al.* applied economic and mathematical modelling to assess the impact of investment on food production, in particular, the Statgraphics software suite was used to build forecasts. Instead, I. Rumyk *et al.* considered long-term forecasts of food security until 2030, using multi-factor models to estimate agricultural production per capita.

The study by I.-M. Gren et al. (2024) analysed the economic impact of trade barriers in Sweden, including the impact of reduced imports on food self-sufficiency, accessibility for low-income households, and the well-being of producers and consumers. The paper addressed the international context, while the present study focused on investments within the region. I.-M. Gren et al. used a multi-factor approach to food availability, and the current study focused on economic indicators. A.Y. Hassan & M.A. Mohamed (2024) analysed the impact of economic and environmental factors on agricultural productivity in Somalia using the Autoregressive Distributed Lag model. Investment and rural population growth have a positive impact on productivity, while CO<sub>2</sub> emissions had a negative effect. A common approach was to assess the role of investment in productivity and consider environmental factors such as precipitation. A.Y. Hassan & M.A. Mohamed evaluated short- and long-term effects, while the current study focused on the regional impact of investment.

V. Georgieva *et al.* (2024) examined the impact of ammonia emissions, organic farming, and production costs on soft wheat prices in France, Germany, Italy, and Spain (2000-2022). The emphasis was placed on the analysis of environmental factors and price stability. The common features with the current study were the attention to the role of economic and environmental factors in the development of the agricultural sector and the use of quantitative analysis. Main differences: V. Georgieva *et al.* covered several EU countries and regional differences in the impact of environmental indicators, while the current study focused on investment and climate conditions in a particular region.

The study by M. Dziamulych *et al.* (2022) predicted the economic performance of agricultural enterprises in Ukraine using the "AGMEMOD-Ukraine" model, considering demographic changes, state support, and production costs. Common features were the emphasis on sustainable development of the agricultural sector and the use of multi-factor models for investment and cost analysis. The difference was in the focus: M. Dziamulych *et al.* focused on economic aspects and long-term forecasts until 2030, while this study focused more on environmental factors such as climate conditions and precipitation.

The study by M. Swain (2014) examined the impact of rain instability, irrigation infrastructure, and fertilisers on yields in Western Odisha, India, where low irrigation coverage and rain dependence were key issues. Together with the current study, the impact of climate on agriculture and the importance of sustainable resource management were highlighted. M. Swain analysed regional issues such as droughts and infrastructure deficiencies, while the current study covered broader geographical and integrated aspects of economic and environmental factors.

Y. Lopatynskyi et al. (2021) analysed the scenarios of transformation of the institutional environment of the agricultural sector of Ukraine through the concept of sustainable development. The researchers proposed forecasting scenarios (pessimistic, realistic, optimistic), focusing on the integration of economic, social, environmental, and institutional components. Common to this study were the emphasis on the concept of sustainable development, scenario analysis, and the importance of a balanced approach. The difference is that Y. Lopatynskyi et al. focused on the long-term transformation of Ukraine's institutional environment using an interdisciplinary approach, while the current study focused on quantitative analysis of investment and climate change. Both approaches complement each other, offering different perspectives for analysing the sustainability of the agricultural sector.

The study by S. Gazuda *et al.* (2024) analysed regional features of agricultural development and its significance for the economy, which coincides with the subject of the current study. Common emphasis was placed on the importance of the agricultural sector for economic stability and the use of quantitative analysis of the impact of agriculture on regional development. The current study focused on the Dnipropetrovsk Oblast, while S. Gazuda *et al.* covered a broader international context, emphasising innovative technologies and government support, which were covered in less detail in this paper.

E. Régnier & A. Catallo (2024) examined the challenges and opportunities of Ukraine's potential accession to the EU, with a focus on reforming agriculture in accordance with the requirements of the common market. Common features were the emphasis on sustainable development of the agricultural sector, the impact of institutional reforms, and the importance of foreign economic relations. The current study focused on internal aspects of regional development and quantitative analysis, whereas E. Régnier & A. Catallo focused on the international dimension and cooperation between Ukraine and the EU.

R.V. Ivanov & Y.V. Hurtovyi (2023) analysed the impact of foreign economic activity of the agricultural sector on the economic security of Ukraine, in particular, export-import balances and the impact of military operations on prices. There was a common emphasis on the role of exports in building economic resilience. However, R.V. Ivanov & Y.V. Hurtovyi focused more on the foreign economic context and challenges of war, while the current study highlighted the long-term investment attractiveness of the agricultural sector.

A.T. Kinkpe *et al.* (2024) investigated the impact of the food industry on Benin's economy, focusing on added value through cashew and pineapple processing. Both studies recognised the importance of agricultural value chains and government support in stimulating development. A.T. Kinkpe *et al.* analysed the African economy using CGE modelling, while the current study focused on the impact of economic changes on the agricultural sector of Ukraine and its integration into the European market.

Analysis of the agricultural sector confirms its strategic importance for ensuring food security and economic

#### Conclusions

The findings of this study highlighted the key role of the agricultural sector in the economic development of the Dnipropetrovsk Oblast in the context of economic instability caused by military operations and macroeconomic challenges. In 2021, gross agricultural output amounted to UAH 41.6 billion, but in 2022 this figure fell to UAH 27.5 billion, which reflects the serious economic consequences of the war. In 2023, there was a partial recovery, and gross output reached the level of UAH 32.5 billion, which, however, was below the pre-war level. Investment dynamics have also undergone significant changes. In 2021, the total volume of investments in the agricultural sector amounted to about UAH 8.5 billion, of which 20% accounted for state investments, 15% - for foreign investments, and 65% were provided by private sources. In 2022, due to difficult economic conditions, the total volume of investment decreased to UAH 5.2 billion, although the share of public investment increased to 25%, which indicates active support from the government. In 2023, the total volume of investments increased to UAH 6 billion due to the restoration of confidence of foreign investors (15%) and the adaptation of the private sector (60%).

A deeper analysis showed that the gross regional product in 2022 decreased to UAH 313.83 million (compared to UAH 582.36 million in 2021) had a significant impact on the economic stability of the region. The partial recovery in 2023 to UAH 398.73 million indicates the adaptation of the agricultural sector to new challenges. A significant factor in stabilisation was public investment, which contributed to the modernisation of production infrastructure and support of production processes. To predict wheat yields, this study used a regression model, where the dependent variable was yield, and the independent variables were fuel price and inflation rate. The basic yield was 55.2 cwt/ha, provided that the fuel price – 55 UAH/l, and the inflation rate – 0%. According to the model, each increase in the price of fuel by 1 UAH/l reduced the yield by 0.2 cwt/ha, and each increase in inflation by 1% reduced the yield by 0.3 cwt/ha. Forecasts until 2028 indicated a gradual decline in wheat yields due to rising fuel prices and inflationary impacts. The forecasted yield in 2024 was 54.16 cwt/ha, and in 2028 – 36.08 cwt/ha.

Structural changes in acreage, in particular, an increase in the share of sunflower and rapeseed, indicate a strategic reorientation of farmers to more profitable crops. This helped to partially compensate for losses from reducing the area under grain crops. The recovery of export potential in 2023 also indicated the stabilisation of logistics chains, which were significantly disrupted in 2022. The results of the study show that in order to ensure the longterm sustainability of the agricultural sector, it is necessary to expand investment programmes, stimulate the private sector, and attract foreign investment. Further economic recovery in the region is possible due to the diversification of agricultural production, support for environmentally sustainable agriculture, and expansion of export opportunities. In addition, it is important to ensure the effective use of state resources to support the agricultural sector, which will consolidate positive dynamics and create the basis for stable economic growth in the region.

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# Прогнозування регіонального розвитку аграрної сфери в умовах економічної нестабільності

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Анотація. Метою дослідження було оцінити вплив економічних факторів на аграрний сектор Дніпропетровської області за період 2021-2024 років, визначити ключові тенденції та розробити підходи до підвищення економічної стійкості регіону. У рамках дослідження було застосовано методи регресійного аналізу, економетричного моделювання та сценарного підходу для оцінки динаміки врожайності, структури посівних площ, інвестиційної активності та частки аграрного сектору у валовому регіональному продукті. Результати дослідження показали, що частка аграрного сектору у валовому регіональному продукті коливалася в межах 7,5-8,76 % протягом аналізованого періоду. Найвищий показник у 8,76 % був зафіксований у 2022 році через скорочення загального валового регіонального продукту на 46 % у порівнянні з 2021 роком. Водночас, обсяг виробництва аграрної продукції зменшився на 33,9 % у 2022 році, але частково відновився у 2023 році, досягнувши 32,5 млрд грн. Проведений регресійний аналіз виявив, що зростання ціни на паливо на 1 грн/л знижує врожайність пшениці на 0,2 ц/га, а підвищення рівня інфляції на 1 % призводить до зменшення врожайності на 0,3 ц/га. Сценарний аналіз продемонстрував можливі наслідки змін економічних умов: у песимістичному сценарії врожайність пшениці до 2028 року може знизитися до 36,08 ц/га. Значущість отриманих результатів полягає у можливості їх використання для формування стратегій відновлення та розвитку аграрного сектору в умовах економічної нестабільності. Запропоновано акцентувати увагу на залученні іноземних інвестицій, диверсифікації посівів та впровадженні енергоефективних технологій для підвищення стійкості регіону. Результати дослідження також підкреслюють важливість державної підтримки, яка становила 25 % загальних інвестицій у 2023 році, що сприяло частковому відновленню економічної активності в аграрному секторі

**Ключові слова:** валова продукція; інвестиційна діяльність; диверсифікація культур; страхування врожаїв; структура посівів