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Economic consequences of implementing sustainable energy consumption programmes in industrial companies

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Abstract. The aim of the study was to determine the impact of managerial and technological changes in energy use on the performance of industrial companies. The methodology was based on theoretical, empirical and comparative methods for analysing the effects of energy efficiency and sustainable energy consumption. The economic mechanisms of the impact of investments in energy efficiency were identified: reduction of specific energy costs and volatility of operating expenditure, increase in total factor productivity, and hedging of regulatory and price risks. It was emphasised that the effect is significantly enhanced by the availability of digital technologies (artificial intelligence-based energy management, predictive maintenance) and access to financing, while tight credit conditions remain a key barrier to the implementation of energy efficiency projects. It has been established that investments in energy efficiency reduce energy costs and risks, increase operational efficiency and competitiveness through modernisation and digitalisation, while limited financing and low digital maturity of enterprises remain the main obstacles. Metinvest Holding reduced its energy consumption to ≈ 8.2 billion kWh in 2024 and allocated USD 145 million to energy efficiency, Interpipe maintained the highest Earnings Before Interest, Taxes, Depreciation, and Amortisation margin of 34%, while ArcelorMittal invested ≈ USD 110 million in decarbonisation programmes. It has been found that in Ukraine, the share of renewable energy sources in production in 2024 is 8.7%, 17-18% in summer, 4-7% in winter, with profits for large/medium-sized enterprises at 776.4 → 947.3 billion UAH (+22%) and loss-making companies at ~22.1%. Ukrainian industry proved that even in crisis conditions, energy efficiency programmes ensure cost reduction, profit growth and increased sustainability of enterprises. It is advisable to implement comprehensive energy efficiency programmes – a combination of technical solutions, digital management systems and financial monitoring of savings. The results can be used by companies and government agencies to improve energy efficiency and develop sustainable energy consumption strategies, particularly in Ukraine

Keywords: profitability; optimisation; forecasting; resource efficiency; energy productivity; hedging

Introduction

Energy consumption in industry is becoming one of the main factors in sustainable development and competitiveness. Improving energy efficiency, transitioning to resource-saving technologies and minimising carbon footprints are not only environmental but also economic challenges. In the context of global energy challenges caused by stricter climate policies, rising energy prices, and the need to improve national energy security, the implementation of sustainable energy consumption programmes is seen as a strategic direction for industrial modernisation and a fundamental tool for long-term economic growth, including in Ukraine.

Scientific research confirms that the economic feasibility of energy modernisation of industrial enterprises is based on optimising the structure of energy consumption and adapting technological processes. A. Huang *et al.* (2025) proved that combining economic and environmental optimisation can reduce energy costs by 15-25% and cut specific CO_2 emissions, demonstrating the mutually reinforcing effect between energy efficiency and financial performance in production. This meant that investments in hybrid energy systems generate long-term economic benefits, increasing the competitiveness of the industrial sector even in conditions of energy instability. The study by T. Schmitt *et*

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al. (2025) contributed to the development of methods for improving energy efficiency by proving the effectiveness of simulation and optimisation approaches in industrial management. The authors found that such integration of optimisation models increases not only energy efficiency but also production productivity, providing a sustainable economic effect for enterprises.

J. Kim *et al.* (2024) emphasised that energy, material and resource efficiency should be considered comprehensively, as it is the synergy of technological innovations and socio-technical systems that ensures the maximum economic effect of industrial decarbonisation. Countries that implement policies to promote resource efficiency gain an additional 1.5% in gross domestic product (GDP) growth each year by reducing their dependence on imported energy and increasing domestic investment. This has shaped a systemic view of the link between energy strategy, industrial innovation and macroeconomic growth J. Andrijevskaja & A. Volkova (2025) summarised quantitative approaches to energy conservation assessment and showed that systematic management of energy consumption data improves the accuracy of forecasting and the rationality of investment decisions in the industrial sector. The use of combined indicators of energy intensity and economic performance allowed the authors to identify the most effective areas for modernising production processes, deepening the understanding of the relationship between analytical accounting of energy resources and improving the overall economic efficiency of enterprises.

One of the key aspects of the economic efficiency of energy modernisation is the identification of internal causes of irrational energy consumption and opportunities for its optimisation. The work of J. Ma (2024) focused on a cause-and-effect analysis of energy inefficiency and showed that management losses and ignoring dynamic consumption factors significantly reduce the economic return on investment in the modernisation of production systems. This approach highlighted the relationship between the quality of management decisions and the financial results of energy efficiency programmes. Increasing the flexibility of electricity consumption in industry as a factor in reducing costs and stabilising the energy balance was studied in a study by S. Rojas-Innocenti *et al.* (2025). The authors compared different configurations of industrial enterprises and found that the adaptability of electricity consumption systems allows for a reduction in peak loads and savings of up to 8-12% in energy costs, which directly affects the cost of production. The results confirm the economic feasibility of implementing flexible energy management systems as an effective tool for increasing the competitiveness of the industrial sector.

In the Ukrainian context, the issue of sustainable energy consumption is critical due to energy challenges caused by the war, rising energy prices, and the need to reduce import dependence. F. Mei *et al*. (2024) found that corporate social responsibility is one of the factors contributing to increased energy efficiency in Ukrainian industrial companies. The authors demonstrated a positive link between the level of corporate social responsibility and the reduction of specific energy consumption, indicating the potential synergy of socio-economic and technological instruments in the sustainable development of enterprises. A study by V. Horskyi (2025) revealed an increase in the efficiency of thermal energy consumption by Ukrainian industrial enterprises under environmental constraints and proved that the introduction of heat recovery technologies can reduce the energy intensity of products by up to 30%, increasing competitiveness in the European market. This revealed the economic potential of recovery technologies in Ukrainian industry and highlighted their importance for the implementation of a low-carbon development strategy for the national economy. U. Andrusiv *et al*. (2023) proved that systematic assessment and forecasting of fuel and energy resource use make it possible to optimise the structure of the national energy balance and reduce the financial burden on the industrial sector. The results obtained have deepened the understanding of the role of analytical forecasting in improving the effectiveness of Ukraine's energy policy and its ability to ensure sustainable economic growth under resource constraints.

However, despite the availability of research, there was a lack of comprehensive analysis of the economic consequences of implementing sustainable energy consumption programmes at the level of industrial companies, as most studies have a technical, technological or environmental focus. In the Ukrainian context, the issue of integrating energy efficiency into corporate strategies and financial planning of enterprises has been considered to a limited extent. There is also a need for further research on assessing the multiplier effect of energy modernisation, in particular its impact on employment, innovation activity and long-term profitability. Thus, the aim of the study was to substantiate the economic prerequisites and results of improving the energy efficiency of the industrial sector through the implementation of solutions aimed at optimising energy consumption and strengthening the competitiveness of enterprises. To achieve this aim, the relationship between the level of technological modernisation, digital maturity and financial indicators of enterprises in various industries in Ukraine was investigated, the economic effects and barriers to the implementation of rational energy consumption programmes were summarised, and the conditions for their impact on sustainable growth in efficiency and profitability were identified, with adaptation to the Ukrainian context.

Materials and Methods

The study covered a comprehensive approach that involved the use of analysis, comparison and generalisation methods to assess the economic effects of sustainable energy consumption, study the impact of energy modernisation and identify areas for adapting effective models to the conditions in Ukraine. Economic mechanisms were presented for the impact of investments in energy efficiency

(EE) on the performance of industrial enterprises, reducing operating expenditure (OPEX) (Amendola *et al*., 2024) and increasing total factor productivity (TFP) (Na *et al*., 2025). The effect of hedging price and regulatory risks (Dorigoni & Anzalone, 2024) and the role of digitalisation (Artificial Intelligence (AI), predictive maintenance) and financing as mediators of this relationship (Li *et al*. 2025) were considered. The main goal was to build a theoretical framework for the economic effect of EE and to form an analytical basis for further analysis. The effect of EE programmes on profitability was assessed using energy intensity indicators (kWh/t; GJ/t), specific energy costs in production costs (%), and financial metrics (EBITDA, margin). EBITDA elasticity with respect to energy intensity and a comparison of the "before/after" implementation of projects were used for interpretation.

Using the comparative analysis method, the energy and financial results of leading industrial companies in Ukraine – Metinvest Holding (2023), Interpipe (2023; 2024) and ArcelorMittal (2024) based on publicly available corporate reports for 2023-2024 (the analysis was based on data for 2023-2024 as the latest available and relevant). The companies' data covered various types of energy strategies (modernisation, digitalisation, decarbonisation), which made it possible to compare the effectiveness of different approaches to sustainable energy consumption in the Ukrainian context. For each enterprise, the following indicators were assessed: energy consumption, energy balance structure, energy costs, capital expenditure (CAPEX), profitability (Earnings Before Interest, Taxes, Depreciation, and Amortisation (EBITDA), margin, net profit) and implementation of energy efficiency programmes. The objective of this stage was to empirically verify the economic effect of sustainable energy consumption programmes at the level of individual enterprises and to confirm the correlation between energy modernisation, digitalisation, and financial results (profitability, return on investment, operational stability).

Using empirical methods of comparative and structural analysis, a quantitative assessment of the conditions for implementing sustainable energy consumption programmes was carried out. To this end, Ukraine's key energy and financial indicators for 2023-2024 were analysed based on official reports from BDO (2023) (Binder Dijker Otte), NERC (National Energy and Utilities Regulatory Commission of Ukraine) (2023) and the State Statistics Service of Ukraine (2025). Additional information for comparative analysis was obtained from reports by the International Energy Agency (2025), DiXi Group (2025a; 2025b), Energy Partnership Ukraine (2024) and Ember (2024). The selected criteria (installed capacity of RES (renewable energy sources), share of RES in electricity generation, volumes of "green" generation, investments in RES/ (Distributed Energy Resources (DER) and total corporate profits) represented the technical, structural, financial and performance components of energy development. They were selected due to the need to reflect both the resource base and the level of energy independence, as well as the economic effect of modernisation on the national economy. The objective of this stage was to determine the relationship between the dynamics of renewable energy development, investment activity and the financial results of industry, which made it possible to comprehensively assess the economic conditions of Ukraine's energy transition in 2023-2024. In addition, an analytical summary of the data obtained was carried out with the construction of comparative series and dynamic indicators for 2023-2024. This made it possible to track changes in the structure of the energy balance, investment activity and financial results of industrial enterprises. The relationship between the development of renewable energy sources, the share of RES in electricity production, the volume of investments in DER, and the aggregate profit of enterprises was assessed by comparing the growth rates of the relevant indicators. Based on these calculations, the economic mechanisms of the impact of energy efficiency programmes on the profitability and productivity of enterprises were determined.

Results and Discussion

In industry, investments in energy efficiency (EE) operate through three main mechanisms: the sustained reduction of specific energy costs and OPEX volatility, which directly supports profit margins and reduces the risk of cash gaps; the growth of operational efficiency (from reduced downtime and defects to optimised capacity utilisation), which increases total factor productivity (TFP) and enhances firms' ability to withstand price competition; and the strategic hedging of regulatory and price risks (carbon payments, tariffs), which helps stabilise cash flows and the cost of capital (Dorigoni & Anzalone, 2024; Romero-Jordán *et al*., 2025). The effect is significantly amplified when complemented by digitalisation (AI-based energy management, predictive maintenance), as algorithms enable additional savings from existing assets and accelerate the payback of modernisation projects (Li *et al*., 2025). A major constraint is access to finance: tight lending conditions lead to systemic underinvestment in EE projects even when they have a positive Net Present Value (NPV), delaying benefits for profitability and business resilience (Zhang *et al*., 2025).

At the business-model level, EE increases energy productivity (output per unit of energy consumed), which is transformed into higher factor productivity and competitiveness due to lower production costs and greater pricing flexibility. For energy-intensive industries (steelmaking, chemicals), this creates a long-term "profitability framework": the effect is not one-off but accumulates with each shift in the technological paradigm (Na *et al*., 2025; Romero-Jordán *et al*., 2025). However, potential diminishing returns must be considered (the most profitable measures are implemented first), as well as the rebound effect, where part of the savings is absorbed by increased production volumes. This creates the need for comprehensive portfolios of EE solutions and management practices that allow sav-

ings to be captured in companies' financial results (Amendola *et al.*, 2024).

The practical implementation of these approaches covers the following areas: equipment modernisation – targeted replacement or retrofitting of components with high energy profiles (furnaces, compressors, drives, heat exchangers) aimed at reducing specific energy consumption and maintenance costs; in metallurgical processes this includes heat recovery, optimisation of blast parameters/calcination and electrification of selected stages (Na *et al.*, 2025); energy-efficient technologies – technical and digital solutions enabling the same production output with lower energy use: variable-speed drives, heat recovery, high-efficiency burners, VSD pumps, as well as AI-based dispatching systems and predictive maintenance, which reduce peak loads and downtime (Li *et al.*, 2025); and resource consumption optimisation – the managerial layer atop the technical base: Energy Management Systems (EnMS), KPIs of energy intensity per unit of output, dynamic shift and load planning, "energy budgeting" and savings verification. It is this layer that converts the technical potential of EE into sustained financial returns and TFP growth (Sitompul *et al.*, 2024). This means that EE variables (CapEx for modernisation, technology adoption, and managerial practices) should statistically correlate with indicators of profitability and productivity (margin, EBITDA, Return on Assets (ROA), energy intensity, TFP). At the same time, the strength of this relationship is mediated by access to finance and the level of digital maturity of the enterprise (Zhang *et al.*, 2025, Li *et al.*, 2025).

Renewables and energy-efficiency programmes are accompanied by a range of systemic barriers that determine the speed and scale of their deployment in global industry. The most significant of these is financial constraint: the high capital intensity of energy-efficiency projects and limited access to credit resources suppress firms' investment activity. Companies facing financial restrictions invest 30-40% less in energy-efficiency measures, whereas an easing of credit constraints can increase energy efficiency by an average of 7 percentage points (Zhang *et al.*, 2025). Another structural challenge is the high energy intensity of heavy industry, particularly the steel sector. Modernising production can reduce energy consumption by 108.6 kg of standard fuel per tonne of output, cut CO_2 emissions by 539 kg/t and generate an economic benefit of around 97.6 CNY/t (Na *et al.*, 2025). However, such results are achievable only with large-scale capital investment, which makes the decarbonisation process financially vulnerable in itself.

Equally critical is the technological gap and low level of digitalisation. The use of AI systems and digital energy management has proven capable of significantly reducing production energy intensity. At the same time, most companies in developing countries (Indonesia, Vietnam, Brazil) lack access to such technologies (Li *et al.*, 2025), creating a gap between potential and actual modernisation practices. An additional obstacle is institutional and regulatory instability. The absence of consistent, long-term energy-efficiency policy diminishes the effectiveness of implemented programmes. Improvements in energy productivity can stimulate TFP growth, but only under conditions of coherent state support and a stable institutional environment (Romero-Jordán *et al.*, 2025). Fragmented policies, on the other hand, undermine investor confidence and complicate the achievement of long-term outcomes (Amendola *et al.*, 2024). Profitability volatility is also observed due to political and market uncertainty. Even in developed markets, companies' financial results depend on macroeconomic conditions. Investment in renewables increases profitability indicators but does not reduce the Weighted Average Cost of Capital (WACC), indicating the persistence of financial risks (Dorigoni & Anzalone, 2024).

Another major challenge is investment risk under uncertainty. Even during energy crises, firms continue to invest in renewables and energy efficiency, but only on a limited scale and with elevated risk. This gives rise to the phenomenon of "risk-adjusted payback", in which a positive NPV does not guarantee the actual implementation of projects. The heterogeneity of results across sectors and countries forms a barrier to predictability: studies confirm the positive impact of renewables on company performance but highlight considerable variation depending on industry structure, institutional conditions and technological maturity (Sitompul *et al.*, 2024). Such variability underscores the need to adapt energy-efficiency strategies to national contexts, particularly in Ukraine, where the combination of wartime risks and limited financial resources shapes a unique configuration of barriers and opportunities for energy modernisation. Despite these systemic barriers, Ukraine shows gradual recovery of its energy sector and adaptation of industry to wartime conditions. The implementation of energy-efficiency programmes, the development of renewables and the modernisation of thermal generation remain priority areas for ensuring economic and energy resilience. Table 1 presents an analysis of indicator dynamics, enabling the tracing of trends in the transformation of the energy balance, investment structure and industrial sector profitability.

Table 1. Key energy indicators for Ukraine (2023-2024)

Indicator	2023	2024	Description
Installed RES capacity (GW, excluding HPP)	~7.0	~7.0	As of mid-2024: about 7 GW, including ~6 GW of solar generation. Losses in the southern regions (due to events in 2022) amount to 30-40% of capacity (~1.1-1.5 GW). Total losses from March-July 2024 = 9.2 GW. Approximately 3 GW of thermal generation has been restored thanks to repairs.

Table 1. Continued

Indicator	2023	2024	Description
Share of RES in electricity generation (%)	~10.0	8.7 (annual); 17-18 (summer)	In 2024, the share of RES decreased to 8.7% (compared with 9.4% in 2021). During summer, the share reaches 17-18%, while in winter RES covers only 4-7% of consumption. Nuclear power accounts for 55-60% (up to 7.5 GW of capacity in winter).
Volumes of "green" generation/purchases (thousand GWh)	7,936 (purchases by the SE "Guaranteed Buyer" from RES producers)	-	In 2023, the "Guaranteed Buyer" purchased 7,936 thousand MWh (+27% compared to 2022) totalling UAH 40.4 billion. Average tariff – UAH 5.13/kWh. No data available for 2024.
Investments in RES / DER (billion USD, cumulative / forecast)	~12+ (estimated)	15.5-23	Total RES investment at the beginning of 2022 was estimated at USD 12 billion. Forecast expenditure on DER development for 2023-2025 is USD 15.5-23 billion, which may ensure up to 5.6% system-wide cost savings.
Profit of enterprises (billion UAH, total)	776.4	947.3	In 2023, the total profit of large and medium-sized enterprises reached UAH 776.4 billion; in 2024 it increased to UAH 947.3 billion (+22%).

Source: compiled by the author based on BDO (2025), NERC (National Energy and Utilities Regulatory Commission of Ukraine) (2023), State Statistics Service of Ukraine (2025), International Energy Agency (2025a), DiXi Group (2025a,2025b), Energy Partnership Ukraine (2024), Ember (2024)

Table 1 provides important data on the energy situation in Ukraine, in particular on renewable energy sources, "green" generation volumes, investments in RES and DER, as well as financial indicators of enterprises. In 2023, the installed capacity of RES in Ukraine was approximately 7.0 GW, and this figure remained unchanged in 2024. The bulk of this capacity is solar generation, which accounts for about 6 GW. According to the table, attacks on energy infrastructure in the southern regions resulted in the loss of 30-40% of capacity, which is approximately equal to 1.1-1.5 GW. Total losses due to attacks between March and July 2024 amounted to 9.2 GW, but repairs restored about 3 GW of thermal generation. The share of RES in electricity production in 2023 was about 10%, and in 2024 this figure fell to 8.7% (for the year). However, in the summer, the share of RES can reach 17-18%, while in winter this figure drops to 4-7%. This highlights the seasonal dependence of electricity generation on RES, indicating the need to develop energy storage systems. In 2023, the State Enterprise "Guaranteed Buyer" purchased 7,936 thousand GWh of "green" electricity from RES producers, which is 27% more compared with 2022. This indicates a positive trend in supporting renewable energy sources in Ukraine. Data for 2024 are not available, which may point to difficulties with reporting or a reduction in purchase volumes due to national instability. At the beginning of 2022, cumulative investments in RES amounted to roughly USD 12 billion. The forecast for 2024 suggests an increase to USD 15.5-23 billion by 2030. This makes it possible to estimate potential cost savings of up to 5.6%, which is important for supporting the sustainable development of the renewable energy sector. In 2023, the profit of large and medium-sized enterprises in Ukraine totalled UAH 776.4 billion, and in 2024 this figure rose to UAH 947.3 billion, which represents an improvement of 22%. However, despite overall profit growth, around 22.1% of enterprises remained unprofitable, indicating an uneven impact of energy efficiency programmes at the level of individual companies.

Overall, the data in Table 1 indicate a certain stability in Ukraine's energy sector for 2023-2024, although there are several challenges: capacity losses due to military actions and seasonal fluctuations in the share of RES indicate the need to improve infrastructure for a stable energy supply. The growth in "green" generation and investment in RES and DER is a positive sign for the development of the renewable energy sector, but this process requires further investment and political stability to ensure long-term energy independence. The growth in corporate profits indicates an improvement in the financial situation in Ukraine, but to ensure business stability, it is important to reduce the share of loss-making enterprises and increase the efficiency of energy programmes. For a more detailed comparison of the impact of energy efficiency and RES development programmes on key energy and financial indicators, a comparative analysis of three leading industrial companies in Ukraine – Metinvest, Interpipe and ArcelorMittal – was conducted. Table 2 provides data on energy consumption, energy costs, investments and profitability of these companies in 2023-2024.

Table 2. Comparative energy and financial indicators of industrial companies in Ukraine (2023-2024)

Indicator	Metinvest Holding	Interpipe	ArcelorMittal	Comment/trend
Total energy consumption	≈ 8,200 million kWh	ND (not disclosed in open sources)	≈ 4,800 million kWh (estimate based on average consumption in 2021-2022, adjusted for reduced production due to martial law)	In 2024, Metinvest reduced energy consumption through modernisation and energy audits; ArcelorMittal demonstrates stable consumption despite production restrictions
Share of renewables in energy consumption	12% (own solar PV plants, biogas projects, external green-energy suppliers)	ND (not disclosed; partial use of own solar PV plants at industrial sites)	≈ 10% (purchase of "green" electricity from ArcelorMittal Energy suppliers)	Metinvest has the highest level of RES integration, while ArcelorMittal is gradually increasing the "green" share in its consumption structure

Table 2. Continued

Indicator	Metinvest Holding	Interpipe	ArcelorMittal	Comment/trend
Energy carrier expenditures, million USD	USD 1,080 million	ND (integrated into production cost)	≈ USD 290 million (a 12% y/y increase due to rising electricity and natural gas tariffs)	Metinvest sees a decrease in energy costs thanks to production optimisation, while ArcelorMittal sees an increase due to price pressure
CAPEX for energy efficiency	USD 145 million (investments in decarbonisation, equipment modernisation, and energy audits)	USD 31 million (not itemised separately, included in total CAPEX)	≈ USD 110 million (investments in decarbonisation programmes, blast furnace modernisation, and energy audits)	Largest investments in ArcelorMittal as part of the decarbonisation programme
EBITDA	USD 2,519 million	USD 337 million	≈ USD 420 million (estimate for the local division based on its share of ArcelorMittal's global EBITDA for 2024 = USD 7.1 billion)	Increased profitability across all companies due to improved operational efficiency and energy management
EBITDA margin	18%	34%	≈ 15%	Reflects Interpipe's higher operational efficiency and ArcelorMittal's gradual recovery
Net profit	USD 850 million	USD 280.48 million (2024), USD 252.89 million (2023)	≈ USD 120 million (a slight increase following a loss-making 2022)	General trend towards a revival in profitability after the 2022 crisis
Core strategy	Modernisation, digitalisation	Digital energy management	Decarbonisation, renewables (RES)	Companies' approaches are aimed at increasing efficiency and reducing their carbon footprint
Identified effects	Reduction of OPEX, ↑ TFP	Reduction of energy intensity	Reduction of CO_2 emissions	Confirms the economic and environmental feasibility of energy-efficient investments

Note: Interpipe's energy KPIs (total energy consumption, share of RES, individual energy costs, CAPEX for energy efficiency) are not disclosed in public reports for 2023-2024. The company publishes financial indicators in IFRS format (International Financial Reporting Standards – reflecting only the company's financial indicators, therefore energy data (kWh, RES, energy costs) are not included), non-financial (ESG) data on energy are not publicly available or are not detailed. The indicators for ArcelorMittal are marked as estimated (≈) due to the absence of official energy KPIs in the public reports of the Ukrainian division, calculated based on the aggregated data of the ArcelorMittal group (2023-2024)

Source: compiled by the author based on Metinvest Holding (2023), Interpipe (2023; 2024), ArcelorMittal (2024)

Ukrainian industrial companies are gradually integrating energy-efficient and environmentally friendly approaches into their production activities. Metinvest Holding has made the most systematic transition to renewable energy sources and has invested heavily in modernisation. Interpipe maintains the highest operational efficiency, reflected in an EBITDA margin of 34%, although the company does not disclose detailed energy performance indicators. ArcelorMittal is focusing its investments on decarbonisation projects and the restoration of production capacity after the crisis of 2022. In 2023-2024, Ukrainian industrial producers are gradually moving from energy consumption based on an inertial model to sustainable development strategies focused on energy efficiency, digitalisation and carbon emission reduction. This indicates the convergence of corporate policies with European requirements and the formation of the foundations for a decarbonised industry.

The Ukrainian energy sector has remained relatively stable despite significant losses in generating capacity and high risks to infrastructure. Although the share of renewable energy sources remains limited, the recovery of investment activity and the growth in industrial profitability indicate the gradual adaptation of the economy to new energy and financial realities. The results of the study revealed that energy efficiency is one of the key factors in increasing the TFP of industrial enterprises on a global scale. This is consistent with P. Montalbano *et al*. (2022), which showed that investments in EE not only contribute to reducing operating costs but also create long-term competitive advantages through increased technological and production efficiency. The authors proved that energy-efficient enterprises have higher financial stability, especially in periods of market volatility. Similar conclusions were obtained in this study: the implementation of sustainable energy consumption programmes has a positive impact on profitability, margins and cash flow stability. Both approaches emphasise the multiplier effect of EE, which manifests itself in increased TFP, EBITDA and reduced risks. Improving energy efficiency is a systemic driver of economic productivity and competitiveness of enterprises, even with limited investment opportunities.

A study by A. Ketenci & M. Wolf (2024) shows that even small manufacturing enterprises not associated with energy-intensive industries can achieve significant energy savings through the implementation of structured energy management. The authors proved that internal energy audits, equipment modernisation and process optimisation reduce energy consumption by 20-30%, increasing

production efficiency without significant capital investment. They emphasised that the effectiveness of EE programmes depends primarily on management consistency, cost control and the integration of digital monitoring tools. These results are consistent with the findings of the current study, which also confirms that the phased implementation of energy modernisation programmes at Ukrainian enterprises (in particular Interpipe and Metinvest) provides financial returns through reduced OPEX and increased operational stability. Systematic energy management is a determining factor in the effectiveness of modernisation processes and business sustainability. The work of N. Taghavi (2022) demonstrated that improving energy efficiency in manufacturing operations is achieved through the practical integration of EE principles into daily production management processes, in particular through improved operational discipline, energy consumption control and the implementation of management optimisation mechanisms. The author emphasised that systematic operational control ensures sustainable energy modernisation results even without large-scale investments. The current study confirmed similar patterns: the implementation of EnMS systems, energy intensity KPIs and energy budgeting allows energy savings to be reflected in the financial results of enterprises. Systematic process optimisation, from reducing downtime to load planning, is the main mechanism for improving operational efficiency. Both studies show that it is managerial consistency, and not just technical modernisation, that ensures a stable economic return from EE programmes, indicating the practical significance of energy management methods in improving the financial performance of industrial enterprises.

The results of the study confirmed that staff training and organisational knowledge accumulation have a significant impact on the energy efficiency of industrial enterprises. This correlates with the findings of J.Jr. Aduba *et al.* (2025), which found that continuous employee training systems can reduce energy consumption by 10-15% and increase overall productivity. The authors emphasised that the effectiveness of EE programmes depends not only on technical investments, but also on the managerial capacity of staff to use innovative practices. This approach confirmed the importance of human capital as a mediator between energy modernisation and financial results. The formation of competencies and the development of an energy efficiency culture are necessary prerequisites for sustainable economic growth in industry. Y. Zhang *et al*. (2024) proved that digitalisation is one of the key factors in improving the energy efficiency of industrial enterprises. The authors found that the introduction of Internet of Things (IoT) technologies, AI and automated monitoring systems can reduce energy consumption by 10-12% and increase energy productivity by 8-10%. It was shown that the digital maturity of an enterprise acts as an intermediary between technological innovations and economic results, ensuring a stable return on investment in modernisation. The researchers also emphasised that the integration of intelligent energy management systems contributes to reducing risks and increasing the financial stability of the business. The findings were consistent with the results of the current study on the implementation of ACES, EnMS and predictive maintenance technologies at Interpipe and Metinvest, which delivered significant energy savings. Digital transformation in Ukrainian industrial companies has shown a similar trend – a reduction in OPEX, an increase in TFP and an increase in profit margins. Digitalisation acts as a catalyst for the economic effect of energy modernisation and a critical factor in increasing the competitiveness of enterprises. Thus, energy efficiency is a systemic factor in the growth of productivity, profitability and sustainability of industrial enterprises, ensuring a reduction in operating costs, an increase in technological efficiency and the formation of long-term competitive advantages.

The results of the study showed that during times of military risk, the energy resilience of industrial enterprises is formed through a combination of energy efficiency, diversification of energy sources, and digital monitoring. Comprehensive energy modernisation reduces dependence on external suppliers and maintains production stability even in crisis conditions. Similar patterns were identified in a study by P. Lebepe & T.N.D. Mathaba (2025), which systematised the key challenges and strategies for strengthening the energy resilience of enterprises, in particular through the development of energy management systems and the decentralisation of energy supply. The authors concluded that companies with a high level of energy control recover their operational efficiency more quickly after disruptions. The results of both studies confirmed that energy sustainability management is a fundamental factor in the financial stability of industrial companies. The results of the study confirmed that the implementation of energy monitoring systems and regular assessment of energy consumption efficiency (in particular through ACES and EnMS systems) provide a significant reduction in energy costs and production costs without the need for large-scale investments. Structured energy management and technological modernisation enable stable energy savings and increased profitability even in conditions of military instability. Similar results were reported in a study by D. Al Momani *et al.* (2023), where an energy audit at a food industry enterprise reduced energy consumption by 18% without significant capital investment. The authors demonstrated that systematic maintenance, process optimisation and continuous monitoring are effective sources of sustainable savings. The conclusions of both studies indicate that energy audits are a basic tool for energy modernisation, transforming operational savings into sustainable growth in companies' financial results.

A. Berner *et al*. (2022) investigated the effects of the rebound effect in German industry, showing that 15-25% of the savings achieved by EE complexes are offset by an increase in production activity. The authors concluded that in order to maintain financial efficiency, it is necessary to integrate management mechanisms for consumption

control and energy intensity KPIs. This was consistent with the results of the current study, which noted the usefulness of EnMS, energy budgeting and KPIs in capturing savings. The EE effect must be supported by systematic management to avoid losing the results of modernisation. Digitalisation is not only a technical but also a strategic factor in the financial stability of enterprises. Digital technologies are shaping a new level of energy consumption management, turning EE into a competitive advantage. The results of the study showed that, despite the risks of war and loss of capacity, the Ukrainian industrial sector is demonstrating a gradual recovery in investment activity and improved financial results. This is consistent with the findings of C.-C. Lee & H. Wen (2025), who demonstrated that the participation of enterprises in global value chains (GVCs) is a key catalyst for improving energy efficiency. The inclusion of companies in international production and distribution networks leads to stricter requirements for energy management, environmental reporting and process standardisation, as transnational partners increasingly demand compliance with ESG (Environmental, Social, Governance) principles. Such conditions encourage industrial enterprises to implement energy-saving technologies, energy consumption monitoring systems, digital energy flow management solutions (AI-based energy management) and to develop internal decarbonisation policies. Global interaction is not only an external stimulus for energy efficiency, but also a mechanism for long-term consolidation of the effects of modernisation, integrating Ukrainian enterprises into the system of sustainable industrial development. Thus, energy efficiency is not only a technical or environmental priority, but also a strategic factor in macroeconomic and corporate sustainability. Its strengthening through digital solutions, human capital and international integration creates the basis for the formation of a competitive, low-carbon and innovative model of industrial development, particularly in Ukraine in the post-war period.

Conclusions

The study results showed that effective energy modernisation increases EBITDA, profit margins and energy productivity, while reducing financial and operational risks. In industry, the effect of energy efficiency is manifested through a reduction in specific energy costs and OPEX volatility, an increase in TFP and a reduction in downtime and losses. The easing of credit restrictions increases the energy efficiency of enterprises by an average of 7 percentage points, while the lack of financing reduces EE investments by 30-40%, which directly affects margins and EBITDA.

Digitalisation is a strategic driver of energy modernisation: the use of AI-based energy management and predictive maintenance systems provides additional resource savings, increases the flexibility of production processes and reduces the payback period for modernisation projects. This demonstrates the close link between a company's level of digital maturity and its financial stability. In 2023-2024, leading Ukrainian manufacturers are showing steady progress: Metinvest Holding and ArcelorMittal are reducing their energy consumption (4.8-8.2 billion kWh), the share of RES is growing to 10-12%, and the combined CAPEX for energy efficiency of the three companies (Metinvest, Interpipe and ArcelorMittal) exceeds USD 250 million, accompanied by growth in EBITDA and net profit. At the same time, the implementation of RES and energy efficiency programmes is accompanied by a number of systemic barriers. Key challenges include financial constraints and the high capital intensity of projects, which hinders investment activity. Strengthening the credit infrastructure can significantly increase the effectiveness of energy modernisation. Equally significant are technological gaps and low levels of digitalisation in energy-intensive sectors, as well as institutional instability, which reduces investor confidence and slows down the implementation of long-term programmes. Only a comprehensive state policy and access to modern technologies can ensure the transition from situational to structural energy efficiency effects. Despite the difficult conditions, Ukraine is showing a gradual recovery in the energy sector – in 2024, approximately 7 GW of renewable energy capacity will be preserved, and the profits of industrial enterprises will increase by 22% compared to the previous year. It is projected that the development of DER in Ukraine will require USD 15.5-23 billion in investments by 2030, providing up to 5.6% in systemic energy cost savings. This creates the potential to strengthen the competitiveness of national industry after the war. Further research should focus on econometric analysis of the relationship between investment, digitalisation and the efficiency of Ukrainian enterprises, and the development of national energy efficiency indicators in line with international standards.

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Conflict of Interest

None.

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Економічні наслідки впровадження програм сталого енергоспоживання у промислових компаніях

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Анотація. Метою дослідження було визначення впливу управлінських та технологічних змін у сфері енерговикористання на результати діяльності промислових підприємств. Методологія базувалась на теоретичних, емпіричних і порівняльних методах для аналізу ефектів енергоефективності та сталого споживання енергії. Визначено економічні механізми впливу інвестицій у energy efficiency – зниження питомих енергетичних витрат і волатильності Operating Expenditure, підвищення Total Factor Productivity та хеджування регуляторних і цінових ризиків. Підкреслено, що ефект значно посилюється за наявності цифрових технологій (Artificial Intelligence-based energy management, predictive maintenance) і доступу до фінансування, тоді як жорсткі кредитні умови залишаються ключовим бар'єром для реалізації energy efficiency проєктів. Встановлено, що інвестиції в енергоефективність знижують енерговитрати й ризики, підвищують операційну ефективність і конкурентоспроможність завдяки модернізації та цифровізації, тоді як головними перешкодами залишаються обмежене фінансування й низька цифрова зрілість підприємств. Metinvest Holding у 2024 скоротив енергоспоживання до ≈ 8,2 млрд кВт·год і спрямував 145 млн дол. на енергоефективність, Interpipe зберіг найвищу маржу Earnings Before Interest, Taxes, Depreciation, and Amortisation – 34 %, тоді як ArcelorMittal інвестував ≈ 110 млн дол. у декарбонізаційні програми. Виявлено, що в Україні частка відновлювальних джерел енергії у виробництві 2024 складає 8,7 %, 17-18 % влітку, 4-7 % взимку, прибуток великих/середніх підприємств: 776,4 → 947,3 млрд грн (+22 %), збиткові компанії ~22,1 %. Українська промисловість довела, що навіть у кризових умовах енергоефективні програми забезпечують зниження витрат, зростання прибутку та підвищення стійкості підприємств. Доцільно впроваджувати комплексні програми енергоефективності – поєднання технічних рішень, цифрових систем управління та фінансового моніторингу економії. Результати можуть бути використані підприємствами та урядовими структурами для підвищення енергоефективності й розробки стратегій сталого енергоспоживання, зокрема в Україні

Ключові слова: рентабельність; оптимізація; прогнозування; ресурсоефективність; енергопродуктивність; хеджування

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The impact of service quality on customer satisfaction in the hotel and restaurant business

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Abstract. The aim of the study was to comprehensively substantiate the impact of service quality on customer satisfaction and the financial performance of the hotel and restaurant business in Ukraine, with an emphasis on post-war transformations and the growth of competitiveness in the industry. The methodological basis included economic and statistical and correlation analysis, comparison, content analysis of reviews and ratings of Ukrainian hotels on the online platforms Booking.com and TripAdvisor. The analysis used data from the State Tax Service of Ukraine and analytical materials from the "National Tourism Organisation of Ukraine" public association. Thanks to a systematic approach, key trends were studied: the share of the hospitality sector in Ukraine's gross domestic product increased from 1.5% in 2019 to 11.6% at the end of 2024. It was also established that revenues from tourist tax, after peaking at UAH 235.4 million in 2021 and falling sharply in 2022 to UAH 178.9 million and UAH 107.1 million at the end of 2024, recovered by 33%, reaching UAH 142.6 million in the first half of 2025. It was found that in 2024, the average hotel occupancy rate peaked in the Carpathians, reaching 54.6%, exceeding the 2023 figure (54.4%), and the average price per room in Kyiv in January 2025 was UAH 2,236, which is 14% higher than in the same period in 2024. A correlation analysis of monthly occupancy rates and average room rates for the period from January 2024 to February 2025 was conducted, confirming the impact of high service quality on business profitability. An analysis of Ukrainian hotel ratings on Booking.com and TripAdvisor showed that establishments with higher ratings have higher occupancy rates and the ability to set higher prices. The results can be used to develop strategies for improving service quality, digitising processes and refining pricing policies, which will help strengthen the financial stability and long-term competitiveness of Ukraine's hotel and restaurant sector

Keywords: financial efficiency; tourist tax; hospitality industry; correlation analysis; pricing policy

Introduction

Service quality in the hotel and restaurant business, as a fundamental element of industry competitiveness, determines the ability to build lasting customer loyalty and ensure profitability growth. With significant human resources and infrastructure capabilities, Ukraine's hotel and restaurant sector faces challenges related to growing consumer demands, the influence of digital rating platforms, and the need to adapt to developments in the context of a full-scale military invasion. Therefore, the development and implementation of effective approaches to measuring and improving service quality is crucial both for enhancing the financial stability of the hotel and restaurant business as a whole and for strengthening Ukraine's position in the face of global competition.

Mechanisms for assessing service quality in Ukraine's hotel and restaurant business remain fragmented. Industry policy focuses primarily on supporting current operating performance, while a systematic model for measuring the impact of customer satisfaction on financial results is still in its infancy. The lack of a unified methodology for integrating online rating data with financial reporting, a weak analytical base, and limited use of international practices create a situation in which a significant portion of profitability factors are not taken into account. This

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reduces the effectiveness of management decisions and complicates the development of strategies to increase the competitiveness of Ukraine's hotel and restaurant sector in the context of post-war transformations. The impact of innovation on management efficiency and service quality in the hotel and restaurant business is explored in the work of V. Tokareva *et al*. (2024). The authors argue that the introduction of digital technologies, automated booking systems and management platforms significantly optimises business processes, reduces time spent by staff and ensures a higher level of customer satisfaction. It is emphasised that innovative solutions are becoming a key tool for increasing the competitiveness of hotel and restaurant establishments in changing market conditions. At the same time, in the study by B. Dmitrishin (2023), innovation is identified as the main factor in the development of the hotel and restaurant industry. The author found that without the active implementation of digital strategies, it is impossible to ensure sustainable growth in the sector and compete effectively with international chains. In particular, the paper examines issues of service modernisation through the automation of service processes, digital customer experience management platforms and the development of loyalty systems.

The introduction of modern service practices and technologies creates a positive customer experience, which directly affects the ratings of establishments on international platforms. According to N. Rogova & O. Onishchenko (2024), innovation is a means of improving the quality of service in hotels and restaurants. The authors emphasise that innovation not only improves internal business processes but also strengthens the reputation of enterprises in the long term. At the same time, T.V. Gushtan *et al*. (2025) investigated innovative technologies as a factor in the formation of service quality management strategies. The authors found that the level of consumer satisfaction and customer service in general is directly related to the profound transformation of the hotel and restaurant business. Experts are convinced that digital solutions, including electronic booking systems, Customer Relationship Management (CRM) systems, and customer data analytics, enable hotel and restaurant businesses to respond more effectively to changes in demand and provide personalised service.

Innovative approaches to assessing and influencing the perception of service quality on business competitiveness are described in a study by V. Rusavska & S. Neilenko (2022). The authors emphasised that a high level of service directly affects repeat demand and customer loyalty. The concept of quality in the work of specialists arises in the context of the main criterion for satisfying the needs of restaurant business consumers. Assessing the impact of service quality on consumer satisfaction in the hotel and restaurant business, V. Mazur (2025) found that psychological factors also influence effectiveness. According to the author, emotional interaction, the level of empathy of staff and psychological comfort significantly influence the perception of service quality. The study found that service quality is formed not only through technical standards, but also through the communication skills and communication culture of staff.

Instead, O. Kurakin (2024) proposed a concept of quality service for hotel businesses, which includes criteria for assessing customer satisfaction and mechanisms for improving processes. The study examines how quality management can be a component of strategic development in the hotel business. The author emphasised that a systematic approach to service organisation ensures sustainable growth and improves the position of establishments in a competitive environment. According to I. Minich (2025), the development of the hotel and restaurant business in Ukraine and the improvement of customer service quality in the era of globalisation are also impossible without the implementation of international practices. The author investigated the mechanisms for adapting international experience in improving labour productivity in the hotel and restaurant business in Ukraine. The researcher is convinced that the implementation of international practices not only increases the efficiency of enterprises but also significantly improves the quality of customer service.

In scientific research on service quality, the main focus is on revealing the essence of the concept, analysing innovative technologies, psychological factors of staff and customer interaction, and developing conceptual approaches to service management in the hotel and restaurant business. Issues related to the quantitative measurement of the impact of service quality on the financial results of enterprises, the comprehensive use of data from international online evaluation platforms, and the integration of these indicators with internal financial reporting remain insufficiently covered. There was also a lack of systematic empirical research covering the dynamics of service ratings over time and their correlation with the profitability and occupancy of establishments in Ukraine.

The aim of the study was to determine how service quality determines customer satisfaction and the financial results of the hospitality sector in Ukraine, taking into account post-war changes and the strengthening of its competitiveness. To achieve this aim, a set of objectives was defined, including: theoretical and analytical understanding of service quality as a key factor in the competitiveness of the hotel and restaurant business; analysis of the state of the hotel and restaurant business in Ukraine for the period starting in 2020, taking into account the dynamics of the industry's development, financial indicators, occupancy rates, and the impact of external factors on performance; empirical research on the relationship between service quality and financial results.

Materials and Methods

The study was empirical in nature and covered the period from 2020 to June 2025, during which Ukraine's hotel and restaurant business was affected by the COVID-19 pandemic and a full-scale military invasion, which

determined the key challenges and conditions for the industry's adaptation. Based on data from the State Tax Service of Ukraine (2025) and analytical materials from the National Tourism Organisation of Ukraine (2024), the analysis examines the dynamics of the hospitality sector's contribution to Ukraine's gross domestic product and revenues from tourist tax, and assesses key trends. Content analysis was used to describe the impact of the full-scale military invasion of Ukraine in February 2022 on the development of the hospitality sector and to analyse key trends.

To comprehensively define the essence and role of the concept of service quality, a theoretical generalisation of the results of V.A. Zeithaml *et al*. (2017) was carried out, and the Service Quality (SERVQUAL) model developed by the authors was studied. Based on this, an analytical comparison of consumer behaviour and expectations with international service quality standards (ISO 9001, 2025) was carried out in five categories: reliability, responsiveness, assurance, empathy, and tangibles. A combined diagram was constructed in accordance with the data obtained. A systematic approach was used to describe the relationship between the sustainability of the hotel and restaurant business in Ukraine and the socio-psychological aspect of service quality, which includes intangible factors (attentiveness of staff, ability to create an atmosphere of hospitality and emotional comfort).

An analysis of service quality and financial results in the Ukrainian hospitality sector was carried out based on data from leading analytical platforms – TripAdvisor and Booking.com. Eight hotels and six restaurants with more than 200 reviews were selected for the study, ensuring the representativeness of the sample. The data was collected in June 2025. The characteristics of the rating scales were taken into account: TripAdvisor (from 1 to 5) and Booking.com (from 1 to 10). In the restaurant business segment, the highest-rated establishments according to TripAdvisor were analysed: Baczewski Restaurant (TripAdvisor, n.d.g), BAO Modern Chinese Cuisine (TripAdvisor, n.d.h), Dacha (TripAdvisor, n.d.i), Kanapa Restaurant (TripAdvisor, n.d.j), Fratelli Ristorante & Enoteca (TripAdvisor, n.d.k), Terrace. Sea View (TripAdvisor, n.d.l). Based on ratings and reviews, a comparative characteristic of the level of service quality was formed. In the hotel business segment, establishments with different average scores on the Booking.com platform were studied: from 7 to 8, from 8 to 9, and from 9 to 10 on a 10-point scale. The sample included: Motel (Booking.com, n.d.i), Amsterdam (Booking.com, n.d.j), Palm (Booking.com, n.d.l), Alexandria (Booking.com, n.d.k), Premier Hotel Odesa (Booking.com, n.d.h), Hotel Ukraine (Booking.com, n.d.d), Emily Resort (Booking.com, n.d.b), Capsule Hotel Constellation 89 (Booking.com, n.d.a), Mountain Residence Wellness & SPA (Booking.com, n.d.f). A table and graphic materials were created to assess the level of service quality. A comparative analysis of the assessments was carried out, key customer behavioural responses were identified, as well as problem areas of service, including the need to upgrade the technical equipment in the rooms. The results obtained made it possible to correlate the level of service quality with the financial performance of the establishments, ensuring the comprehensiveness of the study.

A comprehensive analysis was used to describe the impact of economic, social and tourism factors on the dynamics of financial indicators and hotel occupancy in Ukraine. Based on data from The State Agency for Tourism Development of Ukraine (2025), the general dynamics of room occupancy and average room rates in Ukrainian hotels for the period from January 2024 to February 2025 were identified, due to the availability of complete official statistics only up to that month. In addition, seasonal and regional fluctuations in room occupancy rates and trends in hotel financial indicators were examined.

To quantitatively verify the relationship between service quality and financial performance, a correlation analysis was performed in the study using Pearson's coefficient. This method was chosen because of its suitability for measuring the linear relationship between two quantitative variables. The study was based on monthly data on room occupancy and average room rates in Ukrainian hotels for the period from January 2024 to February 2025. Pearson's correlation coefficient (r) was calculated using the following formula:

$$r = \frac{\sum_{i=1}^{n}(x_i-\bar{x})\times(y_i-\bar{y})}{(n-1)\times s_x \times s_y}, \quad (1)$$

where n – the sample size (14 months), x_i – the occupancy rate in the i-th month, y_i – the average price per room in the i-th month, $\bar{y}$ and $\bar{x}$ – their aggregate averages for the entire period under review, s_x and s_y – standard deviations.

The following formulas were used to calculate the standard calculations:

$$s_x = \sqrt{\frac{1}{n-1}\times \sum_{i=1}^{n}(x_i-\bar{x})^2}, \quad (2)$$

$$s_y = \sqrt{\frac{1}{n-1}\times \sum_{i=1}^{n}(y_i-\bar{y})}. \quad (3)$$

To verify the statistical significance of the obtained correlation coefficient, Student's t-test was also calculated using the formula:

$$t = r \times \sqrt{\frac{n-2}{1-r^2}}. \quad (4)$$

The interim results of the calculations were presented in the table. The calculated Student's t-test confirmed a high level of significance ($p < 0.01$). The study also calculated the Revenue per Available Room (RevPAR) indicator using the formula:

$$\text{RevPAR} = \frac{y_i}{x_i} \times 100\%. \quad (5)$$

The results of the calculations are shown in the table. The calculations confirmed the existence of a strong direct link between service quality and financial results.

Results

Contribution of the hotel and restaurant business to Ukraine's GDP and its transformation in 2020-2025

The hotel and restaurant business in Ukraine is an integral part of the tourism industry and the service sector, accounting for a significant share of gross domestic product (GDP). According to the "National Tourism Organisation of Ukraine" (NTOU), the hospitality sector's contribution to Ukraine's GDP will be around 11.6% by the end of 2024, which is significantly higher than the 2019 figure of 1.5% (National Tourism Organisation of Ukraine, 2024). The development of the industry is creating new jobs and transforming regional development, which is shaping the country's positive image on the international market. At the same time, significant shocks were observed during 2020-2025, which necessitated adaptation to crisis conditions.

The COVID-19 pandemic in 2020-2021 was a turning point for the sector. Strict quarantine restrictions led to a drop in demand for hotel services and the virtual shutdown of a significant number of restaurants. During this time, the volume of services sold and revenue from tourist tax decreased. The dynamics of the tourist tax indicator for the period starting in 2020 is presented in Figure 1.

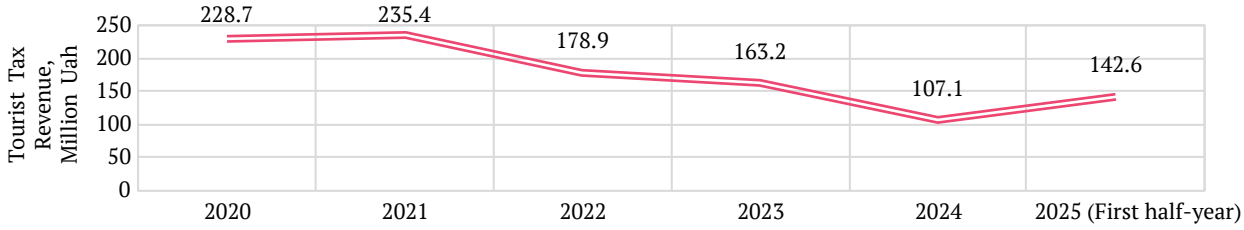

Figure 1. Volume of tourist tax in Ukraine for the period from 2020 to June 2025

Source: compiled by the author based on materials from Horwath HTL (2021), The State Agency for Tourism Development of Ukraine (2025), State Tax Service of Ukraine (2025)

While in 2021 this indicator amounted to 235.4 million hryvnias (UAH), in 2022 it decreased by 24% and amounted to only 178.9 million UAH. This trend reflects the depth of the crisis faced by the industry during the combination of pandemic restrictions and the first months of the full-scale invasion. From 2023 to June 2025, a gradual recovery in tourist activity can be observed. Thus, in the first half of 2025, revenues from tourist tax amounted to UAH 142.6 million, which is 33% more than in the first half of 2024 – UAH 107.1 million. The largest growth is observed in Kyiv, Lviv and Ivano-Frankivsk regions, where domestic tourism and regional mobility of the population stimulate the development of hotel and restaurant services. This indicates the industry's adaptability to new conditions and the gradual restoration of its financial potential.

With the start of a full-scale armed offensive on the territory of Ukraine in February 2022, the problems of the industry have significantly worsened. In many regions, businesses were forced to cease operations due to the destruction of infrastructure or the inability to ensure the safety of customers and staff. An additional limiting factor was the increase in energy costs, logistical difficulties and staff shortages due to migration. However, during the same period, in the western regions of Ukraine, where 85% of internally displaced persons had moved, there was an increase in demand for temporary accommodation and catering (Ribas Hotels Group, 2024). This contributed to the revitalisation of small and medium-sized enterprises, which were able to adapt their services to the new conditions.

Key trends in the industry include the digitisation of management and marketing processes, the active use of online platforms for booking and delivery, and increased attention to quality and safety standards. There is a growing focus on domestic consumers, the development of regional tourist routes, and the creation of specialised formats of establishments adapted to the needs of domestic tourism (National Tourism Organisation of Ukraine, 2024). In summary, as of June 2025, Ukraine's hotel and restaurant business can be described as being in crisis, but with signs of gradual recovery and stability. Despite significant losses, the industry is demonstrating its ability to adapt quickly to change, seek new business models and niche markets. Its future prospects are linked to the end of the war, the restoration of international tourist flows and the intensification of digital transformation, which has already become an integral part of business strategies in the hospitality sector.

Service quality as a key factor in the competitiveness of Ukraine's hotel and restaurant business

One of the key factors determining the competitiveness of Ukraine's hotel and restaurant business is service quality. This indicator shapes consumer experience and builds long-term customer loyalty. In a situation where the industry is undergoing crisis transformations under the influence of a full-scale invasion, the level of service quality becomes not only a means of satisfying consumer needs, but also a strategic resource for the survival and development of hospitality businesses. A similar approach to strategic management in the tourism sector is supported by A. Pavlenchyk & N. Tsizdyn (2025), who argue that the foreign economic activity of tourism enterprises is an important factor in shaping their competitiveness. In countries with developed tourism infrastructure, service quality is considered a complex category that encompasses tangible and

intangible aspects, including staff competence, environmental comfort, technological processes, and compliance with international standards.

In scientific literature, service quality is interpreted through various conceptual approaches. One of the most common is the SERVQUAL model developed by V.A. Zeithaml *et al.* (2017), which defines service quality as the difference between consumer expectations and their actual perception of the service. The principle was based on five key dimensions: reliability, responsiveness, assurance, empathy, and tangibles. This approach made it possible to quantitatively assess service quality and identify areas for improvement. Another theoretical approach, proposed by H. Zavarika & O. Zelenko (2024), is to interpret service quality as the result of a combination of technical (what the customer receives) and functional (how it happens) components. Thus, the focus is not only on the final product, but also on the process of its delivery.

To ensure the sustainable development of the hotel and restaurant business in Ukraine, the socio-psychological aspect of service quality is also important. This component covers the culture of communication and the ability of staff to create an atmosphere of hospitality and emotional comfort. The experience of 2020-2024 shows that it is precisely intangible factors – friendliness, an individualised approach, and a willingness to help the customer – that become a key element of competitive advantage in conditions of increased uncertainty and instability (Sereda, 2025). This is particularly important for domestic tourists and internally displaced persons, for whom quality service is associated not only with comfort, but also with safety and psychological support. Innovative theoretical approaches emphasise the need for a comprehensive measurement of service quality. This means integrating classic assessment models with modernised concepts of customer experience management, digital service and sustainable development strategies. In this context, service quality is seen not as a static characteristic, but as a dynamic process that is shaped by the interaction between the enterprise and the customer (Hospitality Financial and Technology Professionals, 2024). For the hotel and restaurant business in Ukraine, this means that future competitiveness will largely depend on the ability of companies not only to provide a basic level of service, but also to create a unique service experience focused on long-term interaction with customers.

Consumer expectations and behaviour in Ukraine's hotel and restaurant business are shaped by a number of internal and external factors, including cultural characteristics, economic conditions, the level of development of tourism infrastructure and individual customer experience (Sereda, 2025). At the same time, current trends in globalisation and the integration of the Ukrainian market into the global space place additional demands on the compliance of services with international standards, in particular ISO 9001 (ISO, 2025) in the field of quality management, and hotel industry standards by star rating categories applied in countries with developed tourism infrastructure. A comparison of Ukrainian consumers' expectations with international service quality standards according to the SERVQUAL model (Zeithaml *et al.*, 2017) is presented in Figure 2.

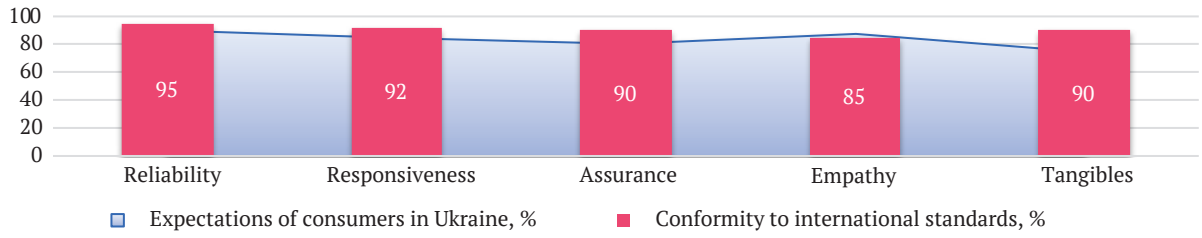

Figure 2. Comparison of Ukrainian consumers' expectations with international service quality standards

Source: compiled by the author based on analytical materials World Tourism Organisation (2018), National Tourism Organisation of Ukraine (2024)

Research into consumer behaviour shows that Ukrainian customers expect hospitality businesses to offer a high level of reliability and comfort, a personalised approach, quick and effective problem solving, and a safe stay. Compared to international standards, the most noticeable gaps are in the areas of technological support for services, digitisation of booking and payment processes, and standardisation of service delivery procedures. At the same time, the socio-psychological aspects of service – attentiveness of staff, ability to create an atmosphere of hospitality and emotional comfort – often exceed the global average, which gives Ukrainian establishments a competitive advantage in the domestic tourism and displaced persons service segments.

When considering the competitiveness of the Ukrainian hospitality sector, the example of Ukrainian hotels should also be used to assess the impact of service quality on customer behaviour. For analysis on the Booking.com platform and to ensure a comprehensive overview, hotels from different regions of Ukraine will be selected at random with an average rating of up to 7 points, from 7 to 8, from 8 to 9 and from 9 to 10 points on a 10-point scale. In order to assess the level of service quality of a hotel, it is necessary to summarise and determine the average between the ratings in the categories "Staff", "Cleanliness", "Comfort", "Amenities", "Value for money", "Location", and "Free Wi-Fi" presented on the platform. The results of the analysis are presented in Table 1.

Table 1. Level of service quality in Ukrainian hotels

Evaluation criteria	Hotels with an average score of up to 7		Hotels with an average score of 7 to 8		Hotels with an average score of 8 to 9		Hotels with an average score of 9 to 10	
	Motel	Amsterdam	Palm	Alexandria Hotel	Premier Hotel Odesa	Hotel Ukraine	Emily Resort	Capsule Hotel Constellation 89
Staff	81	74	86	85	86	90	94	94
Amenities	70	63	78	76	88	84	96	88
Cleanliness	75	63	78	77	89	85	95	90
Comfort	73	65	78	78	90	85	97	89
Value for money	78	68	81	72	83	83	88	95
Location	77	73	66	86	92	96	96	90
Free Wi-Fi	–	80	85	78	94	84	91	83
Level of service quality	64.9	69.4	78.9	78.9	88.9	86.7	93.9	89.9

Source: systematised by the author based on data from Booking.com (n.d.a; n.d.b; n.d.d; n.d.h; n.d.i; n.d.j; n.d.k; n.d.l)

Having divided hotels into rating groups, it is advisable to visually assess the impact of the service quality level of Ukrainian hotels on customer behavioural responses. To do this, it is necessary to summarise and compare the service quality indicators obtained with the number of reviews with a rating of 9 to 10, taking into account the total number of reviews (Fig. 3).

Consumer behaviour in the context of expectations and actual experience shows a clear correlation: the higher the level of service quality, the higher the likelihood of positive reviews on digital channels. The summary data in the figure shows a "threshold effect". After moving from an average level of compliance to the 81-90% range, the share of 9-10 ratings significantly prevails, and in the group with a service quality indicator of over 90%, it constitutes an absolute majority, along with a sharp increase in the total number of reviews. This indicates that high standards not only improve the quality of perception but also increase customer engagement in digital channels (willingness to share experiences and leave reviews), which enhances the effect of reputation and price leverage for establishments.

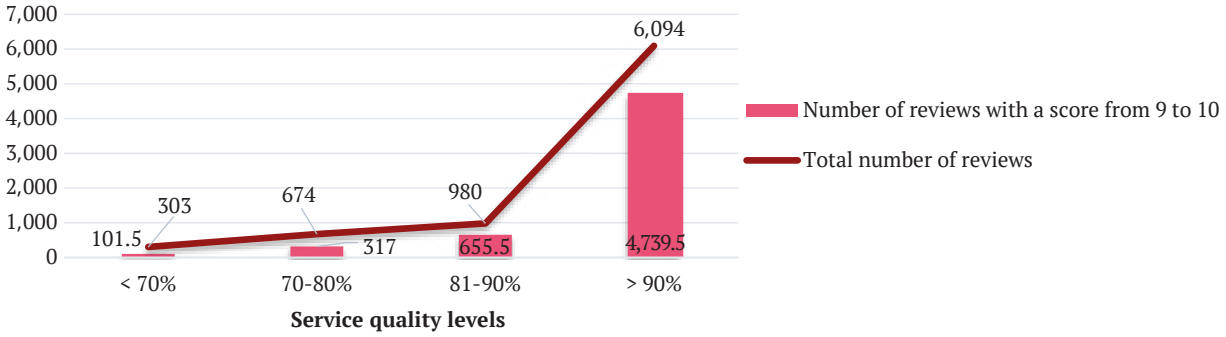

Figure 3. Impact of the level of service quality in Ukrainian hotels on customer behavioural responses (positive reviews)
Source: constructed by the author based on data from the Booking.com platform (n.d.a; n.d.b; n.d.d; n.d.h; n.d.i; n.d.j; n.d.k; n.d.l)

For scientific and practical analysis of such interrelationships, an integrated approach is important, combining traditional assessment tools (the SERVQUAL model, measurements of technical and functional quality) with modern methods of monitoring customer experience and digital interaction. Service quality is a critical factor that determines customer satisfaction and loyalty in the hotel and restaurant business in Ukraine. Research shows that a high level of service contributes to a positive customer experience, which in turn encourages repeat visits and recommendations to others (Hospitality Financial and Technology Professionals, 2024). An analysis of reviews on popular Ukrainian travel platforms, such as Booking.com, shows that customers highly value reliability, attentive staff, a comfortable environment, technological processes, and compliance with international standards. For example, the Hotel "Ukraine" in Lutsk received high ratings in three categories: "convenient location," "delicious cuisine," and "beautiful scenery," which had a positive impact on customer satisfaction (Booking.com, n.d.d). Users note that the willingness of staff to accommodate their needs, for example, by allowing early check-in or late check-out, significantly increases their loyalty to the establishment. However, not all aspects of the service receive positive reviews. Some customers point to the need to update the technical equipment in the rooms, such as replacing old TVs or improving the air conditioning. These comments highlight the importance of constantly improving the physical infrastructure of hotels to maintain a high level of service. Overall, the analysis of customer feedback confirmed that

service quality directly affects customer satisfaction and their willingness to return to the establishment or recommend it to others. This means that in order to remain competitive in the hotel and restaurant services market in Ukraine, businesses need to focus on high standards of service and constantly work to improve them.

Analysis of service quality and financial results in the Ukrainian hospitality sector

In the context of economic and social challenges, the Ukrainian hospitality sector has made significant progress in improving service quality, which directly affects the financial performance of businesses. Online booking platforms such as Booking.com and TripAdvisor have become key tools for assessing service levels and customer satisfaction. An analysis of the ratings of Ukrainian hotels and restaurants on these platforms has made it possible to assess the level of service and the impact of these indicators on financial results.

The service quality of Ukrainian restaurants is determined by three indicators: operational reliability (consistency of serving times, cleanliness, food safety standards), customer experience in the dining room and online (communication, empathy, complaint handling, transparency in reviews) and digital processes (electronic menus, reservation options, convenient payment options, demand analytics, delivery). After 2022, the Ukrainian restaurant business became more polarised. Establishments that quickly standardised procedures and the digital chain (online reservations, CRM systems, integration with delivery services, automated order taking) demonstrate greater service stability, better peak hour load management and a higher proportion of positive online reviews (Sereda, 2025) . The key drivers of loyalty are predictability and speed: guests "forgive" limited menus or simple interiors, but react worse to delays, inconsistencies between the dining room and kitchen, poor communication, and untidiness. Seasonality and regional factors remain: in tourist hubs (Kyiv, Lviv, Carpathians, Odesa), there are higher demands for speed of service and personalisation, while in residential areas, there are higher demands for price/quality and children's/family infrastructure. Restaurants that have implemented standards of preparation and service (SOP), regular internal cleanliness audits, communication scripts, and repeat visit analytics are better at maintaining average check sizes and recover more quickly from reputational setbacks. In general, service quality is increasingly determined not by the internal atmosphere, but by the ability to systematically manage demand, expectations, and feedback in real time – from the table in the dining room to reviews on the internet.

Review platforms, primarily TripAdvisor, serve as basic indicators of perceived service quality in the restaurant segment and allow for a unified comparison of establishments by city and format. An analysis of Ukrainian restaurant ratings on TripAdvisor shows a concentration of high ratings for establishments with established service standards and transparent review management. For example, in Lviv, Baczewski Restaurant has a rating of 4.4 out of 5 based on 3,084 reviews and is among the top establishments in the city's ranking, indicating consistent service quality across a large sample size. In Kyiv, BAO Modern Chinese Cuisine has the same rating, 4.4 out of 5 based on 499 reviews, and is among the best establishments in Kyiv, which indicates stability in the modern cuisine category. In Odessa, Dacha has a rating of 4.4 out of 5 based on 1,001 reviews and is among the top five in the city, which is consistent with its high rating for hospitality and service organisation during peak seasons. The summary distribution of average ratings for leading restaurants is shown in Figure 4.

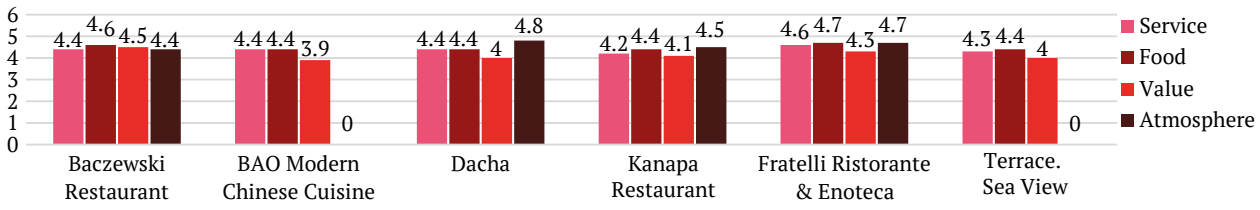

Figure 4. Distribution of ratings for the best Ukrainian restaurants on TripAdvisor (on a scale of 1-5)
Source: compiled by the author based on data from TripAdvisor (n.d.g; n.d.h; n.d.i; n.d.j; n.d.k; n.d.l)

According to the data presented in Figure 4, ratings for key service quality metrics in Ukrainian restaurants are concentrated in the upper range of the scale: the "Service" and "Food" categories show relatively stable high values in all establishments, while "Value" is systematically several tenths of a point lower, reflecting consumers' sensitivity to the price-quality ratio. At the same time, "Atmosphere" is a differentiating factor: its peak value is observed in Dacha (visually the highest among the compared establishments), while in a number of establishments this indicator is not available in open data. The dynamics of the distribution of points indicate that guests' behavioural preferences are primarily based on the reliability and speed of service and the quality of the cuisine; these measurements have the smallest gap between establishments. On the other hand, perceived value and atmospheric characteristics create competitive positions: even with similar ratings for service and cuisine, restaurants with a higher sense of value proposition and a more distinctive atmosphere receive better overall ratings and potentially higher willingness to recommend. A selective comparison of the best restaurants (city, average rating, number of reviews, service features) based on data from the TripAdvisor platform is presented in Table 2.

Table 2. Comparison of ratings for the best Ukrainian restaurants on TripAdvisor

Restaurant	City	TripAdvisor rating (1-5)	Number of reviews	Comments
Baczewski Restaurant	Lviv	4.4	3,084	The establishment consistently receives high ratings across a large number of reviews, with comments regularly noting the speed of service, the politeness of the staff, and the cleanliness of the dining room.
BAO Modern Chinese Cuisine	Kyiv	4.4	499	Guests emphasise the organisation of the service, the waiters' knowledge of the menu, and their efficiency; they also give separate positive reviews for the staff's work and the visual presentation of the dishes.
Dacha	Odesa	4.4	1,001	Despite seasonal peaks, the establishment maintains a predictable pace of service; reviews often note the attentiveness of the waiters and the quality of the home-style dishes.
Kanapa Restaurant	Kyiv	4.3	1,046	The restaurant receives "good-excellent" ratings for the work of the staff; at the same time, during peak hours, there are comments about waiting times, but the overall service is perceived positively.
Fratelli Ristorante & Enoteca	Odesa	4.5	532	Visitors note the consistent quality of Italian cuisine, attentive staff, and clear communication when booking tables and paying the bill.
Terrace. Sea View	Odesa	4.5	698	Reviews consistently highlight the friendliness of the staff, speed of service, and pleasant atmosphere; during the high season, there is an increased workload, but service standards are maintained.

Source: compiled by the author based on data from TripAdvisor (n.d.g; n.d.h; n.d.i; n.d.j; n.d.k; n.d.l)

In summary, it can be stated that the service quality of Ukrainian restaurants, according to TripAdvisor data, consistently remains in the upper range of the scale: the dimensions of service and food quality receive the highest and least variable ratings, while perceived value is noticeably lower and more sensitive to fluctuations. The differentiation of establishments is primarily based on atmosphere and price/quality ratio, which, with similar basic service standards, determine the transition to the top quartile of the rating. Higher average scores on platforms are consistent with demand indicators (intensity of new reviews, positions in local ratings), indicating a strong association between service consistency and restaurant competitiveness. The Booking.com platform offers a wide selection of hotels in Ukraine, from budget to luxury. Among the best, for example, is the "Emily Resort" hotel in Lviv, which received a rating of 9.5 out of 10, indicating a high level of guest satisfaction (Booking.com, n.d.b). Other hotels, such as "Capsule Hotel Constellation 89" (Booking.com, n.d.a) in Lviv and "Mountain Residence Wellness & SPA" (Booking.com, n.d.f) in Bukovel, also received high ratings (9 and 9.3, respectively), confirming the trend towards improving the quality of service in Ukrainian hotels. The ranking of the best hotels by number of reviews and average rating on Booking.com is presented in Figure 5.

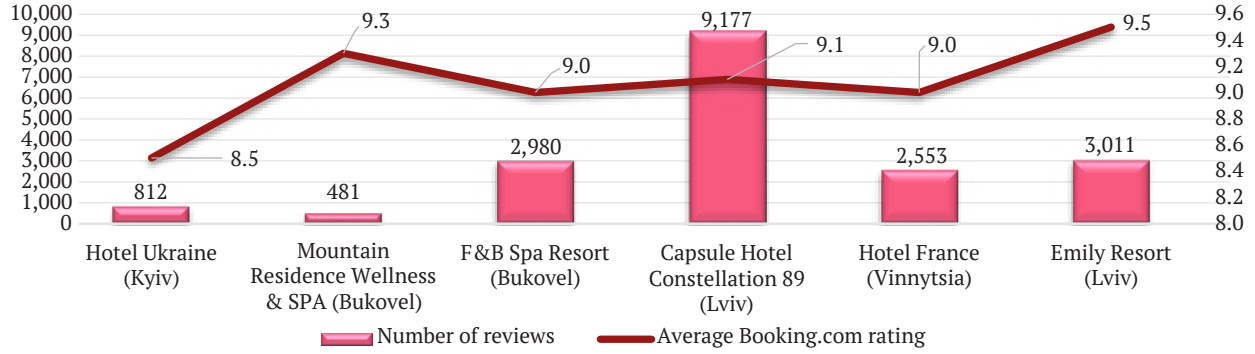

Figure 5. Distribution of ratings for the best Ukrainian hotels on Booking.com (on a scale of 1-10)

Source: compiled by the author based on data from Booking.com (n.d.a; n.d.b; n.d.c; n.d.d; n.d.f; n.d.g)

At the same time, TripAdvisor provides additional information about the quality of service in Ukrainian hotels. For example, the "Senator Maidan" hotel in Kyiv ranks second among 133 hotels in the city, receiving 601 reviews and a rating of 4.8 out of 5 (Tripadvisor, n.d.c), which indicates a high level of service and customer satisfaction. Other hotels, such as "Premier Hotel Odesa" and "Hotel France" in Vinnytsia, also received high ratings (4.6 and 4.4, respectively), confirming the general trend towards improving service quality in Ukrainian hotels. Table 3 compares TripAdvisor and Booking.com ratings for the best Ukrainian hotels.

Table 3. Comparison of TripAdvisor and Booking.com ratings for the best Ukrainian hotels

Hotel	City	Rating on Booking.com	Number of reviews on Booking.com and TripAdvisor	Rating on TripAdvisor	Comments
Emily Resort	Lviv	9.5	3,008 (Booking.com), 10 (TripAdvisor)	3.7	A complex with its own infrastructure; reviews emphasise cleanliness, staff organisation and breakfast quality; service remains consistent even during peak periods.
Mountain Residence Wellness & SPA	Bukovel	9.3	481 (Booking.com), 18 (TripAdvisor)	3.5	The establishment offers comprehensive spa services, comfortable rooms and a wide range of additional leisure services.
Capsule Hotel Constellation 89	Lviv	9.1	9,177 (Booking.com), 1 (TripAdvisor)	3.0	Capsule accommodation format with high ratings on Booking.com and a large database of reviews; at the same time, the number of reviews on TripAdvisor is minimal, so the average rating cannot be considered indicative.
F&B Spa Resort	Bukovel	9.0	2,980 (Booking.com), 80 (TripAdvisor)	3.5	The hotel is known for its delicious breakfasts, attentive staff, and high level of service, which creates a comfortable experience for guests.
Hotel France	Vinnytsia	9.0	2,553 (Booking.com), 88 (TripAdvisor)	4.4	Guests consistently note the convenient location in the centre, the politeness of the staff and the cleanliness of the rooms; the service is adaptable for both leisure and business trips.
Premier Hotel Odesa	Odesa	8.7	1,148 (Booking.com), 32 (TripAdvisor)	4.6	The hotel is distinguished by its comfortable accommodation, friendly staff and high-quality service for tourists and business clients.
Hotel Ukraine	Kyiv	8.5	812 (Booking.com), 69 (TripAdvisor)	3.7	The hotel is noted for its convenient location, high level of service and pleasant atmosphere for guests.

Source: compiled by the author based on data from TripAdvisor (n.d.a; n.d.b; n.d.d; n.d.e; n.d.f; n.d.m; n.d.o) and Booking.com (n.d.a; n.d.c; n.d.d; n.d.f; n.d.h; n.d.g; n.d.m)

High ratings on booking platforms directly affect hotels' financial results. Hotels with high ratings usually have higher occupancy rates, which allows to set higher prices and increase profits. For example, the "Emily Resort" hotel, with a rating of 9.5 out of 10, has a high occupancy rate, indicating its popularity among guests (Booking.com, n.d.b). This confirms the importance of high-quality service for achieving financial success in the hospitality industry. However, not all aspects of service receive positive reviews. Some customers point to the need to upgrade the technical equipment in the rooms, for example, replacing old TVs or improving the air conditioning. These comments demonstrate the importance of continuously improving the material base of hotels to maintain a high level of service. Hotels that are actively working to improve their infrastructure and implement the latest technologies can significantly increase customer satisfaction and, accordingly, their financial results. Thus, an analysis of Ukrainian hotel ratings on Booking.com and TripAdvisor shows positive trends in improving the quality of service in the Ukrainian hospitality industry. High customer ratings directly affect the financial results of businesses, confirming the importance of focusing on high service standards to achieve success in the market. However, to maintain and improve these results, it is necessary to continuously work on improving the material base and introducing the latest technologies in the hospitality industry.

The combined impact of economic, social and tourism factors is reflected in the dynamics of financial indicators and hotel occupancy rates in Ukraine. In 2024, there was a positive trend towards growth in operating indicators in leading tourist cities such as Kyiv, Odesa, Lviv and Bukovel (State Tax Service of Ukraine, 2025). However, most hotels have not yet reached pre-war levels of occupancy and profitability. The exception was properties located in the Bukovel area, where profitability significantly exceeded its maximum values for the period from 2021 to 2025. For a comprehensive assessment, Figure 6 shows the generalised dynamics of room occupancy and average room rates for the period from January 2024 to February 2025.

According to the data presented in Figure 5, a seasonal influence can be observed on both indicators: a gradual increase from spring to the summer peak, followed by a decline in autumn and winter. The minimum values are recorded at the end of the winter period (for example, February 2024 indicators: occupancy 46%, average price 1,950 UAH), the maximum values are recorded in the middle of the summer season (July 2024 indicators: occupancy 64%, average price 2,300 UAH). This pattern indicates a clear seasonality in room occupancy rates and that the improvement in commercial parameters during the peak season is supported by simultaneous growth in both prices and occupancy rates, while in winter both indicators tend to decline; already at the beginning of 2025, there are signs

of a gradual recovery after the winter period. Overall, the dynamics of financial indicators and hotel occupancy in Ukraine indicate a gradual recovery of the industry after the shock caused by the start of the full-scale invasion. However, in order to achieve pre-war levels of efficiency, it is necessary to continue working on improving service quality, introducing new technologies and adapting to changing market conditions.

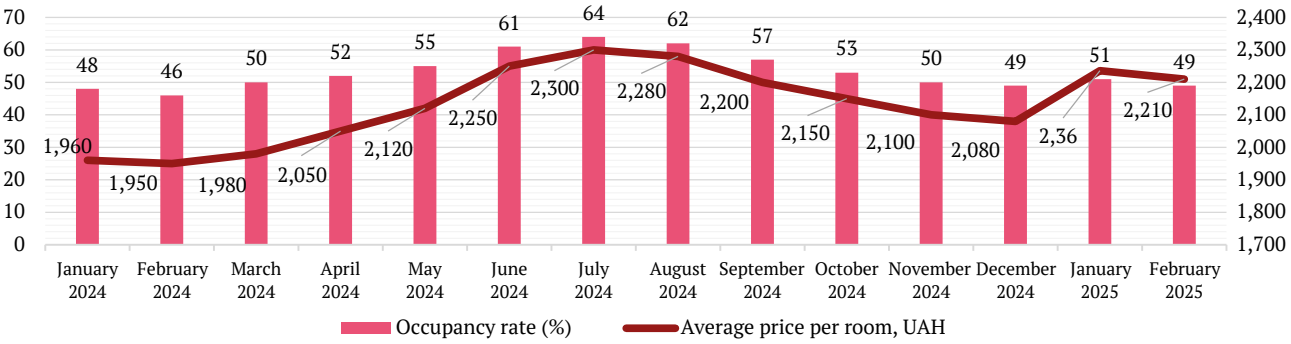

Figure 6. Generalised dynamics of room occupancy and average price per room in Ukrainian hotels for the period from January 2024 to February 2025

Source: compiled by the author based on analytical materials National Tourism Organisation of Ukraine (2024), The State Agency for Tourism Development of Ukraine (2025), Booking.com (n.d.e)

Based on the presented monthly indicators of room occupancy and average room rates in 2024-2025, it is possible to analyse the relationship between service quality and financial results in the Ukrainian hospitality industry. The initial data demonstrate the relative seasonality of the hotel business: the lowest occupancy rates are recorded in the winter months (46-50%), while in the summer season they rise to 61-64%, indicating an increase in demand from domestic and foreign tourism. At the same time, the average price per room has a stable upward trend – from UAH 1,950 in February 2024 to UAH 2,236 in January 2025, confirming inflationary processes and price adaptation of enterprises to increased demand. To quantitatively examine the relationship between service quality and financial performance, a correlation analysis is conducted with the calculation of the Pearson correlation coefficient. According to the formulas defined in the previous section, calculating the average monthly hotel occupancy rate ($\bar{x}$), gives a result of 53.4%. At the same time, the average price ($\bar{y}$) is 2,133.3 UAH, and the standard deviationsand are 5.6 and 118.4, respectively. The intermediate results of the calculations are presented in Table 4.

Table 4. Interim results of calculations for correlation analysis of the relationship between service quality and financial results in the hospitality sector in Ukraine

i (month)	x_i, %	y_i, UAH	$x_i - \bar{x}$	$y_i - \bar{y}$	$(x_i - \bar{x})^2$	$(y_i - \bar{y})^2$	$(x_i - \bar{x})^2 (y_i - \bar{y})^2$	RevPAV, UAH
January 2024	48	1,960.0	-5.4	-173.3	28.7	30,027.9	928.3	941.0
February 2024	46	1,950.0	-7.4	-183.3	54.1	33,593.7	1,348.5	897.0
March 2024	50	1,980.0	-3.4	-153.3	11.3	23,496.5	514.6	990.0
April 2024	52	2,050.0	-1.4	-83.3	1.8	6,936.5	113.0	1,066.0
May 2024	55	2,120.0	1.6	-13.3	2.7	176.5	-21.8	1,166.0
June 2024	61	2,250.0	7.6	116.7	58.4	13,622.2	892.0	1,373.0
July 2024	64	2,300.0	10.6	166.7	113.3	27,793.7	1,774.3	1,472.0
August 2024	62	2,280.0	8.6	146.7	74.7	21,525.1	1,268.0	1,414.0
September 2024	57	2,200.0	3.6	66.7	13.3	4,450.8	243.0	1,254.0
October 2024	53	2,150.0	-0.4	16.7	0.1	279.4	-6.0	1,140.0
November 2024	50	2,100.0	-3.4	-33.3	11.3	1,107.9	111.7	1,040.0
December 2024	49	2,080.0	-4.4	-53.3	19.0	2,839.4	232.2	1,019.0
January 2025	51	2,236.0	-2.4	102.7	5.6	10,550.2	-242.1	1,130.0
February 2025	49	2,210.0	-4.4	76.7	19.0	5,885.1	-334.3	1,083.0
	$\bar{x}$	$\bar{y}$			s_x	s_y		
	53.4	2,133.3			5.6	118.4		

Source: interim calculations made by the author using the following formulas (2), (3), (5)

The RevPAR calculations show a clear seasonal revenue profile: a low in February 2024 (UAH 897) and a high in July 2024 (UAH 1,472), when higher room rates and increased occupancy combine. When compared with service quality indicators, a consistent association can be observed: higher service ratings are accompanied by higher average RevPAR values. This is consistent with the mechanism of lower price sensitivity of demand and a higher probability of repeat bookings at establishments with stable service standards. Thus, maintaining high service quality is an economically significant factor in increasing revenue per available room.

Substituting the obtained values into the Pearson correlation coefficient calculation formula (1), obtained a value of 0.79, which corresponds to a strong direct relationship. The significance of this result can be verified using Student's t-test (4), which is equal to 4.40, corresponding to a two-tailed significance level of $p = 0.000859$. Interpreting this indicator shows that, under the hypothesis of no linear relationship (null hypothesis $r = 0$), the probability of obtaining such or a more extreme value of the t-test is approximately 0.086%. Since this probability is negligible, the null hypothesis is rejected at conventional significance levels ($\alpha = 0.05$, $\alpha = 0.01$). In other words, the obtained correlation is statistically significant. This means that the relationship between occupancy and average price is statistically highly reliable ($p < 0.01$). To illustrate the direction of this relationship, Figure 7 presents a simple linear regression in which the average price acts as the dependent variable and occupancy as the independent variable.

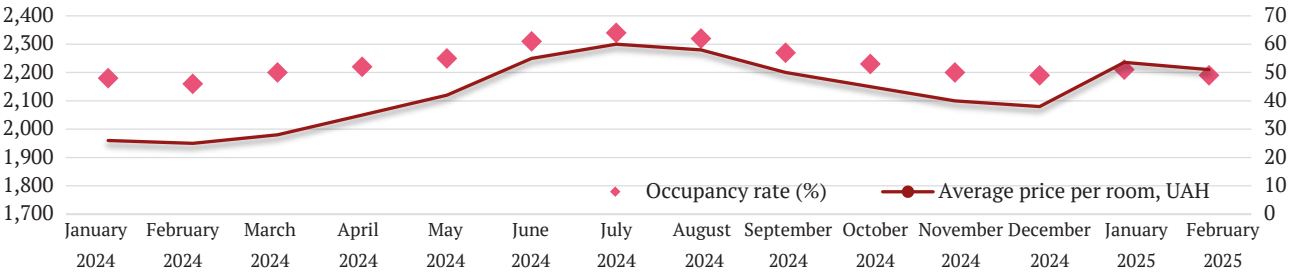

Figure 7. Dependence of average price on occupancy rate

Source: constructed by the author based on calculations of Pearson's correlation coefficient (formula 1)

The results obtained allowed to make several generalisations. First, high occupancy rates can be interpreted as an indicator of adequate service quality, which encourages repeat bookings and positive recommendations. Second, the correlation indicates the ability of companies to flexibly adjust their pricing policy depending on demand, which is a key factor in financial stability. Thirdly, the identified relationship indicates that investments in improving service quality (staff professionalism, service standards, digital solutions for customers) indirectly lead to revenue growth through the mechanism of increased occupancy rates. Thus, the results of the correlation analysis confirmed the existence of a relationship between the level of service quality and the financial performance of the hotel and restaurant business. They demonstrate that the development strategy for the hospitality sector should be based on a balance between maintaining high service standards and an effective pricing policy that maximises profitability in the face of seasonal fluctuations in demand.

Discussion

In the context of the dynamic development of the hotel and restaurant business in Ukraine, service quality assessment is a key tool for increasing competitiveness and building long-term customer loyalty. Ratings on Booking.com and TripAdvisor serve as feedback, allowing companies to adjust management decisions, optimise internal processes, and improve staff performance. At the same time, it is important to study the relationship between service ratings, occupancy rates and financial results, as this allows to determine the real impact of service quality on the profitability and strategic development of enterprises. This approach makes it possible to consider service quality not only as an operational indicator, but also as a complex factor that determines the financial stability, reputation, and long-term competitive advantages of establishments.

The work of M.A.A.M. Harif *et al*. (2022) examines the relationship between open innovation, hotel service quality, and marketing strategies with the financial results of the hotel business. The authors show that integrating innovative practices into the service process and marketing positioning directly affects the competitiveness of establishments and customer satisfaction. The study finds that the systematic combination of management innovations and service standards allows hotels to increase profitability and strengthen consumer confidence. The results confirm that improving service quality is directly linked to improved financial performance. The study also revealed a close relationship between service quality and profitability, which manifests itself in increased occupancy and average price. Thus, both approaches demonstrate the decisive role of service standards in shaping the competitiveness and financial stability of hospitality establishments. In particular, S. Singh *et al*. (2024) found that the active use of online platforms, social networks and data analytics shapes the reputation of establishments and directly influences consumer

choice. The authors examined the impact of digital marketing on the competitiveness of the restaurant industry. The study clearly demonstrates that the integration of digital promotion channels with service quality management allows restaurants to increase customer loyalty and financial efficiency. The results of the study confirm that digital tools, in particular online platforms and data analytics, increase customer loyalty and financial efficiency. The study also demonstrates that a higher level of service correlates with better economic results for businesses. Thus, both approaches agree that technological solutions and service quality complement each other in increasing competitiveness.

The study also found that quality service standards ensure repeat sales and sustainable profitability. This indicates that investments in customer experience management technologies enhance the economic effect of service quality. According to J.A. Al-Gasawneh *et al*. (2021), the integration of customer experience management technologies is of utmost importance in a service strategy to strengthen the competitive position of enterprises. After analysing the impact of various aspects of customer relationship management on service quality, the authors showed that the systematic use of CRM tools increases customer satisfaction and ensures repeat sales and visits. The conclusions of the study on the role of CRM systems in strengthening customer satisfaction are consistent with the results obtained. E.F. Amissah *et al*. (2021) are convinced that a high level of service contributes to the formation of positive customer experiences and repeat visits, which directly affects the economic efficiency of the tourism sector. The study establishes a relationship between service quality, tourist satisfaction and loyalty to a tourist destination in developing economies. The experts also outline the mechanisms by which service standardisation and personalisation increase the attractiveness and competitiveness of destinations. The established relationship between service quality and tourist loyalty is consistent with the trends identified in the study. The increase in occupancy and prices during periods of high demand also confirms the key role of service standards in financial performance. Thus, these results reinforce the argument that quality service is the basis for the sustainable development of the tourism business.

The analysis conducted in the study clearly demonstrated that improved service characteristics are accompanied by increased workload. This once again emphasises that key service elements directly shape positive customer experience and determine economic performance. The results showing the impact of staff professionalism and speed of service on customer satisfaction are fully consistent with the study conducted by J.A. Bayad *et al.* (2021). According to the authors, service quality shapes a positive customer experience, which directly influences repeat visits and guest loyalty. The study examines the key components of service, including staff professionalism, speed of service, and service standards, which determine the level of customer satisfaction. In contrast, the study by S. Ahmed *et al*. (2022) analyses the complex relationships between consumer loyalty, their perception of service quality, prices and satisfaction levels in restaurant service. The authors showed that customer satisfaction acts as a mediator between service evaluation and loyalty formation, and the balance between price and service quality determines consumers' willingness to revisit establishments. The conclusions about the role of customer satisfaction as a mediator between service quality and loyalty are consistent with the study. The analysis showed that the combination of quality service and adequate pricing policy directly affects the profitability of establishments. This emphasises the importance of a harmonious balance between price parameters and service quality in shaping repeat demand.

The study also revealed a link between service characteristics and financial indicators, confirming that investments in human capital and service standards contribute to increased profitability. The results obtained, which demonstrate the dependence of customer satisfaction on the professionalism of the staff and the atmosphere of the establishment, coincide with the opinion of O. Abdullah *et al*. (2022). The authors found that high service standards increase satisfaction and form lasting relationships between customers and the establishment. The researchers identified key factors that influence service evaluation, including staff training, atmosphere, and timeliness of service. Thus, high service quality is a determining factor in the loyalty and sustainable development of hotel businesses. The impact of service quality and customer satisfaction on hotel room occupancy rates was analysed in a study by P. Candra *et al*. (2023). The authors showed that an increase in the level of service directly correlates with an increase in the occupancy rate of the room stock. The study also emphasises that standardisation of procedures, personalisation of services and quality control ensure stable growth in occupancy rates and financial performance of hotels. The results regarding the impact of service quality on room occupancy directly correspond to the conducted study. Data analysis also confirmed that higher service standards are accompanied by an increase in occupancy rates and profitability. This is consistent with the conclusion about the importance of standardisation, personalisation, and quality control in ensuring stable financial results.

At the same time, A. Biswas & R.K. Verma (2022) found that additional measures of service quality influence the image of a restaurant and consumer perception, using the Indian catering industry as an example. The authors showed that a positive company image affects customer satisfaction and loyalty, enhancing the effect of traditional aspects of service quality, such as speed of service and staff politeness. The study also highlights the importance of strategic image management in maintaining the competitive advantages of restaurants. The identified impact of additional dimensions of service quality on the image of an establishment partially differs from the conducted research. In the present study, the emphasis was placed primarily on the relationship between occupancy and financial performance, whereas the authors' work focuses on the role of corporate

image. Nevertheless, both approaches indicate that service quality is a key determinant of customer satisfaction and loyalty. The relationship between the concept of Total Quality Management (TQM), job satisfaction, and organisational commitment among hotel employees in the provinces of Zhejiang and Hainan (China) is examined in the study by Y. Mo and N.M.D. Borbon (2022). The authors emphasised that effective implementation of TQM contributes to increased staff motivation, the formation of long-term organisational commitment, and improvements in guest service performance. The study demonstrates the interdependence of managerial practices and service quality in the context of sustainable development. The results regarding the impact of TQM implementation on service quality are consistent with the study. As with the identified link between service quality and financial performance, it is confirmed here that management practices directly shape the level of service and determine the sustainability of development. This indicates that strategic quality management is a key tool for improving efficiency in the hospitality industry.

M. Mendocilla *et al*. (2021) developed a service quality assessment tool for the fast food restaurant segment – QUICKSERV. The authors proved that systematic assessment of service standards allows companies to identify weaknesses, optimise processes and increase customer satisfaction. The article emphasises the practical significance of the tool for standardisation and quality control in the fast-paced restaurant business segment. The conclusions about the importance of systematic service assessment for improving customer satisfaction are consistent with the study. The analysis also showed that quality control and standardisation of procedures are closely related to financial results. Thus, both approaches emphasise the importance of using measurement tools to maintain a high level of service. The study by S.N. Yeong *et al*. (2022) analysed the relationship between customer satisfaction and loyalty using the example of Malaysian resort hotels, taking into account the level of empathy, reliability and material aspects of service. The authors demonstrated that these components of service quality have a direct impact on repeat visits and customer recommendations, as well as determining the perception of the overall value of the service. The study emphasises the role of a personalised approach and attention to small details in shaping the competitive advantages of hotels. The identified direct impact of various aspects of service quality on repeat visits and recommendations is consistent with the results obtained. The study confirmed that raising service standards leads to increased occupancy and profitability. This demonstrates once again that personalised service and attention to detail are crucial for building competitive advantages.

A comparison of the results of the analysis with international studies suggests that service quality is a key factor in shaping customer satisfaction and the financial performance of hotels and restaurants. The experience of European countries shows that high service quality, integration of digital technologies, and strategic image management directly affect consumer loyalty, repeat visits, and occupancy rates. The Ukrainian case confirms these conclusions. Higher service standards, innovative management practices, and active use of platforms to assess customer experience contribute to the growth of financial indicators and competitiveness of establishments. This allows to conclude that further improvement in the efficiency of Ukraine's hotel and restaurant business is only possible with a comprehensive combination of service quality control, process digitalisation, and systematic analysis of consumer feedback.

Conclusions

The study provides a comprehensive overview of the dynamics of service quality and financial results in the Ukrainian hospitality sector in 2020-2025 and confirms the decisive impact of service levels on the profitability of hotel and restaurant businesses. Ratings on Booking.com and TripAdvisor showed that high service ratings correlate directly with higher room rates and consistently high occupancy rates. Thus, the average occupancy rate of hotels in the Carpathians increased from 54.4% in 2023 to 54.6% in 2024, and the average price per room in Kyiv in January 2025 rose to UAH 2,236, which is 14% higher than in January 2024. The positive dynamics are also confirmed by the recovery of revenues from tourist tax: after a decline in 2024 to UAH 107.1 million, this indicator grew by 33%, amounting to UAH 142.6 million in the first half of 2025 alone. This indicates a gradual recovery in demand and an increase in consumers' willingness to pay for higher quality services even in the face of military and economic risks.

A correlation analysis of the relationship between average hotel ratings on Booking.com and average room rates showed a strong correlation: Pearson's coefficient confirmed the statistical significance of the results. This means that a one-tenth point increase in the rating is accompanied by a proportional increase in revenue per room. It is worth noting the hotels that achieved the highest ratings, in particular "Emily Resort" in Lviv (average rating 9.5/10) and "Mountain Residence Wellness & SPA" in Bukovel (average rating 9.3/10), which demonstrate a direct link between service quality and the ability to set premium rates.

The limitation of the study consists in its dependence on open online ratings and selective financial data, which may contain subjective user assessments and do not always reflect the full picture of the actual quality of service and profitability. Further research should focus on improving the methodology for integrated monitoring of the relationship between service quality and financial results, developing regional scenarios for the restoration of tourism infrastructure and taking into account external risks – from macroeconomic fluctuations to climate and security challenges – that will determine the trajectory of the industry's development in the medium term.

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Conflict of Interest
None.

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Вплив сервісної якості на рівень задоволеності споживачів у готельно-ресторанному бізнесі

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Анотація. Метою дослідження було всебічне обґрунтування впливу сервісної якості на рівень задоволеності споживачів та фінансові результати готельно-ресторанного бізнесу України з акцентом на післявоєнні трансформації та зростання конкурентоспроможності галузі. Методологічна база включала економіко-статистичний та кореляційний аналіз, порівняння, контент-аналіз відгуків та рейтингів українських готелів на онлайн-платформах Booking.com та TripAdvisor. Для аналізу використано дані Державної податкової служби України, аналітичні матеріали громадської спілки «Національна туристична організація України». Завдяки системному підходу були вивчені ключові тенденції: частка сфери гостинності у валовому внутрішньому продукті України зросла із 1,5 % у 2019 році до 11,6 % на кінець 2024. Встановлено також, що надходження від туристичного збору після пікового значення 235,4 млн грн у 2021 році та різкого падіння у 2022 році до 178,9 млн грн та 107,1 млн грн на кінець 2024 року відновилися на 33 %, склавши 142,6 млн грн у першому півріччі 2025 року. Виявлено, що у 2024 році середня завантаженість готелів досягла пікового значення у Карпатах, сягнувши 54,6 %, перевищивши показник 2023 року (54,4 %), а середня ціна за номер у Києві у січні 2025 року становила 2 236 грн, що на 14 % вище показника у аналогічний період 2024 року. Проведено кореляційний аналіз щомісячних показників завантаженості та середньої ціни за номер за період з січня 2024 року по лютий 2025, що підтвердило вплив високої сервісної якості на прибутковість бізнесу. Аналіз рейтингів українських готелів на Booking.com і TripAdvisor засвідчив, що заклади з вищими оцінками мають вищу заповнюваність та можливість встановлювати вищі ціни. Отримані результати можна використати для розробки стратегій підвищення якості обслуговування, цифровізації процесів та вдосконалення цінової політики, що сприятиме зміцненню фінансової стійкості та довгострокової конкурентоспроможності готельно-ресторанного сектору України

Ключові слова: фінансова ефективність; туристичний збір; сфера гостинності; кореляційний аналіз; цінова політика

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Monetisation of repair and resale of premium clothing in Ukraine

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Abstract. The aim of this study was to analyse the prospects for the development of the market for repair and resale of premium clothing and accessories in Ukraine. The methodology was based on a combination of content analysis of scientific works, statistical analysis of sales and import volumes, case studies of start-ups and platforms, as well as the systematisation of proven resale practices. The time frame covered 2020-2025, which made it possible to track market dynamics and identify forecast scenarios for its development. The results showed that in 2024, the sales volume of the clothing and footwear market in Ukraine amounted to approximately $1.4 billion, which is 13.07% more than in 2023, while the footwear segment reached $549.22 million, of which more than $318 million was accounted for by women's footwear. After imports fell by approximately 60% in 2022, a gradual recovery began: in 2024, China accounted for 34% of imports (over $1 billion), and Turkey for 17% (over $500 million). Demand for repairs and restoration also grew: the average cost of restoring premium items in 2024 ranged from 500 to 2,000 UAH, and the average bill for bags and footwear was 1,000-1,500 UAH. At the same time, premium segment workshops demonstrated monthly revenues in the tens or hundreds of thousands of UAH, actively implementing Customer Relationship Management systems. Rozetka remained the leader in online commerce with a 30-40% share, while Prom.ua accounted for 10-15% and OnLine eXchange was the leader in resale. In total, the number of active online shoppers reached about 11 million, and the share of mobile purchases grew from 42% in 2023 to 53% in the first half of 2024. The practical significance of the study lay in the possibility of using its results to form strategies for the development of repair and resale services for premium items in Ukraine

Keywords: circular economy; consumer; demand; brand; import

Introduction

The fashion industry is one of the most dynamic and resource-intensive sectors of the global economy, which has a significant impact on the environment and consumer practices. In a global context, models of reuse, repair and resale of goods are becoming increasingly important, in line with the concept of sustainable development and reduction of overproduction. For Ukraine, this issue has a dual significance. On the one hand, it is linked to the adaptation of the domestic market to international trends in the circular economy, and on the other, to the search for new economic instruments in a period of economic and social challenges.

The Ukrainian clothing and footwear market is affected by the full-scale war, which has led to a reduction in imports, a decline in purchasing power and the migration of some consumers. N. Mashchak & O. Chechikova (2024) studied the state of light industry, identifying key macro challenges, including import dependence, resource shortages, lack of state support, and unequal competitive conditions. Their work outlined the transformations in the consumer behaviour of Ukrainians: growing interest in online shopping, trust in brands, and support for national producers, particularly through the popularity of clothing with elements of Ukrainian ornamentation. The Ukrainian clothing market was characterised by significant fluctuations and growing dependence on imports, accompanied by a decline in the share of Ukrainian production and increased competition. S. Polkovnychenko & M. Korovinchenko (2021) studied this market, segmenting consumers according to various criteria, outlining the structure of the product range for men, women and children, and analysing foreign trade

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in clothing. The results showed an increase in imports, a decrease in exports, and changes in the dynamics of retail turnover, especially during the COVID-19 pandemic.

The clothing segment in Ukraine was characterised by a significant influence of external factors, ranging from competition from manufacturers with cheaper labour to outdated equipment, which hindered the modernisation of production. S. Kovalchuk & S. Pavliuk (2024) referred to this study, focusing on the growing popularity of online sales, the transformation of consumer habits under the influence of the COVID-19 pandemic, the seasonality of demand, and growing competition among online platforms. The Ukrainian clothing market was undergoing a transformation under the influence of digitalisation, globalisation processes and changing consumer preferences. L. Derman *et al*. (2023) studied the introduction of new business models, the development of e-commerce and the use of modern marketing management tools. Their findings highlighted the growing role of online commerce, the increasing importance of consumer environmental awareness, and increased competition between national and international brands. The authors emphasised that the success of enterprises depended on their ability to quickly adapt to innovative trends and expand their presence in the digital environment.

The Ukrainian fabric market was characterised by growing dependence on imports and insufficient domestic production, which had a negative impact on the development of domestic consumption. A. Kotlyk & K. Larina (2020) studied the dynamics of this segment, noting an increase in the volume of retail turnover of textiles and clothing, growth in imports, as well as divergent trends in the individual and business consumption segments. The authors recorded a decline in individual fabric consumption due to the availability of cheap ready-made products and, at the same time, an increase in demand in the business segment due to the development of clothing production for export. The fashion industry was influenced by growing interest in circular economy models and responsible consumption, which changed perceptions of the value of brands and goods. G. Murtas & G. Pedeliento (2025) studied approaches to rethinking the role of fashion products in the context of reuse and extending the life cycle of items, focusing on the relationship between consumer awareness, brand strategies and the prospects for their economic sustainability. The study showed that the formation of new practices is based not only on economic benefits, but also on the growth of the symbolic and emotional value of things that acquire a "second history" through resale or repair.

The fashion industry demonstrated a contradiction between mass production trends and growing interest in sustainable consumption practices. C. Liu *et al*. (2023) studied the functioning of luxury clothing resale platforms using text mining methods to analyse user reviews. The results showed that economic benefits, product uniqueness, and service convenience had the greatest impact on customer engagement, while environmental motivation remained secondary. The clothing consumption sector was characterised by the search for ways to extend the life cycle of items through various restoration models. R.H. McQueen *et al*. (2023) studied repair practices among young consumers and identified the factors that determined the choice between self-repair, paid or free repairs. The authors showed that the availability of skills, tools, time, and economic feasibility played a key role: women were more likely to repair items themselves, while younger respondents preferred free help from relatives or friends. The results also highlighted that the high cost of professional services limited their use, while the availability of resources contributed to the growing popularity of self-repairs.

The clothing and footwear market in Ukraine has undergone significant transformations under the influence of war, economic crises, and digitalisation. On the one hand, the reduction in imports and purchasing power has increased dependence on external supplies and intensified competition; on the other hand, the role of online commerce, new business models, and environmentally conscious consumption practices has grown. However, the segment of repair and resale of premium items remains understudied, particularly in terms of economic effects and motivational factors, which determines the relevance of this study. The aim of this study was to assess the economic potential of the restoration and resale of branded items in Ukraine. The objectives of the study were to analyse current trends and factors influencing the development of repair and resale services for premium clothing and to investigate the role of digital platforms in shaping new monetisation models in the Ukrainian context.

Materials and Methods

This study was analytical and descriptive in nature and covered the period from 2020 to 2025, allowing to track changes in the development of premium clothing repair and resale practices in the context of economic crisis, pandemic and full-scale invasion. To reveal the essence of the circular economy in the fashion industry, the method of content analysis was used, which allowed for the systematisation of the scientific works of A.K. Schnatmann *et al*. (2023) and A. Abdelmeguid *et al*. (2024a). These studies were selected for their comprehensiveness and relevance: the first defined management approaches to forming sustainable chains in the fashion industry, while the second focused on the basic principles of circularity, such as durability, resource efficiency and closed cycles. These formed the theoretical basis for further analysis. A comparative analysis method was used to study global initiatives and practices, including Jeans Redesign (n.d.) and Patagonia's Worn Wear programme (n.d.). The activities of the Depop (n.d.) and Vestiaire Collective (n.d.) platforms were also analysed. These examples reflected different approaches to implementing the principles of circular fashion, from the production of recyclable items to the scaling of resale through digital tools. To classify circular fashion business models, a structural-functional analysis method was used, based on research by L. Coscieme *et al.* (2022). The case study

method was used to study the Ukrainian context. The activities of the startups Restyleme (2022) and DressX (n.d.), as well as the platforms Shafa (n.d.) and OnLine eXchange (OLX) (OLX, n.d.), which demonstrated the spread of resale and digitalisation practices, were characterised. The rental services Matusenko dress (n.d.) and Vision Dress (n.d.) were considered separately, reflecting the integration of global trends into the Ukrainian market and the formation of new consumption models.

A systematisation method was used to analyse the development of the verified resale infrastructure. The study looked at international platforms, including Vestiaire Collective (n.d.), The RealReal (n.d.) and Fashionphile (n.d.). In addition, Ukrainian analogues The Originals (n.d.), Selluxury (n.d.) and Kvezal_resale (n.d.) were analysed, which made it possible to determine the role of authentication in reducing the risk of fraud and building consumer trust. A statistical analysis method was used to study the dynamics of market development. Data on sales and imports of clothing and footwear in Ukraine were analysed, which made it possible to identify the main trends and changes (What was the best-selling item on the clothing..., 2025; Analysis of the clothing and footwear..., 2025; Which foreign fashion retailers have increased..., 2025). The spread of repair and restoration practices in the premium segment was considered separately, as well as the dynamics of the average repair bill, which made it possible to take into account the impact of global events and changes in demand (Masterskaya, n.d.; Sinsay, Zara or H&M: Which foreign fashion..., 2025).

The secondary data analysis method was used to study the development of online platforms and marketplaces Rozetka (n.d.), Prom.ua (n.d.), OLX (n.d.). The activities of the specialised platforms Kasta (n.d.) and Bigl.ua (n.d.), which occupy separate niches in the Ukrainian market, were considered separately. The importance of mobile commerce and the growth in the activity of online shoppers was also analysed, which was determined using statistical data and industry reviews (Research on the Ukrainian..., 2024; Sokha, 2024; Ukrainian electronics market is growing rapidly..., 2024). The final stage was the application of a comparative and predictive analysis method, which made it possible to determine the prospects for the development of the premium clothing repair and resale market in Ukraine.

Results and Discussion

Fundamentals of developing practices for repairing and reselling premium clothing

The circular economy in fashion is a new economic and environmental paradigm designed to transform the traditional linear "take-make-dispose" model of industry development into a more sustainable system where products are designed with durability, repairability, reusability and recyclability in mind. In this model, items remain in circulation for as long as possible, their value is maximised throughout their life cycle, and at the end, materials are regenerated to create new products. This not only reduces waste and resource use, but also creates new economic opportunities, particularly through the development of resale, rental, repair and remanufacturing models (Abdelmeguid *et al*., 2024a).

The main principles of the circular economy in fashion are a focus on durability and reuse, resource efficiency and regeneration, and the formation of closed cycles. Durability involves creating clothing from high-quality materials that can be repaired and recycled, as well as encouraging consumers to use products for longer. Resource efficiency is achieved through the use of environmentally friendly, renewable or recycled materials and the minimisation of waste during production. Closed loops mean creating systems in which items are collected after use and are reused, recycled or biodegraded, preventing them from ending up in landfills. The implementation of the circular model has a number of economic and environmental benefits. Key environmental outcomes include reduced textile waste, reduced pollution and slowed depletion of natural resources. From an economic perspective, the new model increases business sustainability, reduces dependence on raw material price fluctuations, and opens up access to new market opportunities estimated to be worth hundreds of billions of dollars. The development of resale, rental and repair services creates added value in segments that have been undervalued in the linear economy (Schnatmann *et al*., 2023).

Examples of the implementation of the circular model around the world include the Jeans Redesign initiative (n.d.) by the Ellen MacArthur Foundation, which has developed standards for the creation of jeans that are suitable for reuse and recycling. Patagonia (n.d.) runs the Worn Wear programme (n.d.), which encourages the repair, resale and reuse of clothing. At the consumer level, the popularity of platforms such as Depop (n.d.) and Vestiaire Collective (n.d.), which provide a secondary market for fashion, is growing. The EU is developing a regulatory framework, in particular through extended producer responsibility, which requires the mandatory collection and recycling of textiles. Table 1 shows the main international practices for implementing circular fashion principles. A comparative analysis showed that the initiatives differ in terms of the level of integration of circularity principles. Jeans Redesign focuses on manufacturing standards and creating durable products, while Patagonia Worn Wear implements an after-sales service model, encouraging reuse. The Depop and Vestiaire Collective platforms represent the consumer level of circular fashion, targeting the resale market. At the same time, a common feature is the transition from a linear consumption model to closed cycles that combine economic feasibility and reduced environmental impact. It is also worth noting that these examples demonstrate different mechanisms for building trust between market participants: from manufacturer certification (Jeans Redesign) to official repair services (Patagonia Worn Wear) and authenticity verification (Vestiaire Collective). It is the existence of institutional and technological mechanisms of trust that becomes a key condition for scaling circular practices. Another trend

is digitalisation: both Depop and Vestiaire Collective actively use mobile applications and social features, which not only increases accessibility but also attracts a younger audience, shaping a culture of shared consumption. All initiatives also demonstrate the synergy of economic and environmental effects: increasing the value of items on the secondary market is combined with reducing waste and environmental impact. This dual effectiveness makes circular models attractive not only to consumers but also to investors and government sustainable development strategies.

Table 1. Key international practices for implementing circular fashion principles

Initiative/ platform	Country of origin	Main approach	Key instruments	Economic effect	Environmental effect
Jeans Redesign	United Kingdom	Production of recyclable jeans	Development of design standards, manufacturer certification	Increased product durability	Reduction of textile waste
Patagonia Worn Wear	USA	Repair, resale and reuse	Online platform, official repair centres	Extended product life cycle	Reduction of resource consumption
Depop	United Kingdom	Peer-to-peer sales of used items	Mobile marketplace, social features	Diversification of user income sources	Reduction of consumption of new goods
Vestiaire Collective	France	Verified resale of luxury brands	Authentication, international logistics	Formation of a secondary premium market	Reduction of production volumes of new items

Source: compiled by the author based on Jeans Redesign (n.d), Worn Wear Patagonia (n.d.), Depop (n.d.), Vestiaire Collective (n.d.)

Circular fashion involves several types of business models. Durability models are based on creating products that last longer, including the provision of repair services. Access models provide temporary use of items through rental or leasing. Examples include wedding and business attire rentals and services such as Hirestreet (n.d.) or By Rotation (n.d.). Collection and resale models focus on collecting and selling used items that are given a "second life." Finally, material recycling and reuse models aim to regenerate fibres, in particular through the use of deadstock fabrics or the introduction of new textile recycling technologies (Coscieme *et al.*, 2022). In Ukraine, the concept of a circular economy in fashion is reflected in the activities of a number of start-ups and platforms that are shaping a new culture of consumption and creating an infrastructure for the reuse of items. Case studies have shown that the startup Restyleme (2022) emerged in response to the lack of online services that provide secure buying and selling of branded clothing that already had an owner. The problem of consumer distrust of unofficial channels was solved by creating a platform with user verification, content moderation, seller ratings, and a photo catalogue of goods. Within its first year of operation, Restyleme attracted about 8,000 users, demonstrating the demand for legal resale and confirming the role of digital transparency as the basis for trust. This experience showed that the development of the Ukrainian resale market requires official certification of branded clothing and partnerships with repair shops to maintain product quality.

The Shafa (n.d.) and OLX (n.d.) platforms solved another problem: the fragmentation of the second-hand market and limited access to organised online platforms. Their Customer-to-Customer (C2C) sales model allowed users to exchange items directly, fostering a culture of reusing clothing and accessories. In 2024, Shafa had over 1.5 million active users, while the "Clothing and Footwear" category on OLX was consistently among the top three most popular. This experience has shown that accessibility and mass appeal are key conditions for the spread of resale practices, and that the combination of mobility, ease of use, and basic trust mechanisms creates the conditions for a transition from an informal to a systematic secondary market. The Matusenko dress (n.d.) and Vision Dress (n.d.) services emerged as a response to the high cost of one-off purchases of festive or designer clothing. They introduced a short-term rental model that provides customers with access to premium items without the need to purchase them. Both platforms provide a full range of services, from selecting and preparing clothing to delivery and return, which contributes to the spread of sharing economy practices. The decline in purchasing power has made this model attractive to a wide range of consumers, while demonstrating the potential for scaling up rentals in related segments such as business attire and accessories. An innovative approach is represented by the start-up DressX (n.d.), which has proposed a solution to the problem of overproduction and the growing carbon footprint of the fashion industry by creating digital clothing. Its concept is to replace physical products with virtual models for social networks and metaverses. The startup became the first Ukrainian representative in the field of digital fashion, collaborating with global companies Meta and Google, as well as high fashion brands, integrating the Ukrainian creative industry into the international context. DressX's experience has demonstrated that innovative approaches can combine sustainable development with digital transformation and the creation of new economic niches.

The fashion market underwent rapid changes between 2015 and 2024, with the growth in popularity of resale and repair services in the premium segment occupying a special place. Whereas previously, second-hand luxury clothing was seen as a compromise or a necessary alternative, nowadays it has become a conscious choice linked to lifestyle, a desire to reduce negative impact on the

environment and, at the same time, gain access to unique, high-quality items. This global trend is gradually being integrated into the Ukrainian context, shaping new approaches to consumption, monetisation and preservation of the value of premium goods (Wicker, 2024). One of the key trends is the growing demand for products from well-known brands such as Chanel, Louis Vuitton, Hermès, Dior and Gucci. These brands have always been a status symbol, but their high cost has limited access to their products. The resale market has created new opportunities for a wider audience, as used items retain their prestige, but their price is significantly lower compared to new collections. This explains the dynamic growth of interest in premium resale both globally and in Ukraine, where such goods are seen as a profitable investment and a way to gain access to timeless classics (Top rating of sites selling used..., 2021).

Among the factors contributing to this development is the emergence of specialised platforms that ensure transparency and security of transactions. At the global level, these are platforms such as Vestiaire Collective (n.d.), The RealReal (n.d.), and Fashionphile (n.d.), which have popularised the culture of verified resale by introducing product authentication mechanisms. Thanks to these mechanisms, authentication becomes a tool for monetisation: verified items are sold at a higher price, platforms charge a premium fee for confirming authenticity, and the level of returns and disputed transactions is significantly reduced. In Ukraine, similar functions are performed by The Originals (n.d.), Selluxury (n.d.), and Kvezal_resale (n.d.), which offer customers verified items with confirmation of authenticity. This approach reduces the risk of fraud, increases consumer confidence and, at the same time, creates a financial basis for the formation of a profitable premium resale infrastructure that meets the requirements of modern customers. Repair and restoration services have also become an integral part of the premium segment. The high initial cost of luxury items motivates owners to keep them in perfect condition, as their preserved appearance directly affects the market price when reselling. Popular services include the restoration of leather goods, seam repair, and the polishing of metal fittings or accessories. In global practice, examples include Hermès and Gucci, which offer official repair services to maintain the durability of their products. In Ukraine, such services are also gaining popularity, as owners see them as a way to extend the life cycle of expensive items and preserve their investment appeal. Conscious consumption has become another driver of change. Modern premium segment buyers are increasingly choosing resale not only because of the economic benefits, but also because of the opportunity to embrace an environmentally responsible lifestyle. The luxury second-hand market is seen as a way to reduce overproduction, cut textile waste and support sustainable development. In this context, resale is becoming a socially significant practice that combines rationality and aesthetics (Abdelmeguid *et al*., 2024b).

It is also important to note the growing popularity of rental services. Globally, services such as Rent the Runway (n.d.) have become popular among those who want to wear luxury clothing for special occasions without spending a lot of money on purchases. In Ukraine, similar practices are also spreading, especially among services that rent dresses and accessories for photo shoots and special events. This creates an additional market segment that allows premium items to have several life cycles instead of being used only once (Chi *et al*., 2023). Thus, the formation of the repair and resale market in Ukraine is driven by a combination of economic constraints, changing consumer priorities, environmental challenges, technological innovations, and socio-cultural transformations. All these factors create the basis for the active growth of a segment that is gradually becoming an element not only of the fashion industry but also of broader processes of transition to a circular economy.

This study focused on the monetisation of repair and resale of premium clothing in Ukraine, highlighting the impact of full-scale invasion, declining purchasing power, the growing role of online platforms, and the emergence of authentication services. The emphasis was on the circular economy, consumer environmental awareness, and the desire to preserve the investment value of branded items. Y. Kwon's (2021) study analysed the second-hand market in China and Korea, comparing leading platforms, product categories, brands, motivations and barriers. It was found that women's and luxury items predominated in China, while children's and everyday clothing predominated in Korea. The common motive was environmental friendliness, but the differences lay in the focus on affordability and limited collections in China and on rationality and "vintage" in Korea. Similar parallels were found in the study by S. Liu *et al*. (2024), which focused on Chinese resale from the perspective of sellers. Unlike the Ukrainian experience, where the investment attractiveness of luxury clothing remained key, S. Liu *et al.* emphasised the leading role of economic motives alongside environmental ones. In China, barriers were more pronounced: under-pricing, buyer dishonesty and the spread of counterfeits. At the same time, both studies noted the crucial importance of digital platforms as a channel for the development of resale.

Differences were also observed in comparison with the work of M. Gossen & L. Turunen (2024), dedicated to second-hand business models in Finland. While in Ukraine, premium resale was seen as part of the circular economy, combining economic and environmental benefits, in Finland, the focus was on commercial practices. The authors showed that the use of discounts, treasure hunt tactics and convenient services attracted consumers, but at the same time stimulated excessive consumption, reducing the environmental effect. The study by M.-H. Nguyen *et al*. (2025) analysed the willingness of Italian consumers to pay for sustainable fashion. Unlike the Ukrainian focus on luxury resale, the Italian case demonstrated a difference in the perception of bio-based clothing and second-hand clothing: the former was valued as a premium product, while the latter was seen as a product that needed to be

discounted. The choice was influenced by income, education level, age, and stylistic preferences. Both studies confirmed the importance of economic and environmental motives, but the Ukrainian study focused on the investment value of the premium segment, while the Italian study reflected mass preferences and willingness to support sustainability through everyday consumer decisions.

The development of the circular economy in fashion reflects a systemic shift from a linear consumption model to an innovative concept focused on extending product life cycles, optimising resources and forming closed loops. The application of the principles of durability, reuse, resale and repair creates conditions not only for minimising environmental risks, but also for expanding economic opportunities in the premium segment. Examples of global brands and international initiatives, as well as the development of Ukrainian start-ups and online platforms, have demonstrated that the integration of circular practices can strike a balance between environmental sustainability and economic viability.

The dynamics of the development of repair and resale practices for premium clothing in Ukraine in 2020-2025

The demand for repairs of branded clothing and accessories in Ukraine in 2020-2025 was influenced by a number of factors, including the economic crisis, the COVID-19 pandemic, and full-scale war. In 2020, restrictions caused by the pandemic led to a decline in household income and a reduction in sales of new luxury goods, but this stimulated the development of repair services as consumers sought to preserve their valuable items. From 2022, after the start of the full-scale invasion, the trend towards repairs continued, as the closure of international brand stores, falling purchasing power and migration processes increased the importance of resource conservation. In 2023-2025, demand was driven not only by economic motives, but also by the development of online services, the introduction of innovative technologies (3D printing, use of environmentally friendly materials) and growing interest in personalised services (Filatova & Volchkevych, 2024).

Sales of clothing and footwear in Ukraine reached approximately $1.4 billion in 2024, which is 13.07% more than in 2023. The footwear segment in 2024 amounted to $549.22 million, of which more than $318 million was accounted for by women's footwear (What was the best-selling item on the clothing…, 2025). In 2019-2020, the market was estimated at approximately UAH 60 billion, but the pandemic caused a short-term drop in sales, while demand for sports and homewear increased. In 2022, the full-scale invasion caused a sharp decline in the market, but in 2023-2024, a recovery was observed, thanks in particular to the return of international brands and the growth of online trade (Analysis of the clothing and footwear…, 2025). Imports also showed instability. In 2021, they grew by 15%, exceeding €1 billion, with international brands accounting for over 50% of the Ukrainian market at that time. In 2022, imports fell by about 60% due to the closure of H&M, Inditex and other major operators. At the same time, a gradual recovery began in 2023-2024: H&M and New Yorker returned, and Inditex announced the reopening of its stores. The leaders in imports in 2024 were China (34% of the market, about $1 billion) and Turkey (17%, over $500 million) (Which foreign fashion retailers have increased…, 2025).

At the same time, demand for repairs and restoration grew. In 2024, the average cost of restoring premium items in Ukraine ranged from 500 to 2,000 UAH per order, and the average bill for bags and shoes was 1,000-1,500 UAH. Minor repairs were estimated at 50 UAH, while complex work ranged from 750 UAH to 2,000 UAH and above (Masterskaya, n.d.). Workshops targeting the premium segment reported monthly revenues ranging from tens of thousands to hundreds of thousands of UAH, actively implementing Customer Relationship Management (CRM) systems to optimise business processes. At the same time, fashion retail data indicates a market revival. In 2023-2024, the revenue of the largest foreign companies grew by 63%. The Polish group LPP (n.d.) increased sales by 47%, Adidas by 56.5%. H&M reached UAH 1.2 billion, and Inditex – UAH 6.2 billion. At the same time, Turkish Colin's and DeFacto recorded declines of 10% and 7%, respectively. In 2024, the ten largest fashion retailers earned over UAH 11 billion in profits, indicating a recovery in demand and the parallel development of related segments – repair and resale (Sinsay, Zara or H&M: Which foreign fashion…, 2025).

The main market shares of Ukraine's leading marketplaces in 2024-2025 reflect the processes of trade digitalisation and changes in consumer behaviour. Rozetka (n.d.) remains the largest player in the e-commerce market, accounting for about 30-40% of online sales. The platform offers over 60 million product items, has the largest audience and stable growth in both the number of orders and user spending. Prom.ua (n.d.) ranks second, covering about 10-15% of the market, providing a wide range of products and serving as a key platform for small and medium-sized businesses. OLX (n.d.) plays a decisive role in the resale and second-hand goods segment, where it holds a leading position thanks to its C2C sales model and active mobile audience. Smaller in volume but notable players are Kasta (n.d.) and Bigl.ua (n.d.), which occupy specialised niches and maintain a stable customer base (Which Ukrainian marketplaces to sell…, 2024). The structure of the Ukrainian e-commerce market is reflected in Table 2, which shows the types of platforms, main product categories, key features and their approximate market shares. In 2024, Rozetka had about 5 million daily users, making it the undisputed leader in terms of traffic and number of orders. In total, there were about 11 million active online shoppers in Ukraine, who made an average of 17 purchases per year with an average check of about UAH 1,300. The total volume of e-commerce in 2024 grew by approximately 25% in monetary terms compared to 2023, while the number of orders increased by 35% (Research on the Ukrainian…, 2024). Prom.ua and other marketplaces

showed an increase in user activity due to an increase in the frequency of purchases, although the average check remained at the level of previous years. OLX maintained its leadership in resale and developed its mobile segment, whose share in total e-commerce grew from 25% in 2023 to 38% in 2024. This indicates the growing popularity of smartphone shopping, especially in the used goods category (Sokha, 2024). Mobile commerce is growing rapidly: the share of mobile purchases in Ukraine increased from 42% to 53% in the first half of 2024, indicating the growing popularity of smartphone shopping, including in the resale segment (Ukrainian electronics market is growing rapidly..., 2024). Thus, in 2024, online marketplaces played a key role in the development of both e-commerce in general and the resale market. They not only made premium brands accessible to a wider audience, but also created the infrastructure for the spread of sustainable consumption through repair and resale.

Table 2. Major online platforms and marketplaces in Ukraine in 2024-2025

Platform	Type	Main categories	Features	Market share, % (approx.)
Rozetka	Online store and marketplace	Electronics, clothing, household goods	Largest selection, delivery	30-40
Prom.ua	Marketplace	Various categories	Large number of sellers	10-15
OLX.ua	C2C marketplace	Used goods (clothing, appliances, cars)	Leader in resale	Leader in the second-hand goods sector
Kasta	Online store and marketplace	Fashion, cosmetics	Specialised	Average
Bigl.ua	Marketplace	New and used goods	Wide range	Moderate

Source: which Ukrainian marketplaces to sell on in 2025 (2024), Rozetka (n.d.), Prom.ua (n.d.), OLX (n.d.), Kasta (n.d.), Bigl.ua (n.d.)

The current study, focused on the development of repair and resale practices in Ukraine, examined how the war, declining purchasing power and the spread of digital platforms with authentication services influenced consumer behaviour. The repair and resale of premium clothing was seen as a way to preserve the value of branded items, combining economic expediency with environmental awareness and gradual integration into the circular economy. The study by S.N. Sarokin & N.M.P. Bocken (2024), on the other hand, analysed circularity at the business model level, showing how companies integrated reuse and product life cycle extension into their strategies. Organisational barriers, the need for innovation, and new forms of value creation that went beyond a single market or segment were identified. Common to both works was the recognition of the key role of repair and resale in reducing environmental impact and creating new economic opportunities. However, the differences lay in scale: the Ukrainian approach reflected the consumer level and the impact of crisis conditions, while S.N. Sarokin & N.M.P. Bocken analysed the transformation of business models and the strategic aspects of circularity. In the current study, the development of repair and resale practices for premium clothing in Ukraine was explained by a combination of economic and social factors: war, falling purchasing power, and the growing role of digital platforms. The repair and resale of luxury items were interpreted as a way to preserve their investment value and, at the same time, as a component of the circular economy, combining economic incentives and environmental responsibility. These results echoed the conclusions of K. Niinimäki & M. Durrani (2020), who examined the global challenges facing the fashion industry, in particular overconsumption and the environmental consequences of the linear production model. The authors emphasised the need to transition to new business models focused on durability and reuse. Thus, the common point of both studies was the recognition of the role of repair and resale in extending the life cycle of things, but the Ukrainian context focused on local crisis conditions, while K. Niinimäki & M. Durrani analysed structural changes at the global level.

Further analysis showed that Ukrainian repair and resale practices were strengthened by the growth of online commerce and demand for repair shops, which was in line with global trends towards circular economy integration. In this respect, they echoed the research of G.C. de Oliveira Neto *et al*. (2024), which demonstrated how repair, resale and reuse of materials contributed to waste reduction and the creation of new business opportunities. However, while the Ukrainian analysis focused mainly on the local crisis context, G.C. de Oliveira Neto *et al*. emphasised global organisational models and the systemic effect of circular practices. Similar parallels could be drawn with the work of M. Mathew & R. Spinelli (2025). The authors focused on global business models that combined repair, resale and rental, emphasising their contribution to waste reduction and increased sustainability. The similarity with the Ukrainian case was in recognising these practices as key tools for extending the life cycle of things, but the difference was in scale: the Ukrainian study described adaptive solutions in wartime conditions, while M. Mathew & R. Spinelli described strategic global changes in the fashion industry. The importance of digital technologies for the development of resale was another common element. The Ukrainian case showed growing demand for online platforms and authentication services, while the study by V. Schiaroli *et al.* (2024) analysed more innovative solutions – blockchain and smart contracts, which ensured transparency and traceability on a global scale. The recognition of trust and transparency as critical conditions for the functioning of the resale market remained common, but in the first case, they were a response to local challenges, and in the second, the result of technological solutions for the global fashion industry.

In 2020-2025, demand for the repair of branded clothing and accessories in Ukraine was shaped by the pandemic, the economic crisis and full-scale war. Under these conditions, repair and resale served as means of preserving the value of premium items and spreading circular economy practices. The market recovery in 2023-2024 was accompanied by the growing role of online commerce, the return of international brands, and the development of specialised services that combined economic incentives with environmental awareness. Thus, the Ukrainian experience demonstrated how crisis conditions became a catalyst for the formation of sustainable consumer practices, where the repair and resale of premium items were gradually integrated into modern business models in the fashion industry.

Prospects for the development of the premium clothing repair and resale market in Ukraine

The prospects for the premium clothing repair and resale market in Ukraine are shaped by a combination of economic, social and technological factors that are changing consumption patterns and corporate strategies in the fashion industry. Against the backdrop of recovery from the pandemic and the crisis associated with the full-scale invasion, there is a growing awareness of the need to use resources sparingly and extend the life cycle of goods. This creates conditions for the development of the repair and resale segments, which previously had a rather marginal status but are now becoming an independent market segment with its own rules, infrastructure and consumer base. The key factor determining the prospects for this segment is the transformation of consumer preferences. While in the 2010s, buying new things was the main marker of status and material well-being, in 2020-2025, conscious consumption practices based on the principles of rationality and responsible attitude towards things are becoming increasingly popular. Young consumers, especially Generation Z, are developing a value for authenticity and uniqueness, which can be achieved through the resale of rare branded items or the restoration of high-quality premium products. Added to this is environmental motivation, which is reflected in the growing importance of the circular economy and the reduction of waste in light industry (Essiz & Senyuz, 2024).

Digital technologies have a significant impact on market development. Online platforms and mobile applications have simplified the process of buying and selling used items, enabled rapid communication between sellers and buyers, and introduced authentication services that reduce the risk of fraud. The gradual introduction of Customer Relationship Management systems in workshops allows for the effective organisation of customer relations, creating a loyal audience and ensuring stable financial flows. Mobile commerce, which accounted for more than half of all e-commerce transactions in 2024, makes repairs and resales more accessible, as purchases are made quickly and offers are personalised thanks to recommendation algorithms. Institutional and market factors have a significant impact on market development. After a sharp decline in 2022 caused by the closure of international brand stores, the clothing and footwear market is gradually recovering. The return of H&M and New Yorker, the expected opening of Inditex stores, and the activity of LPP (n.d.) are creating conditions for growth in imports and increased competition. However, in parallel with the recovery in sales of new products, the resale segment is also growing, partially replacing limited access to certain brands during the crisis years. At the same time, the development of specialised workshops and services for the restoration of premium items shows that this segment has its own value for consumers, as it allows to extend the life of items that would otherwise be lost when worn out (Which foreign fashion retailers have increased…, 2025).

In 2020, COS (n.d.), part of the H&M Group, launched its own platform for reselling used clothing. Owners of the brand's items were given the opportunity to sell them for a symbolic commission aimed at supporting the platform's operation. In addition, consumers are offered access to the brand's archive collections, which helps to extend the life cycle of the products. This step is seen as a response to reputational challenges related to criticism of the H&M Group's methods of disposing of unsold clothing. The flagship brand of the H&M holding company has also stepped up its resale activities by partnering with the Swedish online platform Sellpy, which specialises in the resale of used goods (Snoeck, 2020). At the same time, there has been a growing interest among investors in such business models: in particular, the media holding company Condé Nast (n.d.) has invested in the Vestiaire Collective platform, which specialises in the resale of luxury brands. The additional capital raised during the economic challenges caused by the pandemic indicates that both consumers and entrepreneurs recognise the resale market as promising. Other high fashion players are also actively joining the resale ecosystem. In 2020, Gucci signed an agreement with The RealReal platform, creating a special page with the brand's archive collections and second-hand items (Farra, 2020). Similar initiatives are also spreading in the mass consumption segment. Levi's (n.d.) launched the Levi's SecondHand programme (Sheremet, 2020), which combines the resale of used jeans at affordable prices (30-100 US dollars) with a consumer incentive system: by returning their own products, buyers receive bonus cards worth $15-30 for future purchases. Although there have been doubts in academic discussions as to whether the company is seeking to strengthen its control over the already established independent market for used jeans, the very fact that such initiatives are being developed reflects the growing importance of circular business models in the fashion industry (Resell of branded goods…, n.d.).

Looking ahead to 2025-2030, several key drivers of market development can be identified. Increased demand for sustainable consumption practices, which will have both economic and social foundations. The role of marketplaces that provide a simple infrastructure for reselling items and

support the development of small businesses in the repair sector is expected to continue to grow. The development of financial instruments and credit services integrated into e-commerce platforms will allow for the expansion of the consumer base even in conditions of declining purchasing power. The introduction of innovative technologies into repair practices, such as the use of 3D printing for the manufacture of parts or environmentally friendly materials for restoration, will improve the quality of services and expand the range of offerings. It is impossible to predict market development without taking risks into account. The main risk remains economic instability caused by full-scale invasion and slow recovery of the population's purchasing power. Currency fluctuations and rising import prices may reduce the margins of both new product sales and resale. An additional barrier is the underdevelopment of legal regulation in the field of resale of premium clothing, which creates risks for buyers and reduces the level of trust. Finally, there is a shortage of personnel in the repair sector, as working with premium items requires highly skilled specialists, and their training remains limited. To assess the prospects more clearly, Table 3 presents forecast scenarios for the development of the resale and repair market for premium clothing in Ukraine until 2030.

Table 3. Forecast scenarios for the development of the premium clothing repair and resale market in Ukraine until 2030

Scenario	Annual growth rate	Resale market share in the fashion industry	Key characteristics
Optimistic	15-18%	20-25%	Rapid economic recovery, return of international brands, active development of marketplaces and authentication technologies
Baseline	8-12%	12-15%	Moderate economic growth, recovery of imports, growing popularity of mobile applications, spread of CRM in workshops
Pessimistic	3-5%	5-7%	Economic stagnation, low purchasing power, limited return of brands, prevalence of local informal services

Source: compiled by the author based on research conducted

Thus, the market for repair and resale of premium clothing in Ukraine is in the process of forming long-term trends that will determine its development over the next decade. The most likely scenario is the baseline one, which assumes a gradual increase in the share of resale to 15% in the fashion market structure. However, in the event of a favourable economic and political environment, an optimistic scenario is also possible, which would make Ukraine one of the regional leaders in the field of circular fashion. At the same time, the risks remain high, and their realisation could push the segment to the periphery of the market. The optimistic scenario envisages not only economic recovery but also Ukraine's integration into global sustainable development chains, which could attract investment and lead to international collaborations in the field of resale and upcycling. The baseline scenario is the most realistic, as it takes into account the gradual recovery from the crisis and the existing trends in the growth of mobile commerce, CRM tools, and specialised online platforms. This aligns with approaches to the standardisation and digitalisation of business processes that enhance operational efficiency and manageability, as highlighted by O. Kot *et al.* (2025). It reflects the "middle path" when the market develops organically, without sharp jumps. The pessimistic scenario outlines not only economic risks, but also the possible strengthening of the "shadow" sector in the field of repair and resale. In this case, official services and platforms may lose consumer confidence, which will complicate the institutionalisation of resale as a full-fledged industry. In general, each scenario shows that further development will depend on the level of economic stability, the recovery of international trade, and the pace of digitalisation. It is the balance of these factors that will determine whether Ukrainian premium clothing resale will become a local niche or whether it will be able to transform into a competitive sector in the Eastern European region.

The current study examined the circular economy through the prism of the Ukrainian premium fashion market, focusing on how the war, the decline in purchasing power, and the emergence of authentication services shaped the demand for the repair and resale of branded clothing. T. Hussain *et al.* (2025) also paid similar attention to the importance of circularity in the fashion industry, but their approach was different: the authors focused on a critical analysis of the "grey" literature, emphasising the vagueness of key concepts and the dubiousness of claims about combining economic growth with environmental sustainability. Compared to the work of M.G. Calaza *et al*. (2022), a different logic of comparison was observed. Both studies recognised the potential of the circular economy to reduce environmental impact and extend product life cycles, emphasising the role of digital platforms and resale. However, M.G. Calaza *et al*. considered this issue from a broader perspective, linking it to the agri-food sector and the bioeconomy, while the current study focused on the local context of the fashion industry, demonstrating specific implications for Ukrainian society and the economy. A certain similarity in subject matter was also evident in the work of A. Mehn *et al*. (2022). Both works drew attention to repair, resale and digital services as means of reducing environmental risks, but the difference lay in the scale and subject of the research. A. Mehn *et al*. analysed the transformation of business models in the European context, focusing on barriers to the implementation of sustainable practices. In contrast, this study highlighted more applied aspects focused on changes in consumer behaviour and adaptation to crisis conditions. Similarly, the work of K. Singh *et al*. (2025) emphasised the role of circularity in the fashion

industry, but did so in a different analytical framework. While the current study demonstrated the local challenges and opportunities of the Ukrainian market, K. Singh *et al*. considered the global level, focusing on business models, regulatory mechanisms, and sustainable development policies. The complementarity of these approaches emphasised that the circular economy has both local dimensions related to specific markets and systemic dimensions that determine its strategic directions on a global scale.

Thus, the market for repair and resale of premium clothing in Ukraine remained in its infancy, and its development was determined by a combination of economic difficulties, changing consumer preferences, and the influence of digital technologies. Despite local challenges, trends were observed that were consistent with global trends in the circular economy and the gradual spread of conscious consumption practices. The growing role of mobile marketplaces, the emergence of specialised authentication services, and the integration of CRM solutions in workshops indicate a gradual transition from fragmented initiatives to more systematic business models. At the same time, cultural and value factors are becoming more influential: the younger generation is increasingly supporting the idea of reusing items as part of their lifestyle and a way to demonstrate environmental responsibility. Thus, even in conditions of economic instability, the Ukrainian premium goods resale segment shows potential for integration into the global system of sustainable development, making it promising for both entrepreneurs and consumers focused on a new culture of consumption.

Conclusions

The findings of this study showed that the market for repair and resale of premium clothing in Ukraine in 2020-2025 was shaped by a combination of economic crises, the COVID-19 pandemic and full-scale war, which forced consumers to change their behaviour to become thriftier and more rational. Statistical data confirmed the dynamics of recovery after a deep recession: in 2024, the volume of sales in the clothing and footwear market reached $1.4 billion, which is 13.07% more than in 2023, with the footwear segment accounting for $549.22 million, of which more than $318 million was accounted for by women's footwear. Despite a sharp decline in imports in 2022 by approximately 60% due to the closure of international brand stores, a gradual recovery began in 2023-2024, in particular due to the return of H&M and New Yorker, as well as the announcement of the opening of Inditex stores. The leaders in imports in 2024 were China with a 34% share (over $1 billion) and Turkey with 17% (over $500 million), which demonstrates Ukraine's stable integration into global supply chains.

At the same time, there was an increase in demand for repair and restoration services. In 2024, the average cost of restoring premium items ranged from 500 to 2,000 UAH, while the average bill for bags and shoes was 1,000-1,500 UAH. This shows that even in crisis conditions, consumers viewed repairs as an investment in preserving the value of branded items. Premium segment workshops demonstrated stable revenues reaching hundreds of thousands of UAH per month, actively implementing CRM systems to optimise business processes. This trend combined economic motives with environmental awareness, as extending the life cycle of items helped reduce waste and was in line with the principles of the circular economy.

Digitalisation proved to be a key factor in the transformation of the market. In 2024, the number of active online shoppers reached about 11 million, with an average purchase amount of 1,300 UAH. The Rozetka platform held the largest share of online sales – 30-40% of the e-commerce market, while Prom.ua accounted for 10-15%, and OLX remained the leader in the resale segment. Mobile commerce showed rapid growth: the share of purchases made from smartphones rose from 42% in 2023 to 53% in the first half of 2024. This reflected the growing role of digital platforms, which made premium resale accessible to a wider audience and increased trust through authentication services.

Forecast data shows that, in an optimistic scenario, the repair and resale market could grow by 15-18% annually, reaching a 20-25% share of the fashion industry, while in a baseline scenario, it could grow by 8-12% with a 12-15% share. The pessimistic scenario predicts a slowdown to 3-5% and a market share of only 5-7%, which highlights the segment's dependence on economic dynamics and the return of international brands. The prospects for future research were to expand the empirical base by conducting in-depth interviews and analysing the effectiveness of business models for repair and resale services.

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Монетизація ремонту та ресейлу преміального одягу в Україні

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Анотація. Метою даного дослідження було проаналізувати перспективи розвитку ринку ремонту та ресейлу преміального одягу та аксесуарів в Україні. Методологія ґрунтувалася на поєднанні контент-аналізу наукових праць, статистичного аналізу обсягів продажів та імпорту, кейс-стаді стартапів та платформ, а також систематизації практик перевіреного ресейлу. Часові рамки охоплювали 2020-2025 роки, що дозволило простежити динаміку ринку та визначити прогнозні сценарії його розвитку. Результати показали, що у 2024 році обсяг продажів ринку одягу та взуття в Україні становив близько $1,4 млрд, що на 13,07 % більше, ніж у 2023 році, тоді як сегмент взуття сягнув $549,22 млн, з яких понад $318 млн припадало на жіноче взуття. Після падіння імпорту у 2022 році приблизно на 60 % розпочалося поступове відновлення: у 2024 році Китай забезпечував 34 % імпорту (понад $1 млрд), а Туреччина – 17 % (понад $500 млн). Попит на ремонт і реставрацію також зростав: середні витрати на відновлення преміальних речей у 2024 році коливалися від 500 до 2 000 грн, а середній чек для сумок і взуття складав 1 000-1 500 грн. Паралельно майстерні преміального сегмента демонстрували щомісячну виручку у десятки чи сотні тисяч гривень, активно впроваджуючи Customer Relationship Management-системи. У сфері онлайн-торгівлі лідером залишалася Rozetka з часткою 30-40 %, тоді як Prom.ua займала 10-15 %, а OnLine eXchange була провідною у ресейлі. Загалом кількість активних інтернет-покупців сягнула близько 11 млн, а частка мобільних покупок зросла з 42 % у 2023 році до 53 % у першій половині 2024 року. Практичне значення дослідження полягало у можливості використання його результатів для формування стратегій розвитку сервісів ремонту та ресейлу преміальних речей в Україні

Ключові слова: циркулярна економіка; споживач; попит; бренд; імпорт

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Impact of logistics disruptions on the business models of regional food producers

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Abstract. The aim of the study was to determine the features of adaptation of the production and sales strategies of food industry enterprises in Ukraine to the challenges caused by crisis phenomena in logistics chains. The methodology was based on an empirical approach with an analysis of fuel costs, the level of inflation, foreign trade and the financial results of leading companies. Economic-statistical, comparative and financial-analytical methods were used to examine the average prices of diesel and petrol, which rose from 24.54 and 25.18 UAH/l in 2020 to 52.66 and 58.49 UAH/l in 2024. The consumer price index in 2022 reached 126.6%, which, together with higher energy prices, sharply increased enterprise costs. Foreign trade in 2022 declined, exports of processed food products decreased to USD 2.5 billion, whereas in 2023-2024 there was a recovery: exports rose to USD 3.27 billion in 2023 and about USD 41 billion in 2024. Financial analysis showed that the revenue of Myronivsky Hliboproduct increased from USD 1,414 million in 2020 to USD 2,262 million in 2024, while net profit in 2022 was negative (-USD 269 million), but in 2024 recovered to USD 141 million. Kernel recorded a record profit of USD 513 million in 2021, but in 2022 incurred a loss of USD 41 million, partially restoring its indicators to USD 168 million in 2024. Regional examples – the Bashtanskyi cheese factory and the Haisyn dairy plant – were additionally considered; these enterprises demonstrated different resilience to logistics challenges, which made it possible to assess the vulnerability of local producers compared with holdings. The practical significance lies in the possibility of using the results to develop strategies for minimising logistics risks and increasing the financial resilience of enterprises

Keywords: supply; costs; exports; profitability; competitiveness; revenue

Introduction

The food industry is under the influence of numerous challenges, among which interruptions in the operation of the transport system, shortages of raw materials and rising energy costs play a key role. The most vulnerable to these processes are regional-level enterprises, which have limited possibilities for rapid response to changes

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compared with large national or transnational structures. Changes in logistics schemes lead to higher production costs, a narrowing of the product range, a reduction in export opportunities and a transformation of the competitive environment.

In the production of bakery products, obstacles to stable functioning remain interruptions in supplies caused by damage to transport infrastructure, port blockades, rising fuel costs and unstable demand. In the study by V. Nidelchu (2025) it was shown that these factors directly increase production costs, reduce profitability and complicate the maintenance of continuity in production processes. The author emphasised the impact of shortages of critical resource stocks and delivery delays on the quality of the final products, and also found that the lack of adaptive approaches in logistics strategies often leads to production stoppages. In the food supply system, a key challenge remains, ensuring the preservation of quality and minimising losses of perishable products. I.O. Mukharovska & M.V. Shkrobot (2021) considered the application of the principles of integrated logistics in cold supply chains, focusing on the need to coordinate the interests of all participants, adaptability, and the use of information technologies. The authors emphasised that cold logistics requires investment in refrigeration equipment, timely technical maintenance and the introduction of innovative control systems, including Radio Frequency Identification (RFID) tags, which make it possible to monitor the condition of cargo in real time.

The functioning of small businesses in the food industry of Ukraine is under pressure due to military actions, economic instability, infrastructure destruction, rising costs and the outflow of labour. In the study, P. Tishakov (2025) outlined structural and dynamic trends in the development of small enterprises during the war, focusing on such factors as inflation, reduced purchasing power of the population, increased tax burdens and a shortage of staff due to mobilisation and emigration. The author stressed the importance of state and international support programmes that make it possible to mitigate the effects of the crisis on entrepreneurs and partially restore the activities. Food production in Ukraine faces numerous challenges, including infrastructure destruction, blocked transport routes, shortages of raw materials, rising costs and loss of labour resources. V.L. Yevstakhevich *et al.* (2024) investigated logistics, financial, personnel and technological risks for enterprises during an armed conflict, emphasising the need for comprehensive risk management that covers supplier diversification, improved quality management and the creation of emergency response plans. The authors found that war leads to a significant increase in costs, delivery delays and a shortage of skilled labour.

In the sale of crop products, one of the key challenges is the high cost of transport and storage, which directly affects purchase prices and the level of enterprise profitability. This issue was examined by D. Semenda *et al.* (2021), who focused on the structure of logistics costs and proved that exporters' expenditure on transporting and storing grain reduces producers' profitability, as it forms lower selling prices. The authors emphasised the advisability of optimising the use of silo capacities and determining the most advantageous periods for selling products, taking into account fluctuations in the exchange rate and the costs of storage and transport.

The efficiency of logistics systems in times of military challenges is accompanied by a number of difficulties that complicate the maintenance of supply continuity and require the search for new approaches to flow management. In the study by O.M. Kovryga (2024), the features of the development of the transport and logistics system in Ukraine under conditions of instability were analysed, and the key factors affecting its performance were identified, in particular infrastructure limitations, customs barriers and the need for innovative management technologies. The author concluded that improvements in logistics processes are possible through the integration of digital solutions, increasing the level of coordination between participants and the formation of adaptive strategies. Y. Ivanov *et al.* (2025) investigated the role of logistics in forming enterprises' competitive advantages and increasing the efficiency of production and sales processes, emphasising that effective management of logistics systems contributes to higher productivity, improved customer service quality and stronger market positions for companies. The study defined the importance of innovative technologies, including automation, artificial intelligence and blockchain, for optimising transport and warehousing processes.

The operation of transport and logistics companies under martial law is accompanied by difficulties, including infrastructure destruction, blockades, the need to use longer routes and rising costs. A. Kholodenko & N. Petrusyk (2024) studied the impact of martial law on the quality of logistics services in Ukraine and noted that uncertainty and risks significantly complicated the maintenance of a high level of service. The authors emphasised that the optimal level is not the maximum but an economically justified quality of services, which enables companies to remain competitive without excessive costs.

The aspects of the long-term effectiveness and scaling of innovative logistics solutions, the integration of digital technologies and the impact on the resilience and competitiveness of enterprises in the post-war period remain insufficiently studied. The purpose of this study was to clarify transformational changes in the production and sales approaches of food industry enterprises at the regional level under the influence of disruptions in the supply system, since these approaches form the basis of business models and directly reflect companies' ability to adapt to logistics challenges. The tasks of the study were: to investigate the main types of interruptions in transport and logistics processes and the impact on enterprise functioning; to analyse producers' adaptation strategies for maintaining efficiency and competitive positions under conditions of unstable supplies.

Materials and Methods

The study was empirical in nature and covered the period 2020-2024; it was also extended to August 2025 to track the latest trends and the dynamics of enterprise recovery. This interval was chosen because of its representativeness: it combined different stages of the development of Ukraine's economy – from relative stability to crisis phenomena caused by the pandemic and military events, as well as an initial recovery period characterised by the gradual rebuilding of logistics infrastructure, increased export volumes and stabilisation of domestic production. This made it possible to trace the impact of logistics factors on the resilience of food industry enterprises in a changing environment. For the assessment of the dynamics of logistics service costs, an economic-statistical approach was used, within which the average prices of fuel in Ukraine in 2020-2024 were examined (MinFin, n.d.). The task of this stage was to identify the relationship between rising fuel prices and increased costs of transporting products. The problem of inflationary pressure was analysed using the comparative method, which made it possible to compare consumer price index indicators over the study period (Summary table of consumer price..., 2020; 2021; 2022; 2023; 2024). The analysis was conducted in order to determine the scale of the impact of macroeconomic fluctuations on production and logistics processes.

The application of the structural-dynamic method made it possible to trace changes in foreign trade in processed food products (Ukraine's Foreign Trade in Goods..., 2023; Ukrainian exports in 2024 grew by 13.4%..., 2024). The method was used to analyse the dependence of the food industry on export markets and the impact of changes in logistics infrastructure on trade flows. A descriptive approach was used to characterise modern digital tools applied in logistics, in particular RFID technologies (RFID in Supply Chain Management..., n.d.), as well as Warehouse Management System (n.d.) (WMS) warehouse management systems. The possibilities of Microsoft Dynamics 365 (n.d.) CRM and SMART WMS (Warehouse at your fingertips..., 2024) as examples of integration solutions for improving the efficiency of logistics processes were examined separately. This made it possible to outline the possibilities of digitalisation in reducing costs and increasing the efficiency of resource management. The statistical method, based on the use of descriptive statistics and comparison of average tariff values and sales indicators, was applied to assess changes in the structure of producers' logistics costs (Freight transportation tariff will..., 2024) and the volume of products sold in 2020-2024 (Smolinska *et al.*, 2025). The analysis made it possible to compare the dynamics of transport tariffs with sales indicators and the financial resilience of enterprises.

To specify the results, a financial-analytical approach was applied, focusing on two leading companies in the sector – Myronivsky Hliboproduct (MHP, n.d.) and Kernel (n.d.), which were selected because of the market leadership, high export volumes and representativeness for assessing the impact of logistics challenges. In the case of MHP, the lines of activity and export geography were examined (Export brands of MHP, n.d.; MHP is the leader in Ukrainian food exports..., 2025). Indicators of revenue, profitability, and margins in 2020-2024 were analysed separately on the basis of the company's financial reports (Financial results for the third quarter and nine..., 2021; 2022; 2023). Additional information was used from the 2024 report (Financial results for the third quarter and nine months..., 2024), which made it possible to track financial dynamics under conditions of military events. For MHP, the elasticity of profits with respect to the growth of logistics costs was assessed using a descriptive-analytical method by comparing financial results with the dynamics of fuel prices and transport tariffs. The absence of detailed data on transport and warehousing costs complicated precise calculations, so the analysis relied on aggregated indicators – fuel tariffs, inflation levels and increases in rail freight charges.

The analysis of Kernel's financial reporting was carried out on the basis of the company's official documents. The company's annual reports (Kernel Holding S.A. annual report..., 2020; 2021; 2022; 2023), which reflected activity dynamics in the pre-war and crisis periods, were used. Additional analysis was carried out based on the 2024 report (Kernel Holding S.A. annual report..., 2024), which outlined the company's recovery trends. This made it possible to trace key trends in changes in revenue, costs, and profitability under the influence of logistics transformations. In the case of Kernel, data on export volumes (Kernel exported 4.4 million tons..., 2025) were also considered, which made it possible to compare transformations in the logistics structure with the dynamics of foreign economic activity. The analysis of profit elasticity was carried out in accordance with the company's financial results, changes in the logistics structure and on the basis of data from annual reports.

Within the framework of the study, the activities of the Bashtanskyi cheese factory (Bashtanskiy cheese factory, n.d.) were analysed using financial-analytical and comparative methods, in particular its financial reporting, trading activity, number of employees, volumes of raw materials and production and sales indicators in the stability period of 2020-2021 and in the crisis period of 2022-2024. Data on the use of the raw material base, changes in transport support and logistics barriers associated with infrastructure destruction and the redirection of supplies were additionally taken into account. Information on the company proved to be limited, particularly regarding the full structure of logistics processes, which complicated the formation of a comprehensive picture of the enterprise's functioning (A well-known cheese factory plans to resume..., 2024; ALC "Bashtanskyi cheese factory", n.d.). The choice of this enterprise was justified by its status as a regional producer of dairy products that suffered direct destruction as a result of military actions, lost access to its raw material base and demonstrated critical dependence on local logistics routes.

The Haisyn dairy plant (Haisyn Dairy, n.d.) was considered separately, for which an analysis of financial reporting was carried out: the dynamics of revenues and profits, production capacities and the features of logistics infrastructure in 2020-2024. Among the indicators, the scale of milk purchases from local farmers, the operation of the raw material reception facility, the presence of a fleet of isothermal bodies and refrigerated lorries, as well as cold stores for finished products, were assessed. As in the case of the Bashtanskyi cheese factory, information on the company was limited, primarily regarding the structure of suppliers, logistics flows and partnership relations (LLC "Gaisinsky Dairy Plant", n.d.). The criteria for including this enterprise were its status as a medium-sized regional producer of cheese products, dependence on local raw materials and the demonstration of relative resilience to crisis challenges thanks to the presence of its own logistics infrastructure. A comparative analysis of the differences in the impact of logistics disruptions on regional food industry enterprises and large integrated holdings was also carried out.

Results and Discussion

Foundations of the impact of logistics crises on the activities of food industry enterprises

Logistics disruptions in the current economic conditions of Ukraine constitute a complex multifactor phenomenon that combines interruptions of transport routes, disruptions in the supply of raw materials and finished products, constraints on exports and imports, as well as a sharp rise in the costs of ensuring the continuity of production and sales processes. The essence lies in the fact that any element of the supply chain may be thrown out of balance under the influence of external or internal factors, which leads to reduced efficiency of enterprises, a slowdown in the circulation of goods and an increase in production costs. A distinctive feature of the current situation is the combination of global and local challenges, which mutually reinforce one another and create complex threats for the economy in general and for the food industry in particular.

Military actions, accompanied by the destruction of transport infrastructure, port blockades and restrictions on the use of traditional export routes, have an impact on logistics processes. This has led to the reorientation of freight flows to road and rail transport, which has resulted in an overload of existing corridors and longer delivery times. Rising energy prices have become one of the key factors determining the level of logistics costs for food industry enterprises. Table 1 presents the dynamics of average fuel prices in Ukraine in 2020-2024.

As shown in Table 1, in 2020 fuel remained relatively affordable, but price growth was already observed in 2021. In 2022, due to Russia's full-scale invasion, prices doubled, and as of August 2025, the price had already reached a record high for the years under review. In parallel, the rise in fuel costs took place against the background of inflationary pressure. The inflation index amounted to 105.0% in 2020, 110.0% in 2021, 126.6% in 2022, 105.1% in 2023 and 112.0% in 2024 (Fig. 1).

Table 1. Average fuel prices in Ukraine in 2020-2024

Year	Diesel, UAH/l	Petrol A-95, UAH/l
2020	24.54	25.18
2021	29.40	30.21
2022	55.13	51.94
2023	51.50	51.48
2024	52.66	58.49
2025 (as of 15.08)	56.06	58.94

Source: compiled by the author on the basis of MinFin (n.d.)

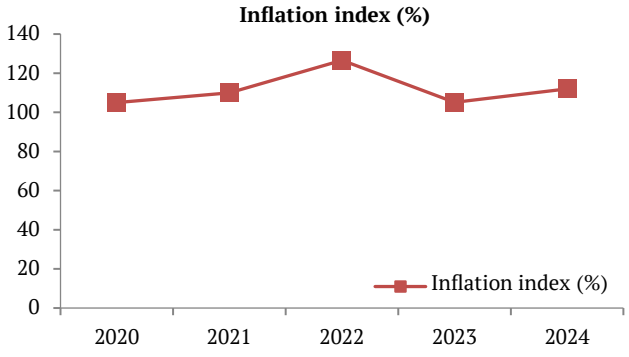

Figure 1. Dynamics of the inflation rate in Ukraine in 2020-2024

Source: compiled by the author on the basis of consumer price index indicators (Summary table of consumer price... 2020; 2021; 2022; 2023; 2024)

The graph demonstrates a wave-like dynamic of inflationary processes, which indicates the instability of the macroeconomic environment and its direct impact on the cost structure of producers. The largest leap occurred in 2022, which, together with record increases in energy prices, significantly raised enterprise costs and reduced the profitability. Subsequent fluctuations in the indicator reflected the complexity of business adaptation to conditions of uncertainty and the need for flexible approaches to cost management.

Another characteristic feature of current logistics challenges is dependence on imported resources. Some food industry enterprises require the import of packaging materials, auxiliary components and certain ingredients, which creates additional risks in the event of delays during customs clearance or disruptions in foreign currency settlements. Such factors reduce the predictability of

supplies and complicate production planning. Against this background, there is a growing trend towards the search for local suppliers, which stimulates the gradual restructuring of business models and helps to reduce dependence on external sources. In 2020, the volume of exports of products from Ukraine's agro-industrial complex and food industry amounted to about USD 20 billion, which almost matched the 2019 level with a minimal decrease of 0.3%. The main sales markets remained the European Union countries, which accounted for 28.9% of total exports (about USD 5.8 billion), as well as China (USD 3.1 billion) and India (USD 1.3 billion). The largest share in the export structure comprised grain crops, oils (primarily sunflower), poultry meat, honey, fruit, nuts and also bakery and confectionery products. Imports of food products during this period tended to decline due to pandemic restrictions. Total imports of goods into Ukraine in 2020 amounted to USD 54.2 billion, of which food products formed a smaller part, mainly in the form of specific ingredients and auxiliary components required to supply the domestic market (Infographic: TOP-5 products of export and import…, 2021; In 11 months of 2020, Ukraine exported…, 2021).

In 2021, exports of processed food products grew by 30.5% and reached USD 3.79 billion, while total agri-food exports amounted to USD 27.7 billion. The largest groups were residues and waste from the food industry, sugar and confectionery products, grain-based products, beverages, and products made from meat and fish. Imports amounted to USD 3.58 billion, which indicated the domestic market's dependence on external supplies. Overall trade became more active: exports grew by 25% compared with 2020, and imports by 27.6% (Us, 2022). The military events of 2022 caused a sharp reduction: exports of processed products fell to USD 2.5 billion (64.9% of the previous year's level), total exports amounted to USD 44.15 billion, and imports to USD 55.27 billion, with a negative balance of USD 11.12 billion. In the second quarter of 2025, exports of goods amounted to USD 10,077 million, decreasing by 1.12% compared with 2024 (How Ukrainian exports…, 2025). Imports of food products totalled USD 2.65 billion, reflecting reduced demand and logistics problems. The export structure was dominated by residues from the food industry, sugar, grain products and beverages, but volumes declined due to corridor constraints (Ukraine's Foreign Trade in Goods…, 2023).

In 2023, signs of recovery appeared: exports of processed products rose to USD 3.27 billion (+31% compared with 2022), but were 13.6% below the 2021 level; these products accounted for about 9% of exports. The main groups were residues from the food industry (USD 1.4 billion), sugar and confectionery products (USD 596 million), grain-based products (USD 314 million) and alcoholic beverages (USD 283 million). Imports amounted to more than USD 3.25 billion, which was 23% higher than in 2022, but below 2021 (In 2023, exports of prepared food products…, 2024). In 2024, exports increased due to the restoration of ports and access to markets: total exports reached USD 41 billion (+13.4% compared with 2023). The largest export flows were sunflower oil (over USD 5 billion), sunflower meal (over USD 1 billion), poultry meat (USD 945 million) and sugar (USD 408 million). Imports also grew, offsetting logistics and production imbalances (Ukrainian exports in 2024 grew by 13.4%…, 2024). Alongside this positive dynamic, internal logistics challenges, particularly the functioning of cold chains, became more acute, since a stable temperature regime determines product quality. Any disruptions lead to direct losses and additional costs. To minimise risks, enterprises invest in refrigerated warehouses, automated monitoring and modern technologies (Pajić *et al.*, 2024).

RFID technologies are actively being introduced in the food industry to control production stages and storage conditions. RFID chips are used to track goods, including at meat-processing enterprises where each trolley has a tag. This makes it possible to determine the production stage and the duration of a batch's stay in cooling or smoking, minimising losses. Further development is associated with the integration of temperature and humidity sensors to maintain appropriate conditions. GPS technologies are used to organise logistics and track cargo movements, which is especially important during post-war recovery (RFID in Supply Chain Management…, n.d.). WMS systems (Warehouse Management System, n.d.) are gaining popularity, including Ukrainian solutions based on Microsoft Dynamics 365 (CRM from Microsoft, n.d.) – SMART WMS (Warehouse at your fingertips…, 2024), which automate receipt, storage and dispatch, reducing labour costs and errors. At the same time, labour shortages caused by mobilisation and migration create a need for broader automation to support logistics operations (Ionin & Zagorodny, 2024). In 2020-2024, the structure of logistics costs changed significantly. The greatest impact came from higher rail freight tariffs due to Ukrzaliznytsia's annual indexation: in 2021-2022 tariffs for various classes rose by 8-20%, and in summer 2022 by almost 70%. In 2024, the supervisory board approved a new indexation of 37% because of higher energy and repair costs (Freight transportation tariff will… 2024). Loss of access to ports in 2022 caused a shift towards rail and road transport, which increased demand and tariffs. Road haulage routes lengthened by 10-40%, increasing delivery time and cost (Optimisation of transport logistics…, 2022). Overall logistics costs also rose due to higher customs payments, insurance and security services. In 2024, the State Customs Service transferred UAH 591.7 billion in customs revenues, which was one third higher than the previous year. This was due to an increase in import volumes, higher rates of value added tax (VAT), duties and excise taxes. At the same time, insurance company tariffs and costs for securing infrastructure increased because of heightened risks in wartime conditions (Budget revenues from customs payments…, 2025).

In 2020-2024, the production of food products in Ukraine developed unevenly under the influence of the COVID-19 pandemic and military events, which directly affected the state of logistics chains. The total volume

of sold products rose from UAH 480 billion in 2020 to UAH 708.27 billion in 2022, which indicated the ability of enterprises to adapt rapidly to crisis conditions, in particular through the search for new logistics routes and cost optimisation. However, in 2024 the indicator fell to UAH 522 billion, which was due to further complications in the transport sector, rising transport costs and deepening economic instability. The dynamics of the production index confirm these fluctuations. In 2020, it stood at 99.2%, exceeding the average industrial level (95.5%), which indicated the relative resilience of the sector even in the context of initial logistics disruptions. In 2022 the index sharply decreased to 78.4% because of large-scale damage to transport infrastructure and the blocking of export corridors. Already in 2023, thanks to the partial restoration of logistics channels and diversification of supplies, it rose to 106.8%. In the first half of 2024, the indicator reached 115.9% compared with the same period of 2023, which points to the active recovery of production capacity in close connection with the gradual stabilisation of logistics processes (Smolinska *et al*., 2025).

The present study and the work of F.A. Ghapar (2024) coincide in the conclusions about the multifactor nature of logistics disruptions and the impact on production costs, financial resilience and the competitiveness of enterprises. Both emphasise the importance of supplier diversification, flexible strategies and digital solutions to maintain efficiency. The difference lies in the context: F.A. Ghapar considered the global consequences of the COVID-19 pandemic – panic buying, labour shortages and problems in international flows. This study focuses on war-related risks, infrastructure destruction and the energy crisis, confirming its conclusions with statistics on fuel prices, inflation, and exports. A similar comprehensive perspective can be seen in the work of J.J. Rojas-Reyes *et al*. (2024). The authors systematised scientific literature, highlighting a wide range of factors threatening food chains – from climatic to socio-political. This study, in turn, reveals the local dimension of these threats, showing, on the example of Ukraine, how military events transformed producers' business models. Whereas J.J. Rojas-Reyes *et al.* mainly provided a conceptual framework, here the focus is on empirical data and examples of RFID and WMS implementation to support process continuity.

Another angle on the problem was proposed by J. Sun & Y. Ma (2024), who, summarising international experience, emphasised the critical role of logistics in the functioning of food chains. The conclusions also touched on the impact of the Russian-Ukrainian war, which caused disruptions in grain exports and higher transport costs. However, while J. Sun & Y. Ma focused on global-scale recommendations – the introduction of Delivered at Frontier, development of cold chains and digital monitoring platforms – this study presents practical examples of Ukrainian companies' adaptation, supported by statistics and analysis of the implementation of modern warehouse management systems. The research of N. Li *et al*. (2023) broadened the discussion with an environmental and long-term dimension. The authors focused on global risks – from climate change to structural imbalances – and considered the prospects of "green logistics" as a basis for sustainable development. This study offers another perspective: Ukraine's wartime realities, port blockades, rising fuel prices and infrastructure destruction, which created immediate economic challenges for producers.

The present study and the work of P. Haessner *et al*. (2024) share a common view of the multifactor character of logistics disruptions and the impact on the financial resilience and competitiveness of enterprises. Both emphasise the importance of digital technologies, automation, and supplier diversification for risk reduction and increased efficiency. Both works also share an understanding that supply disruptions directly affect production costs, profitability, and export opportunities for food producers. At the same time, differences concern the analytical context. P. Haessner *et al.* examined logistics challenges mainly through the prism of global value chains, stressing how digitalisation, standardisation and stronger resilience can enhance system adaptability under conditions of pandemics, geopolitical tensions or climate threats. This study instead concentrates on Ukraine's wartime realities, analysing infrastructure destruction, port blockades, rising fuel prices and inflationary fluctuations, confirming its conclusions with statistical data.

In the work of A.Z.A. Muzamiln *et al.* (2024), the key idea was also to highlight the role of digital tools in strengthening supply resilience. The authors focused on a bibliometric analysis of global literature, which allowed constructing worldwide scenarios of digital and "green" logistics. This study is consistent with these conclusions, as it also notes the importance of digitalisation for maintaining the effectiveness of business models. However, it differs in its applied orientation: unlike the review character of A.Z.A. Muzamiln *et al.*, here attention is paid to statistical data and real examples of enterprises adapting to the conditions of a wartime economy. Another interesting perspective was offered by G. Chavez-Miguel *et al*. (2024), who examined the resilience of agro-ecological systems in Peru, Germany, and the USA. The analysis centred on farmers who confronted crises by developing local markets and social networks. This approach resonates with the findings of the present study, since in both cases the multifactor nature of crisis challenges and the need for diversification and adaptive strategies are recognised. At the same time, the Ukrainian context is distinctive: infrastructure destruction, inflationary pressure and logistics blockades posed more acute threats that required technological solutions and rapid restructuring of business models. Thus, logistics disruptions in Ukraine in 2020-2024 were driven by a combination of war risks, inflation, rising fuel prices and imbalances in foreign trade. These disruptions led to higher costs of transport and warehousing, disruptions in cold chains and increased dependence on imported resources. The dynamics of exports and imports showed a decline in 2022 and gradual recovery in 2023-2024, which confirms the vulnerability of food flows to external shocks.

Analysis of operating costs and profitability of regional food producers

In 2020-2024, Ukraine's agro-industrial companies faced large-scale economic and geopolitical challenges that significantly affected the financial performance and logistics strategies. Among the largest food producers are MHP (n.d.) and Kernel (n.d.), which are at the same time leading Ukrainian exporters, supplying poultry, grain, and sunflower oil to global markets. For both companies, the logistics factor became decisive in shaping operating costs and profitability, as over 50-90% of the output was exported. During 2020-2024, MHP remained Ukraine's leading agro-industrial company, combining poultry production, crop farming, processing of grain and oilseeds, as well as the development of retail and culinary businesses. The company's main areas of activity remained the production of poultry meat and ready-to-eat foods, the cultivation of maize, wheat, sunflower, soya and rapeseed, and the operation of feed mills and silos. An important strategic step was the launch of new sales formats: "Myasomarket" shops, "Döner Market" street food outlets and the "Sekrety shefa" gastro studio, which strengthened the company's presence in the domestic market and simultaneously diversified its profitable segments (Export brands of MHP, n.d.).

External challenges in 2020-2024, including the COVID-19 pandemic, military actions and the blockade of Ukrainian seaports, significantly affected MHP's business model. Loss of access to traditional export routes through the Black Sea in 2022 forced the company to develop alternative logistics routes actively, particularly by using land border crossings and international subsidiaries. Perutnina Ptuj in the Balkans played an important role in this, providing production and distribution in Slovenia, Croatia, Serbia, and Bosnia and Herzegovina. This strategy made it possible to maintain a presence in European markets even during logistics crises (MHP is the leader in Ukrainian food exports..., 2025).

Geographically, the company's exports in 2024 covered 86 countries. The main importers remained the European Union (the Netherlands, Ireland, Belgium, Poland, Italy, Greece), the United Kingdom, markets in the Middle East (UAE, Saudi Arabia) and Africa. North American markets (USA, Canada) also remained important, while the Balkans were seen as a springboard for further expansion in Central and Eastern Europe. Through market diversification, MHP generated record export revenues of USD 1.7 billion in 2024, confirming the adaptation of its business model to difficult conditions. The company's financial results during this period show cyclicality caused by changes in logistics and energy costs and the availability of transport infrastructure (MHP considers the EU, Great Britain, Japan, the USA..., 2025). Table 2 presents MHP's key financial indicators for 2020-2024.

Table 2. Key financial indicators of MHP in 2020-2024 (USD million)

Indicator	2020	2021	2022	2023	2024
Income	1,414	1,647	1,876	2,294	2,262
Operating profit	194	416	176	247	346
Operating profitability, %	14	25	9	11	15
Net profit / (loss)	-109	377	-269	122	141
Net profit margin, %	-8	18	-14	5	6

Source: compiled by the author on the basis of official MHP reports (Financial results for the third..., 2021; 2022; 2023; 2024)

The table shows that in 2020-2021, the company demonstrated a significant increase in profitability, with operating profit more than doubling. In 2022, military actions and logistics disruptions led to a deterioration in performance: net loss amounted to USD 269 million and profitability turned negative. However, by 2023-2024 the company managed to stabilise the situation: operating profit rose to USD 346 million and net profit to USD 141 million, confirming MHP's ability to adapt its business model to challenges. In 2020-2024, MHP experienced a significant impact from logistics challenges related to rising transport tariffs, higher fuel prices and route reorientation as a result of Ukrainian port blockades. It is known that transport costs traditionally account for 15-25% of the cost of agricultural products in Ukraine, and in wartime this indicator approached the upper bound. This makes it possible to estimate conditionally the elasticity of the company's profitability with respect to changes in logistics costs. For example, in 2022, a sharp increase in Ukrzaliznytsia tariffs (by 70%) and a doubling of diesel prices led to a substantial rise in logistics costs. As a result, MHP's operating profit fell to USD 176 million (compared with USD 416 million in 2021), and the operating margin decreased from 25% to 9%. Thus, it can be argued that the increase in logistics costs had an elastic effect: each significant increase in transport tariffs and fuel prices led to a disproportional drop in profitability. At the same time, in 2023-2024, despite further tariff indexation, the company showed improved financial results. Operating profit rose from USD 247 million in 2023 to USD 346 million in 2024, and the operating margin – from 11% to 15%. This is explained by the introduction of digital solutions that reduced the sensitivity of financial results to logistics cost increases. In other words, profit elasticity with respect to logistics costs gradually declined, as process optimisation and automation compensated for external price shocks. Taking these data into account, it is possible to conclude that for MHP in 2020-2022, profitability elasticity with respect to logistics cost growth was high, whereas in 2023-2024 the company demonstrated greater resilience thanks to digitalisation and market diversification. This confirms that in a crisis, effective logistics management is a key factor in maintaining profitability even under rising transport costs.

Alongside financial results, investment in digitalisation remained an important factor. In 2020-2024, the company implemented GPS tracking of transport, warehouse management systems (WMS) and the Smart Maintenance platform for predictive equipment servicing. This allowed logistics costs to be reduced, storage and transportation of products to be optimised, downtime to be minimised and resources to be used more efficiently. In the poultry segment these solutions helped to maintain export volumes even when production was reduced, while in the grain segment these solutions increased margins by reducing losses during storage and processing (How Adaptation, Efficiency ..., 2025). An important addition was the creation of the "MHP-Logistics" division (MHP Logistics Branch of Private Joint-Stock..., n.d.), which serves not only internal needs but also external clients, turning into a separate business direction. This marked the company's transition from a classical agro-producer model to an integrated structure where logistics became a profitable sphere. In 2020-2024, MHP demonstrated its ability to adapt to global and domestic challenges: after a decline in financial results in 2022, by 2024 the company had already returned to growing profitability, ensuring market diversification, logistics digitalisation and the development of international chains. This confirmed that innovation in management and a strategic focus on external markets became key factors of competitiveness under conditions of instability.

Kernel remains a key player in the agricultural market, focusing its activities on three areas: production and export of sunflower oil, cultivation, and sale of grain crops, and trading and logistics. The company provides about 9% of global sunflower oil exports and is the largest exporter of Ukrainian grain. In 2020-2024, its activities were shaped by fluctuations due to global market conditions and military events. In 2024, Kernel launched a new plant in Western Ukraine, increasing processing by 24% compared with 2023, yet profitability declined because of more expensive logistics and losses from asset impairment. Despite this, oil sales in the 2024 financial year reached 1.09 million tonnes (+40% year-on-year) and grain exports 6.3 million tonnes (+80%). After Russia's withdrawal from the "grain initiative" in July 2023, the company lost access to Black Sea ports, which caused a sharp drop in meal shipments (159 thousand tonnes in Q1 2024), although by Q2 volumes had increased to 399 thousand tonnes. Dependence on port logistics confirmed the vulnerability of Kernel's business model (Kernel Holding S.A. annual report..., 2024).

To minimise risks, the company invested in the development of port infrastructure and alternative routes. In 2024, transhipment of grain and oilseeds through Kernel's terminals increased by 51% and reached 6.7 million tonnes. Danube ports (Reni, Izmail, Ust-Dunaisk) and EU transport corridors became particularly important. The company also expanded its fleet of rail wagons and containers, which made it possible to maintain export volumes, albeit at a higher cost of production (Kernel exported 4.4 million tons..., 2025). The company's financial results for 2020-2024 reflect these challenges and adaptation efforts (Table 3).

Table 3. Key financial indicators of Kernel in 2020-2024

Indicator	2020	2021	2022	2023	2024
Revenue (USD million)	4,107	5,647	5,332	3,455	3,581
Operating profit (USD million)	443	929	220	544	381
Operating margin (%)	10.8	16.4	4.1	15.8	10.6
Net profit / (loss) (USD million)	118	513	-41	299	168
Net profit margin (%)	2.9	9.1	-0.8	8.7	4.7

Source: compiled by the author on the basis of official Kernel reports (Kernel Holding..., 2020; 2021; 2022; 2023; 2024)

In 2020-2021, logistics costs remained under control thanks to the operation of Black Sea ports and the company's well-developed own infrastructure. This enabled Kernel to demonstrate high profit elasticity: even with rising transport costs, operating profit more than doubled – from USD 443 million in 2020 to USD 929 million in 2021, while net profit increased from USD 118 million to USD 513 million. The situation changed radically in 2022, when, after the start of Russia's full-scale invasion, logistics through the Black Sea ports were severely restricted. Kernel was forced to reorient shipments to rail and road transport and to use alternative routes through Danube ports and EU countries. This led to a three- to four-fold increase in transport costs, which directly affected profitability: operating profit fell to USD 220 million, and the net financial result turned negative and amounted to -USD 41 million, while the operating margin dropped to 4.1%. In 2023, the situation partially stabilised thanks to the functioning of the "grain corridor". Although transport costs remained significant, the company managed to restore profitability: operating profit increased to USD 544 million, net profit reached USD 299 million, and the operating margin rose to 15.8%. This demonstrated the flexibility of Kernel's business model: the company offset part of the cost increase through route optimisation, the use of its own silos and terminals, and sustained demand for oil and grain from key importers. In 2024, despite the opening of the "maritime corridor" under the protection of the Ukrainian armed forces, logistics costs remained high due to rising insurance payments and the limited throughput of alternative routes. This led to a decrease in operating profit to USD 381 million (down 30% compared with 2023) and a reduction in net profit to USD 168 million, with the net profit margin falling from 8.7% to 4.7%. Another important factor was the change in export geography. The traditional Black Sea ports remained under threat of shelling, so Kernel made

more active use of routes through the European Union (EU) and the Danube region. The main importers of sunflower oil were India, EU countries, China, Türkiye, Iraq and Egypt, which together accounted for up to 80% of global demand. At the same time, rising transport and insurance costs reduced the profitability of transactions (Kernel Holding S.A. annual report..., 2024). As a result, in 2020-2024 Kernel demonstrated high adaptability to wartime and logistics challenges, but at the same time suffered a tangible loss in profitability compared with pre-crisis years. The company retained its leadership in the global sunflower oil and grain market, yet its financial results reflect a significant dependence on logistics infrastructure and geopolitical risks.

Bashtanskiy cheese factory (n.d.) (Bashtanka, Mykolaiv region), known under the trademark "Slaviya", is an example of a regional dairy producer that has undergone substantial transformations under the impact of logistics disruptions and military action. In 2020-2021, the plant recorded stable revenue (UAH 906.9 thousand and UAH 826.7 thousand respectively) and employed more than 400 workers. Its products were represented in most retail chains in Ukraine, which required an extensive distribution system and resilient logistics. The situation changed sharply in 2022. Due to hostilities in the Bashtanka district and a significant reduction in livestock numbers (by up to 60-70%), the plant lost access to the necessary raw material base: to reach at least break-even, the enterprise needed 100 tonnes of milk per day, whereas actual volumes were several times lower. Logistics challenges were exacerbated by road destruction and a reduction in the number of milk tankers delivering raw materials (from nine vehicles in the pre-war period to two after 2022). Part of the milk began to be transported to Kryvyi Rih and Voznesensk by private suppliers, which further complicated the supply of production (A well-known cheese factory plans to resume..., 2024; ALC "Bashtanskyi cheese factory", n.d.).

In 2023-2024, the enterprise was unable to restore pre-war production volumes: revenues remained at UAH 236 thousand in 2023 and fell to UAH 220 thousand in 2024, the workforce decreased to 300 employees, and financial results fluctuated between profit and loss (ALC "Bashtanskyi cheese factory", n.d.). Thus, Bashtanskiy cheese factory demonstrated that regional producers are much more vulnerable to disruptions in logistics chains than large integrated holdings. Dependence on local raw materials, limited transport routes and a lack of resources to diversify markets predetermine the critical instability of the business models in crisis conditions.

Another example is Haisyn Dairy (Haisyn Dairy, n.d.), a medium-sized food industry enterprise specialising in the processing of cow's milk and the production of cheese, butter, dried dairy products and other dairy goods. During 2020-2024, the enterprise showed an increase in activity volumes, yet its financial results remained unstable. In 2020, the plant's revenue amounted to UAH 231.9 million and net profit to UAH 4.1 million. In 2021, revenue rose to UAH 280.9 million, but the enterprise recorded a loss of UAH 9.6 million. From 2022, the plant returned to profitability: with revenue of UAH 411.1 million, net profit was UAH 25.1 million. In 2023, the indicators again increased – revenue reached UAH 556.3 million and net profit amounted to UAH 14.5 million. In 2024, the enterprise reached a new maximum: revenue amounted to UAH 697.2 million and net profit to UAH 16.4 million. From a logistics perspective, the plant is a typical example of a regional producer dependent on the local raw material base. Raw materials are supplied by external providers – farms and local producers. To ensure stable quality, the enterprise has created a modern raw milk reception facility, where milk undergoes bactofugation, separation and pasteurisation, which allows the parameters of purchased milk to be equalised and guarantees compliance with technological requirements. The plant's own logistics infrastructure is particularly important: a fleet of isothermal trucks and refrigerated lorries ensures cooling of milk during transportation, preserving its quality. The presence of refrigerated storage enables the required storage regime for finished products to be maintained. This approach minimises risks associated with supply disruptions or rising logistics costs and provides the enterprise with greater resilience in crisis conditions (LLC "Gaisinsky Dairy Plant", n.d.).

Additionally, it is worth emphasising that the impact of logistics disruptions reveals differences between regional and large food industry companies. For regional producers, dependence on local raw materials and a narrow network of transport routes is critical: if roads are destroyed or the number of suppliers decreases, the production process is immediately blocked. A lack of own storage capacity and a limited vehicle fleet make it impossible to respond quickly to supply interruptions. As a result, even short-term disruptions lead to increased cost of production, loss of output and reduced profitability, as evidenced by the examples of regional plants. Large integrated holdings, by contrast, possess a much wider range of adaptation tools. Thanks to access to diversified supply channels, the own transport companies and international markets, large integrated holdings are able to partially offset higher costs due to the scale of operations. Moreover, the use of digital technologies (GPS monitoring, RFID systems, WMS platforms) and investments in infrastructure development increase the flexibility and help avoid critical disruptions in production and distribution chains. This explains why, under crisis conditions, many regional enterprises were forced to suspend or minimise production, while large companies demonstrated an ability to maintain financial stability and even increase export performance. Thus, enterprise size and the degree of integration into international logistics networks became key factors differentiating the impact of crisis phenomena on food industry business models. In the context of addressing logistics challenges and the need to adapt to new economic conditions, the role of digital transformation in logistics is crucial. As emphasised by G. Saktaganova *et al.* (2025), digital technologies offer significant opportunities for enhancing

global integration in the transport and logistics sectors. The study stresses the importance of implementing digital solutions to improve efficiency, manage disruptions in supply chains and ensure seamless integration into the global market. This is consistent with the findings of the present study, in which it is discussed how the introduction of modern digital tools such as RFID systems and WMS is critical for strengthening the resilience of logistics operations under current disruptions.

The present study and the work of M. Drljača *et al*. (2025) share a common position on the decisive role of logistics disruptions in shaping the financial resilience of enterprises. Both highlight that rising costs required diversification of suppliers and active implementation of digital solutions. At the same time, the approach of M. Drljača *et al*. was broader: the authors went beyond the corporate level and proposed a multi-level resilience model encompassing enterprises, national economies and the global system, using macroeconomic risk indicators to forecast future crises. A similar logic can be traced in the study by S. Jagtap *et al*. (2024), which confirmed the multifactor nature of logistics disruptions and the impact on profitability. Both works emphasised the need for process digitalisation and management flexibility; however, the difference lay in the scale of analysis: the present study examined the problems of Ukrainian producers in wartime conditions, whereas S. Jagtap *et al*. focused on the European context, identifying the role of Brexit, the pandemic and other systemic challenges. Common features were also observed between this study and the work of J. Pyeman (2025). Both highlighted the transformation of food chains under the influence of the pandemic and crisis phenomena, which led to rising costs and declining profitability. Both regarded liquidity management, diversification and digital technologies as critically important. At the same time, J. Pyeman concentrated on Malaysian retail, where financial models and machine learning were applied to forecast profitability, whereas the present study raised the issue of war risks and restricted access to external markets.

In the work of Y. Zhu & G.T. Tsoulfas (2024) and in this study, a shared idea emerges: long supply chains are extremely vulnerable to shocks, and the shortening, coupled with digital tools, can reduce risks. The difference, however, lies in the context: in Ukraine, the key problems were war, port blockades and inflation, whereas Y. Zhu & G.T. Tsoulfas examined the case of the Netherlands, where challenges were driven by small production scales and high logistics costs. A similar parallel can be drawn between this study and the work of I. Ali *et al.* (2024). Both emphasised the vulnerability of chains to crises and the need for technological modernisation. Yet while the present research describes war-economic risks for Ukrainian producers, I. Ali *et al.* considered global challenges caused by the pandemic, placing emphasis on transparency, traceability, and coordination in international networks. A related line can also be seen in comparison with the study of S. Tian & Y. Mei (2023). In both works – the present study and that of S. Tian & Y. Mei – the importance of innovative strategies, digitalisation and diversification of supply channels is recognised. However, S. Tian & Y. Mei focused on Chinese companies and the impact of geopolitical threats, whereas this study underscores wartime challenges in Ukraine – infrastructure destruction, port blockades and sharp inflationary fluctuations. Similar emphases are observed when comparing this work with the study of O. Olabode *et al*. (2025). Both studies note the multifactor nature of disruptions and the role of innovative solutions in ensuring resilience. At the same time, O. Olabode *et al*. analysed global structural challenges related to climate change and resource constraints, whereas the present study shows local war-related consequences for the Ukrainian economy. In the work of M.C.-P. Poo *et al*. (2024), too, there is a common focus on the multifactor character of logistics disruptions and the need for digitalisation. However, that paper examined global risk management strategies, integrating principles of the circular economy and green logistics, whereas the present study is more applied and localised within the Ukrainian wartime reality. When compared with the research of Z.F. Ardekani *et al*. (2023), there is a shared understanding of the critical role of digital solutions, diversification and sustainable practices. The difference lies in the context: Ukraine's wartime reality versus Brazil's experience of the COVID-19 pandemic, where the main attention was devoted to environmental aspects and the transition to more sustainable agri-food chains.

Summarising the results of the analysis, it can be noted that MHP and Kernel demonstrated different levels of profit elasticity in response to rising logistics costs. For MHP, the most critical year was 2022, when port blockades and higher "Ukrzaliznytsia" tariffs led to a more than twofold decline in operating profit. However, thanks to the introduction of digital technologies, in 2023-2024 the company managed to reduce the sensitivity of financial results to external shocks and restore profitability. Kernel, by contrast, maintained strong financial indicators in 2020-2021, but under wartime conditions and export reorientation to more expensive routes in 2022-2024 its profitability fell sharply. Both companies confirmed the ability to adapt to crisis conditions by diversifying markets and developing alternative logistics, yet the extent to which logistics costs impacted final financial results proved to be the decisive factor in the resilience.

Conclusions

Summarising the results of the study, it can be concluded that in 2020-2024, logistics disruptions became the key factor transforming the business models of regional food producers in Ukraine. The combination of war-related risks, inflationary pressure and rising energy prices significantly increased enterprise costs. Diesel prices rose from UAH 24.54 per litre in 2020 to UAH 52.66 per litre in 2024, while petrol A-95 increased from UAH 25.18 to UAH 58.49 per litre. Inflation peaked in 2022 (126.6%), which, together with infrastructure destruction, led to declining profitability and higher production costs.

External trade also changed. In 2020, exports of agri-food products amounted to about USD 20 billion, whereas in 2022 the exports fell to USD 44.15 billion in total exports owing to port blockades. Exports of processed food products decreased by one third – to USD 2.5 billion – while imports amounted to USD 2.65 billion. In 2023-2024, there was partial recovery: exports of processed products grew to USD 3.27 billion in 2023 and continued to increase in 2024, providing about USD 41 billion of exports, with sunflower oil (over USD 5 billion) and poultry meat (USD 945 million) remaining the main items.

The analysis of leading companies showed different levels of resilience. At MHP, revenue rose from USD 1,414 million in 2020 to USD 2,262 million in 2024, whereas in 2022 the company incurred a loss (-USD 269 million) due to logistics constraints and higher fuel prices. By 2024, profitability had been restored to USD 141 million, and the operating margin increased to 15%. Kernel recorded a record net profit of USD 513 million in 2021, but in 2022 moved into loss – USD 41 million – because of higher transport costs. In 2023, the company partially recovered its performance (USD 299 million net profit), yet in 2024 profit fell to USD 168 million, underlining dependence on port logistics and international market conditions.

The key factors undermining financial resilience were higher transport tariffs, rising fuel prices, Black Sea port blockades and the need to reorient routes through the Danube and the EU. Logistics costs within the cost structure reached 25% and directly affected profitability. At the same time, investments in digitalisation – GPS tracking, RFID, WMS systems – reduced profit elasticity in response to rising costs, enhancing the efficiency of resource management. Unlike large holdings, regional producers showed greater dependence on logistics: Bashtanskiy cheese factory displayed critical vulnerability due to loss of raw materials and transport, whereas Haisyn Dairy, thanks to its own infrastructure, maintained resilience and increased revenue from UAH 231.9 million in 2020 to UAH 697.2 million in 2024. A limitation of this study is that it focused mainly on the Ukrainian context and the 2020-2024 time frame, without considering the long-term implications for global supply chains. A promising avenue for future research is an in-depth examination of the effectiveness of digital technologies and alternative logistics routes in ensuring the resilience of the food industry in the post-war period.

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Вплив логістичних збоїв на бізнес-моделі регіональних виробників харчової продукції

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Анотація. Метою дослідження було визначити особливості адаптації виробничо-збутових стратегій підприємств харчової промисловості України до викликів, спричинених кризовими явищами у логістичних ланцюгах. Методологія ґрунтувалася на емпіричному підході з аналізом вартості пального, рівня інфляції, зовнішньої торгівлі та фінансових результатів провідних компаній. Використано економіко-статистичні, порівняльні й фінансово-аналітичні методи для дослідження середніх цін на дизель і бензин, що зросли з 24,54 та 25,18 грн/л у 2020 році до 52,66 та 58,49 грн/л у 2024 році. Індекс споживчих цін у 2022 році досяг 126,6 %, що разом із подорожчанням енергоносіїв різко збільшило витрати підприємств. Зовнішня торгівля у 2022 році скоротилася, експорт готових харчових продуктів зменшився до 2,5 млрд дол., тоді як у 2023-2024 роках відбулося відновлення: експорт зріс до 3,27 млрд дол. у 2023 році та близько 41 млрд дол. у 2024 році. Фінансовий аналіз показав, що дохід Миронівського хлібопродукту зріс із 1 414 млн дол. у 2020 році до 2 262 млн дол. у 2024 році, при цьому чистий прибуток у 2022 році був від'ємним (-269 млн дол.), але у 2024 році відновився до 141 млн дол. Kernel у 2021 році зафіксувала рекордний прибуток у 513 млн дол., проте у 2022 році отримала збиток – 41 млн дол., частково відновивши показники до 168 млн дол. у 2024 році. Додатково розглянуто регіональні приклади – Баштанський сирзавод і Гайсинський молокозавод, які продемонстрували різну стійкість до логістичних викликів, що дозволило оцінити вразливість локальних виробників порівняно з холдингами. Практичне значення полягає у можливості використання результатів для розробки стратегій мінімізації логістичних ризиків та підвищення фінансової стійкості підприємств

Ключові слова: постачання; витрати; експорт; рентабельність; конкурентоспроможність; дохід

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Research on the relationship between the level of innovative activity and the profitability of enterprises in the oil and gas sector of Kazakhstan

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Abstract. The objective of this research was to assess how innovative activity influences the financial performance of enterprises in Kazakhstan's oil and gas sector. The research was empirical and covered the period 2020-2024, using official financial statements of Joint Stock Company "KazMunayGas" and corporate documents on innovation programmes. The methodology combined statistical analysis of production volumes and financial dynamics with content analysis of strategic projects. Results showed that oil production fluctuated between 84-89.9 million tonnes, totalling 433.1 million tonnes, while gas production rose from 53-54 to 60.5 billion m^3. In 2024, Tengiz, Karachaganak and Kashagan fields provided over 60% of national output (27.8, 12.4 and 17.9 million tonnes). Financial indicators reflected both innovation effects and market volatility: in 2020, net profit was only 172 billion tenge with revenue of 3,625 billion, while in 2022 profit peaked at 1,307 billion and revenue at 8,693 billion. By 2024, net profit reached 1,094 billion tenge, free cash flow 1,199 billion, and net debt fell to 1,163 billion – the lowest in five years. Investments in technological projects exceeded 250.8 billion tenge, with 98.2 billion for high-tech areas. More than 500 initiatives, including digital twins and artificial intelligence systems, were implemented in 2024. The results of this study can be used to develop an effective strategy for the innovative development of oil and gas enterprises in Kazakhstan in order to enhance their financial stability and competitiveness

Keywords: strategies; revenue; investment; competitiveness; efficiency

Introduction

In the current conditions of Kazakhstan's development, the oil and gas industry remains a key driver of economic growth, generating a significant share of state revenues and providing foreign exchange earnings. However, increased competition in global energy markets, fluctuations in hydrocarbon prices and shifts in the global energy balance require enterprises to find new ways to improve their performance. In Kazakhstan's oil and gas sector, reliance on the raw material model of development persisted, reducing sustainability and creating risks for the country's economic security. A. Maldynova *et al.* (2023) examined the innovative potential of enterprises and demonstrated that internal expenditure on innovation and the volume of innovative products have a direct positive impact on companies' innovative development. The authors showed that the growth of innovative activity is an important prerequisite for increasing competitiveness and modernisation of production processes. On the other hand, N. Kurmanov *et al.* (2022) conducted an empirical analysis of innovation processes in oil and gas regions, using a multifactor model to identify key drivers of innovation dynamics. They identified five groups of factors: regional economic development and agglomeration effects, market potential and infrastructure, structural characteristics, human capital and investment support.

In Kazakhstan, the key challenge remained the instability of oil and gas region development due to their high dependence on market fluctuations, particularly price factors, interest rates and equipment imports. The analysis of innovative development directions discussed by S. Beisembekova *et al.* (2022) relied on theoretical models that

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evaluated how spending on research and development, technology transfer and professional training affect economic growth. Meanwhile, S. Bibi (2024) emphasised that although Kazakhstan benefited from the oil and commodity supercycle of 2003-2014 with high growth rates, persistent current account deficits were observed due to large dividend payments to foreign corporations and capital outflows. The study also highlighted the lack of successful diversification of production and continuing vulnerability to external shocks, making the prospects for long-term development uncertain.

Kazakhstan has significant reserves of oil and gas, but their predominant export in raw form reduces opportunities for creating added value and increases dependence on external conditions. Research on the refining sector by U. Shalbolova *et al.* (2024) demonstrated that modernisation of the three key oil refineries in Atyrau, Pavlodar and Shymkent boosted the output of light petroleum products by 4.3 million tonnes annually, raising the share of petrol to 70% and diesel fuel to 20%. Despite these achievements, Kazakhstan's position as a major oil and gas exporter remained marked by imbalance in relations with China and dependence on external factors. Complementary findings from B. Du *et al.* (2024) revealed that a 1% rise in Gross Domestic Product (GDP) in both Kazakhstan and China increased trade flows by 1.47%, yet growth in domestic production did not translate into proportional export expansion to China, given the country's prioritisation of European markets and rising domestic consumption.

The Kazakh economy is largely dependent on oil and gas, which makes the implementation of sustainable development principles especially relevant. Research by G. Beisembayev & A. Akhmetkyzy (2025) showed that the effectiveness of Environmental, Social and Governance (ESG) practices in oil and gas companies is uneven: high environmental performance often coincides with weaker outcomes in the social sphere and corporate governance. Their findings also revealed a strong correlation between wage levels and pollution, pointing to economic–environmental trade-offs, while emphasising that ESG approaches can serve as a tool for modernisation and risk reduction. At the same time, many enterprises continue to rely on outdated equipment, which lowers efficiency. Additional insights provided by S. Zhumadilla *et al.* (2024) highlighted key drivers of innovation activity, including the share of knowledge-intensive products, personnel qualifications, capital intensity of equipment, investment efficiency and environmental performance. Among these, the most decisive factors proved to be human resources potential and investment efficiency, whereas environmental aspects remain weakly integrated.

The studies revealed low patent activity, weak science–business ties, dependence on foreign capital, limited diversification, ESG barriers and low innovation, underscoring the need for further research on financing, sustainability and long-term effects. The purpose of this study was to explore the relationship between innovative activity and the financial performance of Kazakhstan's oil and gas enterprises. The main objectives of the study were: to analyse the dynamics of innovative activity in oil and gas enterprises and its relationship with key financial indicators; to identify factors that restrain or stimulate innovative processes; and to assess their impact on companies' efficiency.

Materials and Methods

This study was empirical in nature and covered the period 2020-2024. It determined the dynamics of oil and gas production in Kazakhstan during this period based on official reports and statistical materials (Kazakhstan produced 85.7 Mt of oil and..., 2021; Kazakhstan raises oil and gas..., 2023; Kazakhstan's Energy Ministry again lowers outlook..., 2024). The application of statistical analysis made it possible to trace changes in oil and natural gas production over a five-year period and link them to key production and institutional factors. The choice of timeframe was due to the need to cover the crisis phenomena of 2020, associated with the global oil price collapse and reduced demand for energy resources during the COVID-19 pandemic, the subsequent recovery phase, and the implementation of large-scale innovation projects in 2023-2024.

The financial part of the analysis was based on indicators of JSC NC KazMunayGas (n.d.), the largest integrated operator, which reflects the general trends in the industry. For this purpose, the company's official annual reports for 2020-2024 were used (Key 2021 financial results, 2022; JSC NC KazMunayGas announces..., 2024; JSC NC KazMunayGas announces..., 2025). The main indicators included revenue, net profit, Earnings Before Interest, Taxes, Depreciation and Amortisation (EBITDA), free cash flow, gross debt and net debt. Additionally, net profit margin and EBITDA margin were applied to assess profitability. This approach made it possible to examine the company's financial stability and operational efficiency under conditions of external volatility.

To characterise innovation activity, strategic documents and investment programmes of KazMunayGas were used, in particular Tengiz Effect – 2033 (2024) and the Future Growth Project – Wellhead Pressure Management Project (Tengizchevroil, n.d.b). Content analysis of corporate materials made it possible to identify the main areas of innovation expenditure and assess their role in the company's long-term development. Karachaganak Petroleum Operating's innovation investments in 2024 and planned programmes for 2023-2026 were also taken into account (Karachaganak Petroleum Operating, n.d.; Operator to invest over $1.7 bln..., 2023), which made it possible to analyse the scale of innovation expenditure by different operators. The analysis further included Kazakhstan's total oil and gas spending in 2024 (Kazakhstan to invest $15 billion in oil and gas..., 2025), which enabled a comparison of corporate and state innovation programmes. The study also incorporated an assessment of prospects for enhancing innovation activity and improving profitability in Kazakhstan's oil and gas sector, outlining strategic directions for future development. It took into account the provisions of

the roadmap for 2024-2030 (Kazakh Government approves 2024-2030..., 2024), strategic directions for the industry's development until 2040 (Kazakhstan Greenlights 2025-2040..., 2025), as well as documents aimed at human capital development (Mamyshev, 2025) and the environmental aspects of transformation (Decree of the President of the Republic of Kazakhstan No. 121, 2023).

Results and Discussion

Empirical analysis of the relationship between innovation processes and financial results

Between 2020 and 2024, Kazakhstan's oil and gas sector remained a fundamental pillar of the national economy, securing a substantial share of export revenues and contributing significantly to the state budget. Its role during this period was shaped not only by production volumes, but also by the growing need to integrate innovation as a response to external volatility and structural challenges. The sector faced global oil price shocks, pandemic-related disruptions and a subsequent recovery phase, while simultaneously launching large-scale modernisation and digitalisation projects. Figure 1 presents the dynamics of oil and gas production in Kazakhstan over the 2020-2024 periods, providing the basis for further empirical assessment of the link between innovation activity and financial performance.

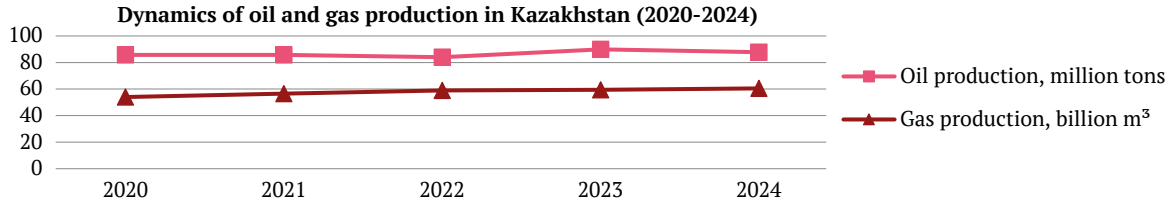

Figure 1. Dynamics of oil and gas production in Kazakhstan (2020-2024)
Source: compiled by author based on Kazakhstan produced 85.7 Mt of oil and condensate in 2020 (2021), Kazakhstan raises oil and gas condensate output by 7% in 2023 (2024), Kazakhstan's Energy Ministry again lowers outlook for domestic oil output in 2024 (2024)

Oil and condensate production volumes during this period fluctuated between 84 and 89.9 million tonnes per year, with the five-year total amounting to around 433.1 million tonnes. In 2020-2021, output was maintained at 85.7 million tonnes, but in 2022 it declined to 84 million tonnes (Kazakhstan produced 85.7 Mt of oil and..., 2021). By 2023, production had risen to 89.9 million tonnes, representing a 7% increase compared with the previous year, before easing slightly to 87.8 million tonnes in 2024. Natural gas production showed a steady upward trend, from 53-54 billion m^3 in 2020 to 60.5 billion m^3 in 2024, confirming the overall expansion of production capacities in the sector.

The largest contribution came from three key fields – Tengiz, Karachaganak and Kashagan. In 2024, Tengiz accounted for 27.8 million tonnes of oil, or 31.7% of national output. Despite temporary reductions caused by repair work, the completion of large-scale innovation projects – the Future Growth Project and the Wellhead Pressure Management Project – increased production capacity and enhanced stability. Karachaganak delivered around 12.4 million tonnes in 2024, representing a modest rise of 1.6%, while Kashagan lifted output to 17.9 million tonnes (+2.9% year-on-year). Both fields demonstrated relative stability, though they remained dependent on periodic repairs and technical modernisations (Mashaev, 2025). Overall, innovation and infrastructure projects played a decisive role in sustaining and expanding production. They not only supported the sector's competitiveness but also generated broader effects: over 90,000 jobs during construction, substantial orders for local enterprises and investment in related industries (Tengizchevroil Fact Sheet..., 2024). These large-scale production and innovation efforts were directly reflected in the financial performance of the leading national company, KazMunayGas, whose results captured both the benefits of modernisation and the challenges of external market volatility.

The financial results of JSC NC KazMunayGas (n.d.) in 2020-2024 reflect the complex impact of both external and internal factors. The dynamics of key indicators were shaped by fluctuations in global oil prices, macroeconomic conditions, investment programs of the company, and its ability to maintain stability in times of crisis. To summarise the trends in the company's financial performance, the main indicators are presented in Table 1.

Table 1. Financial indicators of JSC NC KazMunayGas in 2020-2024 (bln KZT)

Year	Revenue	Net profit	EBITDA	Free cash flow	Gross debt	Net debt
2020	3,625	172	810	50	4,078	2,594
2021	5,839	1,197	1,609	669	3,746	2,204
2022	8,693	1,307	2,536	1,116	4,154	2,154
2023	8,320	924	1,995	984	3,757	1,645
2024	8,330	1,094	2,001	1,199	3,967	1,163

Source: compiled by author based on Key 2021 financial results (2022), JSC NC KazMunayGas announces 2023 FY financial results (2024), JSC NC KazMunayGas announces 2024 FY financial results (2025)

Analysis of Table 1 shows that in 2020 the company experienced a sharp decline in performance due to the collapse of oil prices and reduced demand for energy resources, which resulted in minimal free cash flow and critically low net profit. By 2021, financial results had rebounded, with revenues and profits more than doubling, reflecting the recovery of global oil markets. The peak of the five-year period came in 2022, when both revenue and EBITDA reached their highest levels, supported by large-scale innovation investments in refining and petrochemicals. In 2023, however, falling oil prices and weaker contributions from joint ventures reduced profitability by almost one third. By 2024 the company managed to stabilise operations: revenues remained steady, net profit exceeded 1.04 trillion KZT, and net debt fell to its lowest level in five years, creating favourable conditions for financing further innovation and modernisation projects. Overall, the dynamics of financial indicators in 2020-2024 demonstrate that the company successfully overcame the 2020 crisis, adapted to volatile global markets and achieved gradual growth across most indicators. The implementation of innovation and capital projects strengthened its financial base and reduced debt pressure. At the same time, dependence on oil prices and fluctuations in profitability highlight the need for further diversification and enhanced innovation activity as the basis for long-term competitiveness. Table 2 highlights net profit margin and EBITDA margin as measures of operational efficiency.

Table 2. Profitability indicators of JSC NC KazMunayGas in 2020-2024

Year	Net profit margin (%)	EBITDA margin (%)
2020	4.74	22.34
2021	20.50	27.56
2022	15.04	29.17
2023	11.11	23.98
2024	13.13	24.02

Source: compiled by author based on Key 2021 financial results (2022), JSC NC KazMunayGas announces 2023 FY financial results (2024), JSC NC KazMunayGas announces 2024 FY financial results (2025)

Analysis of Table 2 shows that profitability indicators were highly sensitive to external volatility and internal efficiency measures. The lowest values were recorded in 2020, when the net profit margin fell to 4.74%, reflecting the company's inability to generate stable earnings under crisis conditions. In contrast, the peak was achieved in 2022, as the EBITDA margin exceeded 29.17%, confirming the highest level of operational efficiency during the five-year period. Although 2023 brought another contraction, by 2024 margins had stabilised above 24.02%, illustrating the company's capacity to restore efficiency through financial discipline and modernisation efforts.

Systematising the results of various studies shows that, regardless of the region or scale of analysis, the oil and gas sector has consistently been viewed as a key element of economic sustainability. For instance, D.F. Dongo & S. Relvas (2025) focused on the theoretical level, developing a universal framework of six dimensions of the energy transition and emphasising the need for innovation and modernisation to ensure sustainability. This conceptualisation echoed the empirical analysis of the Kazakhstani context, where the same factors were observed through specific financial indicators and investment programmes. A similar attention to innovation, though from a different angle, was evident in the work of Y. Alsuhaibany (2025), who examined the synergy between digital technologies and the circular economy in Saudi Arabia. Unlike the survey-based studies, he relied on quantitative data from manager questionnaires, enabling him to demonstrate empirically the positive impact of digitalisation and environmental practices on sectoral sustainability. In both Saudi Arabia and Kazakhstan, the findings converged in identifying diversification and technological innovation as prerequisites for long-term competitiveness.

The environmental dimension was prominent in the study by A.M. Jaffe *et al.* (2022), which analysed "green" innovations in BRICS state-owned companies. The authors showed that these entities lag behind private corporations in developing low-carbon technologies. Once again, the importance of innovation and modernisation was emphasised, although the Kazakh analysis focused more closely on financial outcomes. A completely different perspective was proposed by R. Moralista and E.M. Martir (2023), who examined how oil price fluctuations affected the profitability of small businesses in the Philippines. Their findings highlighted the vulnerability of small entrepreneurs and underscored the need for risk management tools. Despite differences in scale, the common denominator was recognition of the critical role of oil and gas for economic stability.

The issue was brought to the global level by N. Hajiyev *et al.* (2024), who developed financial strategies for leading international corporations, emphasising diversification and flexible budget management in volatile conditions. This echoed the Kazakh case in terms of the need to combine financial sustainability with innovative development, although the approaches differed: N. Hajiyev *et al.* used global models, while the Kazakh study analysed specific indicators of KazMunayGas. Similarly, K. Halttunen *et al*. (2023) adopted a strategic perspective, showing that large international companies had limited willingness to abandon fossil fuels and that their steps towards

renewable energy remained insufficient. As in other studies, this confirmed the necessity of diversification and modernisation, albeit in a broader strategic context, while the Kazakh case highlighted the link between innovation and financial efficiency.

Between 2020 and 2024, Kazakhstan's oil and gas sector retained its role as a key driver of the economy, providing a significant share of export earnings and budget revenues. Despite fluctuations in production volumes and dependence on external conditions, it was innovation and infrastructure projects that enabled stability and created the foundations for growth. Modernisation at the Tengiz, Karachaganak and Kashagan fields demonstrated that technological investment was vital not only for expanding output, but also for strengthening energy security and generating additional socio-economic effects.

The level of innovative activity of enterprises in the oil and gas sector of Kazakhstan

Kazakhstan's oil and gas sector is a key element of the national economy, forming the basis of export revenues and a significant share of budget receipts. However, the competitiveness and sustainability of companies are increasingly determined not only by production volumes, but also by their ability to implement modern innovative solutions. Between 2020 and 2024, the national company KazMunayGas demonstrated the most structured approach to financing innovation. The total volume of investments in technological projects amounted to about 250.8 billion tenge, of which approximately 98.2 billion tenge was directed to high-tech areas aimed at strengthening competitiveness. Notably, in 2024 alone, the company implemented more than 500 technological initiatives focused on optimising production processes and improving management practices. These included advanced seismic surveys, the introduction of new chemical compositions for monitoring reservoir characteristics, radial fracturing technologies, digital twins, artificial intelligence systems for data analysis, and measures to increase energy efficiency at oil refineries. The scale of innovation activity reflects the systemic nature of transformations at KazMunayGas, aimed not only at boosting production but also at enhancing technological maturity (Innovative technology…, 2024).

In this context, KazMunayGas' strategy deserves special attention, demonstrating its commitment to greater transparency and a clear strategic focus on high-tech areas. A significant USD 15 billion investment plan accelerated petrochemical development, including a steam cracker unit for the Atyrau complex and the construction of an USD 11 billion polyethylene plant. Plans were also announced to create a urea plant worth USD 1.2 billion and a polyethylene terephthalate (PET) plant to reduce import dependence. At the same time, innovation activity across the sector remains relatively low, necessitating reforms to improve the effectiveness of innovation expenditure. Potential areas include developing new accounting methods for innovation costs, raising transparency requirements in financial reporting, creating incentives for expanding research and development collaboration with universities and international partners, and prioritising product innovations with higher added value (Tengiz Effect – 2033…, 2024).

Despite these substantial total investments, the share of innovation expenditure in the company's overall cost structure remains low – approximately 1% of annual revenues. This meets regulatory requirements, which oblige extractive industry companies to allocate at least 1% to innovation and research and development. However, compared with global benchmarks, this remains modest: in OECD countries (OECD, n.d.), the share of investment in research and development (R&D) exceeds 2% of GDP, underlining the need to strengthen the financing of innovation in Kazakhstan's oil and gas sector. A key example of innovative investment is the Future Growth Project – Wellhead Pressure Management Project (FGP/WPMP) (Tengizchevroil, n.d.b), with a total investment of approximately USD 46.7 billion. The project aims to increase annual production at Tengizchevroil (n.d.a) (TCO) by 12 million tonnes, bringing output to 39 million tonnes per year. Its implementation relies on high-tech engineering solutions, including hydrogen sulphide injection technologies, modular equipment and modern drilling systems. FGP/WPMP is strategically important for Kazakhstan's oil and gas sector, reinforcing the country's position as a leading oil producer in the region. The project encountered a number of challenges at earlier stages, including delays and cost overruns, which highlighted the complexity of managing large-scale industrial initiatives in a changing global environment. Nevertheless, the expected outcomes – increased production, improved economic returns and a long-term impact on Kazakhstan's energy security strategy – make it a key driver of development. Recent developments confirm positive momentum: as of April 2024, TCO successfully began operation of WPMP facilities, including the transition of the first metering station to low pressure and the launch of the Pressure Boost Facility (PBF). This stage is critical for maintaining the full capacity of processing plants – about 28 million tonnes per year. The mechanism involves reducing wellhead pressure and subsequently increasing it to ensure stable operation of existing production lines. During 2024, additional PBF compressors are planned to be launched, with the gradual transition of the remaining metering stations (Tengiz Effect – 2033…, 2024).

A similar approach is used by KPO (Karachaganak Petroleum Operating, n.d.), which manages one of the largest gas condensate fields. The company integrates innovation expenditure into capital investment and operating costs rather than allocating it as a separate item. The main areas of KPO's innovation activity include reservoir management, enhanced oil recovery technologies, hydrogen sulphide processing systems and localisation of technologies to involve local contractors. In 2024, the company made significant investments in expansion and innovation projects. In particular, more than USD 970 million was invested in the first phase of the Karachaganak Expansion Project

(KEP-1A, 2021-2024), which involved the construction of the fifth injection compressor and other production facilities designed to ensure long-term production stability (KPO reports 2024 performance..., 2025). Additional investments of USD 735 million are planned for 2023-2026 for the construction of a sixth compressor and associated facilities, with total investment in the project expected to exceed USD 1.7 billion by 2027. In parallel, KPO is conducting a feasibility study for a new gas processing plant to increase output to 4 billion cubic metres and expand production of the propane-butane fraction. An important component of the company's innovation activity has been environmental projects. In 2024, a record gas utilisation level of 99.95% was achieved, while about USD 458.9 million was allocated to environmental initiatives, particularly improving energy efficiency and reducing methane emissions. In addition, advanced technologies and business processes are being introduced, aimed at the sustainable development of the field, with a strong focus on local content and the training of national personnel (Operator to invest over $1.7 bln..., 2023).

In 2024, Kazakhstan's oil and gas sector intensified investments in technological innovation, integrated into a broader USD 15 billion investment plan focused on developing the petrochemical industry. The primary goal of these investments is to increase the share of industrial products with high added value and reduce dependence on raw material exports. Among the most significant projects is the activity of Kazakhstan Petrochemical Industries Inc. (n.d.), which has operated a polypropylene production complex worth USD 2.6 billion since 2022 (Kazakhstan to Invest $15 Billion in Oil and Gas..., 2025). At the end of 2024, construction began on a new polyethylene plant with an investment of USD 7.4 billion, scheduled for completion in 2029. These projects are innovative in nature, relying on advanced hydrocarbon processing technologies and creating a domestic market for high-tech products. Innovation spending by individual companies is usually included in overall capital investment and rarely reported separately. According to available data, in 2024 total technological innovation spending within major fields and projects amounted to several million US dollars. On average, Kazakhstan's large oil and gas companies allocate about 1% or less of their annual revenues to innovation, which meets regulatory requirements but remains significantly below international standards. Investment conditions in 2024 were shaped by an average oil price of USD 75-85 per barrel and an exchange rate of around 460 tenge per US dollar. In such circumstances, large-scale projects in the oil and gas sector were valued in billions of dollars, with a substantial share including innovative components – advanced drilling technologies, well pressure management, digital solutions and environmental innovations (Investment potential – oil..., 2025). The analysis shows that although Kazakhstan's leading oil and gas companies – KazMunayGas, Tengizchevroil and Karachaganak – are making large-scale investments in technological projects, innovation activity remains insufficient by international standards. Key features include the low share of innovation expenditure in total costs, limited transparency in financial reporting and a predominant focus on process rather than product innovations. This underlines the need for a comprehensive review of financing and evaluation approaches to enhance the competitiveness of Kazakhstan's oil and gas enterprises in global markets.

The analysis also revealed parallels with international research. Both this study and the work of V. Grosu *et al.* (2023) interpreted the oil and gas sector as a crucial factor in economic stability. In both cases, the interaction between financial stability and innovative activity was emphasised as determining long-term competitiveness. V. Grosu *et al.* employed econometric methods to substantiate the relationship between financial indicators and innovation, highlighting liquidity, risk management and adaptability in crisis conditions. While their research focused on Romanian companies in 2008-2022, the Kazakhstani analysis placed greater emphasis on structural investment aspects. Similarly, comparison with the work of S. Sletten *et al.* (2023) revealed convergences and differences. Both studies agreed that modernisation and technological change are prerequisites for sustainability and competitiveness. However, in Norway the emphasis was on business model innovation as a driver of the "green" transition. Suppliers showed a readiness to adopt renewable energy, whereas extractive companies remained conservative due to the high profitability of traditional operations. In Kazakhstan, the emphasis was on large-scale modernisation projects, but innovation spending remained limited at about 1% of revenues – markedly below international benchmarks.

Further insights were provided by B. Zengin & G. Kurt (2024), who examined the Turkish context. In both Turkey and Kazakhstan, innovation was shown to have a positive impact on profitability, although the methodologies and contexts differed significantly. B. Zengin & G. Kurt (2024) studied 45 manufacturing companies listed on Borsa Istanbul, demonstrating that R&D, patents and intangible assets had a significant positive effect on return on assets. By contrast, in Kazakhstan, the focus was on large oil and gas corporations, where innovation spending remained minimal and transparency low, despite the scale of investment programmes. Comparison with R.K. Perrons *et al.* (2024) broadened the perspective further. Both studies confirmed that innovation is a key factor in the resilience of the oil and gas sector to global challenges. However, the approaches diverged: R.K. Perrons *et al.* analysed individual employee behaviour, distinguishing between "researchers" and "exploiters" of innovation, and highlighted the role of education and organisational culture. The Kazakh study, by contrast, concentrated on the macro level – investment flows and strategic projects. This contrast underlines the multidimensional nature of the issue: efficiency depends both on corporate-level resource management and on the innovative behaviour of individual specialists.

Thus, Kazakhstan's oil and gas sector has demonstrated increased investment in technological projects and production modernisation, which represents an important step towards greater sustainability. At the same time, the share of innovation expenditure within revenue structures remains low, pointing to the need to strengthen financing mechanisms and improve the efficiency of innovation activities.

Perspectives for enhancing innovation activity and improving profitability in Kazakhstan's oil and gas sector

Kazakhstan's oil and gas sector remains the main driver of the country's economic development, providing more than half of export revenues and making a significant contribution to the state budget. At the same time, dependence on raw material exports and fluctuations in global energy prices create risks to financial stability. For this reason, the integration of innovation into production processes and the development of petrochemicals have become central priorities of national policy for the coming decade. In 2024, the government approved a comprehensive innovation strategy and roadmap for the oil and gas sector, covering the period from 2025 onwards and setting out systemic tasks for modernisation, digital transformation, enhanced environmental sustainability and export diversification. The key targets of this strategy include increasing the depth of oil refining to 94%, expanding refinery capacity from the current 18 to 39 million tonnes per year by 2040, and raising the share of exports of high value-added products to 30% of total production. Another benchmark is to expand supplies to China, India and Central Asian countries, in line with shifting geo-economic flows in the region. A further priority is the integration of ESG (Environmental, Social and Governance) principles to ensure compliance with international sustainable development standards, including emission reduction, reduced gas flaring and improved energy efficiency (Kazakhstan Greenlights 2025-2040…, 2025).

One of the main areas is the large-scale digitalisation of production processes. Research by G. Saktaganova *et al.* (2025) highlighted that digital transformation plays a decisive role in enhancing competitiveness and innovation capacity in Kazakhstan's industries, particularly in the context of global integration. Pilot projects for the digitalisation of oil refineries will be launched in 2025, involving artificial intelligence technologies, digital twins, predictive maintenance systems and automated monitoring. These solutions are expected to reduce production costs, shorten the time needed to detect emergencies, increase management transparency and ensure rapid responses to market fluctuations. Innovative practices are also being introduced in the upstream segment. Projects employing Internet of Things (IoT) sensors, digital modelling and enhanced oil recovery (EOR) methods are already in operation at major fields such as Tengiz, Karachaganak and Kashagan. These include CO_2 injection and polymer solutions, which make it possible to increase hydrocarbon recovery from ageing reservoirs. At the same time, the use of unmanned aerial vehicles to monitor pipelines and facilities, as well as robotic systems employing acoustic resonance to diagnose internal pipeline conditions, is becoming more widespread (Sitmagambetov, 2025).

The second strategic vector is the strengthening of petrochemicals, aimed at reducing reliance on crude oil exports and creating new domestic value-added chains. The 2024-2030 Roadmap envisages an increase in petrochemical output from 357.8 thousand tonnes in 2023 to 1.8 million tonnes in 2030. To this end, six large-scale projects are being implemented with total investment of USD 14.7-15 billion. Their implementation is expected to create about 3,500 permanent and 16,000 temporary jobs (Kazakh Government approves 2024-2030…, 2024). These projects involve expanding the production of polypropylene, polyethylene, methanol, ammonia, urea, synthetic rubber, PET and paraxylene. A central role in this process is played by the National Petrochemical Technopark in Atyrau, being developed as a key industrial cluster for attracting foreign and domestic investment. The planned production volumes could significantly reshape the export structure by increasing the share of high value-added products. Special attention is also given to gas processing. The comprehensive plan for the development of the gas industry for 2025-2029 includes the construction of four new plants in Zhanaozen, Kashagan and Karachaganak. These facilities are intended to raise gas processing capacity to meet domestic demand and provide a stable base for petrochemicals. By 2030, gas production is expected to reach 74 billion cubic metres. Parallel efforts are planned in gas transportation and storage infrastructure to reinforce the country's energy security (Kazakhstan's new gas & petrochemical projects…, 2025).

Human capital development is a determining factor for the success of the innovation strategy. In conditions of rapid technological progress, a new generation of specialists – so-called "hybrid professionals" combining expertise in operational management with digital technologies – is required. The government has prioritised the creation of a training system based on partnerships with universities, research centres and international companies, enabling the integration of local expertise with global innovation management practices. To stimulate innovation, new R&D financing mechanisms are being introduced. These include mandatory deductions of 1% of hydrocarbon production costs or investment to the state budget, directed to centralised funding of scientific research and development. This reform is intended to address shortcomings of the previous system, where companies formally complied with requirements but innovation returns remained low. Additional tax incentives are also envisaged, including a 100% deduction for modernisation, equipment and software expenditure, as well as a zero production tax for new low-profit fields in the first five years. Such measures are designed not only to support innovation activity but also

to attract foreign investment and encourage technology transfer (Mamyshev, 2025).

Environmental aspects occupy a special place in the strategy. Kazakhstan seeks to reduce the carbon footprint of the oil and gas sector by introducing emission reduction technologies, improving waste disposal systems and tightening controls on gas flaring. The implementation of these measures is expected not only to meet the requirements of international partners but also to ensure integration into global energy value chains, where environmental responsibility is becoming increasingly critical. Thus, the innovative development of Kazakhstan's oil and gas sector in 2025-2030 will be based on large-scale investments in modernisation and petrochemicals, digital transformation and artificial intelligence, reform of the R&D system and the development of local engineering capacity. Combined with the integration of ESG principles and a gradual transition to a low-carbon economy, these efforts are expected to enhance enterprise profitability, strengthen competitiveness and consolidate Kazakhstan's position as a regional leader in the energy sector. The strategy reflects the state's ambition to combine economic growth with sustainable development objectives and adapt to the global challenges of the energy transition (Decree of the President of the Republic of Kazakhstan No. 121, 2023).

Comparison with international studies showed that the financial sustainability of the oil and gas sector is determined not only by production volumes, but also by management efficiency and the level of innovative activity. For example, M.N. Huda & M.A. Sabur (2025) demonstrated that the profitability of gas distribution companies in Bangladesh depended on liquidity and asset turnover, while excessive receivables reduced financial results. A similar conclusion was reached in research on the prospects of Kazakhstan's oil and gas sector, which highlighted innovation and modernisation as prerequisites for sustainable growth. Comparable findings were observed in the study by R. Herman *et al.* (2023), which revealed that rising energy prices in the EU reduced company profitability and heightened risks of financial instability. In this context, modernisation and the adoption of new technologies were recognised as necessary to maintain competitiveness. H.A. Abdou *et al.* (2024) likewise confirmed the dependence of financial stability on oil prices, showing that fluctuations significantly affected the Saudi Arabian stock market. For Kazakhstan, the long-term implication is the need for diversification and reduced vulnerability to external shocks.

Further evidence was provided by G.T.H. Vuong *et al.* (2024), who showed that global oil price volatility and China's 2013 pricing reform negatively affected company profitability, particularly among smaller firms. This reinforced the general thesis: the prospects for oil and gas sector development depend on the ability to adapt to global changes through innovation and infrastructure projects. S.G. Buana (2025) drew attention to corporate tax behaviour in Indonesia, which was shaped by CEO characteristics, underlining the importance of management quality. For Kazakhstan, strengthening innovation and investment activity emerged as a decisive factor. A similar approach was also evident in the work of Y. Wang (2023), where profitability was assessed through financial ratios. In both that study and the Kazakh case, the conclusion was the same: only the combination of financial discipline with innovative development can secure long-term sustainability.

Summarising the results of the analysis, it can be concluded that Kazakhstan's oil and gas sector remains the leading driver of economic development, but its future sustainability depends on profound modernisation and the implementation of innovative solutions. The strategic documents approved for 2025-2040 identify priorities such as the digitalisation of production, development of petrochemicals, expansion of processing capacities, integration of ESG principles and the active development of human capital. Together, these measures should raise the share of high value-added products, reduce dependence on raw material exports and strengthen national energy security.

Conclusions

The findings of the study show that Kazakhstan's oil and gas sector remains a key driver of the economy, generating more than half of export revenues and a significant share of the state budget. Its sustainability depends not only on production volumes but also on the integration of innovation. Between 2020 and 2024, oil output ranged from 84 to 89.9 million tonnes per year (a total of 433.1 million tonnes), while gas production increased from 53-54 to 60.5 billion m^3, confirming the expansion of capacity, particularly in the gas segment. Three main fields dominated – Tengiz (27.8 million tonnes in 2024, or 31.7%), Karachaganak (12.4 million tonnes) and Kashagan (17.9 million tonnes) – where innovation contributed to greater stability and productivity. The financial results of JSC KazMunayGas reflected both the effects of innovation and market volatility. In 2020, revenue was 3,625 billion tenge with a net profit of only 172 billion (profitability 4.7%). By 2022, revenue had peaked at 8,693 billion and profit reached 1,307 billion. Despite a downturn in 2023, by 2024 net profit amounted to 1,094 billion, free cash flow 1,199 billion, and net debt fell to 1,163 billion – the lowest level in five years, confirming stronger financial stability.

Total investment in technological projects exceeded 250.8 billion tenge, including 98.2 billion in high-tech areas. In 2024 alone, more than 500 initiatives were launched, including digital twins, artificial intelligence systems, seismic exploration and hydraulic fracturing technologies. Looking ahead, priorities are modernisation and diversification, with the 2024 strategy to 2040 aiming to increase the depth of oil refining to 94%, expand refinery capacity from 18 to 39 million tonnes, and raise the share of high value-added exports to 30%. A limitation of this study is that it focused on the largest companies in the sector and did not examine in detail the performance of medium-sized and smaller enterprises. Future research should extend the analysis of Kazakhstan's oil and gas industry to include the

effects of digitalisation, ESG practices and petrochemical development on long-term profitability and sustainability.

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Дослідження взаємозв'язку між рівнем інноваційної активності та рентабельністю підприємств нафтогазового сектору Казахстану

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Анотація. Метою цього дослідження було оцінити, як інноваційна діяльність впливає на фінансові результати підприємств нафтогазового сектору Казахстану. Дослідження мало емпіричний характер і охоплювало період 2020-2024 років, базуючись на офіційній фінансовій звітності Акціонерного товариства «КазМунайГаз» та корпоративних документах щодо інноваційних програм. Методологія поєднувала статистичний аналіз обсягів виробництва та фінансової динаміки з контент-аналізом стратегічних проєктів. Результати показали, що видобуток нафти коливався у межах 84-89,9 млн тонн, усього – 433,1 млн тонн, тоді як видобуток газу зріс із 53-54 до 60,5 млрд м³. У 2024 році родовища Тенгіз, Карачаганак і Кашаган забезпечили понад 60 % національного видобутку (27,8; 12,4 та 17,9 млн тонн відповідно). Фінансові показники відображали як вплив інновацій, так і ринкову волатильність: у 2020 році чистий прибуток становив лише 172 млрд тенге при виручці 3 625 млрд, тоді як у 2022 році прибуток досяг максимуму – 1 307 млрд тенге, а виручка – 8 693 млрд. До 2024 року чистий прибуток становив 1 094 млрд тенге, вільний грошовий потік – 1 199 млрд, а чистий борг знизився до 1 163 млрд – найнижчого рівня за п'ять років. Інвестиції в технологічні проєкти перевищили 250,8 млрд тенге, з яких 98,2 млрд було спрямовано на високотехнологічні напрями. У 2024 році реалізовано понад 500 ініціатив, включно з цифровими двійниками та системами штучного інтелекту. Результати цього дослідження можуть бути використані для розроблення ефективної стратегії інноваційного розвитку нафтогазових підприємств Казахстану з метою підвищення їхньої фінансової стійкості та конкурентоспроможності

Ключові слова: стратегії; дохід; інвестиції; конкурентоспроможність; ефективність

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Development and stimulation of innovative activity among company staff in the context of the digital era

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Abstract. The study aimed to analyse contemporary approaches to defining the essence of staff innovation activity, to reveal its significance in the context of digital transformations, and to substantiate the concept of developing staff innovation activity in the digital age. The article presented a comprehensive theoretical analysis of staff innovation activity as a key factor in ensuring the competitiveness of modern organisations. It examined the evolution of scientific approaches to interpreting the nature of innovation activity, its structural components and motivational determinants. The multidimensional nature of staff innovation activity was examined, emphasising that it was shaped by a complex set of factors encompassing motivational-psychological, organisational-managerial, technological and socio-cultural aspects. A substantial aspect of the article was the examination of the role of digitalisation in the transformation of HR processes and the management of innovative activity. The study noted that the success of digital transformation depends on a holistic approach that incorporates organisational characteristics, staff readiness for change, and effective risk management. The need for comprehensive management of innovation activity was emphasised, which should be based on the integration of various management practices and tools. To this end, companies should employ a diverse range of incentives (training, delegation of authority, recognition of achievements), as well as standardised methods for evaluating employees' innovative activities. The study proposed that innovative activity be viewed not as a separate process, but as a multifaceted system involving the interaction of psychological drivers, organisational practices, leadership and reward systems. Experience in managing innovative activity in the context of digital transformation was summarised. Proposals were formulated to improve the organisational and economic mechanisms for stimulating employees' innovative behaviour. The impact of digitalisation on stimulating the innovative activity of company staff has been analysed. Key technological and organisational tools of digitalisation were identified, which ensure effective motivation and support for staff innovation. The integration of digital tools into the human resources management system was proposed to develop and stimulate staff innovation, foster an innovation culture, and enhance the competitiveness of companies in the current environment

Keywords: human resource management; employee motivation; creativity; innovative organisational culture; human capital; digitalisation

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Introduction

Since the beginning of 2022, Ukraine has been facing challenging geopolitical, economic and social conditions caused by full-scale military aggression from the Russian Federation, resulting not only in significant losses of human resources and economic potential, but also in prolonged economic destabilisation and strategic uncertainty. Such conditions naturally reduce business motivation for development, meaning that the introduction of innovative technologies is often perceived as an overly risky or unattainable prospect. In such circumstances, the ability of companies to recover and adapt quickly becomes critical, and this depends directly on the innovative activity of staff and their potential. At the same time, the intensification of global digitalisation and competition demands new approaches to the development of human capital as a key resource for resilience, making the development of internal mechanisms to encourage innovative behaviour among employees a strategically relevant task for ensuring future economic progress.

The issue of encouraging innovative behaviour among staff in the context of technological change is being actively researched by academics. In particular, E. Autio *et al.* (2017) investigated spatial and digital opportunities for the development of entrepreneurial ecosystems. However, their work is largely focused on the macro level and the start-up environment, leaving aside the internal organisational mechanisms for motivating employees in traditional companies. The psychological aspects were addressed by H. Wang *et al.* (2022) in an analysis of innovative behaviour through the prism of leadership support and well-being in the workplace. However, this work does not take into account the specifics of digital transformation, which is radically changing the nature of communication and interaction within teams. For their part, P. Wang & Y. Hou (2023) studied the impact of employees' organisational commitment on their innovative activity over time. Despite the depth of the analysis, the influence of external extreme factors (economic or geopolitical instability) on staff's ability to generate innovation remains under-researched.

The role of management practices was examined by S. Guha *et al.* (2025), demonstrating the positive impact of human resource management (HRM) systems on innovative capabilities through knowledge sharing. At the same time, their study provided only a limited analysis of the inhibiting effect of mental barriers inherent among staff in enterprises within transition economies. S. Samuelson *et al.* (2024) examined contemporary practical experience by analysing employee-driven innovation. Despite their empirical value, their findings are based on relatively stable sectors of the economy and require significant adaptation to the conditions of Ukrainian companies in a state of crisis.

The significance of network interaction was highlighted by G. Vaccario *et al.* (2022), who predicted the outcomes of innovation based on research and development (R&D) networks. However, their analysis focuses primarily on patent statistics rather than on the day-to-day innovation routine and the motivation of ordinary company staff. The fundamental principles of creating a creative environment and accumulating the intellectual assets of human potential were explored by A. Karpenko (2018), who demonstrated that humans are the only productive factor capable of creativity. However, the current intensification of global digitalisation and the emergence of unprecedented crisis conditions require the further development of these theories directly at the micro-level.

Thus, the unresolved aspect of the problem, which has become the central focus of this study, remains the development of comprehensive models for stimulating staff innovation directly at the company level. Existing approaches require adaptation to the internal organisational realities of enterprises (particularly small and medium-sized businesses), considering the impact of external destabilisation, local socio-cultural barriers and the latest demands of the digital age. The study aimed to provide a theoretical justification and develop practical recommendations for the formation of internal organisational mechanisms to stimulate the innovative activity of company staff, which effectively integrate the development of employees' intellectual assets with the opportunities of the local business environment in the context of digital transformation and crisis-induced destabilisation.

Materials and Methods

The study employed a range of general and specialised research methods, ensuring a systematic approach to analysing the characteristics of the development and promotion of staff innovation activity within the context of digital transformation. Methods of analysis and synthesis were used to examine contemporary theoretical approaches and practices in managing innovation activity, as well as to systematise the findings of previous research. Within the scope of the work, the meaning of the basic concept of "staff innovation activity" was clarified using linguistic analysis tools, in particular morphological and semantic analysis. This made it possible to establish the deeper essence of this category, determine its polysemy and interdisciplinary connotations, and trace its evolution in contemporary scientific discourse. The method of abstraction was used to identify general principles for creating incentives for innovative activity, which can be flexibly adapted to different organisational contexts. At the same time, the formal-logical method was used to construct the general structure of the study, formulate reasoned conclusions and clearly outline the cause-and-effect relationships between external factors, digitalisation and the level of innovation among employees.

Based on these principles, the comparative analysis method formed the basis for systematising the determinants influencing employees. The comparison of approaches to classifying factors of innovative activity was conducted based on three key criteria (levels): 1) personal (individual) – analysis of internal (intrinsic) motives and socio-psychological traits; 2) organisational – assessment of the influence of internal company structures and the

corporate environment; 3) general (universal) – consideration of broad external socio-economic factors (Scott & Bruce, 1994; Amabile, 1996; Kesting & Ulhøi, 2010). This structuring distinguished between an individual's psychological motives and the influence of the business environment.

The structural-functional analysis method was used to identify specific tools for managing creative potential. The assessment of organisational motivation mechanisms was conducted across five key areas: 1) support for autonomy (delegation and allocation of time for experimentation); 2) competence development (investment in cross-functional skills); 3) psychological safety (tolerance for mistakes); 4) resource provision (access to budgets and technologies); 5) digital HR systems (integration of ideation platforms). The methodological basis for this stage was provided by self-determination theory and research into the psychological climate within teams.

To operationalise the categories under investigation, the content analysis method of classical psychometric techniques was applied. The selection and classification of motivational components of innovative behaviour were based on three dimensions: 1) person-oriented (intrinsic motivation, creative self-efficacy, initiative); 2) organisation-oriented (affective commitment, perceived managerial support); 3) situation-oriented (readiness for risk and uncertainty). Inductive and deductive tools were used to develop a matrix for the implementation of the latest digital technologies (IoT, cloud computing, artificial intelligence, knowledge management systems) and to assess their impact on internal HR mechanisms. The analysis was conducted in accordance with international standards for the collection of data on innovation.

In addition, to establish a solid empirical basis, a method was employed to systematise scientific literature and analytical reports covering the period 2018-2024. Sources were selected based on three criteria: 1) relevance – recent publications were prioritised; 2) authority – inclusion of works by recognised researchers; 3) practical significance – an emphasis on empirical studies and business cases. The synthesis of the theoretical and comparative data obtained can be used for the development of a comprehensive, scientifically grounded model for stimulating staff innovation.

Results and Discussion

It is necessary to examine the category of "staff innovation activity" systematically, exploring its various aspects and all its components. From a grammatical point of view, the category is a phrase comprising the adjective "innovative", the noun "activity" and the genitive form of the determiner "staff". Morphologically, the adjective "innovative" indicates a specific feature of activity, the noun "activity" denotes behavioural dynamics, whilst "staff" identifies the subject of the action. In other words, this category is morphologically composed of a qualitative characteristic of activity (innovative), the core of the action or state (activity), and the subject, the bearer of the activity (staff). This category is used to denote the aggregate actions, initiatives and behavioural patterns of employees aimed at creating, introducing or sustaining innovation within the organisation, and thus serves as a key indicator of the organisation's innovative potential in a changing environment.

From a semantic perspective, the concept of "staff innovation activity" is interpreted as the systematic internal and external readiness and ability of employees to generate, perceive and implement innovations within the organisation. The category is a multi-component semantic construct that combines categories from various levels of organisational, behavioural and managerial vocabulary. The emphasis is placed on the integration of individual potential, organisational climate, motivational factors and digital tools that stimulate innovative behaviour (Mumford & Licuanan, 2004). In other words, it reflects the integration of employees' innovative potential, motivational readiness and organisational behaviour in the process of developing, implementing or sustaining innovations.

In general, morphological analysis can be used to determine the structural organisation of a term and its internal logic, whilst semantic analysis reveals its system of meanings and usage paradigm. Taken together, these methods provide a comprehensive definition of the category, which can be adapted to the specific nature of empirical analysis of innovation activity. Thus, morphological analysis of the category "staff innovation activity" viewed it as a complex lexical construction combining three key elements: a feature (innovative), an action or state (activity) of a subject (staff). In turn, the semantic field of the concept encompasses content domains related to creativity, change and initiative, which are substantial for both organisational psychology and innovation management. Thus, the structural-semantic approach is substantial for refining the research parameters of the category.

The concept of "innovative activity" is interpreted in various ways by academics and practitioners. Traditionally, it is perceived by many in a broad sense and largely as a characteristic of companies' activities – innovative activity – and is also closely linked to the concepts of "innovative potential", "innovative climate" and "innovative process", forming a system of innovative development for an organisation or a specific local level. It is interpreted as a company's focus on achieving strategic development goals, aimed at ensuring stable operation and long-term success (Kharchenko, 2016). In academic discourse, a company's innovative activity is characterised by its participation in various types of activities that generate or implement innovations. According to the OECD (2018), this activity encompasses R&D, engineering and design, marketing, innovation management and staff training. At the same time, the OECD has also provided a clear analytical approach, distinguishing between innovation as a process and as an outcome – a product or business process involving significant changes in a firm's operations.

The innovative activity of companies contributes to their higher productivity. Empirical research by G. Verdier *et al.* (2010) has shown that companies which actively

introduce new products or technologies demonstrate higher productivity, particularly in financially developed economies. Furthermore, an analysis of network embeddedness conducted by G. Vaccario *et al.* (2022) revealed a close link between a company's position within an R&D network and its capacity for innovation. The intensity of research and development, reflected in the ratio of R&D expenditure to sales in Eurostat (n.d.), serves as an additional marker of companies' innovative activity. Thus, companies' innovation activity is typically assessed using indicators such as R&D intensity, the share of innovative products in total sales, the frequency of new technology adoption, and so on (Eurostat, n.d.; OECD, 2023).

Innovative activity is a key economic concept that characterises a company's level of management and encompasses aspects such as the strategic quality of innovations, the mobilisation of internal potential, the level of investment, organisational culture, and the methodological soundness of implementing innovative changes. It serves as a critical link between the analysis of the internal and external environments, goal-setting and strategic planning, encompassing innovation in products, processes and R&D activities (Karpenko, 2018). In other words, innovation activity can be viewed as the link between the stages of analysing the internal and external environments, formulating objectives and planning strategies. Its scope covers three key areas: innovation in production processes aimed at creating new types of products; innovation in the product and service portfolio, involving the modernisation or creation of new goods, the performance of work or the provision of services; innovation in R&D, which ensures the generation of new knowledge and technological solutions. At the same time, innovative activity extends to all participants in the innovation process – consumers of innovative products, innovative manufacturers and investors – and reflects the level of receptiveness to innovations, the intensity and timeliness of actions regarding their implementation, the ability to mobilise the necessary potential, the soundness of the methods applied, and the rationality of the innovation process technology in terms of the composition and sequence of operations. It also reflects a readiness to update key elements of the innovation system – knowledge, technological infrastructure, information and communication technologies, organisational structure and culture – and an openness to new ideas.

Since people are the primary agents and driving force behind any innovative activity, a company's innovative activity is inextricably linked to the innovative activity of its staff. Employees generate ideas, create new products and technologies, implement changes, and ensure their adaptation to market conditions. Therefore, according to A.V. Karpenko (2018), staff innovation activity can be regarded as a specific manifestation of overall innovation activity, reflecting the level of participation of researchers, inventors and entrepreneurs in the implementation of innovation processes within a defined period. Contemporary research has demonstrated that the primary catalyst for companies' innovative activity is their staff, specifically their innovative behaviour. H. Wang *et al.* (2022) have demonstrated that employee innovative behaviour, which involves the generation, promotion and implementation of innovative ideas in day-to-day work, forms the foundation of an organisation's innovative outcomes.

Furthermore, as part of the concept of employee-driven innovation, which emphasises the importance of staff involvement in the creation and implementation of new ideas, regardless of their formal role within the company's structure. The study also noted that employees, even those for whom innovation is not part of their official duties, are active in shaping new approaches and processes within the organisation. S. Høyrup *et al.* (2012) analyse the organisational conditions, leadership approaches and cultural factors that stimulate innovative behaviour, and propose methods for integrating "bottom-up" initiatives into the organisation's strategic development. This highlights that innovation often arises not only at the strategic level, but also through employee initiatives at the micro-practice level. S. Samuelson *et al.* (2024) addressed experiences of communication, team interaction and leadership in such initiatives, as well as factors that facilitate or hinder the successful implementation of changes in work processes. Thus, research shows that innovation often arises not only at the strategic level, but also through employee initiatives at the micro-practice level; in other words, employees can be key drivers of innovation if the organisational culture encourages their initiative and supports shared values.

The innovative activity of staff drives a company's innovative activity, forming the basis for the organisation's innovative potential. As noted by M. Kesting & J. Ulhøi (2010), innovations often arise not only as a result of centralised strategic decisions, but also as a consequence of the initiative of individual employees at all levels of the organisational hierarchy – so-called employee-driven innovations. Thus, the innovative activity of staff can be regarded as the primary level of manifestation of innovative dynamics, which accumulates, transforms and scales within the organisation. Consequently, the study of this phenomenon is critical for interpretation of the sources of companies' innovative capacity.

Staff innovation is an interdisciplinary phenomenon situated at the intersection of labour economics, innovation management, organisational sociology and digital technologies. In this context, the theoretical and methodological basis of the study draws on the following main approaches: institutional, resource-competence, systemic, motivational-behavioural, and ecosystemic. According to D.C. North (1990), institutions are formal rules, informal norms and mechanisms for their enforcement, which structure interaction within society. Therefore, from an institutionalist perspective, staff innovation activity is defined as the result of the influence of normative, cultural and organisational structures that shape an environment conducive to or restrictive of employees' innovative behaviour. In other words, both internal organisational institutions

(HR policies, management models, organisational climate, etc.) and external ones (government policy, the regulatory framework, local traditions, etc.) are substantial.

Within the resource-competence approach, J. Barney (1991) and R.M. Grant (1996) viewed innovative activity as a function of access to unique resources and the ability of staff to transform knowledge into innovative outcomes. Staff competencies, organisational learning, access to digital tools, and cross-functional interaction are all regarded as sources of sustainable competitive advantage. In the systems approach, innovative activity is viewed as the result of the interaction of subsystems: the individual, the organisation, the market, and the innovation value chain. This approach is characteristic of the study by B.Å. Lundvall (1992) and C. Edquist (1997) studied national and regional innovation systems. The motivational-behavioural approach suggests that staff motivation for innovation depends to a large extent on internal (interest, self-actualisation) and external incentives (remuneration, recognition, career progression). A key model is the self-determination theory (Deci & Ryan, 1985), according to which innovative behaviour is shaped by the presence of autonomy, competence and social relatedness.

A substantial contemporary approach to fostering innovation and innovative activity is the ecosystem approach, which emphasises the role of innovation ecosystems – complex networks of interaction between businesses, universities, the state and civil society organisations (Adner, 2006; Autio *et al.*, 2017). Key elements include the cultural environment, knowledge platforms, supporting infrastructure, and so on. Furthermore, over the last 5-10 years, "digital transformation" has increasingly been used as a framework or analytical perspective in management, HR, economics and public administration. In other words, a profound transformation of the nature of work, communication tools and decision-making processes is driven by digital changes. According to the approaches of G.C. Kane *et al.* (2015), digital transformation is not merely the implementation of technologies, but also a shift in mindset and corporate culture. It can therefore be stated that the theory of digital transformation has a significant influence on the formation and development of staff innovation.

At the same time, in the context of the digital economy, the effectiveness of human resources management is becoming increasingly relevant. Strategic HR practices, such as talent selection, training, performance appraisal and reward systems, directly contribute to the development of individual innovative activity (Jiménez-Jiménez & Sanz-Valle, 2005; Agarwal *et al.*, 2012; Guha *et al.*, 2025). Furthermore, a high level of affective commitment enhances an employee's potential and motivation to implement innovations, particularly in the context of the digitalisation of HR systems (Popa *et al.*, 2017; Wang & Hou, 2023). In particular, S. Popa *et al.* studied the impact of HR practices on the innovation climate and open innovation using a sample of Spanish Small and Medium-sized Enterprises and found that engagement-based management practices enhance the innovation climate, which, in turn, promotes both internal and external innovation. The dynamism of the external environment amplifies the positive impact of an active innovation climate on output innovation. P. Wang & Y. Hou (2023) found that affective commitment (employees' emotional attachment to the organisation) enhances their readiness for innovative behaviour. The time-lagged design they developed – in which data was collected in several waves at different times to test causal relationships – revealed a correlation: the stronger an employee's commitment, the more they initiate and implement innovations, particularly when HR systems are digital and adapted to modern ways of working.

Staff innovation can be interpreted as a socio-cognitive process that encompasses the perception of innovations, the intensity of actions involved in transformation, the ability to mobilise knowledge and resources, and adaptation in the form of implementing innovations. As emphasised in the multi-level approach to organisational climate, corporate values and norms that stimulate creativity and innovation are essential prerequisites for the development of innovative behaviour among employees. The concept of innovative activity originates in the works of J.A. Schumpeter (1934), who linked innovation to a new combination of factors of production. J.A. Schumpeter was the first to substantiate the role of innovation as a driver of economic development, emphasising the significance of the "new combination of factors" in the economy. In this context, employees' innovative activity is an element of "new entrepreneurship". Further development of the concept can be traced in studies of P.F. Drucker (1985), where innovation is viewed as a specific tool of entrepreneurship. P.F. Drucker regarded innovation as a "specific tool of entrepreneurship", and the employee as a source of ideas for changes in products, services or processes.

Based on the findings of the authors mentioned above, it can be noted that staff innovation activity refers to the motivated behaviour of employees aimed at initiating, developing and implementing innovations within an organisation. It is a component of the broader concept of "innovative activity", which also encompasses technological, managerial and social innovations.

The multifaceted nature of the category "staff innovation activity" is revealed through its three key components: idea generation – the creative search for new solutions; idea dissemination – the communication of innovative proposals within the organisation; and implementation – the putting of innovations into practice (Scott & Bruce, 1994; Amabile, 1996; Janssen, 2000). The "Frascati Manual" (OECD, 2015), which stipulates standardised approaches to classifying types of research, measuring investment in science and defining the role of human resources in research activities, emphasises the significant importance of researchers, engineers and other specialists involved in the creation and implementation of new knowledge and technologies. According to this methodology, the effectiveness of innovation largely depends on the competencies,

creativity and level of engagement of employees in research and development processes. Indicators reflecting staff involvement in generating new ideas, developing innovative solutions and integrating research results into production and organisational processes were addressed. In other words, it is possible to note that innovative activity is activity related to the transformation of ideas (the results of research and development) into a new or improved product, process or approach that is introduced to the market or into practical activities.

The "Oslo Manual" (OECD, 2018) is a key international methodological document that sets standards for the collection, processing and interpretation of data on innovation activity. It defines innovation as the introduction of a new or significantly improved product, process, marketing or organisational method, and provides tools for measuring innovation activity at both the enterprise level and across the economy as a whole. In the context of researching staff innovation activity, the "Oslo Manual" emphasises the importance of human capital as a source of new ideas and a driving force behind innovation processes, and offers a conceptual framework that can be used for the assessment not only of the results of innovation, but also of the processes that ensure their emergence and implementation, including organisational culture, resources and environment. The document notes that innovations often arise thanks to employees' initiatives, their capacity for creative thinking, interdisciplinary collaboration and commitment to improving internal processes; therefore, it is necessary to assess staff innovation efforts, including participation in solution development, knowledge sharing and teamwork, which contribute to the creation of new value.

In the context of a post-industrial economy, staff innovation is increasingly seen not merely as an outcome but as a driving force behind organisational change. It is a key factor in the competitiveness of modern organisations and determines a company's ability to adapt, develop technologically and make effective use of its employees' intellectual potential. The rapid pace of technological development, the instability of the market environment and the growing importance of human capital highlight the need to foster a propensity for innovative thinking and a readiness to implement innovations among employees. It is necessary to determine the mechanisms that encourage staff to participate in innovative processes and to create an effective incentive system.

Motivation is central in shaping an individual's innovative activity, as it is internal stimuli that drive a person to seek new ideas, unconventional solutions and improvements to existing processes. It is the driving force that determines the level of interest, perseverance and creativity. From a psychological perspective, motivation is divided into intrinsic motivation, which is based on personal satisfaction from the work process, and extrinsic motivation, which is linked to rewards, recognition or career progression.

Studies of innovative activity often identify two main groups of factors: internal (personal) and external (organisational, social). Since a person is a socio-psycho-physiological entity, reflecting the integrity of their existence as biological (the fundamental biological basis supporting vital functions and the capacity for adaptation), psychological (a person's inner world, which includes motivation, emotions, cognitive processes and self-awareness) and socio-cultural (the capacity for communication, cooperation, and the formation of social institutions and cultural traditions that define a person's social identity) systems, it integrates physiological needs and processes, mental states and mechanisms, as well as social roles, norms and values, which are formed in the process of interaction with the environment and is manifested in the individual's innovative activity. It is also worth noting the significance of cultural and spiritual aspects that influence the formation of values and meanings which a person embodies in their activities (Taylor, 2007; Karpenko, 2017, 2018).

In contemporary practice, other approaches to grouping factors of innovative activity and staff motivation are also considered. The choice of model depends on the level of analysis – individual or organisational. For the individual (personal) level of research, the logic is based on psychological and socio-behavioural models that view innovativeness as a trait and the result of individual development, whilst at the organisational level, managerial and structural conditions are identified as a separate block of influence, enabling the design of support systems for innovation teams and the implementation of comprehensive strategies. Thus, the two approaches do not contradict one another, but represent different perspectives on the analysis of a single phenomenon.

Research into the personal level of innovative activity and staff motivation (sustained motivation for creative work and innovative self-expression) focuses on an individual's personal potential (using a more psychologically oriented classification, which is best considered in terms of three groups of factors:

- intrinsic (internal) motivations should be viewed as a complex of psycho-emotional states, including a sense of autonomy (freedom to choose one's actions), a sense of competence (confidence in personal abilities), value alignment (alignment of the employee's values with those of the organisation) and a sense of meaning in the work performed (awareness of its significance) (Deci & Ryan, 1985; Amabile, 1996);
- external and contextual factors include management support, the provision of necessary resources, fair remuneration and recognition of achievements, as well as the implementation of HR practices focused on developing employees' competencies and motivation, that is, they create a favourable environment for the realisation of innovative ideas and shape an organisational culture that supports innovation (Amabile, 1996; Janssen, 2000);
- socio-psychological factors – these are characteristics of the social environment and the psychological climate within a group, which create the conditions for open communication, cooperation and creative activity. These

include psychological safety, social capital, and effective networks of interaction, which are critical for stimulating innovative behaviour, as they create a trusting atmosphere and provide social support for innovative initiatives (Edmondson, 1999). In other words, this approach makes it possible to describe the individual trajectory of innovative activity – from personal qualities and motivation to the influence of the environment and social expectations. Its logic is based on psychological and socio-behavioural models that view innovativeness as a trait and the result of individual development.

At the organisational level, it is advisable to adopt a broader approach to the analysis of employee motivation and behaviour, which should be more nuanced and comprehensive, thereby necessitating a broader classification of factors. The following four groups of factors should be identified:

- individual factors, which include not only personal characteristics but also psychophysiological traits that influence the capacity for innovation. This level examines specific personal traits (creativity, education, skills) that directly shape the potential for innovative activity (Scott & Bruce, 1994; Janssen, 2000).
- motivational factors are an independent mechanism (both internal and external) that determines an individual's activity in the context of innovation and mobilises personal resources for innovative behaviour (Deci & Ryan, 1985; Amabile, 1996);
- external factors that extend outside the organisation (economic, technological, cultural and legal) and shape the context in which the organisation and its staff operate;
- organisational factors, defined as a specific level of support within an organisation, which includes management practices, organisational culture, infrastructure for supporting innovation, etc. (Janssen, 2000).

This approach is appropriate at the organisational level, as it identifies managerial and structural conditions as a distinct sphere of influence, thereby enabling the design of support systems for innovation teams and the implementation of comprehensive strategies. A summary of the three approaches to classifying factors of innovation activity is provided in Table 1.

Table 1. Comparative analysis of approaches to classifying factors influencing staff innovation activity

Level of application	Main categories of factors	Key features / Purpose
Personal (individual)	Intrinsic motives; External and contextual factors; Socio-psychological factors.	Emphasises motivation, psychology and the individual's social environment. Suitable for developing individual potential and personal growth.
Organisational	Individual; motivational; organisational; external factors.	Systematic approach to managing innovation teams. Includes organisational structures and the external environment as separate categories.
General (universal)	Internal (personal motives, traits); External (organisational, social, economic).	Simple classification that is widely used in many studies. Useful for a general overview of the factors influencing innovative behaviour.

Source: compiled by the authors based on S.G. Scott & R.A. Bruce (1994), T.M. Amabile (1996), P. Kesting & J.P. Ulhøi (2010), S. Høyrup *et al*. (2012)

The approaches to discussed classification of factors motivating innovative activity reflect different levels of analysis and research objectives. The first approach, which comprises three groups of factors, focuses on the individual as the bearer of motivation and their immediate social environment. Such a classification is appropriate for psychological and sociological research, as well as for staff development, where the emphasis is on the internal and social aspects of an individual's behaviour. The second approach, which identifies four groups of factors, provides a more comprehensive and systematic picture of motivational influences. This differentiation is particularly useful for the strategic management of innovation in organisations and the development of effective management systems for innovation teams. The third approach, which is based on the division of factors into internal and external, serves as a classic and basic model, often used in the initial stages of analysing the motivation for innovative behaviour. It can be used for a quick outline of the overall influence of various factors and serves as a basis for further in-depth study. Thus, the choice of a specific approach to classifying motivational factors depends on the research objective, the level of analysis, and the practical tasks facing researchers or innovation managers.

The most common and effective tools for managing staff innovation are the implementation of creativity development programmes; motivational mechanisms (non-financial incentives, recognition, involvement in decision-making); flexible working arrangements; the creation of internal innovation incubators; the development of digital skills through continuous learning, etc. Generalised motivation mechanisms reflect a systematic approach to managing staff innovation activity, combining psychological, organisational and resource-related aspects. They are based on the concept of the interdependence of internal and external determinants of motivation, where autonomy, competence development and psychological safety form the basis for the formation of sustainable innovative behaviour, whilst fair reward systems, adequate resource provision and digitalised HR practices ensure the transformation of creative potential into measurable results (Table 2).

Table 2. Motivational mechanisms and organisational tools for their implementation

Mechanism of motivation	How can an organisation work with the component?	Scientific rationale and commentary
Support for autonomy and participation	Delegation of decision-making regarding how tasks are performed, the creation of internal incubators, and setting aside time for experimentation (similar to "20% time").	Self-determination theory and research show that autonomy boosts intrinsic motivation and stimulates creativity and initiative.
Development of competencies and cross-functional skills	Investment in training, mentoring and job rotation schemes to develop domain-relevant skills.	The development of skills enhances the ability to generate relevant innovations and solve complex problems.
Building psychological safety	Management openness to new ideas, tolerance of mistakes, non-judgmental reviews, and a focus on learning.	Psychological safety is a key prerequisite for employees to feel confident enough to put forward innovative ideas without fear of negative consequences.
Fair systems of remuneration and recognition	Balance between financial and non-financial incentives, rewarding the process and learning, rather than just the results.	Over-reliance on external incentives (overjustification) can reduce intrinsic motivation; it is necessary to maintain a balance.
Resource provision and organisational structure	Allocation of time, access to technology, a budget for pilot projects, and setting up facilitation teams.	Without the necessary resources, even high levels of motivation do not lead to results.
HR systems in the age of digitalisation	Use of digital HR platforms for training, communication and collaborative ideation.	Digital environment enhances access to knowledge and accelerates innovation.

Source: compiled by the authors based on T.M. Amabile (1996), A.C. Edmondson (1999), R.M. Ryan & E.L. Deci (2000), D. Liu *et al.* (2011), OECD (2018), S. Guha *et al.* (2025)

Thus, the comprehensive implementation of these tools can be used for an organisation not only to maintain motivation at the individual level but also to establish effective systems for the strategic management of innovation teams. To measure the motivational components of staff innovation activity, it is advisable to use established psychometric tools that influence employees' innovative behaviour. The systematisation of such tools can be used for the selection of the most relevant methods for assessing individual and organisational determinants of innovative activity, and lays the groundwork for further empirical research aimed at improving the effectiveness of human resource management and developing strategies for the development of staff's innovative potential (Table 3).

Table 3. Motivational factors in staff innovation

Author/source	Motivational component	Name of a score/method	Short description
Personality-based			
T.M. Amabile (1996)	Internal motivation for innovation	Work preference inventory	Measures intrinsic and extrinsic motivation in professional life
H. Schuler *et al.* (2004)	Need for achievement	Achievement motivation inventory	Values a commitment to achieving high standards in work
P. Tierney & S.M. Farmer (2002)	Creative self-efficacy	Creative self-efficacy scale	Used to assess an employee's confidence in thяeir ability to generate new ideas
S. Budner (1962)	Tolerance of uncertainty	Tolerance of Ambiguity Scale	Assesses the ability to function in conditions of uncertainty and change
T.S. Bateman & J.M. Crant (1993)	Initiative	Proactive personality scale	Indicates a person's propensity to take the initiative regarding change
Enterprise-based			
J.P. Meyer & N.J. Allen (1991)	Affective Commitment	Organisational commitment questionnaire	Three-component model of engagement: affective, normative and continuance
R. Eisenberger *et al.* (1986)	Perception of support from the organisation	Perceived organisational support scale	Measures the extent to which employees feel supported and encouraged to innovate
Context-based			
E.L. Deci & R.M. Ryan (1985)	External motivation (rewards, career progression)	Intrinsic-extrinsic motivation scale	Assessment of the role of material and non-material incentives in behaviour
R.M. Meertens & R. Lion (2008)	Risk readiness	Risk propensity scale	Measures an individual's propensity for risky behaviour
O. Janssen (2000)	Innovative behaviour	Innovative work behaviour scale	Comprehensively measures the generation, promotion and implementation of ideas

Source: compiled by the authors

An analysis of the tools presented in the table identified three generalised groups of motivational indicators: personality-oriented, organisation-oriented, and situation-oriented. The interaction of these groups of factors forms a comprehensive model of innovation readiness, where personal traits determine potential, organisational conditions determine the resource base, and situational stimuli determine the timing of the implementation of innovative initiatives. The psychometric tools presented demonstrate a wide range of approaches to assessing the

motivational factors of innovative behaviour – from measuring intrinsic and extrinsic motivation to assessing tolerance for uncertainty, proactivity and creative self-efficacy. The use of a comprehensive set of such methods can provide a multidimensional picture of employees' readiness for innovation, identify the strengths and weaknesses of the organisation's motivational environment, and develop targeted interventions to stimulate creative activity. Comparison of data from different scales further demonstrates the interrelationship between personal characteristics, organisational support and external incentives in shaping innovative behaviour. Thus, the systematic use of these tools is a key element of strategic human resource management in the context of digitalisation.

Staff innovation activity can be interpreted as a multi-level structure comprising three levels: the cognitive component (a system of knowledge, professional skills and competencies required for the development and implementation of innovations); the emotional-motivational component (values, a positive attitude towards innovation, a willingness to take on challenges and risks, and intrinsic motivation for creative activity); and the behavioural component (practical participation in research and innovation projects, the demonstration of initiative, the generation of new ideas and their implementation in production or organisational processes). The development of these components depends on the quality of the internal organisational climate, management style, openness to feedback, and the availability of resources for staff training and self-fulfilment. Furthermore, based on classical approaches to measuring innovation activity (OECD, 2015; 2018), which emphasise outcomes (products created, processes implemented, economic and social effects) rather than merely potential and processes, it is advisable to also include an outcome component. The performance level reflects the actual results of staff innovation activities, including quantitative and qualitative indicators (number of innovations implemented, economic impact, productivity growth, increased competitiveness, social benefits, etc.). Thus, staff innovation activity comprises a four-component structure (Fig. 1): cognitive, emotional and motivational, behavioural, and outcome-oriented, which aligns with the approach to assessing the effectiveness of human capital in innovation processes promoted by the OECD.

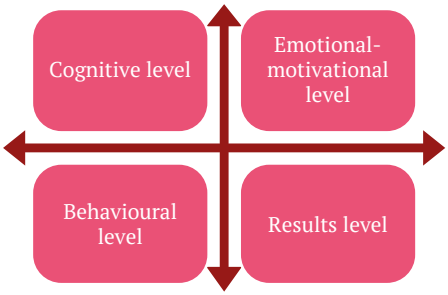

Figure 1. The structure of staff innovation activity
Source: compiled by the authors

The innovative activity of staff depends to a large extent on the local socio-economic environment. According to research by R. Florida (2002), regions with a high level of "creative capital" exhibit significantly higher innovation activity. Local educational institutions, clusters, business incubators and similar are substantial. Innovation activity is considered in several dimensions, notably as a process and a system. Innovative activity as a process is a sequential chain of actions – from the generation of an idea to its implementation in the form of a new or improved product, technological process or approach to services. It includes scientific, technological, production, organisational, financial and commercial activities, which ensure innovations. Innovative activity as a system is the organisation of the research and development process aimed at creating and implementing innovations to generate profit and competitive advantages, covering all stages of the "science-production" cycle and serving as a key factor in an enterprise's stable market position. In the modern interpretation, staff innovation activity encompasses not only the generation of ideas, but also their promotion, adaptation, implementation and evaluation of effectiveness. It is also necessary to address the role of the organisational environment, culture, leadership and HR policies.

The widespread adoption of digitalisation is becoming a key factor in the transformation of human resources management and in stimulating innovation within companies. Digital technologies are not only changing the way employees interact with work processes, but are also creating new conditions for the development of creative potential and the implementation of innovations. In the context of digital transformation, staff innovation is taking on new forms and implementation mechanisms, which are directly linked to the integration of digital tools. Key elements of digitalisation that influence the development of staff innovation include digital platforms for collaboration and communication; automation of routine processes; data analytics and decision support; personalised training and development systems; and incentive schemes based on digital tools.

Digital platforms for collaboration and communication (corporate social networks, knowledge management systems, shared workspaces, etc.) facilitate the rapid exchange of ideas, the formation of innovative teams and the stimulation of creativity, as they blur the traditional boundaries between departments and workplaces, creating conditions for flexible interaction and rapid adaptation to change. The automation of routine processes (robotic systems and artificial intelligence) frees staff from routine tasks, providing additional resources for creative and innovative aspects, which boosts motivation and facilitates the development of the skills needed to implement innovations. Data analytics and decision-making support using digital technologies help to identify new opportunities, assess the effectiveness of innovation initiatives and make informed management decisions, thereby encouraging staff to participate more actively in innovation

development processes. Personalised learning and development systems (digital e-learning platforms, microlearning, virtual and augmented reality) ensure continuous professional development tailored to employees' individual needs, which helps foster an innovative culture and develop the skills required to bring new ideas to life. Incentive schemes based on digital tools (gamification, digital rankings, bonus platforms, etc.) provide an effective way to encourage staff innovation, thereby increasing their engagement and sense of responsibility. In addition to the basic elements of digitalisation, there are several additional technological and organisational tools that significantly expand the opportunities for developing staff innovation (Table 4).

Table 4. Key digital technologies and organisational mechanisms influencing staff innovation

Digitalisation aspect	Feature description	Impact on staff innovation	Examples of use in companies
Internet of Things (IoT)	Real-time device interaction	Process optimisation, boosting creativity	'Smart' production lines, quality monitoring
Cloud technologies	Remote access to resources	Collaboration, knowledge sharing	Remote teams, collaboration platforms
Blockchain technologies	Ensuring security and transparency	Protection of ideas, formation of trust	Intellectual property registration
Artificial intelligence (AI)	Automation of data analysis	Personalisation of motivation, forecasting trends	Automated candidate selection, market analysis
Virtual and augmented reality (VR/AR)	Interactive training sessions, simulations	Skills development, fostering innovative thinking	Training simulators, product testing
Open innovation platforms	Collaboration with external partners	Stream of ideas, collaborations	Hackathons, innovation competitions
Knowledge management systems	Collection and dissemination of corporate knowledge	Fostering creativity through access to experience	Internal knowledge bases, corporate wikis
Staff sentiment analysis	Assessment of employees' emotional state	Creation of a comfortable environment, fostering motivation	Survey platforms, stress monitoring
Flexible digital working environments	Integrated management platforms	Increased autonomy and creativity	Asana, Trello, Microsoft Teams
Digital assessment systems	Automatic feedback	Adjusting the strategy, motivation to improve	Strategy adjustments, motivation to improve

Source: compiled by the authors based on G.C. Kane *et al.* (2015), E. Autio *et al.* (2017), OECD, (2018)

Each of the elements listed is characterised by specific functionalities that help to boost creativity, work efficiency and employee engagement in innovation processes. At the same time, the table provides examples of the practical application of these technologies, illustrating their potential in various areas of activity upon implementation. This comprehensive approach further demonstrates which digital tools are key drivers of innovation and which methods can be used to effectively manage these processes. Thus, staff innovation is a multidimensional phenomenon arising from the interaction of various factors. The first dimension is motivational and psychological, which involves creating favourable conditions for employees' internal and external motivation to engage in creative activity, supporting initiative, recognising achievements, and fostering a sense of commitment and responsibility. The second is the organisational and managerial dimension, which includes the formation of an effective corporate culture, flexible management structures, and the introduction of incentive systems capable of encouraging risk-taking and experimentation. The third dimension covers the technological aspect, which involves the integration of digital tools that simplify knowledge sharing, facilitate collaboration and optimise innovation processes. In addition, socio-cultural dimensions must be considered, in particular the organisation's values, the level of trust among employees, communication channels, as well as the external context, including market conditions, legislation and technological trends. All these dimensions interact with one another, creating a complex, multifaceted system that determines the effectiveness of stimulating innovative activity.

Consequently, digitalisation has a complex impact on staff innovation, transforming its structure, motivational mechanisms and organisational conditions. Successfully fostering innovation within companies requires a comprehensive approach that combines technological tools with management practices aimed at developing staff as a key resource for innovative potential. Overall, the development of staff innovation in the digital age involves not only the introduction of the latest technologies but also the creation of an appropriate culture, changes to the organisational structure, and the improvement of communication and motivation systems, which together create a favourable environment for innovative initiatives.

Conclusions

The study concluded that staff innovation is a key factor in enhancing companies' competitiveness in the digital age, as it is the employees who generate the ideas that are transformed into new products, services and processes. Morphological and semantic analysis of the term demonstrated that it is not a one-dimensional process, but rather a complex, multi-dimensional phenomenon. A substantial methodological outcome of the study is the developed and

theoretically substantiated 4-component structure of staff innovation activity, which organically combines cognitive, emotional-motivational, behavioural and performance components. The study established that organisations require a systematic management toolkit to transform employees' ideas into competitive, innovative products. To this end, the study systematises three approaches to classifying motivational factors: personal (focus on intrinsic motives and psychology), organisational (corporate practices, leadership, systemic HR initiatives) and universal (the influence of the broader socio-economic environment). To facilitate the practical implementation and objectification of these processes, a typology of psychometric assessment tools has been developed. It provides managers with standardised methods for measuring internal psychological drivers, risk appetite and the level of organisational support.

Fostering innovation requires a holistic approach that integrates motivational mechanisms and modern technologies. The implementation of digital tools in human resources management is a prerequisite for companies seeking to remain leaders. A wide range of digitalisation technologies (from the Internet of Things and artificial intelligence to blockchain and virtual reality) creates new opportunities for collaboration and knowledge generation. However, the success of their application depends on a comprehensive approach that considers organisational characteristics, staff readiness for digital change, and effective risk management. Thus, digitalisation not only modernises HR processes but also lays the foundation for the development of an innovative culture and the accumulation of the organisation's intellectual assets. A substantial area for further research should be the development of new metrics for assessing staff innovation activity, as well as models for managing its effectiveness in a turbulent business environment.

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Розвиток і стимулювання інноваційної активності персоналу компаній в умовах цифрової ери

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Анотація. Метою статті був аналіз сучасних підходів до визначення сутності інноваційної активності персоналу, розкриття її значення в умовах цифрових трансформацій, а також обґрунтування концепції розвитку інноваційної активності персоналу в умовах цифрової ери. У статті здійснено комплексний теоретичний аналіз інноваційної активності персоналу як ключового чинника забезпечення конкурентоспроможності сучасних організацій. Розглянуто еволюцію наукових підходів до трактування сутності інноваційної активності, її структурних компонентів і мотиваційних детермінант. Досліджено мультидимензійний характер інноваційної активності персоналу, підкреслюючи, що вона формується під впливом комплексного набору чинників, які охоплюють мотиваційно-психологічні, організаційно-управлінські, технологічні та соціокультурні аспекти. Важливим аспектом статті був розгляд ролі цифровізації в трансформації HR-процесів і управління інноваційною активністю. Водночас зазначено, що успішність цифрової трансформації залежить від цілісного підходу, який враховує організаційні особливості, готовність персоналу до змін, а також ефективне управління ризиками. Наголошено на необхідності комплексного управління інноваційною активністю, яке має базуватися на інтеграції різноманітних управлінських практик та інструментів. Для цього компаніям слід застосовувати різнопланові стимули (навчання, делегування повноважень, визнання досягнень), а також стандартизовані методи оцінювання інноваційної діяльності працівників. Було запропоновано розглядати інноваційну активність не як окремий процес, а як багатогранну систему, що включає взаємодію психологічних драйверів, організаційних практик, лідерства та системи винагород. Узагальнено досвід щодо управління інноваційною активністю в умовах цифрової трансформації. Сформульовано пропозиції щодо удосконалення організаційно-економічного механізму стимулювання інноваційної поведінки працівників. Проаналізовано вплив цифровізації на стимулювання інноваційної активності персоналу компаній. Визначено ключові технологічні та організаційні інструменти цифровізації, які забезпечують ефективну мотивацію та підтримку інноваційної діяльності персоналу. Запропоновано інтеграцію цифрових інструментів у систему управління персоналом для розвитку та стимулювання інноваційної активності персоналу, формування інноваційної культури, підвищення конкурентоспроможності компаній у сучасних умовах

Ключові слова: управління персоналом; мотивація праці; креативність; інноваційна організаційна культура; людський капітал; цифровізація

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