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Innovation and Investment Behavior of Enterprises in the Agri-Food Sector of Ukraine as a Factor in Shaping the Economic Recovery Model

Abstract

The *purpose* of the article is to develop a theoretical and methodological approach to assessing the innovation and investment behavior of enterprises in the agri-food sector of Ukraine and to determine its role in forming a model of economic recovery. The research *methodology* is based on a systematic approach to considering the relationship between investment and innovation activity. For empirical evaluation, comparative analysis, a system of quantitative and qualitative indicators, scoring assessment, Z-standardization and the method of arithmetic mean of standardized values were used to form an integral index of innovation and investment behavior. The study was conducted on the example of five enterprises in the agri-food sector of Ukraine for 2020–2025. The *results* of the study showed significant differentiation of enterprises in terms of the level and nature of innovation and investment transformation. It has been established that high investment activity in itself does not ensure high innovation performance, since the allocation of investments to technological modernization, digitalization, processing development, logistics and energy efficiency is decisive. A model of innovation and investment transformation is proposed, which combines investment, technological, digital, processing, logistics and energy, economic, and resilience blocks. The *practical* significance lies in the possibility of using the proposed approach to diagnose the innovation and investment state of enterprises, determine priority areas of investment and form differentiated trajectories of their technological, digital and organizational renewal during Ukraine's economic recovery. The *value/originality* of the study lies in the complex combination of assessing investment activity with the characteristics of technological, digital, processing and economic transformation of enterprises, which allows us to consider investments not only as a resource for recovery, but also as a tool for forming long-term competitiveness and resilience.

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1 Introduction

The full-scale war has created a fundamentally new operating environment for Ukrainian enterprises, in which investment decisions increasingly determine not the possibilities of business expansion, but the ability to maintain production potential, restore activity and form a basis for further development. The scale of Ukraine's reconstruction creates a unique opportunity not just to restore lost assets, but to carry out

Keywords

innovation, investment, innovation and investment behavior, agri-food sector, economic recovery, technological modernization, digitalization, processing, resilience

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technological and structural renewal of the economy. According to RDNA5, Ukraine's needs for restoration and reconstruction over the next decade amount to almost \$588 billion, which is almost three times higher than Ukraine's nominal GDP for 2025 (World Bank, 2026). Under such conditions, the issue of investment quality becomes of fundamental importance. The fact of increasing the volume of capital investments does not mean modernization of the enterprise, if investments are directed mainly to the reproduction of damaged

fixed assets, the enterprise is actually restoring the previous production model. Instead, directing capital to new technologies, products, production processes, energy efficiency, automation and development of competencies creates the prerequisites for increasing productivity and competitiveness. This is where the key contradiction of the modern development of Ukrainian enterprises arises: the need for innovation is growing, while the financial and resource capabilities for its provision remain limited.

The scientific literature has thoroughly studied innovative activity, investment activity, and innovation and investment potential of enterprises. However, much less attention is paid to the behavioral aspect of their interaction, that is, how the enterprise forms investment priorities, allocates resources between current recovery and modernization, and transforms investments into an innovative result. Thus, the scientific problem lies in the lack of a holistic approach to assessing the innovation and investment behavior of enterprises, which would allow taking into account the level of investment activity, innovation capacity, and the effectiveness of their combination.

The purpose of the article is to develop a theoretical and methodological approach to assessing the innovation and investment behavior of enterprises and determine its role in the formation of a new model of economic recovery in Ukraine.

2 Theoretical Foundations of Innovation and Investment Behavior of Enterprises

In the scientific literature, investment and innovation activities have traditionally been considered as interrelated, but relatively independent directions of enterprise development. At the same time, modern research increasingly substantiates the need for their integrated consideration, since it is investment decisions that determine the resource basis for technological and organizational renewal of the enterprise. Korol S. and Karmansky A. (Korol, Karmanskyi, 2025) propose to consider investment and innovation activity as "adaptive activity aimed at mobilizing and transforming financial, technological, human and network resources into innovative solutions". In contrast to the traditional understanding of investments as a simple investment of capital, the authors emphasize their role in digital transformation, adaptation and ensuring the resilience of enterprises. Khmelyarchuk and Pavlyshyn (Khmelyarchuk, Pavlyshyn, 2025) argue that the investment and innovation potential of an enterprise is shaped by financial, scientific, human, and market resources and that its implementation requires an integrated strategy and adaptive management. This problem is of particular importance in wartime. Nowińska and Roslyng Olesen (Nowińska, Roslyng

Olesen, 2025) show that even amid the escalation of the Russia-Ukraine war, enterprises continue to invest, with their decisions shaped by a combination of economic motives, expectations about future prospects, and the characteristics of the wartime environment. At the same time, Waal et al. (Waal, Kenworthy, Opatska, Trevohe, Boychuk, Kozlova, 2025) show that Ukrainian enterprises demonstrate different recovery trajectories, while adaptability and innovation have become important factors of organizational resilience. Caldara et al. (Caldara, McHenry, Iacoviello, Schott, 2026) show that greater exposure of enterprises to the war in Ukraine was associated with a significant and sustained reduction in corporate investment. Therefore, in modern conditions, it is not enough to estimate only the volume of investments. It becomes important to determine what directions they are directed towards, what technological and organizational changes they provide and to what extent they contribute to the effectiveness and resilience of the enterprise. That is why, within the framework of this study, we propose to consider innovation and investment behavior as "a system of strategic decisions to direct investment resources to technological, product, organizational and digital renewal of the enterprise with a simultaneous focus on economic efficiency and resilience".

3 Comparative Analysis of Innovation and Investment Behavior of Enterprises

For empirical assessment of innovation and investment behavior of enterprises, a sample of five large enterprises of the agri-food sector of Ukraine was formed: MHP, Kernel, ASTARTA, JV NIBULON LLC and OBOLON PJSC. This period covers the pre-war period, the shock of 2022, and the subsequent adaptation of enterprises to the new economic conditions.

The dynamics of the enterprises' activities differs significantly. MHP demonstrates consistent revenue growth from UAH 51516.6 million to UAH 157057.5 million. Kernel is characterized by a high scale of activities with significant income fluctuations: after the peak value of 2021, there was a contraction in 2022-2024, but in 2025 the company resumed growth. ASTARTA reached its maximum value in 2024, after which its revenue decreased in 2025. The most difficult is the dynamics of NIBULON, whose revenue, after significant growth in 2021, fell sharply in 2022 and did not recover to pre-war levels by 2025.

The comparison of incomes showed significant differences between enterprises in terms of scale and nature of development in 2020-2025. At the same time, the dynamics of income does not make it possible to assess which investment decisions ensure the restoration and modernization of enterprises.

TABLE 1 Dynamics of income of the studied enterprises in 2020–2025

Enterprise	2020	2021	2022	2023	2024	2025
MHP	51516,6	64745,5	85487,3	110476,5	122295,9	157057,5
Kernel	110724,7	152732,6	172444,1	126366,4	143776,2	171677,8
ASTARTA	12808,6	15862,2	17329,8	24489,6	26499,8	22531,0
LLC JV “NIBULON”	25840,0	40615,0	15181,0	22901,0	20263,0	18458,0
PrJSC “Obolon”	5465,0	5909,0	8662,0	10763,0	12785,0	13737,0

Source: compiled by the author based on the annual financial and corporate statements of enterprises

TABLE 2 Rates of change in enterprise income in key periods, %

Enterprise	2021/2020	2022/2021	2023/2022	2024/2023	2025/2024	2025/2020
MHP	+24,1	+11,4	+14,3	+0,8	+23,6	+204,9
Kernel	+36,2	-4,7	-35,2	+3,7	+14,9	+55,1
ASTARTA	+18,1	+3,9	+21,4	-1,1	-22,9	+75,9
LLC JV “NIBULON”	+57,2	-62,6	+50,9	-11,5	-8,9	-28,6
PrJSC “Obolon”	+8,1	+46,6	+24,3	+18,8	+7,5	+151,4

Source: calculated by the author

Therefore, further analysis is focused on investment activity as a factor in their transformation.

The obtained assessments characterize the differences between enterprises in the main areas of innovation and investment transformation and are used for further comprehensive assessment. The calculation of the ratio of changes in income and changes in investment activity is given in Table 4.

The given data indicate a significant differentiation of enterprises in terms of income dynamics and intensity of investment activity. High investment activity is not always accompanied by appropriate

income dynamics, which confirms the need to assess not only the volume of investments, but also the directions of their transformational use. For a comprehensive assessment of the innovation and investment behavior of enterprises, a system of eight indicators has been formed. Investment activity is defined as the ratio of capital investments to the income of an enterprise in 2025. The scoring assessments of energy efficiency and logistics were standardized using the same procedure. To ensure the comparability of indicators with different units of measurement, Z-standardization was carried out (1).

TABLE 3 Characteristics and Evaluation of Directions of Innovation and Investment Transformation of Enterprises, Points

Enterprise	Processing development	Technological modernization	Digitalization	Energy efficiency	Logistics	Integral assessment
MHP	3	3	3	3	3	15
Kernel	3	3	2	2	3	13
ASTARTA	3	3	3	3	2	14
LLC JV “NIBULON”	2	2	2	3	3	12
PrJSC “Obolon”	2	1	1	2	2	8

Note: 3 points – high level; 2 points – medium level; 1 point – low level; 0 points – the direction is not implemented or there is no information about its implementation.

Source: developed by the author

TABLE 4 Comparison of enterprises by revenue dynamics and investment activity in 2020–2025

Enterprise	Revenue in 2020, mln. UAH.	Revenue in 2025, mln. UAH.	Change in income 2020–2025, %	Capital investments in 2025, million. UAH.	Capital investments in 2025, %
MHP	51516,6	157057,5	+204,9	43200	27,5
Kernel	110724,7	171677,8	+55,1	18000	10,5
ASTARTA	12808,6	22531,0	+75,9	2600	11,5
LLC JV “NIBULON”	25840,0	18458,0	-28,6	10350	56,1
PrJSC “Obolon”	5465,0	13737,0	+151,4	14000	101,9

Note: calculated according to enterprise data

Source: developed by the author

$$Z_{ij} = \frac{x_{ij} - x_j}{s_j} \tag{1}$$

x_{ij} – the value of the j -th indicator for the i -th enterprise; x_j – average value of the indicator; s_j – standard deviation.

Unlike the preliminary scoring assessment, the composite assessment is based on a standardized system of quantitative and qualitative indicators.

To summarize the results of the assessment, an integral index of innovation and investment behavior has been formed, which is defined as the arithmetic mean of eight standardized indicators (Table 6).

The typologization confirms the need for differentiated transformation trajectories. For leading enterprises, the priority is scaling innovative practices, deepening processing and resource efficiency; for enterprises with an active innovation and investment model – strengthening of the investment component; for enterprises with a moderate model – digital and logistics integration; for enterprises with high investment activity, but lower technological indicators – an increase in innovative return on investment; for recovery-oriented enterprises – ensuring operational and logistics resilience. Thus, the effectiveness of investment policy is determined not only by the volume of resources, but by their ability to ensure technological, digital, logistical and organizational changes.

The results of the study provide a basis for proposing the author's model of innovation and investment transformation of enterprises in the context of economic recovery of Ukraine. Its principal

feature is the consideration of investments not as an independent source of economic growth, but as an initial resource for the complex transformation of technological, digital, processing, logistics and energy processes of the enterprise. The proposed model provides for a sequential combination of seven interrelated blocks: investment, technological, digital, processing, logistics and energy, economic and resilience. At the first stage, investment resources are formed and mobilized, which are directed to the technological renewal of the production base. Technological modernization creates the basis for the digital transformation of management and production processes, which, in turn, ensures a more efficient use of resources and improved quality of management decisions. The next transformation area is the development of processing capacity, which ensures the transition from the sale of raw materials to the formation of products with greater added value. At the same time, technological and digital changes should extend to logistics processes and energy supply of the enterprise. Optimization of logistics flows, digital monitoring of supply chains, reduction of unproductive costs and improvement of energy efficiency form the operational component of the transformation process. The cumulative effect of these changes is reflected in an increase in economic efficiency, income growth, productivity and competitiveness of the enterprise. At the same time, in the conditions of a war economy, the effectiveness of transformation cannot be evaluated solely by economic indicators. An important component is resilience, the ability of the enterprise to maintain functioning,

TABLE 5 Standardized values of indicators of innovation and investment behavior of enterprises

Enterprise	Z ₁ Investment activity	Z ₂ Processing development	Z ₃ Technological modernization	Z ₄ Digitalization	Z ₅ Revenue growth rate	Z ₆ Energy efficiency	Z ₇ Logistics	Z ₈ Resilience in 2025
MHP	-0,407	0,816	0,816	1,069	1,405	0,73	0,73	0,649
Kernel	-0,901	0,816	0,816	-0,267	-0,455	-1,095	0,73	0,140
ASTARTA	-0,872	0,816	0,816	1,069	-0,197	0,73	-1,095	0,043
LLC JV “NIBULON”	0,424	-1,225	-0,408	-0,267	-1,494	0,73	0,73	-1,867
PrJSC “Obolon”	1,756	-1,225	-2,041	-1,604	0,741	-1,095	-1,095	1,035

Source: calculated by the author according to the reporting data of enterprises; standardization was carried out by the method of Z-transformation.

TABLE 6 Calculation of the integral index

Enterprise	Z ₁	Z ₂	Z ₃	Z ₄	Z ₅	Z ₆	Z ₇	Z ₈	Integral index	Rank
MHP	-0,41	0,82	0,82	1,07	1,41	0,73	0,73	0,65	0,73	1
ASTARTA	-0,87	0,82	0,82	1,07	-0,19	0,73	-1,09	0,04	0,16	2
Kernel	-0,90	0,82	0,82	-0,27	-0,46	-1,09	0,73	0,14	-0,03	3
NIBULON	0,42	-1,23	-0,41	-0,27	-1,49	0,73	0,73	-1,87	-0,42	4
Obolon	1,76	-1,23	-2,04	-1,6	0,74	-1,09	-1,09	1,04	-0,44	5

Source: calculated by the author



FIGURE 1. Model of innovation and investment transformation of enterprises in the context of economic recovery of Ukraine

Source: developed by the author

adapt to external shocks and resume activities after disruption of normal operating conditions. Unlike a linear approach, the model incorporates a feedback loop: the economic result obtained and the increase in resilience create the prerequisites for the formation of a new investment cycle and further technological updating. Thus, a closed loop of «investment → innovation → efficiency → resilience → new investments» is formed. Differentiation of enterprises by types of innovation and investment behavior determines different transformation trajectories: for leading enterprises, the priority is to scale innovation and deepen processing; for enterprises with an

active innovation and investment model, to increase investment; for enterprises with a moderate model, to strengthen digital and logistics integration; for investment-adaptive enterprises, to increase the innovation returns on investment; and for recovery-oriented enterprises, to ensure operational and logistics resilience.

4 Conclusions

The study substantiates innovation and investment behavior as an important factor in shaping Ukraine's economic recovery model. The study proposes assessing an enterprise's ability to transform investment resources into technological, digital, processing, logistics, and energy-efficient changes.

The comparative analysis of enterprises in Ukraine's agri-food sector for 2020–2025 revealed significant differences in the nature of innovation and investment behavior. The composite assessment identified enterprises with different levels of transformational activity and substantiated the need for a differentiated approach to setting investment priorities. It has been established that the effectiveness of investments is determined not only by their intensity, but by interaction with technological modernization, digitalization, development of processing, logistics and energy efficiency.

The proposed model of innovation and investment transformation combines investment, technological, digital, processing, logistics, energy, economic, and resilience blocks. Its application makes it possible to move from simple restoration of damaged facilities to comprehensive modernization of enterprises and the formation of a new development cycle.

Further research should focus on expanding the sample of enterprises and improving the methodological framework for assessing innovation and investment behavior. A separate research direction is the quantitative assessment of the impact of digitalization, energy efficiency, logistics transformation, and deep processing on enterprise performance.

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