Innovative Strategies for the Development of Agricultural Enterprises in a Transforming Business Environment

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Abstract

In the article, innovative aspects of the strategic development of agricultural enterprises in the context of transformational changes in the business environment are investigated. It is substantiated that the activities of agricultural business enterprises are influenced by factors of the external and internal environment, which are a limitation on the realization of internal potential. The key areas of innovative development of agricultural enterprises are identified, taking into account the security and economic instability of the environment of their operation. The methodology for calculating the financial and innovative indicators of the activities of agricultural enterprises is proposed, which we propose to implement based on the comprehensive approach to assessing capital investments, operational efficiency and the results of implementing digital and technological solutions in the period of transformational changes and military challenges. The comparative analysis of the effectiveness of the innovative strategies of well-known agricultural companies Kernel, Nibulon and Myronivskyi Hliboproduct (MHP) is carried out, their impact on financial results and export activities is assessed, and conclusions are drawn that are relevant for a wider range of agricultural enterprises in the context of instability and transformational changes in the business environment. It was studied that Kernel is distinguished by large-scale digitalization and innovative management of logistics processes characterizes precision agriculture, Nibulon, and MHP demonstrates the comprehensive approach with the implementation of ERP systems, IoT technologies, and optimization of the production and logistics structure.

Keywords: Innovation, Innovative Aspects, Strategic Development, Agricultural Enterprises, Transformational Changes, Business, Digital Technologies, Digitalization, Business Landscape.

Introduction

Today, agricultural enterprises in Ukraine operate in the business environment characterized by significant changes, namely: structural changes in global agricultural markets and increased competition;

acceleration of digitalization and biotechnological solutions; increased climate risks, transformation of logistics and energy chains, and security factors that affect the innovation and investment capacity of enterprises.

In these conditions of uncertainty and environmental variability, an important aspect for ensuring the competitiveness of enterprises is productivity, efficient use of resources, technological modernization of equipment and adherence to the sustainable development vector. For Ukrainian agricultural enterprises, the issue of innovative development has a dual nature, where on the one hand, there is the need to modernize production facilities, and on the other hand, there is the restoration of damaged infrastructure, restoration of supply chains and financial capacity. Taking into account these aspects, it should be noted that innovative development moves from the plane of improvement to the plane of strategic guidelines, since they reduce vulnerability and increase risk manageability, which allows the enterprise to be built into new regulatory and market rules. That is why the study of innovative aspects of the strategic development of agricultural enterprises in the context of transformational changes in the business landscape is an urgent task for Ukrainian business today.

Literature Review

The modern agrarian sector of Ukraine is experiencing significant transformational changes associated with globalization, digitalization, and climate change, which significantly affects the effectiveness of the strategic development of agricultural enterprises and their competitiveness.

Dovgal O. et al. (2025), Chumpanya J. et al. (2025) consider the features of using sustainable development strategies in the context of increasing the competitive advantages of agricultural enterprises, analyze current challenges, difficulties and opportunities for sustainable development of agricultural enterprises. Kostyrko L. et al. (2024), Hai X. et al. (2024) investigated the formation of the financial strategy of agricultural enterprises under conditions of uncertainty, and proposed a strategy for cooperation between the government and enterprises for the digital transformation of agricultural enterprises.

Abilda S. et al. (2024), Poltorak A. et al. (2024) analyzed adaptive strategies in agricultural enterprises. Fan F. (2023), Makhmetova D. et al. (2023) considered the management strategies that affect the provision of financial indicators for agricultural enterprises, analyzed the waste management strategy of agricultural enterprises as a factor in the development of rural areas.

Sun Y. et al. (2023), Wang L. (2023) analyzed the strategies of agricultural enterprises in the face of intensifying competition and changing consumer needs, and developed a digital marketing strategy for Chinese agricultural enterprises in the face of digital change. Miao Y. et al. (2023), Wang J. et al. (2022) investigated the features of the formation of the innovative strategy for managing agricultural enterprises in the context of globalization, analyzed the pricing strategy of the agricultural supply chain. Zhang J. (2022), Kyrylov Yu. et al. (2021) analyzed the strategy of digital development of agricultural enterprises in the context of intellectual development, outlined the features of the formation of competitive strategies.

Zu X. et al. (2021), Šmaguc T. et al. (2026) proposed strategies for interaction between agricultural e-commerce enterprises and analyzed the potential of the future era of digital transformation and its impact on the modern business landscape. Pai T. V. et al. (2025), Kamal Y. et al. (2024), and analyzed the impact of digital transformation on increasing competitiveness and sustainable development in the modern business landscape, and explored ways to overcome digital changes in the Indian business landscape.

Bozkuş Kahyaoğlu S. (2024), Naskali J. et al. (2018) analyzed in detail the digital transformation cycle in the business environemnt and mapped business transformation in the digital landscape using the maturity model based on regulatory requirements for small businesses. Nikiforov P. et al. (2022), Popelo O. et al. (2021) outlined conceptual approaches to institutional support for the state policy of developing public-private partnership, and developed the strategy for the formation and development of an innovative agro-industrial cluster in the region.

Considering existing publications, it is appropriate to note

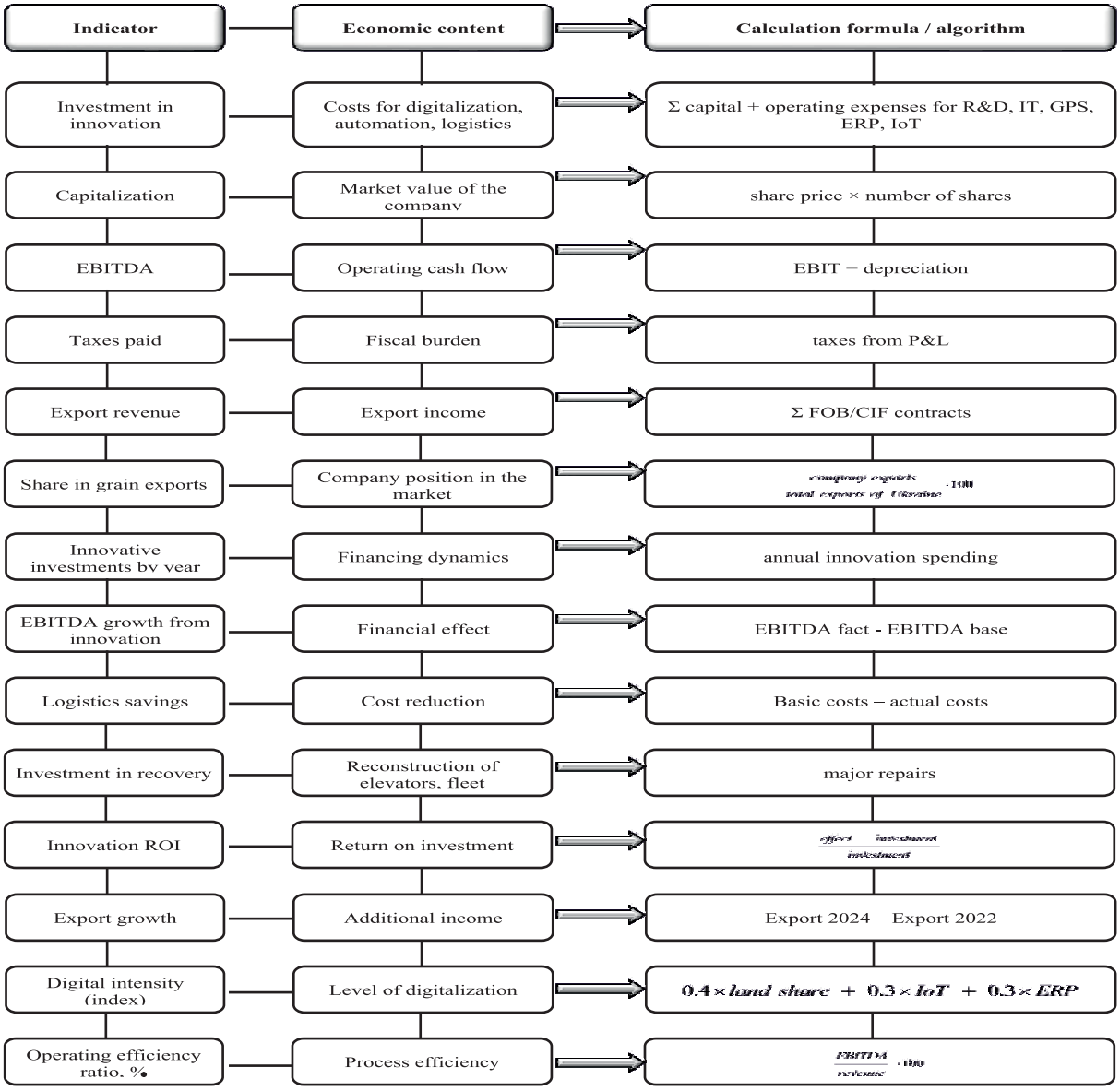
that this article is distinguished by its emphasis on the integration of innovative strategies into the management of agricultural enterprises in the context of rapid transformations of the business environment and is aimed at adapting to new economic and environmental challenges.

The purpose of the article is to study innovative aspects of the strategic development of agricultural enterprises in the context of transformational changes in the business environment.

Methodology

Within the framework of this study, we propose to implement the methodology for calculating financial and innovation indicators of agricultural enterprises based on the comprehensive approach to assessing capital investments, operational efficiency, and the results of implementing digital and technological solutions during the period of transformational changes and military challenges (Fig. 1).

Figure 1. Methodology for calculating financial and innovation indicators of agricultural enterprises



Source: systematized by the authors

Investments in innovation are defined as the sum of capital and operating expenses for R&D, digitalization, automation of equipment, implementation of ERP and IoT systems and optimization of logistics, taking into account additional costs for organizing new logistics corridors and restoring infrastructure destroyed due to hostilities. Capitalization is estimated at the market value of shares or by applying financial multipliers for non-public companies. EBITDA and net profit indicators are calculated based on financial statements with an adjustment for one-time military expenses. Export revenue is defined as the sum of revenues from FOB/CIF contracts and is supported by customs statistics, while the company's share in total grain exports of Ukraine is calculated as the ratio of its export revenue to the total volume of exports. The dynamics of innovative investments and their impact on operational efficiency are assessed by comparing actual EBITDA and logistics costs with baseline scenarios without the implementation of digital solutions and precision agriculture technologies. To assess the return on innovation, the ROI indicator is used, which is defined as the ratio of the total effect of innovation activities to the volume of investments over three years. The digital intensity of enterprises is formed as an integral index that takes into account the share of the land bank for precision agriculture, the number of automated equipment and ERP/IoT solutions, normalized to 100 points. The comparative analysis with European and global indicators is carried out through the ratio of Ukrainian indicators to FAO and OECD data, which will allow assessing the level of technological transformation and the effectiveness of innovation implementation in the national context. All financial indicators and investments are given in USD to ensure correct comparison between companies and years, and the methodology allows integrating both macroeconomic and operational effects of implemented innovations into a comprehensive assessment of the strategic development of agricultural enterprises in conditions of military and transformation risks.

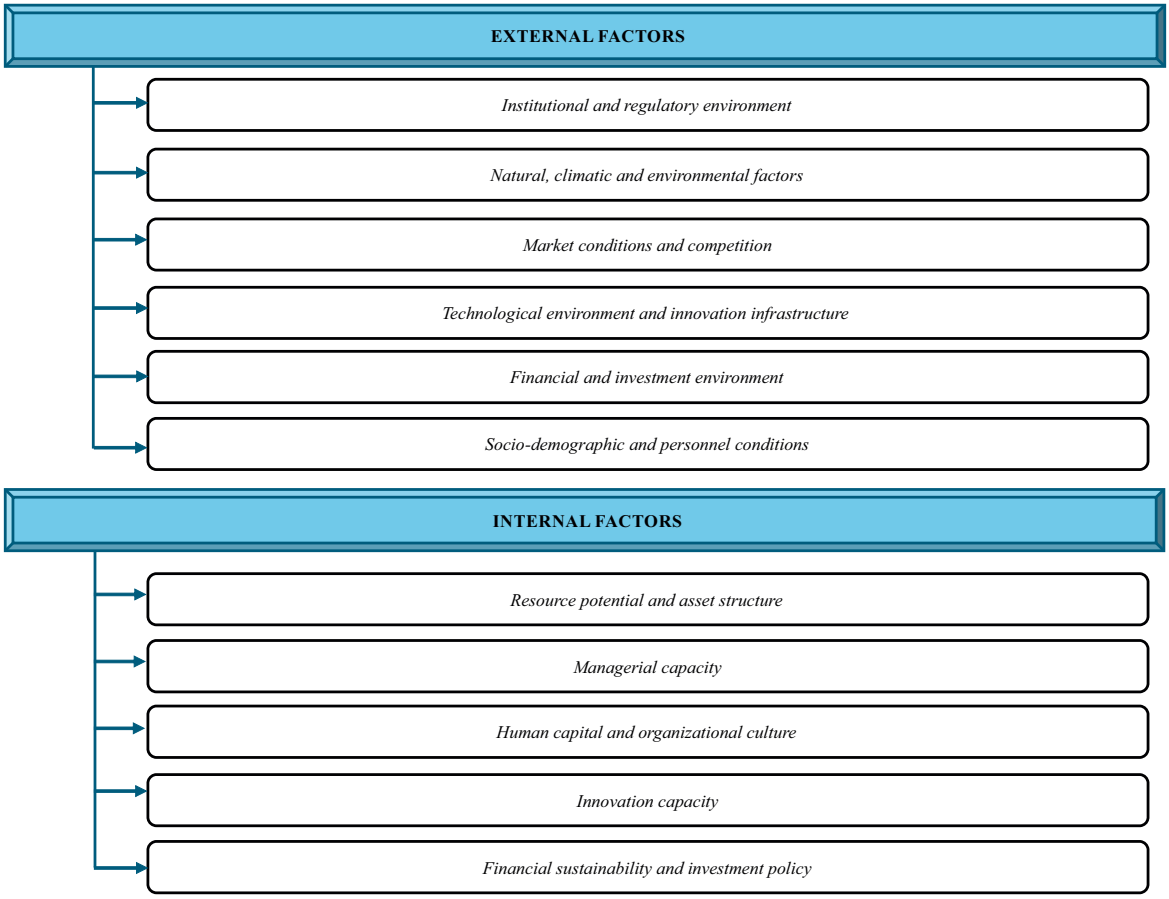
Results

In its development, Ukraine is considered as agrarian country with a high share of the sector in the country's GDP. In conditions of armed aggression, it is the production of agricultural products that increases its role in supporting the domestic economy and population. A special role is given to ensuring food security for both Ukraine and the countries to which Ukrainian products are supplied. Ensuring food security is one of the important areas of supporting the economy and society in difficult war times by reducing social tension, supporting and developing rural areas. Before the period of full-scale invasion, investment projects in the development of the industry were actively implemented.

However, with the beginning of the full-scale invasion, the situation changed, and most enterprises were forced to change their strategic development guidelines from survival to maintaining the business within the limits of profitability. Given the complexity and duration of the conflict escalation, enterprises are faced with new tasks related to the activation of innovative processes aimed at adapting the business to the external operating conditions.

To maintain the competitiveness level and to ensure the development of agricultural enterprises we must radically change the innovative aspects of their strategic support to form the conditions for rapid recovery and adaptation of business. These changes occur under the influence of external and internal environmental factors, which form opportunities and restrictions on their use (Fig. 2). External environmental factors include macro- level factors that enterprises cannot directly influence, but only adapt to them.

Figure 2. Factors influencing the external and internal environment on the formation of innovative aspects of the strategic development of agricultural enterprises



Source: systematized by the authors

The institutional and regulatory environment determines the agricultural policy and the scope of regulation based on established legislation, which regulates subsidies and grants for agribusiness, determines the rules of the access to state and grant support for the development of the industry, quality control and environmental standards. Institutional factors form the European vector of the development of the state and the agricultural sector for the expansion of foreign economic activity.

The legal regime regulating the implementation of activities, which determines the cybersecurity policy, data accounting, the use of electronic services, and the maintenance of electronic registers of international databases.

Agribusiness is the most dependent sphere of activity on natural and climatic conditions, which cannot be influenced and it is important to adapt to them. Thus, climate change, the increase in the frequency of droughts or floods increase the risks of uncertainty of production and the risks of loss of profit, which requires additional measures in the innovative developments aimed at the breeding, irrigation and soil conservation. The directions of sustainable development determine the principles of environmental friendliness and resource conservation, which require appropriate innovative solutions in terms of biotechnology and precision agriculture.

Market conditions and competition determine the pricing policy in the agricultural market, the volatility of which changes the payback of innovations. Given that Ukraine is

an export-oriented agricultural country, dependence on traders and world markets imposes its own restrictions in terms of product certification, labeling, and quality control. Therefore, manufacturers operating in foreign markets are forced to comply with established requirements, which requires updating technological and production equipment. These opportunities are limited by the access to digital technologies, which are the basis of digital transformation in the agricultural sector.

The modern development of digital technologies defines digitalization as a factor in increasing productivity, sustainability and resilience. Development of the AgriTech ecosystem, which includes startup projects, innovative solutions, government initiatives, and grant programs.

Participation in these ecosystems and innovative development require financial capacity, which determines the possibility of modernizing technologies and implementing digital platforms. Grants and support programs of various levels are allocated to support innovative development, modernizing energy efficiency technologies, recovery systems and resource conservation - from state to private investors. The participation in the projects requires appropriate support and development of measures, which is complicated by the shortage of qualified personnel, who today must meet certain requirements for skills and competencies.

Training the personnel takes time, which should be taken into account when forming a personnel reserve for future professions in the agribusiness sector.

Thus, external factors shape the business functioning and require adaptation and flexibility of enterprises to form competitive advantages. However, the possibility of adaptation largely depends on the internal potential of the enterprise, its resource capacity.

The main factors of the internal environment include resource potential and asset structure, which characterizes the land bank of an individual enterprise, and soil quality, which determines the priorities of precision agriculture, yield mapping. The availability of technological capacity is determined by the condition and volume of fixed assets, the presence of autopilots, digital solutions, which affects productivity and production efficiency (World Bank, 2024).

In addition to production aspects, the effectiveness of the management level plays an important role, which determines the quality of strategic management, the enterprise development roadmap, development strategy, investment projects, etc. The high risk of the industry requires the development of appropriate risk management measures, which are part of the overall enterprise development strategy or a separate risk management plan. The use of digital products allows enterprises to model business development scenarios based on the existing analytical base, which greatly simplifies management decision-making.

Using modern technologies in the enterprise requires competent personnel who can work with precise technologies and large data sets. When using digital solutions, experience exchange or training programs with foreign partners or equipment manufacturers are actively implemented. As part of the development of innovative and partnership ties, joint projects are implemented to exchange experience, develop new products, technological solutions, supply and sales chains. In this case, financial capacity and the possibility of attracting investment funds should be taken into account.

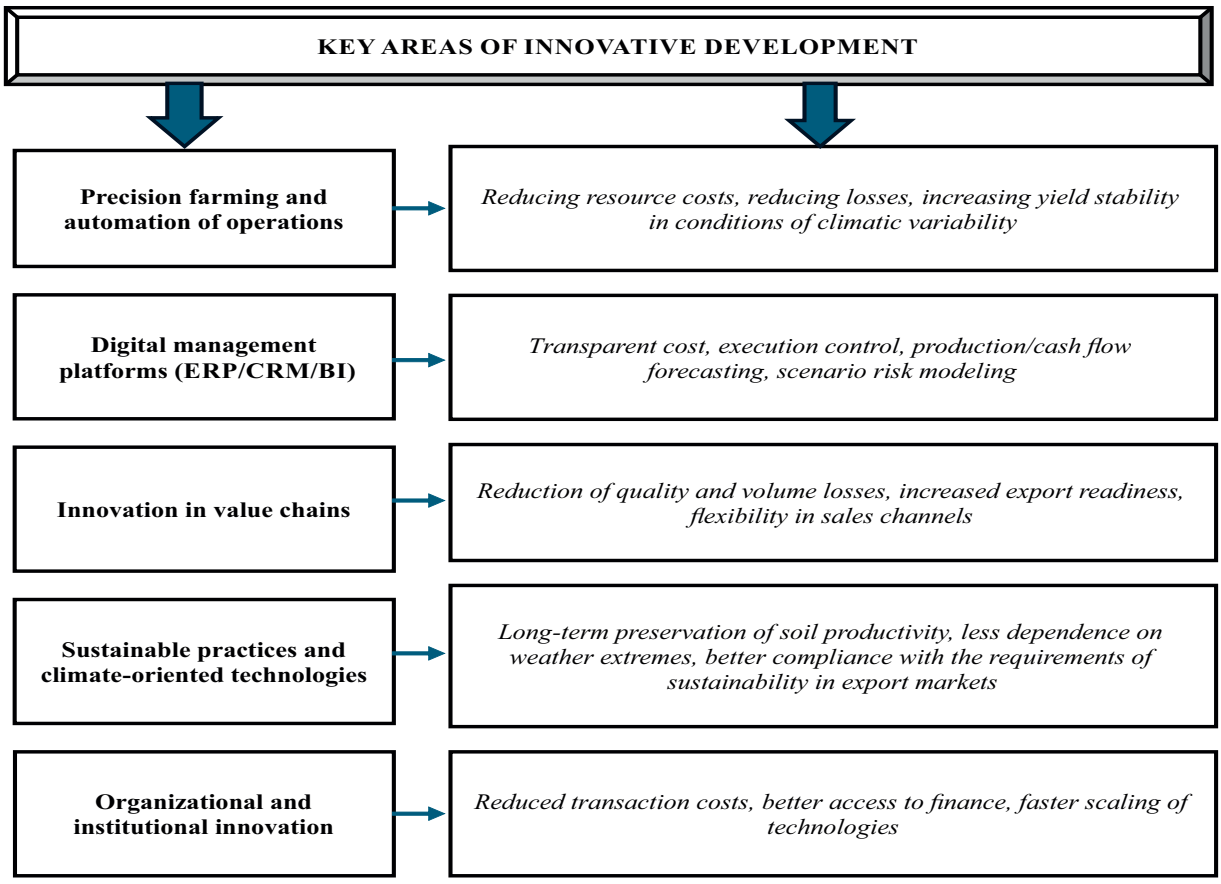
To implement these measures, cooperation between agrarian business and the state is important in terms of ensuring the necessary conditions for the development and functioning of enterprises at the legislative level. It is necessary to create the conditions of regulatory and legal support that would contribute to attracting investments in the sector, easing the tax burden for enterprises, supporting relocated businesses, etc. Attracting and supporting enterprises to participate in international grant programs to support small and medium-sized businesses, which has a positive impact on the adaptation of enterprises to new operating conditions and the expansion of small and medium-sized businesses, which in turn contributes to an increase in tax deductions to budgets of various levels.

The main principles of innovation-oriented strategic development of agricultural enterprises include the following:

1. The strategy should take into account the optimal use of critical resources, diversify supplies, and use scenario planning, which will allow for the formation of directions for the uninterrupted functioning of production and organizational functions of the business. For Ukrainian enterprises, these issues are critical for the security and logistics sectors.
2. The use of data-driven management, which includes using modern software products for processing large data sets, the use of unified data contours that contribute to measuring labor productivity, optimizing costs, which will positively affect resource conservation and energy efficiency.
3. Implementation of digital solutions taking into account cost / benefit, considering efficiency and resource conservation.
4. AKIS (Agricultural Knowledge and Innovation Systems) for compliance, which helps adapt business practices in the agricultural sector.
5. Knowledge cooperation through the science-business-consulting-agricultural system, since innovations in this industry accumulate through ecosystems that include various kinds of partnerships with universities, enterprises in various industries, and the IT sector.

Considering the peculiarities of the functioning of the agro-industrial sector in Ukraine, it is necessary to highlight the main key innovative directions of their strategic development (Fig. 3).

Figure 3. Key innovative directions of strategic development of agricultural enterprises in the conditions of changing business environment



Source: summarized by the authors based on World Bank (2024); Reportlinker.com (2026)

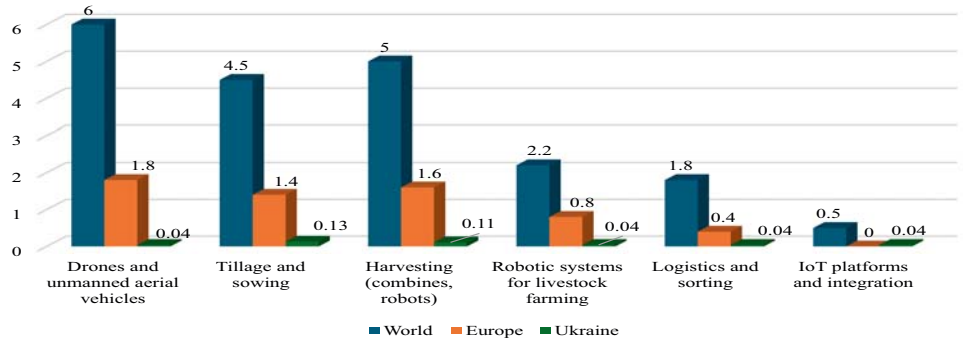
Kernel, Nibulon and MHP reflect different models of strategic development, so their choice as the object of analysis is justified by the leading status in the domestic agricultural sector, a significant scale of production and exports, as well as active participation in the implementation of innovative technologies. Kernel is distinguished by large-scale digitalization and precision agriculture, Nibulon is characterized by innovative management of logistics processes, and MHP demonstrates the integrated approach with the implementation of ERP systems, IoT technologies and optimization of the production and logistics structure. Thanks to this choice, it is possible to carry out a comparative analysis of the effectiveness of innovative strategies, assess their impact on financial results and export activities, as well as draw conclusions relevant for a wider range of agricultural enterprises in conditions of instability and transformational changes (Table 1, Fig. 4).

Table 1. Innovative technologies and global trends in the activities of agricultural enterprises, 2022-2024, billion USD

Direction	2022	2023	2024	Change	
				2024 to 2023	2024 to 2022
World					
Drones and unmanned aerial vehicles	5.0	5.5	6.0	+0.5	+1.0
Tillage and sowing	4.0	4.3	4.5	+0.2	+0.5
Harvesting (combines, robots)	4.5	4.8	5.0	+0.2	+0.5
Robotic systems for livestock farming	2.0	2.1	2.2	+0.1	+0.2
Logistics and sorting	1.5	1.7	1.8	+0.1	+0.3
IoT platforms and integration	0.0	0.1	0.5	+0.4	+0.5
Together the world	17.0	18.5	20.0	+1.5	+3.0
Europe					
Drones and unmanned aerial vehicles	1.5	1.6	1.8	+0.2	+0.3
Tillage and sowing	1.2	1.3	1.4	+0.1	+0.2
Harvesting (combines, robots)	1.4	1.5	1.6	+0.1	+0.2
Robotic systems for livestock farming	0.7	0.7	0.8	+0.1	+0.1
Logistics and sorting	0.3	0.4	0.4	0.0	+0.1
IoT platforms and integration	0.0	0.0	0.0	0.0	0.0
Together Europe	5.0	5.5	6.0	+0.5	+1.0
Ukraine					
Drones and unmanned aerial vehicles	0.02	0.03	0.04	+0.01	+0.02
Tillage and sowing	0.10	0.12	0.13	+0.01	+0.03
Harvesting (combines, robots)	0.08	0.10	0.11	+0.01	+0.03
Robotic systems for livestock farming	0.02	0.03	0.04	+0.01	+0.02
Logistics and sorting	0.02	0.03	0.04	+0.01	+0.02
IoT platforms and integration	0.02	0.04	0.04	0.00	+0.02
Together Ukraine	0.26	0.35	0.40	+0.05	+0.14

Source: calculated by the authors based on Stoianova, A. (2025)

Figure 4. Global trends in the activity of agricultural enterprises, 2024, billion USD



Source: calculated by the authors based on Stoianova, A. (2025)

The indicators in Table 1, Fig. 4 demonstrate the dynamics of innovative development of the agricultural sector at the global, European and Ukrainian levels for 2022–2024, integrating financial, technological and production indicators. The global market for innovative equipment in the agricultural sector shows stable growth from 17 billion USD in 2022 to 20 billion in 2024, reflecting the global increase in investments in the automation of production processes, digitalization and integration of precision agriculture. In Europe, the robotics market is growing from 5 to 6 billion USD, marking the gradual standardization of technologies and the wider implementation of robotic equipment on medium and large farms. The Ukrainian market shows a relatively small but stable growth from 0.3 to 0.4 billion USD, reflecting the limited scale of innovative implementations due to martial law, which significantly limits the possibilities of using unmanned aerial vehicles and automated systems in the country. Therefore, the presented indicators reflect the potential and local implementation of innovations, rather than the mass use of technologies.

The number of agricultural drones in the world is growing from 0.85 to 1 million units, in Europe from 0.4 to 0.5 million, and in Ukraine from 0.05 to 0.08 million. This emphasizes that global and European markets are actively integrating unmanned technologies for crop control, soil condition monitoring, and fertilizer application optimization, while in Ukraine their use is limited and regulated due to legislative and security restrictions, which is due to martial law and a ban on civilian drone flights without special permits.

The digitalization level of the agricultural sector has shown steady growth in all regions: in the world – from 35 to 45%, in Europe – from 40 to 50%, in Ukraine – from 30 to 40%. This indicates the active integration of ERP systems, IoT sensors, analytical platforms and automation of production and logistics processes. The digitalization growth also correlates with the spread of AgTech startups and venture investments, which stimulates the development of innovative solutions and increases the operational efficiency of production.

The logistics effects of innovations, inclusing reduced labor costs and product losses, demonstrate the positive impact of automation and optimization of transportation routes. In particular, in the world, the reduction in labor costs increases from 20 to 30%, in Europe - from 22 to 32%, in Ukraine - from 25 to 40%, which emphasizes the more intensive implementation of technologies to adapt to difficult conditions. The reduction in logistics losses demonstrates a similar trend: in the world from 8 to 12%, in Europe - from 9 to 14%, in Ukraine - from 10 to 15% (Table 2).

Table 2. Financial indicators and innovative investments of agricultural producers, 2022-2024, million USD

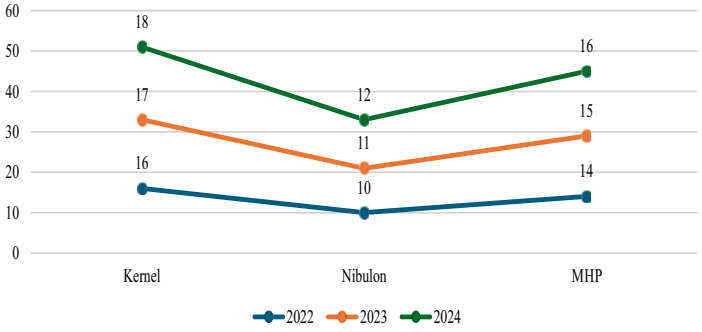
Enterprise	2022	2023	2024	Change 2024 to 2023, %	Change 2024 to 2022, %
Net sales revenue					
Kernel	1820	1830	1833	0.16	0.72
Nibulon	530	540	541	0.19	2.08
MHP	1280	1385	1170	–15.5	–8.6
Cost					
Kernel	1560	1580	1573	–0.44	0.83
Nibulon	440	445	450	1.12	2.27
MHP	1050	1176	855	–27.3	–18.6
Gross profit					
Kernel	260	250	260	+4	0
Nibulon	90	95	91	–4.2	+1.1
MHP	230	209	315	+50.7	+36.9
Operating profit (loss)					
Kernel	10	12	14	16.7	40
Nibulon	5	6	6	-	20
MHP	–6	–17	–22	29.4	266.7

Enterprise	2022	2023	2024	Change 2024 to 2023, %	Change 2024 to 2022, %
Net profit (loss)					
Kernel	10	12	13	8.3	30
Nibulon	4	5	5	-	25
MHP	–11.76	–20.19	–45.55	125	287
Investment in innovation/modernization					
Kernel	16	17	18	5.9	5.9
Nibulon	10	11	12	9.1	9.1
MHP	14	15	16	6.7	6.7
Grain export volume					
Kernel	1150	1200	1220	1.67	6.09
Nibulon	480	490	500	2.04	4.17
MHP	1150	1170	1200	2.56	4.35
Share in Ukrainian grain exports, %					
Kernel	11.5	11.7	12	2.6	4.3
Nibulon	4.8	5	5.1	2	6.3
MHP	8.5	8.6	8.7	1.2	2.4

Source: calculated by the author based on the official Kernel website: https://career.kernel.ua/ , the official Nibulon website https://www.nibulon.com/, the official MHP website https://mhp.com.ua/uk/glorytoUkraine

The dynamics of indicators allows us to assess the pace of innovation development, the effectiveness of measures and their impact on yields and logistics in different regions and creates an analytical basis for the comparative analysis of Ukraine with European and global trends, which is especially important for the formation of strategies for modernization of the agricultural sector and investment planning in war and transformational conditions (Fig. 5).

Figure 5. Investments of agricultural enterprises in innovation/modernization, 2022-2024, million USD



Source: calculated by the author based on the official Kernel website: https://career.kernel.ua/ , the official Nibulon website https://www.nibulon.com/, the official MHP website https://mhp.com.ua/uk/glorytoUkraine

The indicators in Table 2 demonstrate the dynamics of key financial indicators and investments of agricultural enterprises Kernel, Nibulon and MHP for 2022–2024. Kernel's net sales revenue in 2024 increased by 0.16% compared to 2023 and by 0.72% compared to 2022, which indicates the stability of the company's revenues against the backdrop of transformational changes in the agricultural sector and the impact of global factors. Nibulon shows a slight increase in the value of the net income indicator by 0.19% in 2024 compared to 2023 and by 2.08% compared to 2022, which reflects the gradual stabilization of business processes and moderate expansion of the company. MHP has a net income decrease of 15.5% in 2024 compared to 2023 and 8.6% compared to 2022, which is explained by the impact of increased costs and market instability, including the consequences of war and currency fluctuations. Kernel's cost of production in 2024 was practically unchanged compared to the previous year; Nibulon shows a moderate increase of 1.12%, while MHP reduced costs by 27.3% compared to 2023, which contributed to a 50.7% increase in gross profit. Kernel's gross profit increased by 3.85% in 2024 compared to 2023, reflecting effective cost management and productivity improvements, while Nibulon experienced a slight decrease of 4.2%. The Kernel's operating profit increased by 16.7%, Nibulon remained stable, and MHP showed an increase of 29.4%, reflecting a partial reduction in operating expenses and the effectiveness of management decisions. Kernel's net profit

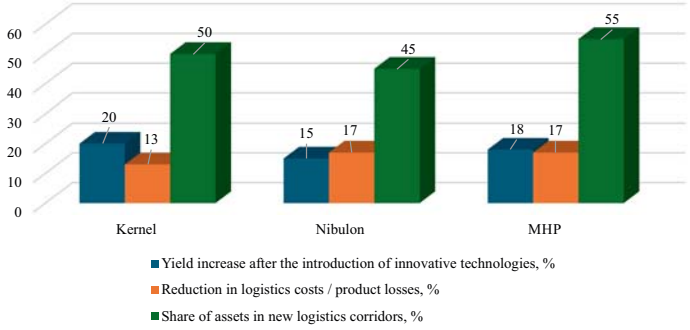
in 2024 increased by 8.3% compared to 2023, Nibulon remained at $5 million, and MHP experienced a significant increase in loss by 125%, which is explained by the combined effect of the decrease in revenues and an increase in financial expenses. Investments in innovation and modernization at Kernel remained at $18 million, Nibulon at $12 million, and MHP at $16 million, which emphasizes the constant attention of enterprises to technological renewal and increasing competitiveness. The volume of grain exports shows a gradual increase in all companies; in particular, Kernel by 1.67%, Nibulon by 2.04%, MHP by 2.56% compared to 2023, and the share of companies in total Ukrainian exports is increasing by several percent, which indicates a stable presence in global markets (Table 3).

Table 3. Comprehensive assessment of innovation strategies of agricultural enterprises of Ukraine, 2022–2024

Enterprise	2022	2023	2024	Change 2024 to 2023, %	Change 2024 to 2022, %
% of land bank for precision agriculture					
Kernel	60	63	65	+3.2	+8.3
Nibulon	30	33	35	+6.1	+16.7
MHP	50	53	55	+3.8	+10.0
Number of units of equipment with GPS/monitoring					
Kernel	1,300	1,350	1,400	+3.7	+7.7
Nibulon	800	825	850	+3.0	+6.3
MHP	1,200	1,230	1,250	+1.6	+4.2
Number of ERP / digital platforms					
Kernel	3	3	3	0	0
Nibulon	2	2	2	0	0
MHP	4	4	4	0	0
IoT -sensors and automated systems, pcs					
Kernel	1,150	1,180	1,200	+1.7	+4.3
Nibulon	750	780	800	+2.6	+6.7
MHP	1,050	1,080	1,100	+1.9	+4.8
Yield increase after the introduction of innovative technologies, %					
Kernel	15	18	20	+11	+33
Nibulon	10	12	15	+25	+50
MHP	12	15	18	+20	+50
Reduction in logistics costs / product losses, %					
Kernel	10	12	13	+8.3	+30
Nibulon	12	15	17	+13.3	+41.7
MHP	12	15	17	+13.3	+41.7
Investments in infrastructure restoration, million USD					
Kernel	4	4.5	5	+11	+25
Nibulon	2	2.5	3	+20	+50
MHP	8	9	10	+11	+25
Share of assets in new logistics corridors, %					
Kernel	45	48	50	+4.2	+11.1
Nibulon	40	42	45	+7.1	+12.5
MHP	50	52	55	+5.8	+10
Implemented digital solutions for logistics					
Kernel	GPS -tracking , TMS				
Nibulon	Fleet monitoring				
MHP	GIS + 1C integration				

Source: calculated by the author based on the official Kernel website: https://career.kernel.ua/ , the official Nibulon website https://www.nibulon.com/, the official MHP website https://mhp.com.ua/uk/glorytoUkraine

Figure 6. Comparative analysis of the main innovation indicators of agricultural enterprises, 2022–2024, %



Source: calculated by the author based on the official Kernel website: https://career.kernel.ua/ , the official Nibulon website https://www.nibulon.com/, the official MHP website https://mhp.com.ua/uk/glorytoUkraine

According to Table 3, Kernel continues to increase the share of the land bank for precision agriculture, which increased from 60% in 2022 to 65% in 2024, while the number of units of equipment with GPS -monitoring increased by 100 units in three years. This indicates the stable modernization of production processes and teh increase in the accuracy of agro-technological operations. The number of ERP and digital platforms remained stable, which indicates sufficient functionality of existing systems for process management, while the implemented digital solutions for logistics, in particular GPS tracking and TMS in Kernel, fleet monitoring in Nibulon and GIS + 1C integration in MHP, provide transparency and control in the supply of products even under martial law restrictions. The yield increase after the implementation of technologies demonstrates a significant effect, namely: Kernel increased yield by 20% in 2024, which is 11% more than in 2023, Nibulon reached 15%, and MHP - 18%, reflecting the effectiveness of precision agriculture, automated systems and optimization of agronomic processes. The reduction in logistics costs and product losses, which is 13% in Kernel and 17% in Nibulon and MHP in 2024, demonstrates the real economic effect of the application of digital solutions in the transportation and storage of products. Investments in infrastructure restoration remain significant, especially in MHP, where in 2024 they reached $10 million, reflecting the need for enterprises to adapt to military and transformational challenges, while simultaneously increasing the share of assets in new logistics corridors to 50-55%, which increases the stability and efficiency of product supply in domestic and foreign markets.

Therefore, the comprehensive approach of agricultural enterprises to digitalization and technological modernization demonstrates that the systematic implementation of innovations affects productivity increases, cost optimization and strengthening of market positions, and increases adaptability to transformational changes and military challenges.

Conclusions

The conducted research allowed us to establish that today agribusiness enterprises operate in conditions of uncertainty and increased risk, which is associated with the unfavorable security and economic situation in the country. The formation of innovative aspects of the strategic development of agribusiness enterprises is influenced by factors of the external and internal environment, which limit the possibilities of realizing the internal potential of the enterprise.

It is substantiated that for Ukrainian agricultural enterprises, the introduction of innovative technologies is a necessary element of the development and expansion of the foreign economic activity. In this aspect, it is advisable to use a three-component model that includes the areas of sustainable development, digital technologies and bioengineering achievements. The implementation of these innovative strategies is carried out with the support of state and international cooperation programs and for agricultural business.

According to the results of the analysis of the financial, technological and operational indicators of Kernel, Nibulon and MHP, clear patterns are observed, confirming the effectiveness of their innovation strategies. Financial indicators demonstrate the stabilization of net income and profit, which provides opportunities for investments in the modernization of production and logistics infrastructure. The dynamics of digitalization and precision agriculture shows that the increase in the share of land cultivated using modern technologies, the increase in the number of equipment with GPS/IoT -systems and the implementation

of ERP platforms directly correlate with the increase in yield and the decrease in logistics costs. The analysis indicates a steady growth of the global and European market for innovative equipment, including drones, robotic systems for soil cultivation, harvesting, animal husbandry and logistics, which creates technological opportunities for the implementation of innovations not only in large holdings, but also in medium and small agricultural enterprises of Ukraine. Although the use of robotics and IoT platforms in Ukraine is still minimal, this means that there is significant potential for modernization and efficiency improvement through careful and phased implementation of technologies focused on the real capabilities of enterprises. The alignment of internal indicators of agricultural enterprises with global trends in the robotics market indicates that innovative technologies are becoming a key factor in the strategic development of the agricultural sector as a whole, creating opportunities for increasing the competitiveness, adaptability and productivity of all enterprises, regardless of their scale.

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