

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

НАУКОВИЙ ВІСНИК

МУКАЧІВСЬКОГО ДЕРЖАВНОГО
УНІВЕРСИТЕТУ

**СЕРІЯ
«ЕКОНОМІКА»**

Науковий журнал

**ТОМ 13, № 1
2026**

**МУКАЧЕВО
2026**

ISSN 2313-8114
E-ISSN 2518-1254

**Рішення Національної ради України
з питань телебачення і радіомовлення № 1564,**
протокол № 15 від 09 травня 2024 року.
Ідентифікатор медіа - R30-04571.

*Рекомендовано до друку та поширення
через мережу Інтернет Вченою радою
Мукачівського державного університету
(протокол № 9 від 1 квітня 2026 року)*

Журнал входить до переліку наукових фахових видань України
Категорія «Б». Спеціальності: 051 – Економіка; 071 – Облік та оподаткування;
072 – Фінанси, банківська справа та страхування; 073 – Менеджмент; 075 – Маркетинг
(Наказ Міністерства освіти і науки України № 1693 від 23.12.2025 р.)

Кластер – Економічні перетворення, бізнес та адміністрування

**Журнал представлено у міжнародних наукометричних базах даних,
репозитаріях та пошукових системах:**

Google Scholar, Фахові видання України, Національна бібліотека України імені
В. І. Вернадського, EconBiz, ERIH PLUS, Polska Bibliografia Naukowa, UCSB Library, Dimensions,
German Union Catalogue of Serials, University of Oslo Library, University of Hull Library,
SOLO - Search Oxford Libraries Online, European University Institute, Leipzig University Library,
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OUCI (Open Ukrainian Citation Index), WorldCat, Litmaps

Науковий вісник Мукачівського державного університету. Серія «Економіка» / Ред. кол.:
Т.В. Шталь та ін. – Мукачево: Вид-во МДУ, 2026. – Том 13, № 1. – 100 с.

Засновник і видавець:

Мукачівський державний університет
89600, вул. Ужгородська, 26, м. Мукачево, Україна
E-mail: info@economics-msu.com.ua
<https://economics-msu.com.ua/uk>

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

SCIENTIFIC BULLETIN

OF MUKACHEVO STATE
UNIVERSITY

**SERIES
“ECONOMICS”**

Scientific Journal

**VOL. 13, No. 1
2026**

**MUKACHEVO
2026**

ISSN 2313-8114
E-ISSN 2518-1254

**Decision of the National Council
of Television and Radio Broadcasting of Ukraine No. 1564.**

Minutes No. 15, dated 09.05.2024.

Media identifier - R30-04571.

*Recommended for printing and distribution
via the Internet by the Academic Council
of Mukachevo State University
(Minutes No. 9 April 1, 2026)*

The journal is included in the list of scientific professional publications of Ukraine

Category “B”. Specialties: 0311 – Economics; 0411 – Accounting and taxation;

0412 – Finance, banking, and insurance; 0413 – Management and administration;

0414 – Marketing and advertising

(Order of the Ministry of Education and Science of Ukraine No. 1693 of 23.12.2025)

Cluster – Economic transformation, Business and Administration

**The journal is presented at international scientometric databases,
repositories and scientific systems:**

Google Scholar, Professional publications of Ukraine, Vernadsky National Library of Ukraine,

EconBiz, ERIH PLUS, Polska Bibliografia Naukowa, UCSB Library, Dimensions,

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Scientific Bulletin of Mukachevo State University. Series “Economics”: / Editorial Board:
T. Shtal *et al.* – Mukachevo: MSU Publishing House, 2026. – Volume 13, No. 1. – 100 p.

Founder and publisher:

Mukachevo State University

89600, 26 Uzhhorodska Str., Mukachevo, Ukraine

E-mail: info@economics-msu.com.ua

<https://economics-msu.com.ua/en>

НАУКОВИЙ ВІСНИК МУКАЧІВСЬКОГО ДЕРЖАВНОГО УНІВЕРСИТЕТУ

СЕРІЯ «ЕКОНОМІКА»

Том 13, № 1. 2026

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SCIENTIFIC BULLETIN OF MUKACHEVO STATE UNIVERSITY

SERIES "ECONOMICS"

Vol. 13, No. 1. 2026

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Scientific Bulletin of Mukachevo State University

Series

Economics

Volume 13, No. 1, 9-20

Journal homepage: <https://economics-msu.com.ua/en>

UDC 658.012.7:658.5

DOI: 10.52566/msu-econ1.2026.09

ISSN 2313-8114

E-ISSN 2518-1254

Algorithm for introduction of KPI-indicators into the system of financial controlling of enterprises of Kyrgyzstan

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Abstract. The purpose of this study was to substantiate the theoretical and applied principles of creating a mechanism for integrating key performance indicators into the financial controlling system of enterprises in Kyrgyzstan to enhance the effectiveness of management decisions and ensure transparency of financial monitoring. The research combined theoretical analysis, legal evaluation, and practical testing of the effectiveness of models using performance indicators in controlling. Scientific approaches to indicator formation were examined, and the regulatory framework of Kyrgyz financial control – including the Constitution, the Budget Code, and strategic national development documents – was analysed in detail. The practical component focused on the activities of Open Joint-Stock Company “Kyrgyztelecom,” Open Joint-Stock Company “RSK Bank,” and Open Joint-Stock Company “Eldik Bank,” which applied performance indicators to manage and improve financial results. Following implementation, Kyrgyztelecom’s profit increased to 107.7 million soms or 1.23 million dollars, while banks demonstrated higher transparency of reporting and enhanced quality of controlling procedures. The main barriers identified included the absence of a unified national standard, insufficient digitalisation, shortage of skilled personnel, and fragmentation of information systems. Based on the obtained findings, a six-step algorithm for integrating performance indicators into financial controlling was developed, enabling the transition from reactive to proactive management and strengthening analytical coordination across management levels. The practical significance of the study lies in offering enterprises a structured methodological framework for adapting performance-based controlling systems to national and sectorial economic conditions

Keywords: performance measurement; strategic management; efficiency; analytics; budget; human resource

Introduction

The transition of Kyrgyz enterprises towards market-oriented management systems has necessitated the development of advanced controlling mechanisms. Financial

controlling, as a subsystem of enterprise management, remains insufficiently developed due to the absence of standardised key performance indicator (KPI) systems and

Received: 11.11.2025, Revised: 02.03.2026, Accepted: 01.04.2026, Published: 06.04.2026

Suggested Citation: Toichiev, T. (2026). Algorithm for introduction of KPI-indicators into the system of financial controlling of enterprises of Kyrgyzstan. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 13(1), 9-20. doi: 10.52566/msu-econ1.2026.09.



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limited digital integration. Within enterprise performance management, there is an increasing demand for digital tools that enable accurate result evaluation and real-time decision support. F. Nunes *et al.* (2024) examined the implementation of KPIs and the creation of Power Business Intelligence (BI) monitoring dashboards in an automotive component manufacturing company. Based on employee surveys, 22 new indicators were designed for various departments, improving analytical accuracy, standardising control procedures, and accelerating managerial decision-making. Similarly, R. Therivel & A. Gonzalez (2024) highlighted the significance of enhancing approaches to evaluating enterprise sustainability by combining quantitative and qualitative indicators within a unified management framework. Their study demonstrated that integrating KPIs with environmental monitoring tools enhances transparency in decision-making and harmonises financial and environmental objectives.

The necessity for management performance assessment systems that combine financial, social, and environmental dimensions continues to grow. A. Faveto *et al.* (2024) proposed a conceptual model for integrating KPIs into the strategic management of sustainable regional development, employing both quantitative and qualitative analysis methods. The authors demonstrated that using multidimensional KPIs creates a flexible framework for evaluating policy effectiveness and improving the transparency of managerial decisions. In parallel, M. van de Ven *et al.* (2023) developed an integrated model for constructing KPIs aimed at assessing the efficiency of strategic projects in the public sector. They outlined the stages of KPI formation – from building indicator databases to automated evaluations through digital dashboards. This model demonstrated high accuracy in identifying inefficient managerial processes and improved coordination between strategic and operational planning levels.

Scholarly research has devoted considerable attention to enhancing the effectiveness of performance management systems, particularly by refining methods for defining and integrating KPIs. H. Purwoko *et al.* (2023) summarised prior studies and demonstrated that KPI implementation serves as a universal tool for performance assessment across diverse organisations. Their findings confirmed the importance of selecting relevant indicators that reflect strategic objectives and enable the monitoring of changes over time. However, management systems have yet to develop a unified approach to KPI selection and integration, complicating the objective evaluation of performance and the alignment of strategic and operational aims. D. Rodrigues *et al.* (2021) proposed using the Analytic Network Process to select relevant KPIs within production systems, systematising 58 previously identified indicators and narrowing them down to nine core metrics consistent with the Balanced Scorecard framework. The resulting model proved effective in ensuring consistency between strategic and operational management levels, enhancing control accuracy and decision-making efficiency.

Insufficient alignment between performance measurement systems and actual organisational outcomes remains a major challenge for effective management. K. Kushariyadi *et al.* (2025) explored the relationship between KPI measurement, employee performance, and organisational effectiveness using quantitative methods and statistical analysis in SPSS. Their results indicated a strong positive correlation between KPI indicators, employee productivity, and overall effectiveness, with 62.3% of performance variation explained by these variables. Likewise, T.T. Mtau & N.A. Rahul (2024) examined the relationship between KPI systems and performance improvement, determining those well-structured indicators promote the achievement of strategic objectives and ensure greater transparency in managerial processes. They stressed that KPI utilisation enhances coordination between management levels and contributes to more efficient resource allocation.

Most reviewed studies underscore that the adaptation of KPI models in enterprises characterised by low digitalisation and economic instability remains limited. Therefore, the purpose of this study was to develop theoretical and practical foundations for establishing a mechanism to integrate KPIs into the financial controlling systems of Kyrgyz enterprises in order to strengthen managerial decision-making and foster greater openness and accountability in financial control processes. To achieve this purpose, the following objectives were defined: to analyse contemporary scientific approaches to KPI implementation in enterprise management and financial controlling systems, and to assess the potential for adapting existing KPI models to the conditions of Kyrgyz enterprises, taking into account the level of digitalisation and the regulatory environment.

Materials and Methods

The study was theoretical and applied in nature and covered the period 2022-2024. At the initial stage, the theoretical foundations of the implementation of KPI in financial controlling were considered. For this purpose, the method of system-comparative analysis was used, which made it possible to explore the scientific approaches of T. Kladnytska *et al.* (2023), A. Ibrahim *et al.* (2024) and A. Twin (2025). The choice of these works was due to their relevance and interdisciplinary nature: in the work of A. Twin, the types of KPI and their role in measuring performance were generalised; in the study of T. Kladnytska *et al.*, the role of financial controlling as a strategic management tool was substantiated; in the work of A. Ibrahim *et al.*, the practices of assessing the effectiveness of management processes at the project level were revealed. A comparison of these approaches made it possible to determine the logical basis for further adaptation of the KPI model to the national economic system of Kyrgyzstan.

An analysis of the regulatory and organisational framework of financial controlling in Kyrgyzstan was conducted. For this purpose, the method of content analysis of official sources was used. The activities of the National Bank of the Kyrgyz Republic (n.d.) and the Chamber of Accounts of the

Kyrgyz Republic, which perform key functions in the field of financial supervision, were considered. The Constitution of the Kyrgyz Republic (2021), which defines the legal framework for budget control, as well as the Budget Code of the Kyrgyz Republic (2016), which regulates financial processes at the state level, were separately analysed.

The Law of the Republic of Kazakhstan No. 304 (1998), the Law of the Republic of Kazakhstan No. 2444 (2022) and the Law of the Kyrgyz Republic No. 461 (1998) were additionally studied. The analysis made it possible to systematise the norms of financial control and identify the absence of a single state standard for KPI-controlling. Materials from international institutions – the International Federation of Accountants (n.d.) and the International Organisation of Supreme Audit Institutions (n.d.) – were also reviewed to assess the degree of harmonisation of the national legal framework with international standards. The study also included an analysis of strategic documents for the country's development, in particular the National Development Strategy of the Kyrgyz Republic 2018-2040 (2018) and the Regulation on the State Agency for the Management of State Property under the Cabinet of Ministers of the Kyrgyz Republic (Kyrgyzstan Newline, 2023). The structural-functional analysis method made it possible to determine how these documents affect the formation of effective management, the implementation of KPIs and the strengthening of controlling functions in the public sector.

The practical component employed the case-study method, focusing on three enterprises: Kyrgyztelecom (n.d.), RSK Bank (n.d.), and Eldik Bank (n.d.). This approach made it possible to trace the relationship between KPI introduction and improvements in financial performance, reporting transparency and employee motivation. However, the analysis was primarily qualitative in nature, as the study did not include detailed quantitative measurement of KPI impact on enterprise performance indicators. Instead, empirical observations and comparative analytical methods were used, based on data from sources such as World Bank (2020) and Akchabar (2022; 2025). These additional sources, including SAP Systems, Applications, and Products in Data Processing/High-Performance Analytic Appliance (n.d.) and Power BI, were examined to illustrate the practical tools applicable for automating KPI monitoring and data visualisation, while the Ministry of Economy and Commerce of the Kyrgyz Republic (n.d.) materials were analysed to clarify the institutional and methodological framework for harmonising performance measurement standards across Kyrgyz enterprises. This made it possible to identify the main limitations of the implementation of the KPI system, associated with regulatory gaps, lack of digital tools and human resources. The final stage was the development of an algorithm for integrating KPI into the financial controlling system, built on the basis of the generalisation and modelling method. In the process of its formation, examples of performance indicators presented in the works of P. Martinis (2024) and S. Beaver (2025) were used. This ensured the formation of

a holistic methodology that combines theoretical principles, digital tools and analytical approaches adapted to the conditions of Kyrgyz enterprises.

Results

Basics of implementing key performance indicators in financial controlling

Financial controlling represents an integral component of the enterprise management system, ensuring coordination between strategic objectives and on-going operational processes. Its function extends beyond recording actual performance results to include the creation of an information environment that supports managerial decision-making aimed at improving resource efficiency, profitability, and financial stability. In this context, KPI serve as a tool that unites the analytical and control functions of financial controlling, providing a quantitative assessment of the extent to which strategic and tactical objectives are achieved.

The concept underpinning KPI use is rooted in performance management theory, which involves assessing activity through objectively measurable parameters. KPIs make it possible to formalise the relationship between enterprise goals, financial outcomes, and the factors influencing their attainment. They perform a dual role: on one hand, they operate as a monitoring mechanism reflecting the actual state of the management system; on the other, they function as a guide for forecasting, planning, and regulating performance. As a result, KPIs are viewed not only as indicators of success but also as a feedback instrument that allows timely responses to deviations from planned targets and facilitates the correction of managerial decisions (Twin, 2025).

Traditionally, financial controlling is built upon key functions such as planning, control, analysis, and the regulation of financial flows. The integration of KPIs into this system entails the creation of a comprehensive model in which key indicators coordinate different management levels – strategic, tactical, and operational. At the strategic level, KPIs assess the implementation of corporate objectives related to profitability, investment appeal, liquidity, and business sustainability. At the tactical level, they serve as tools for evaluating the performance of departments, business units, and projects. At the operational level, KPIs monitor processes that directly influence financial results, such as cost management, receivables, inventories, production cycles, or budgeting (Kladnytska *et al.*, 2023).

The principal advantage of embedding KPIs into financial controlling lies in establishing a unified measurement framework that reconciles financial and non-financial aspects of performance. For instance, combining traditional financial indicators (profit, marginal revenue, return on assets, liquidity ratio) with non-financial metrics (labour productivity, customer service quality, innovation rate, staff satisfaction) provides a more objective and comprehensive view of enterprise performance. This combination facilitates a shift from reactive control to proactive management, whereby KPI analysis enables not only the evaluation

of past performance but also the forecasting of trends and prevention of potential risks. Theoretical approaches to integrating KPIs into financial controlling rest on the principles of consistency, relevance, transparency, and adaptability. The principle of consistency requires that all indicators form a logically coherent structure in which each KPI aligns with the enterprise's overarching goals. Relevance ensures that every indicator carries managerial value and supports decision-making for performance improvement. Transparency guarantees clarity in KPI calculation methodologies, fostering trust among employees. Adaptability reflects the capacity of the KPI system to evolve according to internal and external conditions, a particularly important factor for enterprises in transitional economies such as Kyrgyzstan (London Premier Centre, 2023).

The implementation of KPIs in financial controlling follows a phased approach. The first stage involves identifying the enterprise's strategic objectives and decomposing them into specific management tasks. The second stage focuses on determining the key success factors that directly affect the attainment of these objectives. The third stage consists of developing a system of indicators that quantitatively reflect the level of task achievement. Subsequently, KPIs are embedded into the enterprise's information support system, enabling automated monitoring and the visualisation of results through dashboards or financial panels. The final stage entails evaluating the effectiveness of the KPI system and adjusting it in line with changes in the business environment (Ibrahim *et al.*, 2024).

A crucial theoretical condition for effective KPI implementation is maintaining balance within the system. This principle implies an optimal ratio between the number of indicators and the capacity to monitor them effectively. An excessive number of KPIs can cause information overload and hinder decision-making, whereas too few indicators risk distorting the overall picture of performance. Consequently, prioritisation – identifying the most significant indicators that reflect the strategic logic of enterprise functioning – becomes a critical step. From a financial controlling perspective, KPIs should fulfil three core functions: diagnostic, motivational, and integrative. The diagnostic function involves identifying deviations from planned financial parameters and analysing their causes. The motivational function connects KPI assessment with employee incentives and remuneration, fostering engagement and shared accountability. The integrative function creates a unified information environment that connects all levels of management – from financial analysts to top executives (Setiawan & Purba, 2020).

Another theoretical dimension is the alignment of KPIs with the concept of risk-oriented management. Within financial controlling, this implies that the system of indicators should not only evaluate performance but also signal potential financial risks – such as declining solvency, excessive credit load, cost structure imbalances, or cash flow instability. Thus, KPIs become a preventive control instrument that enables the early identification of risks and the

avoidance of financial crises. Modern theoretical approaches to KPI system development also emphasise the role of digital technologies. The advancement of BI, Big Data analytics, and artificial intelligence allows the transition from static measurement to dynamic, data-driven analysis. This development creates opportunities for automated models of financial forecasting, investment efficiency evaluation, and scenario-based planning. For enterprises in Kyrgyzstan, the adoption of such technologies is a key factor in improving controlling accuracy and decision-making speed (Ionescu *et al.*, 2024).

Therefore, KPIs within the financial controlling system function not merely as tools for evaluating outcomes but as mechanisms of strategic management. They integrate the analytical and managerial functions of controlling, establishing the foundation for enterprise financial stability and competitiveness. Effective KPI implementation requires a clear methodology, digital infrastructure, and organisational readiness to utilise analytical data in decision-making processes. Accordingly, the priority for Kyrgyz enterprises is to develop a comprehensive algorithm for integrating KPIs into financial controlling that accounts for national economic conditions, technical capacity, and human resources – thus providing the foundation for a contemporary performance management model.

Assessment of the current state of financial controlling at enterprises in Kyrgyzstan

The system of financial controlling in Kyrgyzstan is shaped through the interaction of state, internal, and corporate control mechanisms that encompass both the public and private sectors. At the national level, several key institutions are responsible for formulating and implementing financial control policies. The Ministry of Economy and Commerce of the Kyrgyz Republic (n.d.) serves as the central authority for fiscal policy, budget planning and execution, debt management, and oversight of financial reporting. The National Bank of the Kyrgyz Republic (n.d.) regulates and supervises commercial banks and non-bank financial institutions, maintaining monetary stability and enforcing currency and licensing regulations. The Chamber of Accounts of the Kyrgyz Republic functions as the supreme audit institution, conducting external audits of central and local government budgets, social funds, and state enterprises to ensure legality, transparency, and accountability in public financial management. The Service for Regulation and Supervision of the Financial Market under the Ministry of Economy and Commerce of the Kyrgyz Republic (n.d.) oversees non-bank financial institutions, contributing to the development of a transparent and competitive financial environment. Local self-government bodies also carry out financial control functions at the municipal level, aligning their activities with national regulatory frameworks.

The legal foundation of financial controlling in Kyrgyzstan rests on several fundamental legislative acts, including the Constitution of the Kyrgyz Republic (2021) and the Budget Code of the Kyrgyz Republic (2016). In

addition, several external regulatory references are relevant for comparative purposes, such as the Law of the Republic of Kazakhstan No. 147 (2021), the Law of the Republic of Kazakhstan No. 2444 (2022), and the Law of the Republic of Kazakhstan No. 461 (1998). The Budget Code of the Kyrgyz Republic establishes the key principles of budgetary control at both central and local levels, outlining the authority and responsibilities of public oversight bodies.

Kyrgyz legislation distinguishes between three main forms of financial control: state, internal, and corporate. State control functions as an external mechanism focusing on auditing the management and utilisation of public resources. Internal control ensures financial discipline within government agencies and public institutions. Corporate control, in turn, is directed at risk management, accounting accuracy, and regulatory compliance within private enterprises. Collectively, these levels form a multi-tiered structure that promotes transparency, fiscal discipline, and accountability throughout the national economy.

Kyrgyz legislation has gradually aligned with international standards such as Federation of Accountants (n.d.) and International Organisation of Supreme Audit Institutions (n.d.). The Law on Audit Activities (2021) introduced qualification and professional requirements consistent with Federation of Accountants's International Education Standards, while the State Service for Regulation and Supervision of the Financial Market facilitates the application of IFRS and ISA. The Chamber of Accounts operates in line with International Organisation of Supreme Audit Institutions guidelines, promoting accountability and transparency in public sector auditing. Although Kyrgyzstan does not yet have a unified national ISO certification framework, ISO principles of quality management, risk assessment, and control are increasingly reflected in national regulatory practices (World Bank, 2022).

Despite these advances, Kyrgyzstan still lacks a unified national standard for KPI-based controlling systems. Nonetheless, performance-oriented management principles are embedded in national programmes such as the National Development Strategy of the Kyrgyz Republic 2018-2040 (2018) and the reform of the State Property Management Fund into the State Agency for State Property Management (Kyrgyzstan Newslines, 2023). The latter introduced methodological guidelines for applying KPIs to evaluate state-owned enterprises across profitability, solvency, liquidity, and non-financial objectives. These indicators are formalised within management contracts and serve as the basis for annual performance evaluations. However, the absence of standardised criteria continues to complicate the harmonisation of KPI implementation across sectors, particularly among enterprises with limited digital maturity (World Bank, 2020).

Practical implementation of KPI-based controlling in Kyrgyz enterprises can be observed in several illustrative cases. Kyrgyztelecom (n.d.) introduced KPI-based performance management in 2024 to improve profitability and cost optimisation, achieving a net profit of

107.7 million KGS (USD 1.23 million) and total revenue of approximately 2.3 billion KGS (USD 26 million). The majority of revenue (57.8%) was generated by Internet and Internet Protocol Television (IPTV) services, which became a key growth driver. The company also reported a slowdown in the decline of fixed telephony revenues to around 1% annually (previously 9-10%), while reduced operating expenses – particularly overheads, wages, and inventories – improved efficiency in the first half of the year. However, profits remained significantly lower than in 2023 (668.3 million KGS or USD 7.64 million) due to the absence of extraordinary income that had previously supported financial results (Akchabar, 2025).

RSK Bank (n.d.) is a state-owned commercial bank of the Kyrgyz Republic, founded in 1996, with 100% of its shares owned by the government. It provides a wide range of services to retail and corporate clients. According to the World Bank and the US Department of State, in 2022 RSK Bank ranked among the five largest banks by assets (approximately USD 588 million), though it required improvements in control and risk management systems. At the annual general meeting of shareholders, the bank approved the “planned values of KPIs for 2024” alongside its income and expenditure budget and capital investment programme, formalising its approach to performance measurement. The inclusion of KPI reporting in the board of directors' quarterly agenda institutionalised monitoring at the strategic level and integrated KPIs into budgeting processes. While public reporting on KPI achievements remains limited, their formal adoption alongside financial planning represents a gradual transition towards performance-based management (Kyrgyz Stock Exchange, n.d.).

Similarly, Eldik Bank (2023) highlighted the adoption of performance and risk indicators within its 2023 Sustainability Report, signalling a shift towards results-oriented corporate governance. Founded in 1996 as a Cash and Savings Company, the bank was later transformed into a state-owned commercial institution with 100% government ownership. Eldik Bank serves both individual and corporate clients, operates a broad branch network, and positions itself as a “people's bank” providing accessible financial services for households and small to medium-sized enterprises. By the time of its rebranding from RSK Bank to Eldik Bank in 2024, it had developed a substantial capital base exceeding 76 billion KGS (USD 8.7 million) and was classified by international assessments as systemically important for Kyrgyzstan's financial system. Although specific KPI target values are not publicly disclosed, the bank implemented KPI-based management to monitor profitability, credit portfolio quality, and deposit growth. It also received a B- rating with a stable outlook from Fitch Ratings, reflecting its commitment to transparency and operational efficiency. The integration of KPI monitoring into budgeting and reporting processes was supported by a digital transformation strategy focused on service quality and customer experience. Despite progress, the bank continues to face liquidity and macroeconomic risks, and the absence of publicly

available quantitative KPI thresholds limits a comprehensive assessment of its controlling maturity (Eldik Bank, n.d.).

At the municipal level, the Bishkek City Administration approved a KPI system in late 2022 covering five key domains – economic development, transport and construction, social services, property management, and utilities – marking one of the earliest applications of KPI-based

control in Kyrgyzstan's public sector (Akchabar, 2022). Despite these positive developments, several structural and institutional barriers still hinder the effective use of performance indicators in financial controlling. These challenges encompass regulatory, organisational, technical, human resource, and informational dimensions. Table 1 summarised the key barriers and potential mitigation measures.

Table 1. Key problems and barriers in the Use of KPI in Kyrgyz enterprises

Type of barrier	Description	Impact on financial controlling effectiveness	Possible mitigation measures	Example metric/tool
Regulatory/legal	Lack of a unified national KPI or controlling standard; fragmented and sometimes contradictory legislation	Inconsistent implementation and interpretation of performance indicators across enterprises	Development of a national KPI standard; harmonisation of legislation and secondary acts	Compliance index (% alignment of enterprise KPIs with national standards); KPI Standardisation Dashboard (Ministry of Economy portal)
Organisational	Centralised control structures with weak coordination among departments; underdeveloped internal audit	Disconnection between strategic and operational controlling levels	Implementation of hybrid models; clear role definition; strengthening internal audit capacity	Internal Audit Scorecard (share of audited units per quarter); RACI Matrix coverage indicator (% defined responsibilities)
Technical/informational systems	Limited use of ERP and BI platforms; fragmented or manually collected data	Errors, reporting delays, and inability to monitor KPI in real time	Investment in ERP/BI systems; centralised data architecture; system integration	ERP module for financial controlling (SAP S/4HANA); Power BI dashboard for real-time KPI tracking; data latency metric (hours)
Human resource	Shortage of professionals skilled in controlling, analytics, and digital tools	Incorrect KPI design, weak analytical interpretation, and inconsistent application	Training and certification programs; creation of controlling and analytics positions	Number of certified controllers (annual growth rate %); training completion rate; Human Resources dashboard for competency monitoring
Data quality/information	Incomplete or unreliable data; multiple unsynchronised data sources	Distorted KPI monitoring and inaccurate decision-making	Data standardisation; quality control mechanisms; establishment of single data sources	Data quality check index (% validated records); ETL pipeline monitoring tool (Talend, Apache Airflow); duplicate data ratio indicator

Note: RACI – Responsible, Accountable, Consulted, Informed; ETL – Extract, Transform, Load

Source: compiled by the author based on World Bank (2020), Akchabar (2022; 2025), Ministry of Economy and Commerce of the Kyrgyz Republic (n.d.)

The analysis indicates that the main obstacles stem from a fragmented legal framework, the absence of standardised controlling procedures, limited technical infrastructure, and insufficient human capital. Kyrgyz enterprises, particularly those operating in the public and manufacturing sectors, frequently depend on manual data processing and non-integrated accounting systems, which delay performance evaluation and reduce transparency. The quality of financial data also varies considerably, undermining the reliability of KPIs and complicating benchmarking across enterprises. To overcome these challenges, Kyrgyzstan must continue aligning its legislation with international best practices, promote digital transformation within financial management, and enhance professional competence in controlling and auditing. The gradual adoption of ERP and BI solutions, combined with targeted training initiatives and improvements in data governance, will support the transition from fragmented oversight to a unified, data-driven controlling system. Consequently, the regulatory and organisational framework of financial

controlling in Kyrgyzstan is evolving towards an integrated model that unites international standards, digital tools, and performance-based management principles, thereby ensuring greater accountability, efficiency, and transparency across both public and private enterprises.

Development of an algorithm for integrating KPIs into the financial controlling system

The development of an algorithm for integrating KPIs into the financial controlling system constitutes a methodological foundation for transforming traditional control functions into a performance-oriented management mechanism. Within Kyrgyz enterprises, this process seeks to reinforce the analytical dimension of financial decision-making, strengthen the link between strategic and operational objectives, and ensure that managerial actions are aligned with measurable outcomes. The incorporation of KPIs into controlling enables enterprises to move from reactive financial reporting towards proactive management based on quantitative assessment, predictive analytics, and strategic adjustment.

The first stage of the algorithm involves defining enterprise objectives, which provide the conceptual basis for constructing the system of performance indicators. The hierarchical alignment of strategic, tactical, and operational goals ensures a consistent flow of information and accountability throughout the organisation. Strategic objectives reflect long-term priorities such as profitability growth, market expansion, or capitalisation, while tactical goals focus on cost optimisation, liquidity enhancement, and operational efficiency. Establishing this hierarchy creates a logical framework for developing KPIs that translate abstract strategic intentions into measurable and controllable parameters.

The second stage concerns the selection of relevant indicators capable of quantitatively representing goal attainment. For Kyrgyz enterprises, a balanced approach is recommended, encompassing financial, operational, and socio-organisational dimensions. Financial KPIs assess economic performance through measures such as return on sales, profitability, and return on investment, whereas operational indicators evaluate the efficiency of internal processes, including inventory turnover and average collection period. Social and organisational indicators address human capital factors such as employee turnover, training expenditure, and satisfaction levels. The application of such a multidimensional structure ensures that controlling reflects both the enterprise's financial stability and its institutional capacity for sustainable growth.

The third stage focuses on developing a unified methodology for KPI calculation. For each indicator, the formula, unit of measurement, data sources, and reporting frequency must be specified. Methodological standardisation guarantees comparability across departments and over time, reducing informational asymmetry and the likelihood of interpretation errors. The data foundation for controlling is typically drawn from integrated ERP systems, which consolidate accounting, budgeting, human resources, and procurement modules, as well as from BI platforms that enable advanced analytics, visualisation, and forecasting. The effective use of these systems is

essential for achieving real-time monitoring, improving financial discipline, and ensuring data reliability within the controlling function.

The fourth stage entails embedding KPIs directly into the financial controlling framework. This includes incorporating them into budgeting processes, management reporting, planning procedures, and employee motivation schemes. The integration of KPIs into financial plans enables continuous evaluation of deviations from expected targets, while dashboard visualisation tools facilitate prompt decision-making by senior management. Linking KPIs to incentive systems also promotes internal motivation and accountability, transforming performance measurement into a driver of organisational development (Klimaitienė *et al.*, 2020).

The fifth stage of the algorithm emphasises KPI monitoring and adjustment. This involves the continuous observation of actual performance, comparison with target benchmarks, and analysis of deviations. Corrective measures are then introduced to realign operations with strategic plans. Regular monitoring creates a feedback loop between managerial decisions and financial outcomes, enabling dynamic adaptation to market conditions, regulatory changes, or macroeconomic shifts. Periodic reassessment of indicators preserves the relevance and reliability of the controlling system. The sixth stage focuses on evaluating the overall effectiveness of the KPI-based controlling framework. This evaluation determines the extent to which selected indicators contribute to achieving strategic objectives and whether they generate meaningful analytical insights for decision-making. Indicators that lose explanatory value or fail to align with strategic priorities are revised or replaced. Consequently, the system evolves towards greater adaptability, flexibility, and coherence with the external business environment (Kaganski *et al.*, 2017). The empirical validation of the proposed algorithm is based on the identification of the most applicable KPIs for Kyrgyz enterprises. These indicators are summarised in Table 2, which provides practical examples of performance metrics relevant to financial controlling in the national context.

Table 2. Examples of KPIs for Kyrgyz enterprises

Dimension	Example of KPI	Calculation method	Purpose	Data collection frequency/data owner	Target/threshold
Finance	Return on sales	$(\text{Profit} \div \text{Revenue}) \times 100\%$	To enhance profitability	Quarterly/Finance department	$\geq 15\%$
Turnover	Inventory turnover ratio	$\text{Cost of goods sold} \div \text{Average inventory}$	To reduce warehouse costs	Monthly/Logistics or Operations department	≥ 6 times per year
Accounts receivable	Average collection period (ACP)	$(\text{Accounts receivable} \div \text{Revenue}) \times 365$	To improve liquidity	Monthly/Accounting department	≤ 45 days
Human resources	Employee turnover rate	$\text{Number of employees left} \div \text{Average number of employees}$	To reduce personnel risks	Quarterly/HR department	$\leq 10\%$
Customers	Customer satisfaction rate	Based on survey data	To strengthen customer retention	Semi-annual/Marketing and Customer Service unit	$\geq 85\%$ satisfaction index

Source: compiled by the author based on P. Martinis (2024), S. Beaver (2025)

The implementation of the algorithm has demonstrated that integrating KPIs into financial controlling facilitates a shift from passive supervision to active, results-oriented management. The systematic application of performance indicators enhances transparency, optimises resource allocation, and promotes the development of a performance-driven organisational culture. The methodology also strengthens enterprise adaptability by linking financial objectives with digital analytical tools and employee motivation systems. Consequently, the proposed algorithm can be viewed as a practical framework for Kyrgyz enterprises aiming to modernise their controlling systems in accordance with international standards of efficiency, transparency, and digital transformation.

In conclusion, the developed algorithm provides a comprehensive foundation for embedding measurable performance criteria within the financial controlling architecture of Kyrgyz enterprises. It integrates strategic management principles, digital analytical technologies, and financial accountability mechanisms into a coherent structure that ensures both efficiency and resilience. This approach enables enterprises to evolve their controlling function from retrospective monitoring to a dynamic system of forward-looking financial governance. Therefore, the model not only supports managerial decision-making but also establishes a scalable methodological basis for the further institutionalisation of KPI-driven controlling practices within Kyrgyzstan's transforming economic landscape.

Discussion

KPI systems hold a significant position within contemporary management theory and practice. They are employed to enhance managerial transparency, align strategic and operational decisions, and assess both the financial and non-financial performance of enterprises. In academic research, KPIs are increasingly viewed as an integral component of digital business transformation and a key instrument in the shift towards analytical and proactive management. This study and that of B. Mičieta *et al.* (2025) were similar in considering KPI implementation as a fundamental tool for improving managerial efficiency and the financial stability of enterprises. Both works highlighted that the integration of financial and non-financial indicators within the controlling system strengthens transparency, analytical capacity, and the link between strategic objectives and performance outcomes. B. Mičieta *et al.* research, however, was applied in nature, focusing on financial ratio analysis within a Slovak furniture enterprise, revealing positive trends in liquidity, profitability, and Economic Value Added. In contrast, this study adopted a theoretical and methodological perspective, developing an algorithm for integrating KPIs into the financial controlling of Kyrgyz enterprises across the stages of goal-setting, indicator selection, digitalisation, monitoring, and evaluation.

The ideas of S. Munmun *et al.* (2023) further extended this concept, emphasising that KPIs carry not only financial but also motivational significance. Their research examined

how performance indicator systems influence employee engagement and productivity, establishing a clear link between workforce efficiency and overall company results. The present study broadened this logic by combining motivational and managerial dimensions through the development of a systemic model of KPI-controlling that enhances strategic coherence in decision-making. The conclusions of U. Balon *et al.* (2024) were consistent with this research, affirming that integrating KPIs into digital management systems is essential for enterprise effectiveness. U. Balon *et al.*, however, concentrated on the practical aspect – applying KPIs within the framework of Industry 4.0, where automation and artificial intelligence enable real-time control. In contrast, this study addressed the methodological dimension – constructing a generalised algorithm for implementing KPIs in financial controlling that reflects both digital and strategic levels of management.

Digitalisation also featured centrally in the study by M. Sishi & A. Telukdarie (2025), who argued that KPIs form the core of next-generation industrial systems combining analytics, automation, and digital twins. Yet, while M. Sishi & A. Telukdarie approached KPIs from a technological standpoint, the present study interpreted them through a financial and managerial methodology aimed at enhancing the precision of controlling and the consistency of inter-departmental decisions. A valuable addition was provided by J. Krasodomska & E. Zarzycka (2021), who examined the non-financial dimension of KPIs, particularly in the context of corporate reporting by Polish firms under Directive 2014/95/EU. Their findings revealed how stakeholder pressure influences the disclosure of sustainability indicators. This research, by contrast, concentrated on the internal analytical function of KPIs as a control mechanism ensuring management efficiency and digitalisation within the financial monitoring framework.

A practical parallel can be drawn with the study by E. Nabovati *et al.* (2023), which viewed KPIs as tools for systematising performance metrics in Iranian hospitals. The authors identified twenty-five key indicators reflecting financial efficiency, service quality, and patient safety. In this paper, such approaches were generalised: the KPI integration algorithm was designed to harmonise the strategic, operational, and financial objectives of enterprises while enabling their digital execution through ERP and BI systems. This study and that of Y. Sun (2022) also shared a focus on how KPIs enhance management efficiency and decision-making transparency. Both found that indicator systems facilitate the coordination of strategic, tactical, and operational levels of management and promote the transition towards proactive governance. However, Y. Sun's research focused on the implementation of KPIs in Chinese small and medium-sized enterprises, exploring their role in human resource management, motivation, and the efficient allocation of resources.

A systematic comparison of the reviewed works revealed that most scholars regard KPIs as a fundamental component of modern management, though each

addresses the concept from a distinct perspective. For instance, E. Dindar (2025) interpreted KPIs as instruments for integrating economic, social, and environmental dimensions within GRI and Sustainable Development Goal reporting for the Turkish automotive sector. Her conclusions demonstrated a high disclosure level for social indicators but an evident lack of environmental and managerial metrics. In this context, the present study logically extended the multidimensional approach but concentrated not on external reporting, rather on the internal architecture of financial controlling – developing an algorithm that unifies financial, organisational, and digital indicators within a single system.

A different emphasis was presented in W. Sultan's (2022) research, which explored KPI application in Saudi Arabia's public sector through the Balanced Scorecard model. W. Sultan defined KPIs as a foundation for strategic monitoring, accountability, and the standardisation of management processes. Although the integration of indicators into e-government systems proved successful, the author noted persistent cultural and organisational barriers to their widespread adoption. In contrast, this study developed the theoretical basis for KPI construction within the corporate rather than public context, proposing a universal financial controlling algorithm tailored to enterprises operating in transitional economies. Y. Yurtay *et al.* (2023) demonstrated an innovative approach to KPI implementation in Kazakhstan's industrial systems by integrating machine learning into production efficiency forecasting. Their findings confirmed that artificial intelligence enhances the precision of control and managerial adaptability. Compared with their work, the present study is more conceptual – rather than engaging in technological experimentation, it establishes a holistic methodology for KPI-controlling, ensuring coherent interaction between strategic, financial, and digital management levels.

Similarly, J. Peng (2022) focused on optimising personnel evaluation systems in Chinese SMEs, illustrating that KPIs can function as elements of both managerial and motivational mechanisms, reinforcing the relationship between productivity, management quality, and profitability. While J. Peng emphasised analytical hierarchies and digital modelling, this study shifted attention from the micro-level of labour processes to the macro-level – the methodological system of financial controlling within enterprises. Another notable contribution was that of C. Bagwe (2024), who analysed financial control as a foundation of corporate sustainability. C. Bagwe proposed a six-stage model for evaluating financial system efficiency – from goal-setting and monitoring to gap identification and corrective actions. Although KPIs were not explicitly examined, his systemic control approach corresponds with the logic of the present research: in both, financial diagnostics are viewed not as a formal procedure but as an analytical mechanism for ensuring enterprise stability. Overall, the comparative analysis of these studies shows that despite differing contexts – from industry and the public sector to small businesses – all affirm the strategic importance of KPIs as a cornerstone of effective

controlling. From machine-learning-based practical models to theoretical and methodological frameworks for financial monitoring, KPIs emerge as a mechanism uniting analytics, digital technologies, and managerial accountability.

Conclusions

Summarising the findings of the study, it should be emphasised that the proposed algorithm for integrating KPIs into the financial controlling systems of enterprises in Kyrgyzstan has established a comprehensive methodological foundation for the transition towards results-oriented management. The theoretical framework of the research demonstrated that KPIs function not merely as instruments for measuring goal attainment, but also as effective mechanisms for aligning strategic, tactical, and operational levels of management. As a result, financial controlling assumes the roles of not only accounting, but also forecasting, planning, and analytical support for managerial decision-making.

An analysis of the current state of financial controlling in Kyrgyz enterprises revealed that the regulatory framework is gradually aligning with international standards set by Federation of Accountants, International Organisation of Supreme Audit Institutions, and ISO. However, the absence of a unified national KPI standard remains a major impediment. Insufficient digitalisation, a shortage of qualified specialists, fragmented information systems, and weak coordination between control levels continue to undermine managerial efficiency. Nevertheless, certain examples – such as the operations of Kyrgyztelecom, RSK Bank, Eldik Bank, and the Bishkek municipal administration – have demonstrated the successful application of KPIs as a tool for enhancing transparency, profitability, and the quality of financial analysis.

The developed algorithm, encompassing six stages – from defining strategic objectives and selecting relevant indicators to monitoring, evaluating outcomes, and adjusting the system – has proven its capacity to ensure the integration of KPIs into financial planning, budgeting, and motivation mechanisms. Its practical implementation supports the creation of a unified analytical environment in which data from ERP and BI systems are integrated with managerial decisions, providing the basis for a new generation of digital controlling. Through this approach, enterprises are shifting from reactive to proactive management founded on quantitative assessment, predictive analytics, and adaptive strategic adjustment.

Hence, the integration of KPIs into financial controlling serves not only as a means of improving managerial efficiency but also as an essential element in the modernisation of corporate governance in Kyrgyzstan, in line with international standards of transparency, digital transformation, and sustainable economic development. The principal limitation of this study lies in its predominantly theoretical and normative-methodological focus, without a detailed quantitative assessment of implementation results. Future research should therefore involve practical experiments across enterprises in different sectors of Kyrgyzstan to

empirically validate the effectiveness of the proposed algorithm and its adaptability to digital management systems. None.

Funding

Acknowledgements

None.

Conflict of Interest

None.

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Алгоритм впровадження КРІ-показників в систему фінансового контролю підприємств Киргизстана

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Анотація. Метою даного дослідження було обґрунтування теоретичних та прикладних основ створення механізму інтеграції ключових показників ефективності в систему фінансового контролю підприємств Киргизстана з метою підвищення ефективності управлінських рішень та забезпечення прозорості фінансового моніторингу. Дослідження об'єднало теоретичний аналіз, правову оцінку та практичне тестування ефективності моделей використання показників ефективності у контролінгу. Було розглянуто наукові підходи до формування показників та детально проаналізовано нормативно-правову базу фінансового контролю Киргизстану, включаючи Конституцію, Бюджетний кодекс та стратегічні документи національного розвитку. Практична частина була зосереджена на діяльності відкритого акціонерного товариства «Киргизтелеком», відкритого акціонерного товариства «РСК Банк» та відкритого акціонерного товариства «Елдік Банк», які застосовували показники ефективності для управління та покращення фінансових результатів. Після впровадження прибуток «Киргизтелеком» виріс до 107,7 млн сомів або 1,23 млн доларів, а банки продемонстрували більш високу прозорість звітності та покращену якість процедур контролю. Серед основних перешкод було визначено відсутність єдиного національного стандарту, недостатню цифровізацію, нестачу кваліфікованого персоналу та фрагментацію інформаційних систем. На основі отриманих результатів було розроблено шестиетапний алгоритм інтеграції показників ефективності у фінансовий контроль, що дозволяє перейти від реактивного до проактивного управління та посилити аналітичну координацію на всіх рівнях управління. Практичне значення дослідження полягає в тому, що воно пропонує підприємствам структуровану методологічну основу для адаптації систем контролю на основі ефективності до національних та галузевих економічних умов

Ключові слова: вимірювання продуктивності; стратегічне управління; ефективність; аналітика; бюджет; людські ресурси

**Sustainable business development
in the face of turbulence and digitalisation:
Strategic approaches to ensuring competitiveness**

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Abstract. Ensuring business competitiveness in the face of turbulence and digitalisation requires rethinking traditional strategic management. Sustainable development serves as the conceptual foundation for building strategic resilience, combining economic efficiency, social responsibility, and environmental sustainability. The purpose of the study was to substantiate strategic approaches to ensuring business competitiveness in conditions of turbulence and digitalisation of the external environment based on the principles of sustainable development. The study was theoretical and conceptual in nature. It applied methods of conceptual modelling and analytical formalisation, which created prerequisites for further empirical verification of the proposed provisions. Contemporary scientific approaches to interpreting the relationship between sustainable development, digitalisation, and business competitiveness were summarised, and the impact of turbulence on the transformation of business models and management processes was analysed. The paper substantiated the change in the role of digital technologies in the strategic management system, which was manifested in the transition from fragmented use of digital tools to their comprehensive integration into the strategies of sustainable development and

Received: 22.10.2025, Revised: 19.02.2026, Accepted: 01.04.2026, Published: 06.04.2026

Suggested Citation: Okhrimenko, O., Boiko, M., & Kulyk, M. (2026). Sustainable business development in the face of turbulence and digitalisation: Strategic approaches to ensuring competitiveness. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 13(1), 21-31. doi: 10.52566/msu-econ1.2026.21.



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adaptation of enterprises. A conceptual model for ensuring business competitiveness was proposed, which reflected the logic of interaction between external challenges of a turbulent environment, strategic tools for sustainable development, digital management decisions, and mechanisms of organisational adaptation. The analytical relationship between the key processes of the model was formulated, which allowed substantiating hypotheses about strengthening the competitive position of business in conditions of a high level of digital maturity and integration of ESG approaches into strategic management. The practical significance of the results obtained lies in the possibility of their application in the process of strategic planning, development of sustainable development programmes, and implementation of digital business transformation strategies in conditions of increased uncertainty

Keywords: business competitiveness; strategic management; digital transformation; business environment

Introduction

Global environmental, socio-economic imbalances, geopolitical crises and risks, acceleration of technological changes, transformation of consumer behaviour models contribute to the development of insufficiently predictable, to a certain extent chaotic and disordered processes that reflect the turbulence of the society's functioning environment. For business entities, these processes are accompanied by increased uncertainty of strategic decisions, increased competition, and increased requirements for adaptability and sustainability of economic activity. In such conditions, conventional approaches to the development of competitive advantages are insufficient, which is confirmed by the results of empirical and theoretical studies by E.S. Knudsen *et al.* (2021) and D. Hariyani *et al.* (2025), devoted to the analysis of competitive dynamics in conditions of instability and actualising the search for new strategic guidelines for business development.

In this context, the concept of sustainable development, which provides for the integration of economic, social and environmental goals into the long-term strategy of enterprises, is particularly important. M. Porter & M. Kramer (2019) found that the economic, social, and environmental components of sustainable development form an interrelated strategic contour, which directly affects the adaptability of the business to external shocks. Unlike short-term efficiency tools, sustainable development forms a systemic basis for ensuring business competitiveness in conditions of instability, helping to increase its resilience to external shocks, preserve reputational capital, and build trust on the part of stakeholders. As noted in the literature reviews by I.M. Awad *et al.* (2025) and M. Hamdouna & M. Khmelyarchuk (2025), the integration of sustainable development principles is increasingly seen as a strategic factor for long-term competitiveness, rather than as a purely normative or social requirement. However, the practical implementation of the principles of sustainable development requires adaptation to dynamic changes in the digital environment. Digitalisation of business processes acts both as a catalyst for transformation and as a tool for implementing sustainable development strategies. The use of digital technologies is changing approaches to resource management, communication with consumers, management decision-making, and the development of value chains.

According to the research by M. Bosovska *et al.* (2023) and D.S. Bindeeba *et al.* (2025), in a turbulent environment, digitalisation can increase both positive effects and strategic risks, which requires its consideration within a holistic strategic management system.

In this regard, the scientific problem is the need to substantiate and systematise strategic approaches to ensuring business competitiveness based on sustainable development, considering the impact of turbulence and digitalisation of the external environment. The solution of this problem is of great theoretical and practical importance, as it will contribute to the establishment of more adaptive and sustainable development strategies for business entities in the current conditions. That is why the purpose of the study was to substantiate and systematise strategic approaches to ensuring business competitiveness based on the principles of sustainable development in conditions of turbulence and digitalisation of the external environment. The main objectives of the study were: to substantiate of the relationship and mutual influence of turbulence phenomena, sustainable development, digitalisation, and competitiveness of business entities; to define the conceptual foundations of an integrated model for ensuring business competitiveness through sustainable development and digitalisation in conditions of turbulence; to reveal possible key causal relationships between digital transformation, integration of sustainable development principles, and the level of business competitiveness in conditions of external turbulence.

Literature Review

Contemporary scientific literature showed that the issue of sustainable development of enterprises combined with digital transformation and competitiveness is one of the key areas of strategic research in a turbulent environment. This is indicated by a number of systematic reviews and analyses focusing on the relationship between technological innovation, digitalisation, and business sustainability results. A comprehensive review by M. Hamdouna & M. Khmelyarchuk (2025), devoted to the role of technological innovation in shaping competitiveness, highlighted the importance of technology for the sustainable development of enterprise benefits. The researchers emphasised that it is innovation that becomes the key

determinants of sustainable competitiveness in the long term, as it contributes to increasing resilience to external challenges and supporting sustainable growth. Separate metaanalysis by D.S. Bindeeba *et al.* (2025) proved that digital transformation is a strategic factor in improving the economic, social, and environmental performance of businesses. The synthesis of empirical research has shown that digital technologies contribute to the achievement of comprehensive sustainable development goals, in particular, by optimising resources, improving operational efficiency, and improving interaction with stakeholders.

The study by D. Hariyani *et al.* (2025) pointed to the role of digital leadership in mediating the function between external institutional pressures and sustainability indicators. This effect was enhanced by turbulent changes in the environment, which actualised the need for digital management strategies to adapt and maintain competitive advantages. The classical study by E.S. Knudsen *et al.* (2021) showed that digitalisation can both increase competitive advantages and create conditions for their rapid loss, depending on the businessmodel and the use of big data. This means that digital tools do not always automatically lead to stable competitiveness, but with proper strategic management, they can become a source of sustainable growth. In addition, research by D. Chen & S. Wang (2024) examined the mechanisms through which digitalisation contributes to the achievement of environmental, social, and governance goals (ESG, environmental, Social, and Governance), including risk reduction and increased operational flexibility.

Systematic literature review by G.H. Sagala & D. Eri (2024) on digital transformation in small and medium-sized enterprises has shown that success factors include strategic recognition of digital transformation, development of organisational abilities, managerial competencies, and adaptive strategies. These aspects are relevant for building competitiveness strategies precisely in the turbulent context of markets. The study on the example of Chinese enterprises conducted by L. Kong & J. Chen (2024) demonstrated that digital transformation encourages green and sustainable innovation processes, which created the basis for strategic improvement of competitiveness with an environmental component. This confirmed that digital technologies can act as a tool for implementing the sustainable development goals in a turbulent environment. Review by I.M. Awad *et al.* (2025) also showed that the scientific debate is actively developing towards combining digital transformation with various aspects of sustainability – including ESG (Environmental, Social, and Governance factors), social responsibility, and corporate sustainability. Similar results were obtained by F. Kraus *et al.* (2021), who, based on a systematic analysis of scientific publications, proved that digital transformation creates new opportunities for combining economic efficiency with environmental and social goals of enterprises, forming prerequisites for long-term business competitiveness.

Despite the scientific interest in digital transformation, there is a need for integrated research that simultaneously considers environmental turbulence, digital capabilities, and strategic competitiveness management. Accordingly, despite a significant number of scientific studies devoted separately to the problems of sustainable development, digital transformation and business competitiveness, the issue of a complex combination of these approaches within a single strategic logic of business development in conditions of turbulence remains insufficiently systematised in the scientific literature. The lack of agreed strategic approaches complicates the practical implementation of sustainable development principles and reduces the potential of digitalisation as a factor of long-term competitiveness.

Materials and Methods

The research was theoretical and conceptual in nature and was aimed at generalising and systematising scientific approaches to ensuring business competitiveness in conditions of turbulence and digitalisation based on the principles of sustainable development. It was based on systematic, and structural and functional approaches. Thus, the systematic approach provided for the consideration of strategic management as an integral multi-level system, within which sustainable development, digital management solutions, and competitiveness acted as interrelated subsystems. The structural and functional approach determined their internal structure and functional role in shaping the effectiveness of an enterprise in conditions of turbulence.

The study covered the period 2015-2025, as this period was associated with the beginning and intensification of research on digital transformation and the integration of sustainable development ideas into business after the adoption of the United Nations Sustainable Development Goals (2015). The information base for the research was scientific publications and analytical materials of international organisations (World Commission on Environment and Development, n.d.; United Nations, 2015). To ensure scientific validity, sources were selected according to the criterion of academic significance, and most of them were indexed in the international databases Scopus and Web of Science. The key criterion was relevance: the selection of sources was carried out in accordance with such areas as digital transformation of business, the impact of environmental turbulence on the competitiveness of business entities, the relationship between digitalisation and sustainable development for the creation of economic values. The study also considered classical theoretical papers, in particular the concept of the triple result by J. Elkington (1997, 1998) and the theory of dynamic abilities by D.J. Teece *et al.* (1997) as fundamental methodological sources. These concepts were chosen as the methodological basis of the study due to their complementarity. The concept of triple result by J. Elkington provided a theoretical substantiation for the multidimensional nature of sustainable business development

(economic, social, and environmental dimensions), while dynamic ability theory by D.J. Teece *et al.* explained the mechanisms of strategic adaptation of the enterprise in conditions of turbulence. The combination of these approaches allowed integrating target (effective) and process (adaptive) components within a single strategic management model.

Scientific sources were systematised using comparative analysis, which enabled a comparison of different approaches to the interpretation of digital transformation and sustainable development. In addition, logical and structural grouping was used, which helped to create author's tables with the characteristics of key signs of turbulence in the business environment, the evolution of scientific approaches to sustainable development and digital technologies in business. The tables reflected the impact of sustainable development components on business competitiveness and the integration of sustainable development and digitalisation in competitive advantage strategies.

Several methods were used in the study. Analysis and synthesis methods were used to summarise theoretical provisions on sustainable development, ESG approaches, and digital business transformation. The induction method was used to summarise the results of the analysis of scientific publications and empirical data on the impact of turbulence on the digital transformation of enterprises, which allowed forming general conclusions about the role of strategic coherence and adaptability of the proposed model. The deduction method was used to test the theoretical provisions put forward about the relationship between digital solutions, dynamic abilities, transformation, and efficiency of the enterprise by their logical deployment within the proposed conceptual model. The method of abstraction was used to identify key factors of strategic management in conditions of turbulence by separating essential characteristics (strategic consistency, digitalisation, adaptability of the business model, effectiveness) from secondary environmental factors. This helped to form a generalised conceptual design of the study. The formalisation method was used to provide this conceptual construction with a logical and mathematical expression through the construction of an analytical equation that reflected the functional relationships between certain variables and allowed assessing their impact on the enterprise performance.

The method of conceptual modelling was used to substantiate the integration of sustainable development tools into the strategic management system. It allowed combining external challenges, management tools, and adaptation mechanisms into a single logical structure. The research was conducted at the level of an individual enterprise, with a focus on the development of its competitiveness in the context of digital transformation and an unstable external environment. The sectoral and macroeconomic context (institutional constraints, turbulence, ESG requirements) that affect the strategic decisions of business entities were considered.

The limitation of the study was that it was theoretical in nature and did not pass empirical testing in enterprises. It was limited by chronology and sources (2015-2025, Scopus and WoS), which may not consider the latest trends. The analysis was carried out at a general level, without detailing for individual industries or regions. The level of turbulence was estimated conceptually, without the use of precise measurement tools. The proposed indicators of digitalisation, ESG orientation, and strategic management were of a recommendatory nature and may need to be adapted depending on the specifics of the enterprise.

Results

The idea of investigating strategic approaches to ensuring business competitiveness based on the principles of sustainable development in conditions of turbulence and digitalisation lies in the following logical visions: turbulence of the business environment is a factor in the transformation of development strategies → sustainable business development is a strategic basis for ensuring competitiveness → digitalisation is a tool for implementing sustainable business development strategies. These phenomena link turbulence, sustainable development, digitalisation, and the competitiveness of business entities. The contemporary business environment operates in conditions of increased turbulence, which is manifested in the instability of market conditions, the acceleration of technological changes, and the growth of geopolitical and socio-economic risks. In scientific (Teece *et al.*, 1997) and analytical studies (United Nations, 2015), turbulence is considered as an environmental state characterised by unpredictability, nonlinearity, and limited ability to extrapolate previous development trends. Under such conditions, conventional strategic models focused primarily on stability and predictability lose their effectiveness.

The analysis of scientific approaches showed that turbulence transforms the very logic of ensuring business competitiveness: from the dominance of price and resource advantages to advantages based on adaptability, speed of response, and strategic flexibility. K.M. Eisenhardt & J.A. Martin (2000) and E.S. Knudsen *et al.* (2021) proved that in such conditions, the dynamic abilities of business entities, i.e., the ability to integrate and reorient resources in accordance with changes in the external environment, become crucial. In this context, sustainable development takes on a new meaning – not as stability in the traditional sense, but as the ability of a business to operate for a long time in the face of constant changes, which makes it an important tool for strategic management in a turbulent environment. For an in-depth analysis of the impact of turbulence on strategic business development, it is advisable to systematise the main signs of an unstable external environment and their consequences for management decisions. Generalisation of scientific approaches in Table 1 allows identifying the key manifestations of turbulence that form new requirements for strategies to ensure the competitiveness of business entities.

Table 1. Characteristics of key signs of business environment turbulence and their strategic challenges

Sign of turbulence	Manifestation in the business environment	Strategic business challenges	References
High uncertainty	Market instability, demand fluctuations	Shift towards flexible strategies	D. Teece (1997), United Nations (2015), X. Guo & W. Pang (2025)
Acceleration of changes	Fast technology updates	Need for dynamic abilities	G.C. Kane et al. (2016)
Geopolitical risks	Supply chain disruption	Business model diversification	World Commission on Environment and Development (n.d.), United Nations (2015)
Information asymmetry	Excess data	Implementation of digital analytics	G. Vial (2019)

Source: created by the authors

The characteristics presented in the table indicate that the turbulence of the business environment not only complicates the strategic planning process, but also acts as a catalyst for the transformation of management approaches. Growing uncertainty and accelerating change necessitate a move from rigid strategic models to flexible and adaptive strategies focused on long-term business sustainability. The concept of sustainable development in the research by J. Elkington (1997), M.E. Porter et al. (2019) and Nogueira et al. (2022) is considered as an integrated system of economic, social and environmental priorities aimed at creating long-term value for business and society. Unlike conventional approaches to performance management, sustainable development focuses not only on financial results, but also on the quality of resource management, interaction with stakeholders, and social responsibility of businesses.

The analysis of scientific publications has shown that sustainable development is increasingly considered as a

factor in the development of competitive advantages, in particular, through increasing reputational stability, reducing operational risks, and increasing confidence on the part of investors and consumers. Research by E. Nogueira et al. (2022), C. Simbalari (2023) and S.B. Khaled et al. (2025) confirmed the existence of a positive link between the implementation of the principles of sustainable development and the financial performance of companies in the long term. In order to substantiate the role of sustainable development in ensuring business competitiveness, it is important to analyse the evolution of scientific approaches to its interpretation. In the scientific literature, the concept of sustainable development has undergone significant changes – from a predominantly ecological approach to an integrated strategic paradigm of business management. The evolution of relevant scientific approaches is summarised in Table 2.

Table 2. Evolution of scientific approaches to the interpretation of sustainable business development

Author/approach	Key idea	Focus for business	Value for competitiveness
J. Elkington (1997), E. Nogueira et al. (2022)	Triple result	Balance of economy, society, and ecology	Long-term sustainability
M.E. Porter & M.R. Kramer (2019)	Shared value	Integration of social goals	Competitive advantages
ESG approach (Khaled et al., 2025)	Responsible management	Transparency and trust	Investment attractiveness
Strategic management (Simbalari, 2023)	Sustainable strategies	Adaptability	Improvement of sustainability

Source: created by the authors

The generalisation of scientific approaches given in the table gives grounds to assert that the current understanding of sustainable business development goes beyond social responsibility and environmental orientation. Sustainable development is increasingly seen as a strategic tool for building competitive advantages, ensuring long-term sustainability and adaptability of business in conditions of turbulence. In the face of turbulence, sustainable development allows businesses to reduce their dependence on short-term market fluctuations, ensuring a strategic balance between economic feasibility and social and environmental responsibility. However, the effectiveness of implementing sustainable development strategies

largely depends on the ability of enterprises to adapt them to digital transformation.

Digitalisation is one of the key drivers of contemporary business transformation and significantly affects the mechanisms for implementing sustainable development strategies. G.C. Kane et al. (2016) and G. Vial (2019) defined digital transformation as a profound change in business models, management processes, and organisational structures influenced by digital technologies. The research analysis showed that digital technologies create opportunities for more efficient use of resources, increased transparency of management, and improved decision-making processes, which is critical for the implementation of the principles of

sustainable development. In particular, the use of data analytics, digital platforms, and automated management systems helps reduce costs, optimise value chains, and improve business environmental efficiency. Nowadays, digitalisation is an important tool for implementing sustainable business

development strategies. To identify its role, it is advisable to systematise the main digital technologies and areas of their use in the context of achieving economic, social, and environmental goals for the development of enterprises. The corresponding systematisation is shown in Table 3.

Table 3. Digital technologies as tools for implementing sustainable business development strategies

Digital technology	Area of use	Link to sustainable development
Big Data	Solution analytics	Resource optimisation
Digital platforms	Interaction with stakeholders	Transparency
Automation	Business processes	Energy efficiency
AI and ML	Forecast	Risk reduction

Source: created by the authors based on M. Bosovska *et al.* (2023), I.M. Awad *et al.* (2025), D.S. Bindeeba *et al.* (2025), M. Hamdouna & M. Khmelyarchuk (2025)

These tables demonstrated that digital technologies provide a practical basis for implementing the principles of sustainable development, contributing to improving the efficiency of resource management and transparency of business processes. However, their effectiveness depends on the strategic integration of digital solutions into the overall business development model, and not on the fragmented

implementation of individual tools. Despite the significant potential of digitalisation in ensuring sustainable development and business competitiveness, its implementation is accompanied by a number of risks that increase in a turbulent environment. For a comprehensive assessment of these challenges, Table 4 systematised the main types of risks of digital business transformation.

Table 4. Risks and limitations of business digitalisation in the face of turbulence

Type of risk	Characteristics	Potential consequences
Cyber risks	Data leak	Loss of trust
Technological dependence	Platform dependency	Reduced autonomy
Organisational risks	Lack of competencies	Resistance to change
Financial risks	High investment	Rising costs

Source: created by the authors based on G.C. Kane *et al.* (2016), G. Vial (2019), E.S. Knudsen *et al.* (2021), S.B. Khaled *et al.* (2025)

The risk systematisation presented in Table 4 showed that digitalisation requires a balanced strategic approach and the development of appropriate management competencies. Ignoring risks can reduce the expected effects of digital transformation and increase business vulnerability, which is especially important in high turbulence. Digitalisation in the face of turbulence is accompanied by an increase in strategic risks associated with cybersecurity, dependence on technology suppliers, and uneven access to digital resources. This leads to the need for an integrated strategic approach, in which digitalisation is considered not as an end in itself, but as a tool for ensuring sustainable development and business competitiveness.

Generalisation of the results of the analysis of scientific sources allows considering sustainable development and digitalisation as complementary components of modern competitiveness strategies. Digital technologies strengthen the ability to implement the principles of sustainable development, while sustainability forms strategic guidelines for digital business transformation in a turbulent environment. Thus, business competitiveness is formed based on integration of sustainable development and digitalisation strategies. A summary of the impact of key components of sustainable development on the competitive position of the enterprise is given in Table 5.

Table 5. Impact of sustainable development components on business competitiveness

Component of sustainable development	Key tools	Expected strategic effect
Economic	Effective resource management	Improved productivity
Social	Human capital development	Increasing staff loyalty
Ecological	Resource saving	Reduce costs and risks
Institutional	Corporate governance	Reputational sustainability

Source: created by the authors based on J. Elkington (1997), M.E. Porter *et al.* (2019), E. Nogueira *et al.* (2022), S.B. Khaled *et al.* (2025)

The results showed in Table 5 show that business competitiveness is formed not at the expense of individual

components of sustainable development, but as a result of their complex interaction. The integration of

economic, social, and environmental tools into the development strategy allows businesses to increase efficiency, reduce risks, and strengthen their market position in the long term. To summarise the research results and form a holistic vision of strategic approaches

to ensuring business competitiveness, it is advisable to consider the possibilities of integrating sustainable development and digitalisation within a single strategic management logic. The corresponding integration model is presented in Table 6.

Table 6. Integration of sustainable development and digitalisation in business competitiveness strategies

Strategic approach	Role of sustainable development	Role of digitalisation	Expected result
Integrated	Strategic guidelines	Implementation tools	Long-term competitiveness
Adaptive	Sustainability	Flexibility	Risk reduction
Stakeholder	Social responsibility	Communications	Reputational advantages

Source: created by the authors based on M.E. Porter *et al.* (2019), G. Vial (2019), E.S. Knudsen *et al.* (2021), D. Hariyani *et al.* (2025)

The strategic approaches shown in Table 6 confirm that an effective combination of sustainable development and digitalisation principles forms the basis for long-term business competitiveness. Such integration increases enterprise adaptability, reduces strategic risks, and creates sustainable value in an unstable and digitally transformable environment. Thus, in the context of growing turbulence of the external environment, characterised by accelerating technological changes, unstable markets and increasing institutional challenges, conventional approaches to ensuring business competitiveness are not effective enough. This makes it necessary to form integrated conceptual solutions that can combine strategic guidelines for sustainable development with digital transformation opportunities.

Accordingly, the analysis of scientific sources provided the following scientific conclusions:

- digital transformation and ESG orientation are key factors in modern business competitiveness;
- strategic management acts as an integration mechanism for implementing digital and sustainable initiatives;
- environmental turbulence is a factor that changes the effectiveness of strategic instruments.

In this context, a conceptual integrated model for ensuring business competitiveness through sustainable development and digitalisation in conditions of turbulence is proposed (Fig. 1). It systematises the key factors, mechanisms, and results of interaction between sustainable development, digital management tools, and enterprise adaptability to external changes. The model demonstrates that digitalisation enhances the effectiveness of implementing the principles of sustainable development, and sustainable development creates the strategic basis for digital transformation.

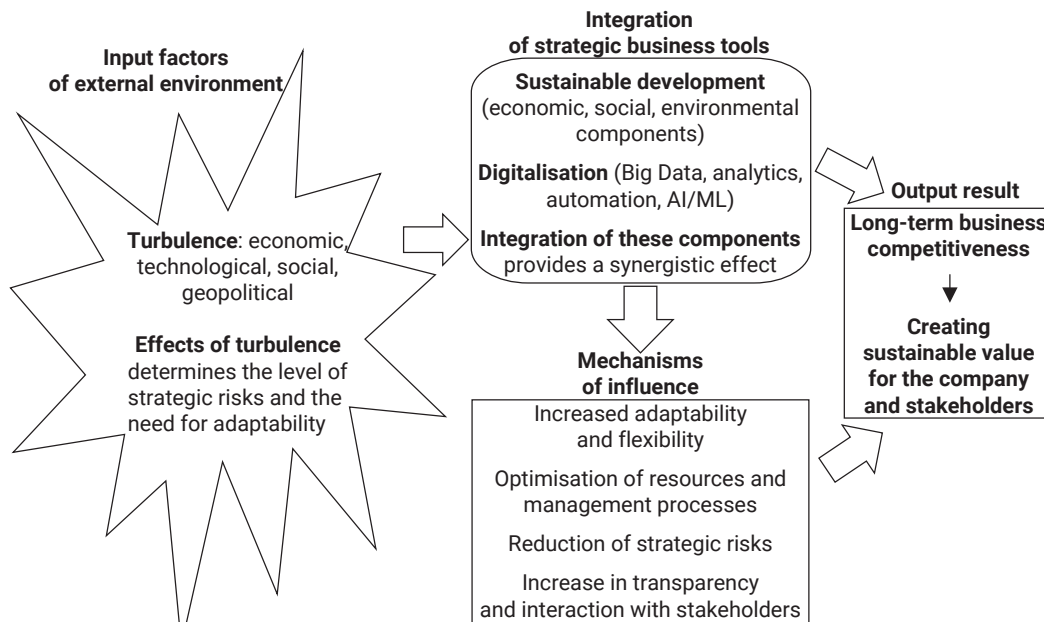


Figure 1. Integrated model for ensuring business competitiveness through sustainable development and digitalisation in the face of turbulence

Source: created by the authors

The proposed conceptual model comprehensively reflects the logic of forming business competitiveness as a

dynamic result of integrating the principles of sustainable development, digital management decisions, and

mechanisms for responding to environmental turbulence. Its application creates a methodological basis for justifying strategic management decisions aimed at improving the sustainability, adaptability, and long-term efficiency of enterprises. In addition, the model can serve as an analytical basis for further empirical research, quantitative assessment of the relationships between its elements, and practical testing in various sectors of the economy.

The presented conceptual model serves as a theoretical basis for further formalisation of relationships between key processes, in particular, digital transformation, integration of ESG approaches, and the level of external turbulence, which makes it necessary to move to an analytical description of these dependencies. In order to deepen the analysis of the relationship between the processes of digitalisation, sustainable development, and ensuring business competitiveness in conditions of increased environmental variability, it is advisable to use an analytical model that considers not only the direct influence of key factors, but also their interaction. Contemporary research proved that the effectiveness of digital and sustainable strategies largely depends on the level of economic, technological, and institutional turbulence, which necessitates a formalisation of the corresponding moderation effects within the framework of strategic analysis.

Competitive strength (CS) is proposed to be considered as a result of the impact of the level of digital transformation (DT), the integration of sustainable development principles and ESG approaches (ESG), the effectiveness of Strategic Management (SM), and the level of external turbulence (ET). To reflect the complex nature of the interaction of these processes, a generalised analytical model is proposed, which includes the moderation effect of turbulence on the results of digitalisation and the implementation of sustainable strategies

$$CS = \alpha + \beta_1 DT + \beta_2 ESG + \beta_3 SM + \beta_4 (DT \times ET) + \beta_5 (ESG \times ET), \quad (1)$$

where α – basic level of competitive potential of the enterprise; β_1 - β_3 – direct impact of digital transformation, ESG orientation, and strategic management, respectively; β_4 and β_5 – reflect changes in the strength of digital and sustainable strategies depending on the level of external turbulence. DT – systematic integration of digital technologies into business processes, management, and value creation that changes the operational model of an enterprise and its competitive behaviour. Theoretically, it is evaluated through: the level of digitalisation of business processes, the share of investment in digital technologies, the use of Big Data, AI, digital platforms, enterprise digital maturity indices, and the share of digital sales channels. ESG orientation – integration of environmental, social, and governance principles into an enterprise's strategic decisions to ensure long-term sustainability and create value for stakeholders. Its possible measurement indicators are: the presence of an ESG strategy, an ESG rating or sustainability indices,

indicators of personnel development, and transparency of corporate governance. SM – ability of an enterprise to develop and implement a long-term competitive strategy based on digital and sustainable benchmarks. Theoretically, this can be evaluated through: the presence of a formalised development strategy, the level of strategic flexibility, innovation activity, and indicators of strategic adaptability. ET – degree of instability, unpredictability, and intensity of changes in the market, technology, and institutional environment. Its possible indicators are: the frequency of changes in regulatory requirements, the intensity of technological innovations in a particular industry, the level of competition, macroeconomic volatility, and business climate indices. The proposed indicators for measuring variables are recommended in nature and can be specified depending on industry specifics and data availability.

It is worth noting that the impact of digitalisation and ESG orientation is not linear and is the same under all conditions. In a stable environment, their effect can manifest itself gradually and through long-term investments. In the face of high turbulence, digital technologies increase adaptability and speed of response, and ESG practices can act as a factor of trust and stability. However, excessive intensity of change can reduce the effectiveness of long-term strategies due to increased uncertainty and risks. That is why the model includes variables (DT \times ET) and (ESG \times ET), which allows considering the variable nature of their influence depending on environmental conditions.

Notably, the proposed model is explanatory (conceptual) in nature, it has not passed empirical testing on a sample of enterprises, and its provisions are based on generalisation and systematisation of scientific sources. However, it reflects the complex nature of the development of business competitiveness in modern conditions, in which digitalisation and integration of sustainable development principles cannot be considered in isolation from the dynamics of the external environment. The inclusion of interacting variables explains the multidirectional results of implementing digital and ESG strategies during periods of increased turbulence and emphasises the key role of strategic management as a mechanism for adapting enterprises to unstable operating conditions. ESG is used both as an independent determinant and as a variable whose influence is modified by the level of environmental turbulence. In this context, competitive advantages acquire not only a technological or environmental dimension, but also a strategic character that ensures their relative sustainability in the long term.

Thus, the conceptual model proposed in Figure 1 reflects the structural and logical relationships between the processes of sustainable development, digitalisation, and ensuring business competitiveness, while the analytical model (1) allows formalising these relationships in the form of functional dependence. The combination of visual and analytical approaches provides a comprehensive disclosure of the problem under study.

Within the framework of the proposed analytical design, the following research hypotheses were formulated:

- Digital transformation of a business has a positive impact on its competitiveness.
- Integration of ESG approaches into the business strategy contributes to the development of sustainable competitive advantages.
- External turbulence moderates the impact of digital transformation on competitiveness by increasing the importance of strategically managed digital solutions.
- Impact of ESG-oriented strategies on business competitiveness depends on the level of external turbulence.

The formulated hypotheses reflect the key causal relationships between digital transformation, integration of sustainable development principles, and the level of business competitiveness in the context of external turbulence. They logically follow from the proposed conceptual and analytical models and create a theoretical basis for further empirical research aimed at quantifying the impact of certain factors and checking moderation effects. These hypotheses serve as a generalisation of the obtained theoretical provisions and determine the areas of further scientific research.

Discussion

The theoretical and methodological foundations of the proposed model were consistent with the results of empirical and review studies by E.S. Knudsen *et al.* (2021), I.M. Awad *et al.* (2025). In these studies, it was proved that digital transformation and integration of sustainable development principles form competitive advantages not in isolation, but through a complex system of interdependencies with the external environment. In particular, research by D.S. Bindeeba *et al.* (2025) showed that in the context of growing market and institutional turbulence, the effectiveness of digital solutions significantly depends on the strategic coherence of management actions and the ability of the enterprise to adapt the business model to changing operating conditions. Accordingly, the results of this study correlate with the findings of D.S. Bindeeba *et al.* (2025), as they also proved that digital solutions do not automatically improve efficiency in turbulence, strategic consistency of management decisions, and the ability of an enterprise to adapt its business model in accordance with changes in the external environment are also an important factor.

Similarly, M. Hamdouna & M. Khmelyarchuk (2025) proved that, in particular, ESG-oriented strategies show a heterogeneous impact on competitiveness. This impact was enhanced in situations of increased regulatory pressure and environmental instability, which was confirmed by the results of systematic reviews and conceptual studies in the field of sustainable business development. In this context, the inclusion of the moderation effect of external turbulence in the analytical model allowed generalising existing scientific approaches. It also explained why digitalisation and sustainability in the strategic dimension were not only tools for improving operational efficiency, but also key mechanisms for ensuring adaptive business competitiveness in the long term.

The results obtained as part of the study were generally consistent with research by I.M. Awad *et al.* (2025) and M. Hamdouna & M. Khmelyarchuk (2025), according to which the competitiveness of a business in conditions of growing turbulence is increasingly determined not by individual management tools, but by their integration into a comprehensive system of strategic decisions. The proposed conceptual model confirmed the opinion that sustainable development and digitalisation do not function independently, but form an interconnected basis for strategic adaptation of business to an unstable external environment, which corresponds to the conclusions of contemporary systematic reviews.

The results of the study added to the scientific discussion about the role of digital technologies in providing sustainable competitive advantages. Unlike approaches that view digitalisation primarily as a driver of operational efficiency, this study, in line with the findings of D.S. Bindeeba *et al.* (2025) and L. Kong & L. Chen (2025), emphasised its strategic role in implementing the principles of sustainable development and ESG approaches. Furthermore, the results obtained are consistent with the conclusions of E.S. Knudsen *et al.* (2021) and D. Hariyani *et al.* (2025), confirming the ambiguous nature of the impact of environmental turbulence on the competitive position of business. On the one hand, increasing instability complicates strategic planning and increases the level of risks, on the other hand, it encourages enterprises to accelerate digital transformation and implement more flexible management models. Thus, sustainable development combined with digital maturity should be considered not only as a regulatory or reputational requirement, but also as a strategic tool for reducing business vulnerability and increasing its adaptability in a turbulent environment.

Conclusions

The study showed that business competitiveness in a turbulent and digitally transformed environment is formed through the integration of sustainable development principles and digital technologies. Sustainable development is a strategic framework that ensures long-term business sustainability, while digitalisation increases the efficiency of management processes, promotes resource optimisation, transparency, and rapid response to changes. In this context, digital technologies are not an end in themselves, but serve as a tool for implementing strategies aimed at achieving economic, social, and environmental goals. The results of the analysis showed that the level of external turbulence moderates the effectiveness of digital and ESG initiatives: in high turbulence, digitalisation increases business adaptability, and ESG-oriented strategies ensure the trust of stakeholders and reputational sustainability. However, excessive volatility can weaken the effect of long-term strategies, which highlights the need for strategic governance as an integration mechanism between digital and sustainable initiatives.

The proposed conceptual model reflects the development of business competitiveness as a result of the integration of sustainable development, digital management solutions, and effective response and adaptation to turbulence. The formalisation of such interaction in the form of functional dependence, considering the moderation role of turbulence, emphasises that competitive advantages are not a linear consequence of the implementation of individual management decisions, but are formed through their strategic consistency and adaptability to changes in the environment. Therefore, it is advisable to combine digital tools and ESG-oriented strategies as the basis for long-term competitiveness of business entities. This approach is consistent with empirical and meta-analytical studies that prove that digital transformation can enhance long-term business performance only if it is integrated into the strategic and value orientations of business entities. The use of a conceptual model can serve as a basis for strategic decisions,

increasing the adaptability and sustainability of business entities. The study provided a theoretical basis for further empirical research aimed at quantifying the proposed relationships, industry adaptation of the model, and analysing the impact of digital maturity on achieving the sustainable development goals in various sectors of the economy. Further research should be directed to empirical verification of the proposed model and hypotheses taking in consideration industry and large-scale features of enterprises' activities.

Acknowledgements

None.

Funding

None.

Conflict of Interest

None.

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Сталий розвиток бізнесу в умовах турбулентності та цифровізації: стратегічні підходи до забезпечення конкурентоспроможності

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Анотація. Забезпечення конкурентоспроможності бізнесу в умовах турбулентності та цифровізації потребує переосмислення традиційного стратегічного управління. При цьому концептуальною основою для формування стратегічної стійкості, де поєднуються економічна ефективність, соціальна відповідальність та екологічна доцільність виступає сталий розвиток. Метою статті було обґрунтування стратегічних підходів до забезпечення конкурентоспроможності бізнесу в умовах турбулентності та цифровізації зовнішнього середовища на засадах сталого розвитку. Дослідження мало теоретико-концептуальний характер. У ньому було застосовано методи концептуального моделювання й аналітичної формалізації, що створило передумови для подальшої емпіричної верифікації запропонованих положень. Узагальнено сучасні наукові підходи до інтерпретації взаємозв'язку між сталим розвитком, цифровізацією та конкурентоспроможністю бізнесу, а також проаналізовано вплив турбулентності на трансформацію бізнес-моделей і управлінських процесів. Обґрунтовано зміну ролі цифрових технологій у системі стратегічного управління, що проявляється у переході від фрагментарного використання цифрових інструментів до їх комплексної інтеграції у стратегії сталого розвитку та адаптації підприємств. Запропоновано концептуальну модель забезпечення конкурентоспроможності бізнесу, яка відображає логіку взаємодії зовнішніх викликів турбулентного середовища, стратегічних інструментів сталого розвитку, цифрових управлінських рішень та механізмів організаційної адаптації. Сформульовано аналітичну залежність між ключовими процесами моделі, що дозволило обґрунтувати гіпотези щодо посилення конкурентних позицій бізнесу за умов високого рівня цифрової зрілості та інтеграції ESG-підходів у стратегічне управління. Практична значущість отриманих результатів полягає у можливості їх застосування в процесі стратегічного планування, розроблення програм сталого розвитку та реалізації стратегій цифрової трансформації бізнесу в умовах підвищеної невизначеності

Ключові слова: конкурентоспроможність бізнесу; стратегічне управління; цифрова трансформація; бізнес-середовище

Scientific Bulletin of Mukachevo State University

Series

Economics

Volume 13, No. 1, 32-44

Journal homepage: <https://economics-msu.com.ua/en>

ISSN 2313-8114

E-ISSN 2518-1254

UDC 336.71:004.738.5

DOI: 10.52566/msu-econ1.2026.32

The Ukrainian pension system of the future: The potential for using cryptocurrency instruments within pension provision

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Abstract. The relevance of the study is determined by the simultaneous deepening of demographic imbalances in the Ukrainian pension system and the active digitalisation of global financial markets, which makes the search for new investment instruments for the cumulative pension level urgent. The aim of the article was to justify the feasibility and conditions for integrating cryptocurrency instruments into Ukraine's mandatory cumulative pension system, taking into account international experience and national institutional constraints. To achieve this aim, methods of analysis and synthesis, comparative analysis, scenario and structural modelling, as well as generalisation of international practice in regulating digital assets were used. The main advantages and risks of using cryptocurrencies in long-term pension strategies are substantiated. The advantages included increased diversification opportunities, potential for growth in returns, and access to innovative financial assets. At the same time, key risks associated with high cryptocurrency market volatility, regulatory uncertainty, cybersecurity threats, and insufficient financial literacy among the population have been identified. An institutional and legal model for the phased introduction of cryptocurrencies into Ukraine's cumulative pension system has been proposed, which provides for the regulatory consolidation of the status of crypto assets, limiting their share in pension portfolios to 5-10%, the use of exclusively regulated instruments (exchange-traded funds, trusts), regular stress testing, training of non-state pension fund specialists, improving the financial literacy of the population, and implementing pilot projects with the participation of state institutions. The results of the study can be used in shaping state policy on the development of funded pension provision, as well as in improving the investment strategies of non-state pension funds in the context of the digital transformation of the economy

Keywords: funded pension provision; investment diversification; risk management; digitalisation; investment strategy

Received: 17.11.2025, Revised: 03.03.2026, Accepted: 01.04.2026, Published: 06.04.2026

Suggested Citation: Nechyaeva, I., & Shylovets, I. (2026). The Ukrainian pension system of the future: The potential for using cryptocurrency instruments within pension provision. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 13(1), 32-44. doi: 10.52566/msu-econ1.2026.32.



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Introduction

The effectiveness of the pension system is a key factor in the socio-economic stability of the state, especially in the context of an ageing population and the growing financial burden on solidarity-based pension mechanisms. In Ukraine, this problem is exacerbated by the decline in the working population, the budget deficit of the Pension Fund, and the delayed introduction of a mandatory accumulation level. Against this backdrop, the digitalisation of financial markets and the emergence of new asset classes are fuelling scientific debate on the possibility of using innovative instruments in pension investment strategies.

The problems of transforming Ukraine's pension system in conditions of long-term socio-economic instability are discussed in detail in the works of Ukrainian scientists. Thus, I.A. Nechaeva (2020) concluded that the current pension insurance model does not provide a sufficient level of social security and requires a structural overhaul involving accumulation mechanisms. A similar position is held by T.O. Staverska & I.L. Shevchuk (2017), who justified the need to diversify the sources of pension payments and increase the role of investment income in the context of the limited capabilities of the solidarity system. At the same time, these studies focus primarily on the institutional aspects of pension reform, without considering digital assets as a potential investment tool.

The use of cryptocurrencies and related financial instruments in portfolio investment has been actively researched in international scientific literature. Thus, A. Petukhina *et al.* (2021) noted that cryptocurrencies can serve as a portfolio diversifier due to their low correlation with traditional financial assets, but their inclusion is accompanied by increased volatility risks. Similar conclusions were reached by M. Soland & P. Schueffel (2021), who emphasised that cryptocurrencies can be acceptable in pension fund portfolios only if their share is strictly limited and subject to a high level of regulatory control. Aspects of financial stability and systemic risks of pension investments were considered in a study by S. Agrawal *et al.* (2025), which focused on the potential impact of non-traditional assets on the long-term sustainability of pension funds. The authors cautioned that excessive use of highly volatile instruments could create additional risks for future pension payments. In this context, the results of studies on the institutional adaptation of pension systems to digital technologies are important.

The practical aspects of integrating cryptocurrencies into the activities of pension funds are discussed in publications by international financial analytical resources. According to Pension Policy International (2024), some US pension funds have begun to invest in cryptocurrency assets through regulated exchange-traded funds, indicating the gradual institutionalisation of digital assets. Similar trends are observed in other countries, particularly in the United Kingdom and South Korea, confirming the global nature of this process (Financial Times, 2025). First, cryptocurrencies demonstrate the potential for portfolio diversification due to their low correlation with traditional

assets. For example, E. Platanakis & A. Urquhart (2020) showed that Bitcoin, Ethereum and other crypto assets acted as diversifiers for European stock indices during the COVID-19 crisis, while some stablecoins even had hedge properties similar to gold. Second, they are capable of providing higher expected returns in the long term, which is important for accumulation systems. Thirdly, there are already successful practices in the world where cryptocurrency Exchange-Traded Funds (ETFs) are included in the investment portfolios of large pension funds, primarily in the United States, the United Kingdom, Japan, and Germany. For example, D. Krause (2025b) analysed real cases where US university endowments and pension funds began to choose Bitcoin ETFs as part of their long-term portfolios, demonstrating real ways to integrate crypto assets into conservative investment strategies. At the same time, cryptocurrencies remain high-risk assets due to their volatility, regulatory uncertainty, potential cyber threats, and technical difficulties in storage. For pension systems, where the main goal is capital preservation and payment stability, these risks are of fundamental importance. That is why it is necessary to critically assess the possibility and admissibility of using digital assets in the context of Ukrainian reform.

Cryptocurrencies can increase the diversification properties of portfolios, but their feasibility depends on the regulatory environment, the competence of administrators, the availability of licensing infrastructure, and the level of financial literacy among the population. In particular, D.G. Baur *et al.* (2018) found that Bitcoin has a low correlation with traditional financial assets but cannot be considered a full-fledged "safe haven" in periods of financial instability. S. Corbet *et al.* (2019) concluded that including cryptocurrencies in a portfolio can improve the risk-return ratio while increasing the overall volatility of assets. In turn, E. Bouri *et al.* (2021) emphasised that the use of crypto assets by institutional investors is only advisable in a developed regulatory environment, with licensed infrastructure and a high level of financial literacy among market participants. For pension systems focused on capital preservation and payment stability, these restrictions are of fundamental importance, which highlights the need for a critical assessment of the possibilities for integrating digital assets in the context of Ukrainian pension reform.

In Ukraine, research in this area is fragmented, and Law of Ukraine No. 2074-IX (2021) has not been fully implemented, creating a gap between the economic potential of innovations and the possibility of their practical implementation. In view of this, there is a need for a comprehensive analysis of whether cryptocurrencies can be integrated into the Ukrainian funded pension system, in what form, under what conditions and with what restrictions. International experience, which demonstrates a wide range of approaches – from cautious investments to models of direct ownership of digital assets – is of particular value to Ukraine. Thus, the aim of this study was to fill the existing scientific gap and justify possible ways of introducing cryptocurrencies

into pension investment portfolios, taking into account the peculiarities of the Ukrainian financial market.

Materials and Methods

The methodological framework of the study consisted of a set of theoretical and empirical methods that provided a comprehensive analysis of the possibility of using cryptocurrencies in funded pension systems. Statistical analysis was used to assess the dynamics of pension indicators in Ukraine and the financial characteristics of cryptocurrencies. The number of pensioners and the employed population for 2021-2025 was analysed, as well as the structure of pension payments based on data from the Pension Fund of Ukraine (2025). An analysis of the regulatory framework (Parliament of Ukraine, 2023) was used to identify the current regulatory conditions for the functioning of the pension system and the virtual asset market in Ukraine. Within the framework of this method, the provisions of national legislation in the field of pension provision were analysed, as well as regulatory acts governing the circulation of digital assets, in particular legislative initiatives on virtual assets. The advantages and risks of investing in cryptocurrencies were studied based on the work of A. Petukhina *et al.* (2021).

The next stage of the study was an analysis of the legal status of cryptocurrencies in countries where they are already included in pension portfolios. A comparative analysis of international experience was used to identify possible models for integrating cryptocurrency instruments into pension portfolios. To this end, countries with different levels of development of pension systems and financial markets were selected – the United States, the United Kingdom, Germany, Japan and South Korea. The criteria for selecting countries were: the existence of funded pension systems, the use of ETFs or similar instruments, and regulatory certainty regarding crypto assets (OECD, 2024; Kovács *et al.*, 2024; Krause, 2025a; 2025b). The study also used elements of socio-economic analysis to assess the impact of the population's level of financial literacy on the perception of digital assets as a potential tool for pension savings, based on the work of R. Munson (2022).

Scenario analysis was used to assess the potential consequences of using cryptocurrency instruments in Ukraine's funded pension system under various regulatory and market development conditions. Two generalised scenarios were developed within the study: conservative and moderately innovative. The main assumptions of scenario modelling were: maintaining the solidarity level of pension provision as the baseline; no direct ownership of cryptocurrency tokens by pension funds; use of exclusively licensed and regulated investment instruments; stability of macro-economic conditions in the medium term. The input data for the scenario analysis were statistical indicators of the

profitability and volatility of Bitcoin and Ethereum cryptocurrencies, data on the average profitability of traditional financial instruments, as well as indicators of pension payments and the demographic structure of the population of Ukraine. The expected returns, risks, and systemic stability of each scenario were compared. The criteria for comparing the scenarios were determined as follows: expected returns on pension assets, level of investment risk, impact on the financial stability of pension funds, and compliance with current and projected regulatory restrictions.

To assess the impact of financial literacy and age characteristics on the perception of digital assets as a pension investment tool, a secondary analysis of empirical data was used. The study is based on a summary of the results of international analytical and scientific publications containing statistical data on the participation of different age groups of the population in investing in cryptocurrencies. The analysis uses descriptive statistics and a comparative demographic approach, dividing respondents into age cohorts (25-34, 35-44, 45-54, 55-64, 65+ years). The criteria for comparison were the proportion of people who have experience investing in cryptocurrencies, as well as their level of willingness to take investment risks. The results obtained made it possible to identify a relationship between age, financial literacy, and the propensity to use digital assets in long-term financial strategies, particularly pension strategies.

Results

In the area of social insurance, particularly pensions, there are significant structural challenges due to increased life expectancy and an ageing population, which is putting more financial pressure on the pay-as-you-go pension system. In response to these demographic trends, many countries are implementing measures such as raising the average retirement age, encouraging private pension savings and restricting access to funds until retirement age is reached. At the same time, these instruments have a limited compensatory effect in the short and medium term and do not ensure a complete balance of the pension system through traditional sources of funding. Under these conditions, there is a pressing need to develop the funded level of pension provision and to seek long-term investment instruments capable of increasing the efficiency of pension asset formation. In this context, cryptocurrency instruments can be considered as a potential element of pension portfolio diversification, provided that there is adequate regulatory control.

As of 1 January 2025, there were 10,343,630 pensioners in Ukraine, which is 172,907 fewer than in 2024. Of these, 2.8 million continued to work, receiving an average of 6,302.76 UAH per month. The average pension as of 1 April of the same year was UAH 6,341.11. The dynamics of changes in the size of pensions for 2021-2025 are shown in Table 1.

Table 1. Dynamics of the average pension amount in Ukraine, 2021-2025

Year	Average pension amount, UAH
2021	3,507.50
2022	3,991.50

Table 1, Continued

Year	Average pension amount, UAH
2023	4,662.60
2024	5,385.25
2025 (1 January)	5,789.05
2025 (1 April)	6,341.11

Source: Pension Fund of Ukraine (2025)

Data analysis showed a steady upward trend in the average pension amount in Ukraine during 2021-2025. Over the period under review, the average pension payment almost doubled, due to both annual indexation and a review of social standards. At the same time, even the recorded growth does not compensate for the impact of inflationary processes and the rising cost of living, which limits the real purchasing power of pensioners. This trend confirms the structural vulnerability of the solidarity

pension system and justifies the need to find additional sources of long-term financing for pension payments, in particular through the development of the accumulation level and diversification of investment instruments. Table 2 showed a gradual decrease in the number of pensioners and workers in Ukraine, with the number of pensioners already exceeding the number of officially employed persons, which creates an additional burden on the solidarity pension system.

Table 2. Dynamics of the number of pensioners and workers in Ukraine for 2021-2025

Year	Number of pensioners	Number of workers
2021	11,100,000	10,400,000
2022	10,900,000	10,350,000
2023	10,600,000	10,200,000
2024	10,500,000	10,150,000
2025	10,343,630	10,100,000

Source: Pension Fund of Ukraine (2025)

The data presented indicates a steady trend towards a reduction in the number of pensioners in Ukraine against the backdrop of a slow but systematic decline in the working population. Between 2021 and 2025, the number of pensioners decreased by more than 750,000 people due to demographic changes, migration processes and the impact of military factors caused by Russia's aggression against Ukraine. At the same time, the number of workers is also showing a downward trend, which negatively affects the ratio between insurance contributors and pension recipients. This situation increases the financial burden on the solidarity pension system and confirms the relevance of developing accumulation mechanisms and diversifying sources of pension provision. The distribution of pensioners by the size of their pension payments clearly demonstrates the unevenness in their level of provision in Figure 1.

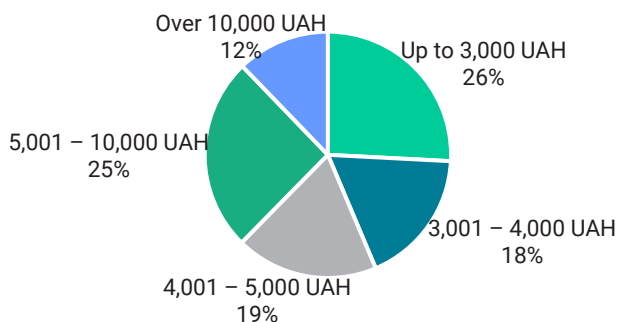


Figure 1. Distribution of pensioners by pension amount
Source: Pension Fund of Ukraine (2025)

The data in the figure show that a significant proportion of pensioners receive pensions that do not provide an adequate standard of living. According to research by D. Petrovskyy (2025), an acceptable level of income for most Ukrainians (31%) is between 20,000 and 30,000 hryvnia. This indicates that current pensions are significantly lower than the real needs of the population, which calls into question their ability to provide an adequate standard of living. Low pension payments and the limited purchasing power of pensioners point to the inefficiency of the current mechanisms for forming pension income. The absence of a cumulative component makes it impossible to use investment instruments to preserve and increase pension savings. In this regard, the integration of innovative financial instruments, in particular cryptocurrency products, into the cumulative system is seen as a potential direction for the modernisation of pension provision. In Ukraine, the creation of the Pension Fund was supposed to bring about a transition from state pension provision to compulsory pension insurance, but in fact this process has not been launched (Marchak *et al.*, 2016).

According to T.O. Stavarska & I.L. Shevchuk (2017), Ukraine's pension system is undergoing reform aimed at ensuring a decent standard of living for citizens who have paid pension contributions throughout their working lives. The introduction of a second level of the pension insurance accumulation system was planned. This step was intended to ensure the financial stability of the pension system and increase the amount of pension payments to citizens, as well as eliminate disparities in the size of

pension payments. In this context, the Verkhovna Rada of Ukraine considered a number of initiatives, the implementation of which was postponed due to the full-scale invasion of Ukraine by the Russian Federation in February 2022. However, legislative work in this area continued: in particular, the law “On Mandatory Funded Pension Provision” (Parliament of Ukraine, 2019) is awaiting consideration, which provides for the phased introduction of a system of contributions amounting to 1% of salary with a gradual increase and redistribution of 5% of the Unified Social Contribution (USC). Draft law No. 9212 “On Funded Pension Provision” (registered on 17 April 2023 and returned for revision) provides for the mandatory participation of all insured persons who pay the USC in the mandatory funded pension system (Press Service of the Parliament of Ukraine, 2023). With regard to potential investment instruments, Ukrainian legislation establishes a list of permitted instruments for investing pension funds, including shares, bonds (government, municipal, corporate), deposits, gold and real estate. There are strict limits on asset allocation to minimise risks. For example, a fund

can place up to 50% of pension funds in bank deposits, with no more than 10% in a single bank (Minfin, 2021).

In the context of modernising financial instruments for investing pension assets in Ukraine, the issue of legalising cryptocurrencies is becoming increasingly relevant. In the event of legislative regulation, non-state pension funds (NPFs) will be able to invest in virtual assets with a limit of 5% of total assets. This practice already exists in the United States, where ETF funds based on Bitcoin futures are traded (Minfin, 2024). However, Ukrainian institutional investors, particularly pension funds, are not ready to invest in cryptocurrencies due to the lack of proper regulatory framework and high level of risk. Pension strategies are usually based on a conservative approach, which is incompatible with the high volatility of the cryptocurrency market (Minfin, 2021). Thus, although the legalisation of cryptocurrencies may open up new opportunities for diversifying NPF assets, the issue of their practical use remains controversial and requires more in-depth analysis, taking into account the protection of the interests of future pensioners. The advantages and risks of investing in cryptocurrencies for the Ukrainian context are presented in Table 3.

Table 3. Advantages and risks of investing in cryptocurrencies

Advantages	Risks
Portfolio diversification (investing in cryptocurrencies can provide additional diversification of a pension fund's investment portfolio).	High volatility (cryptocurrency prices can fluctuate significantly, posing risks to the stability of pension savings).
High return potential (cryptocurrencies have the potential for significant growth in value, which can positively impact the return on pension savings).	Lack of regulation (insufficient legislative regulation of cryptocurrencies in Ukraine complicates their inclusion in the investment portfolio of pension funds).
	Security and storage (storing cryptocurrencies requires specialised solutions to ensure asset security).

Source: A. Petukhina *et al.* (2021)

The data presented in the table indicate that investment in cryptocurrencies combines both significant potential benefits and substantial risks, which is critically important in the context of pension provision. On the one hand, cryptocurrency assets are capable of enhancing the diversification of pension fund investment portfolios and providing an additional source of long-term returns. This is particularly relevant given the limited capabilities of traditional financial instruments and the growing burden on the solidarity pension system. On the other hand, the high volatility of cryptocurrencies, the lack of comprehensive regulatory and legal regulation in Ukraine, as well as increased requirements for the security and storage of digital assets create significant risks for the stability of pension savings. Thus, the results presented in the table confirm the advisability of using cryptocurrencies in pension investments exclusively as an auxiliary instrument with strict restrictions on their share in the portfolio and subject to the implementation of effective regulatory control.

In developed countries, the integration of cryptocurrencies into pension investments occurs mainly within the framework of regulated financial instruments. M. Soland & P. Schueffel (2021) noted in their work that in the United States, the use of cryptocurrencies in pension portfolios is carried out indirectly through exchange-traded funds

(ETFs), which are supervised by financial regulators. In Japan, the government pension fund has initiated a study on the feasibility of using non-traditional assets in long-term investment strategies. In Germany, the BaFin regulator, within the European legal framework, allows the use of digital assets by specialised investment funds, which creates a legal basis for their potential inclusion in pension schemes.

The analysis of international experience in integrating cryptocurrencies into pension systems within the framework of this study was necessary for several key reasons that have both practical and strategic value for Ukraine: avoiding repetition of mistakes, adapting successful practices, and forming a realistic regulatory framework that takes into account modern approaches. In addition, international practice is an argument for the public and investors. According to the Financial Times (2025), in 2023-2025, there was a growing interest among pension funds in various countries in investing in cryptocurrencies. In this context, the results of a survey conducted by a Hungarian researcher among the Hungarian population on the understanding of the risks of cryptocurrencies and the willingness to delegate the management of such assets to pension platforms are indicative. The results obtained allow to assess the level of confidence in innovative investment decisions in funded pension systems and are summarised in Figure 2.

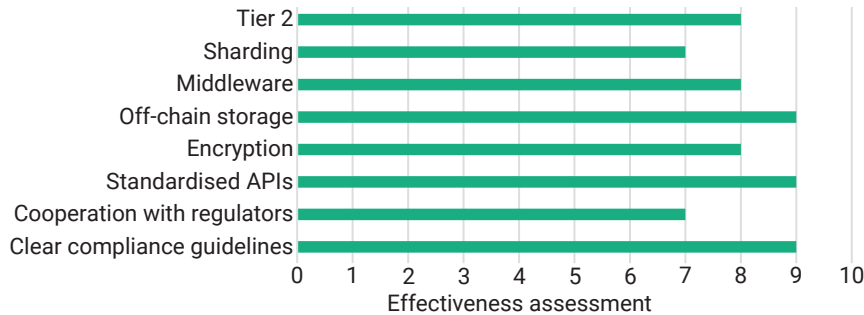


Figure 2. Level of trust among pensioners, administrators and IT specialists in Hungary in various blockchain-based pension system solutions

Source: D. Kovács *et al.* (2024)

The highest level of effectiveness (9) was given to factors such as clear compliance guidelines and standardised APIs. The following received a rating of 8: cooperation with regulators, encryption, off-chain storage, middleware solutions, and Layer 2 solutions. Sharding received the lowest rating (7). This indicates that trust depends most on the clarity of regulatory requirements and interaction standards, while technical aspects are less decisive. The United States is one of the first countries where pension funds began to study and, in some cases, implement cryptocurrencies as part of a long-term investment strategy. As of 2024-2025, there is no single approach to this issue in the United States – some funds choose cautious investment through exchange-traded funds (ETFs), while others, given the regulatory uncertainty, avoid crypto assets (Pension Policy International, 2024). In February 2024, it became known that the Wisconsin State Pension Fund had invested approximately \$99 million in iShares Bitcoin Trust (an ETF created by BlackRock). This is one of the first examples of official participation by a state pension fund in a cryptocurrency ETF. The investment was made cautiously – through a regulated instrument that provides access to Bitcoin without directly purchasing tokens (Pension Policy International, 2024). Similarly, the Jersey City Pension Board approved a pilot investment in a Bitcoin ETF, arguing that it was necessary to modernise assets and take into account new market trends in the interests of insured persons.

Outside the United States, similar processes are observed in other developed countries. For example, in Germany, where the financial regulator (BaFin) has officially allowed digital assets to be included in the portfolios of

specialised investment funds, including pension funds (Feng *et al.*, 2025). Such regulatory recognition lays the groundwork for the gradual adaptation of cryptocurrencies within institutional capital preservation schemes. In turn, South Korea's National Pension Service has acquired a significant stake in the cryptocurrency platform Coinbase, which can be seen as a preparatory step towards deeper participation in the digital economy (Rodrigues, 2025).

In the current context of financial market transformation, particularly as a result of the introduction of digital assets, corporate pension programmes are beginning to view cryptocurrencies as a potential tool for diversifying and increasing the profitability of investment portfolios. For example, the British company Cartwright has announced the creation of a pension payment scheme that allows employers to make contributions directly to employees' Bitcoin wallets. This initiative aims to reduce dependence on employer contributions and gives employees the opportunity to receive pension payments in cryptocurrency (Cartwright Pension Trusts, n.d.). Under this programme, 3% of the pension portfolio was invested directly in Bitcoin, rather than through derivatives or exchange-traded funds (ETFs). This approach is unique in European practice, as it involves direct ownership of digital assets, with all the associated issues of security, storage and regulatory control. It is important to note that the investment decision was made after a comprehensive due diligence process. Using the example of the Hungarian pension system, the effectiveness of implementing blockchain technologies in the pension system was assessed according to various criteria (Fig. 3).

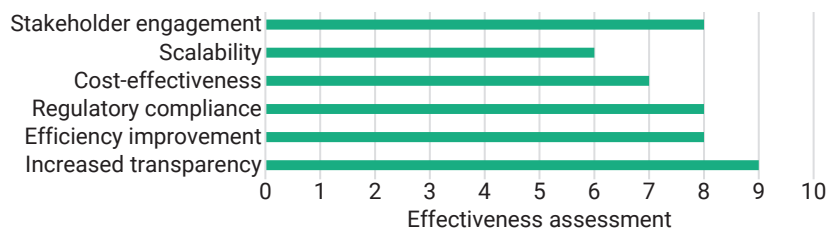


Figure 3. Level of implementation of blockchain solutions in Hungary's state pension systems

Source: D. Kovács *et al.* (2024)

Transparency received the highest rating (Enhanced Transparency – 9 points), followed by stakeholder engagement, efficiency and regulatory compliance (8 points each). The lowest scores were given to scalability (6 points) and cost-effectiveness (7 points). This indicates that the main value of blockchain for pension systems is increased transparency, while scalability and costs remain key challenges. In the process of integrating cryptocurrencies into pension programmes, the role of financial regulators is fundamental, as they form the legal basis, define the institutional framework for investment and ensure a balance between the innovation of financial instruments and the protection of the interests of system participants. The following areas of regulatory activity should be highlighted (Kovács *et al.*, 2024):

- providing a regulatory definition of the status of cryptocurrencies (regulators determine whether digital assets are considered permissible instruments for pension investments);
- ensure “fiduciary responsibility” (supervising funds to ensure they act in the interests of insured persons);
- license infrastructure (regulating exchanges and brokers and ensuring compliance with security procedures);
- monitor systemic risks (assess the potential impact of cryptocurrencies on the financial stability of the pension system and the economy as a whole).

Regulators act not only as arbitrators but also as facilitators of innovation in the pension system. Their strategy determines the speed, depth and safety of the introduction of cryptocurrencies into institutional portfolios. Although the full-scale integration of cryptocurrencies into pension systems has not yet taken place, some developed countries are in the phase of active testing, regulatory definition and strategic planning on this issue. The variety of approaches – from cautious ETF investments to exploring direct participation models – reflects a global trend towards seeking new sources of returns amid heightened financial instability and a paradigm shift in long-term savings.

The introduction of a funded pension system in Ukraine opens a new phase in the transformation of the pension system (OECD, 2024). In this context, the question arises as to the admissibility and expediency of including non-traditional assets – in particular cryptocurrencies – in the investment portfolio of pension savings.

This issue is particularly relevant given the need to ensure high returns, long-term stability and protection against inflationary risks.

On the one hand, Ukraine is seeing positive developments in the recognition and regulation of digital assets. In 2021, the Verkhovna Rada adopted Law of Ukraine No. 2074-IX (2021), which was supposed to become the basis for legalising the cryptocurrency market. However, as of 2025, this law has not entered into force, as the accompanying amendments to the Tax Code have not been adopted and a comprehensive regulatory and legal infrastructure has not been created. Accordingly, the cryptocurrency market in Ukraine remains partially regulated and operates in conditions of legal uncertainty, which creates serious barriers to the participation of pension funds or other institutional investors, as noted by V. Forsiuk (2024).

In practice, the integration of cryptocurrencies into the pension system requires systematic regulatory, technological and regulatory preparation. First, the relevant state authorities must clearly define the role and status of cryptocurrencies as an investment object within pension assets. Separate provisions are needed in the subordinate acts of the National Securities and Stock Market Commission (NSSMC) regarding eligible assets for accumulative pension funds, taking into account the level of risk, volatility and reliability criteria of counterparties. However, given the cross-sectoral nature of cryptocurrencies, which simultaneously covers financial markets, payment systems, tax policy and investment regulation, there is a need for enhanced coordination between several regulators. In particular, the NSSMC, the National Bank of Ukraine (NBU) and the Ministry of Finance should jointly develop a coordinated regulatory framework that would ensure a balance between the innovation of digital assets and the protection of the rights of insured persons. Secondly, the rights of system participants should be protected by setting limits on the share of high-risk assets in the overall portfolio, for example, no more than 5-10%. In this context, two regulatory scenarios were proposed as examples, with limits on the share of cryptocurrencies in the pension portfolio (5% and 10%) and an assessment of their impact on the stability of the system, taking into account the relationship between expected returns and volatility, as well as international experience and regulatory requirements (Table 4).

Table 4. Comparative analysis of regulatory scenarios with limits on the share of cryptocurrencies in the pension portfolio

Parameter	5% limit	10% limit
Expected return	Moderate growth (≈5.5%)	Higher growth (≈6.2%)
Portfolio volatility	Lower risk (≈16%)	Lower risk (≈16%)
Systemic stability	Higher, controlled risks	Lower, increased risks
Participant protection	Better, loss limitation	Weaker, higher probability of losses
Compliance with standards	Consistent with conservative approaches	Corresponds to innovative approaches

Source: compiled by the authors based on M. Soland & P. Schueffel (2021), S. Agrawal *et al.* (2025)

A 5% limit on cryptocurrencies allows for increased portfolio returns without a significant increase in volatility.

This is in line with the conservative strategy used by most pension funds around the world and ensures greater

stability of the system and protection of participants' interests. This approach is recommended for the initial stage of crypto asset integration. Increasing the limit to 10% allows for even higher expected returns, but the risks of volatility increase disproportionately. This can lead to significant fluctuations in the value of the portfolio, which is critical for a pension system where capital preservation and predictability of payments are priorities. Such a scenario is only feasible if there is a developed infrastructure, high financial literacy and effective regulatory oversight. Thus, a lower limit (5%) better protects the pension system from systemic risks, maintaining a balance between return and safety; a higher limit (10%) can only be justified after positive experience has been accumulated.

The determination of the share of cryptocurrency in the pension portfolio should be based on a number of key considerations. In particular, it is advisable to introduce strict restrictions on the share of cryptocurrency assets at a minimum level with the possibility of their gradual increase only based on the results of systematic risk monitoring and assessment of the stability of the pension system. It is also important to use only regulated financial instruments, such as exchange-traded funds (ETFs) or investment trusts, to minimise operational and legal risks. In addition, a necessary element of risk management is regular stress testing of pension portfolios to assess the impact of high volatility of cryptocurrency assets on the overall financial stability of the pension system.

It is critically important for the effective functioning of the accumulation model to take into account the level of financial literacy of the population. Investing in digital assets requires a basic understanding of the risks, the principles of blockchain infrastructure, and knowledge of the rules for using digital wallets and exchanges. In the absence of a systematic educational policy in the field of financial education, investor behaviour can be overly risky, creating additional challenges for the stability of the pension system. An analysis of the perception of digital assets as a pension instrument leads to the conclusion that the level of investment in cryptocurrencies varies significantly depending on age group, as shown in Figure 4.

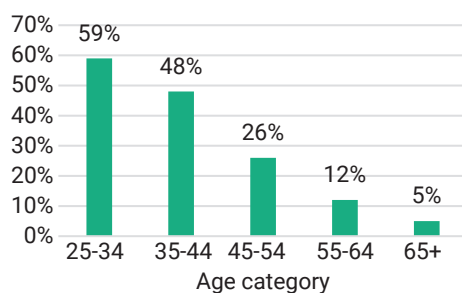


Figure 4. Percentage of those who invest in cryptocurrencies, by age group

Source: R. Munson (2022)

The youngest generation is the most active: 59% of people aged 25-34 and 48% in the 35-44 age group have experience investing in cryptocurrency. In the 45-54 age group, the share of investors decreases to 26%, and among people aged 55-64, to 12%. The lowest level of participation is recorded among people aged 65 and older – only 5%. The results show that investing in digital assets is mainly carried out by the younger population, which demonstrates greater awareness of digital technologies and greater willingness to take risks associated with the volatility of the cryptocurrency market.

Another critical prerequisite is the existence of a regulated infrastructure: licensed exchanges, custodial services, and independent auditing of digital assets. Without clear procedures for storage, transaction verification, and monitoring of intermediaries, the risks of abuse or loss of funds will remain extremely high. In this regard, the experience of the US and the EU in allowing only regulated exchange-traded products, such as spot ETFs or cryptocurrency trusts, into pension portfolios may be most relevant for Ukraine. An additional challenge is ensuring cybersecurity and training specialists capable of administering cryptocurrency assets within pension funds.

Given the current state of the Ukrainian financial market, a mixed model could be a reasonable approach: introducing the possibility of investing in cryptocurrency derivatives (e.g. through international ETFs) (Krause, 2025a; 2025b) that meet European transparency standards, and then, once a reliable infrastructure is in place, gradually move towards partial direct investment. In the long term, if all conditions are met – in particular, technical modernisation, the creation of a guarantee fund and the strengthening of regulatory oversight – the inclusion of digital assets in pension portfolios could serve not only as a source of additional income for insured persons, but also as an incentive for further financial inclusion and the development of the Ukrainian stock market. This study proposes a mechanism for investing pension savings in cryptocurrencies in Ukraine. These proposals constitute an institutional and legal model for the phased introduction of cryptocurrencies into the Ukrainian pension system. This model combines global experience (the United States, the United Kingdom, South Korea), risk assessment (volatility, lack of regulation, security) and consideration of the specifics of the Ukrainian market (low level of financial literacy and legal uncertainty). This mechanism and its expected effects are systematised in Table 5. The proposed ways of investing in cryptocurrencies for the funded pension level in Ukraine reflect a comprehensive approach to the integration of cryptocurrency instruments into Ukraine's funded pension level, combining innovation with the principles of prudence and risk-oriented regulation. The proposed measures cover both investment aspects (use of ETFs, scenario modelling, phased implementation) and institutional conditions (development of a regulatory framework, training of administrators, interagency coordination). Particular emphasis is placed on minimising financial and legal risks by limiting

the share of crypto assets in portfolios, creating guarantee mechanisms and introducing stress testing. Another important component is improving the financial literacy of participants in the accumulation system, which will help

build trust in new investment instruments. The implementation of these proposals will allow Ukraine's pension system to gradually adapt to digital financial transformations without threatening the stability of pension payments.

Table 5. Proposed ways of investing in cryptocurrencies for the cumulative pension level in Ukraine

No.	Proposal	Expected effect/justification
1	Introduction of a cap on cryptocurrency assets in the portfolios of non-state pension funds (NPFs)	Minimisation of risks while preserving the benefits of diversification
2	Investment exclusively in regulated instruments (cryptocurrency ETFs and trusts)	Ensuring transparency, accountability and compliance with international standards
3	Gradual implementation of scenario modelling (stress testing) of pension portfolios	Identification of portfolio sensitivity to crypto market volatility
4	Establishment of a regulatory framework at the level of the National Securities and Stock Market Commission, with a clear definition of cryptocurrencies as an asset class	Prevention of legal gaps and safeguarding the rights of insured persons
5	A phased implementation model: from ETFs to partial direct ownership of cryptocurrencies	Ensuring system adaptation to new instruments and gradual accumulation of practical experience
6	Introduction of specialised training for NPF administrators in digital assets	Enhancement of the efficiency of cryptocurrency instrument management
7	Financial education for future pensioners (particularly individuals aged 25-45)	Strengthening trust in the funded pension system and promoting informed investment behaviour
8	Pilot NPF project with state support based on ETFs and transparent performance monitoring	Establishing a precedent, assessing effectiveness in practice, and promoting the model under real-world conditions
9	Creation of a guarantee insurance reserve in the event of a crypto market collapse	Protection against catastrophic losses in unstable market conditions
10	Multi-agency regulation: coordination between the National Securities and Stock Market Commission, the National Bank of Ukraine, and the Ministry of Finance	Ensuring the integrity of the regulatory environment and policy coherence

Source: developed by the authors

Discussion

The results obtained in this study are generally consistent with the conclusions of contemporary scientific works devoted to the use of cryptocurrencies and related instruments in long-term investment strategies, but at the same time have a number of differences due to the focus on pension systems and, in particular, on Ukrainian institutional realities. Unlike most publications, which view cryptocurrencies primarily as a speculative or portfolio asset, this study analyses them through the prism of financial stability and the protection of the interests of future pensioners. The results of the study confirm that the Ukrainian pension system is undergoing structural transformation and needs to integrate a funded level to ensure financial stability and increase pension payments. Although the growth in the average pension amount in 2021-2025 showed positive dynamics, it does not compensate for the impact of inflation and the rising cost of living, which highlights the structural vulnerability of the solidarity level of pension provision.

Thus, the results of this study correlate with the conclusions of K.O. Rudolf *et al.* (2021), who, based on Dynamic Conditional Correlation Multivariate GARCH modelling, proved that Bitcoin is characterised by high volatility and unstable hedging properties. Similar to their results, this study found that the use of cryptocurrencies in pension portfolios is only possible under strict restrictions on the share of such assets and the application of additional

protective risk management mechanisms. At the same time, unlike the approach of the aforementioned authors, which focuses primarily on financial and mathematical analysis, this study additionally takes into account the institutional and regulatory constraints of pension systems.

A comprehensive review by D. Kang *et al.* (2025) showed that cryptocurrencies are increasingly being viewed as a separate class of financial assets with their own patterns of return and risk. The results of this study confirmed this approach, particularly in terms of the low correlation of cryptocurrencies with traditional assets, which enhances their diversification potential. At the same time, this study emphasised that it is not only the statistical effectiveness of diversification that is important for pension systems, but also the compliance of crypto instruments with the principles of stability and predictability of payments. The issue of the admissibility of using crypto assets in pension investments was examined in detail by J.A. Turner (2025), who emphasised the need for a clear regulatory distinction between direct ownership of cryptocurrencies and investment through regulated instruments. The results obtained in this article are fully consistent with this approach: scenario analysis has shown that the most acceptable option for Ukraine is the indirect use of cryptocurrencies – through ETFs or other licensed products, rather than direct ownership of tokens by pension funds. A separate aspect of the long-term use of crypto assets in pension investments is

related to the issue of macrofinancial stability and systemic risks. Thus, G. Okechukwu (2024) emphasised that despite the diversification potential of cryptocurrencies, their behaviour during periods of financial shocks remains unstable, which may increase risks for institutional investors. The results obtained in this study are consistent with this conclusion, as scenario analysis has shown the increased sensitivity of pension portfolios to crypto assets in crisis conditions, which necessitates the use of conservative restrictions and constant macroprudential monitoring.

Empirical studies by D. Krause (2025a; 2025b), devoted to the analysis of US pension fund and endowment portfolios, have shown that the real integration of Bitcoin ETFs is already taking place within limited asset shares. A similar conclusion is reached in this study: a moderately innovative scenario, which assumes investments at the level of 3-5% of the portfolio, proved to be the most balanced in terms of the ratio of risk and expected return. The difference is that D. Krause focused primarily on the US market, while this article attempts to adapt these approaches to Ukrainian institutional conditions. The role of cryptocurrencies in the long-term portfolios of institutional investors is also discussed in a systematic review by J. Mosina & G. Ševčenko (2024), which emphasised that decisions on the inclusion of digital assets largely depend on regulatory certainty and the level of institutional maturity of the financial system. The conclusions of this study correlate with the results of this work, since for Ukraine, the key constraints on the integration of cryptocurrencies into pension investments remain the underdevelopment of the accumulation level and the limited regulatory framework. Institutional restrictions on the use of crypto assets are also related to issues of corporate governance and the responsibility of financial institutions. Thus, D. Yermack (2017) emphasised that blockchain technologies and related digital assets create new challenges for management systems, transparency and risk control in large institutional structures. The results obtained in this study are consistent with these conclusions, since not only profitability indicators remain critical for pension funds, but also the compliance of crypto instruments with the requirements of accountability, asset protection and trust of pension system participants.

The role of investor confidence and financial culture is explored in a study by Y. Baekström *et al.* (2025), which showed that willingness to participate in the crypto market largely depends on the level of trust in financial institutions. The results obtained in this work confirmed the above conclusion: an analysis of age groups showed that older categories of the population demonstrate a significantly lower willingness to accept cryptocurrencies as an element of pension savings, which reinforces the importance of financial education programmes. Studies by Y. Ma *et al.* (2020) and D. Bianchi & M. Babiak (2022) complemented the results of this work in terms of portfolio optimisation and the effectiveness of cryptocurrency funds. While Y. Ma *et al.* emphasised the potential of digital assets within optimisation models, D. Bianchi & M. Babiak draw attention to

the volatility of crypto fund returns across different market phases. This is consistent with the findings of this study on the need for cautious, phased introduction of cryptocurrencies into pension portfolios with constant monitoring of market risks.

Thus, the results of this article confirmed the global scientific consensus on the possibility of using cryptocurrencies as an auxiliary diversification tool, while expanding it by taking into account the regulatory, demographic, and institutional characteristics of the Ukrainian pension system. The conclusions complement existing research and form a practical basis for further scientific research and pilot projects in the field of funded pension provision. Overall, the study opens the door for further discussion on the optimal model for integrating innovative financial instruments into Ukraine's funded pension systems, taking into account national characteristics and international experience.

Conclusions

The study assessed the potential for using cryptocurrencies in Ukraine's pension accumulation system and identified the key advantages, risks and scenarios for integrating digital assets into pension portfolios. Among the main advantages of investing in cryptocurrencies was their ability to increase the diversification properties of portfolios due to their low correlation with traditional financial assets. In addition, digital assets have the potential to provide higher expected returns in the long term, which is important for the formation of cumulative pension assets. International experience showed that cryptocurrencies can be included in pension portfolios either through indirect instruments (ETFs, trusts) or through direct ownership of tokens, which allows the strategy to be adapted to the level of risk and regulatory certainty. Key risks associated with the integration of cryptocurrencies into pension systems have been identified. The most important ones were determined to be high asset volatility, the lack of adequate legislative regulation in Ukraine, cyber threats, and difficulties with secure storage. For pension systems focused on stable payments and capital preservation, these factors are critically important, necessitating a cautious approach to the use of digital assets.

The results of the scenario analysis indicated the advisability of limited integration of cryptocurrencies into pension portfolios. A conservative scenario with a 5% limit on the share of cryptocurrencies in the portfolio provides a moderate increase in expected returns with a controlled level of volatility and high protection for system participants. A moderately innovative scenario with a 10% limit allows for higher expected returns, but is accompanied by a disproportionate increase in risks and requires a developed regulatory infrastructure, a high level of financial literacy among the population, and regular stress testing of portfolios. The results confirmed that cryptocurrencies can be integrated into the Ukrainian funded pension system only under conditions of clear regulatory oversight, restrictions on the share of high-risk assets, the use of licensed instruments (ETFs, trusts), and effective control by financial regulators.

Possible promising areas for further research in this field are primarily related to assessing the impact of cryptocurrency assets on the long-term financial stability of pension funds under various macroeconomic development scenarios. Special attention should be paid to the development of methodological approaches to stress testing pension portfolios with the inclusion of highly volatile financial instruments, as well as research into models combining traditional and digital assets in order to optimise the ratio of expected return and investment risk. Another important area for further research would be to analyse the effectiveness of financial education programmes and information campaigns aimed at increasing the level of trust in digital assets among participants in the funded pension system. In addition, it is promising to study the mechanisms of interaction between regulatory authorities and pension funds in

the process of introducing innovative financial instruments within the framework of current and future Ukrainian legislation. Thus, the study demonstrated that cryptocurrencies can become an additional tool for diversifying pension portfolios, provided that adequate regulatory control, technological security and a high level of financial competence of the system participants are ensured.

Acknowledgements

None.

Funding

None.

Conflict of Interest

None.

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Українська пенсійна система майбутнього: потенціал використання криптовалютних інструментів у рамках пенсійного забезпечення

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Анотація. Актуальність дослідження зумовлена одночасним поглибленням демографічних дисбалансів у пенсійній системі України та активною цифровізацією світових фінансових ринків, що актуалізує пошук нових інвестиційних інструментів для накопичувального пенсійного рівня. Метою статті було обґрунтування доцільності та умов інтеграції криптовалютних інструментів до системи загальнообов'язкового накопичувального пенсійного забезпечення України з урахуванням міжнародного досвіду та національних інституційних обмежень. Для досягнення поставленої мети було застосовано методи аналізу й синтезу, порівняльного аналізу, сценарного та структурного моделювання, а також узагальнення міжнародної практики регулювання цифрових активів. Обґрунтовано основні переваги та ризики використання криптовалют у довгострокових пенсійних стратегіях. До переваг віднесено розширення можливостей диверсифікації, потенціал зростання доходності та доступ до інноваційних фінансових активів. Водночас визначено ключові ризики, пов'язані з високою волатильністю крипторинку, регуляторною невизначеністю, загрозами кібербезпеки та недостатнім рівнем фінансової грамотності населення. Запропоновано інституційно-правову модель поетапного впровадження криптовалют до системи накопичувального пенсійного забезпечення України, яка передбачає нормативне закріплення статусу криптоактивів, обмеження їх частки у пенсійних портфелях на рівні 5-10 %, використання виключно регульованих інструментів (біржові інвестиційні фонди-ETF, трасти), проведення регулярного стрес-тестування, підготовку фахівців недержавних пенсійних фондів, підвищення фінансової грамотності населення та реалізацію пілотних проектів за участю державних інституцій. Результати дослідження можуть бути використані у формуванні державної політики щодо розвитку накопичувального пенсійного забезпечення, а також під час удосконалення інвестиційних стратегій недержавних пенсійних фондів в умовах цифрової трансформації економіки

Ключові слова: накопичувальне пенсійне забезпечення; диверсифікація інвестицій; управління ризиками; цифровізація; інвестиційна стратегія

Scientific Bulletin of Mukachevo State University

Series

Economics

Volume 13, No. 1, 45-54

Journal homepage: <https://economics-msu.com.ua/en>

UDC 336.7:004:005.334

DOI: 10.52566/msu-econ1.2026.45

ISSN 2313-8114

E-ISSN 2518-1254

Business digital transformation: Innovation, financial security, and inclusive growth – evidence from Ukraine

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Abstract. The accelerated diffusion of digital technologies during the 2015-2025 period substantially transformed global economic systems, intensifying the integration of automation, data analytics, and digital financial services into business processes while simultaneously increasing exposure to cybersecurity risks, regulatory fragmentation, and social inequality. In economies undergoing structural transformation, ensuring that digital innovation supports both financial security and inclusive growth emerged as a pressing scientific and policy challenge. The purpose of this study was to identify and substantiate effective pathways of business digital transformation that simultaneously strengthened financial security and promoted inclusive access to digital financial services. To achieve this objective, the research applied a

Received: 10.11.2025, Revised: 27.03.2026, Accepted: 01.04.2026, Published: 06.04.2026

Suggested Citation: Desyatnyuk, O., Krysovaty, A., Ptashchenko, O., & Kyrylenko, O. (2026). Business digital transformation: Innovation, financial security, and inclusive growth – evidence from Ukraine. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 13(1), 45-54. doi: 10.52566/msu-econ1.2026.45.



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mixed methodological framework combining systemic and institutional analysis, comparative analysis, statistical and correlation modelling, and analytical synthesis of international and national datasets derived from the World Bank, the National Bank of Ukraine, and OECD analytical frameworks. The results demonstrated that the expansion of digital financial technologies was strongly associated with higher levels of institutional stability and economic resilience. Empirical evidence from Ukraine for the 2022-2024 period showed that the number of active payment cards increased by more than 10%, while the share of cashless transactions exceeded 90%, indicating a rapid diffusion of digital payment instruments. The widespread adoption of Near Field Communication technologies, tokenised payment cards, and cloud-based financial services contributed to faster transaction processing, enhanced transparency, and improved protection of financial data. At the same time, the analysis identified persistent risks and barriers related to cybersecurity vulnerabilities, regulatory misalignment, and uneven digital inclusion across population groups, particularly in rural areas and among individuals with limited digital literacy. These findings confirmed that digitalisation generated both efficiency gains and new configurations of financial and institutional risks. The practical significance of the results lies in their applicability for policymakers, financial regulators, and business managers in designing coordinated digitalisation strategies that integrate technological innovation with cybersecurity standards, regulatory coherence, and inclusive financial development

Keywords: digital economy; financial technologies; cybersecurity; institutional resilience; cashless payment

Introduction

In the modern dynamic digital economy, the daily processes of enterprises have inconspicuously transformed into one of the key drivers of growth, competitiveness, and inclusiveness. With the gradual transition of finance and data into the online environment, access to services is expanding, business practices are changing, and, at the same time, new challenges arise, in particular, securing cybersecurity, financial stability, and finding a fragile balance between innovation and regulation. The true feature of this era lies in the attempt to combine technological progress with financial systems that strive for efficiency without losing fairness. As M.A. Adegbite (2025) noted, the expansion of digital financial platforms brings both opportunities and risks: gaps in data protection and cyber vulnerability have become almost inevitable, reminding governments of the need for rapid adaptation of institutional protection mechanisms to preserve trust and information integrity.

Digitalisation operates in two directions. It creates new opportunities, speeds up decision-making, and reduces barriers, but at the same time, it prompts the creation of new system threats. This imbalance is particularly visible in countries where digital infrastructure is still forming and technological innovations exceed regulatory frameworks. Artificial intelligence, blockchain, and open banking environments have made financial processes faster and more interconnected. At the same time, they have raised concerns about fraud and cybercrime. Thus, financial inclusion is not only about expanding access but also about ensuring that the system can remain resilient under crisis conditions.

Over the period of 2014-2024, research on digital transformation and inclusion has become truly interdisciplinary, combining economic, technological, and socio-political approaches. A broad perspective shows how FinTech transforms financial intermediation, creating tools that make the financial sphere more efficient and accessible. The scientific findings demonstrate that digital platforms can integrate previously excluded groups into the formal economy while forcing institutions to rethink risk management

and user protection approaches. For example, V. Kamboj & D. Sharma (2025) viewed inclusion as a multi-level process shaped by technology, governance, and people's readiness to adapt. From this point of view, inclusive growth and digital progress are not conflicting – they are two sides of the same coin that supports long-term stability.

New approaches to measuring inclusion reflect a shift in thinking. B. Marza *et al.* (2021) applied Analytic Hierarchy Process (AHP) and Fuzzy Analytic Hierarchy Process (fuzzy-AHP) methods to assess digital and financial inclusion, combining expert opinions with empirical data, which allows aligning perceptions with real indicators in changing conditions. S. Li & N. Xie (2025) added that digital finance drives business renewal: expanded access to technologies helps attract investments, modernise operations, and maintain resilience in uncertain environments. Their findings confirmed a pattern: the more closely finance and technology interact, the higher productivity and competitiveness become.

Despite this, some questions remain unanswered. One of them is why financial security is seldom considered in discussions about inclusion. Researchers have analysed access and user experience in detail but have not sufficiently explored how inclusion interacts with systemic stability. Another gap is the uneven nature of innovation: although FinTech has transformed banking services, its adoption in small and medium enterprises remains limited due to financial and organisational barriers. A third, more hidden aspect is the link between digital transformation and financial performance: the question is not only whether one factor affects the other but how their coherence shapes resilience. K. Valaskova *et al.* (2025) rightly pointed out that digital transformation reaches its full potential only when strategy, finance, and technology develop in synchrony – a balance that current studies and policies still lack.

Taking these gaps into account, the study aimed to analyse how enterprises adapt to the digital economy. The main focus was on the intersection of gender equality and

security, which is the point where the design process determines whether the advantages of innovation are widespread or only a few. The analysis covered conceptual and institutional frameworks of digital transformation, examines inclusion mechanisms through the lens of data protection and risk management, and poses a practical question: which technologies and management approaches improve efficiency while ensuring openness and fairness of the system? Ultimately, this analytical perspective sought to transform these insights into practical recommendations for creating a financially secure digital environment within enterprises. In this vision, digitalisation appears not as a faceless process of automation but as a human-driven evolution capable of forming systems that combine innovation with responsibility, resilience, and fairness.

Within this framework, the research focused on determining scientifically grounded and practically achievable paths for re-evaluating the evolution of business processes within the digital economy through a dual dimension – financial security and inclusion. The study aimed to investigate how the integration of technologies such as artificial intelligence, blockchain, cloud computing, big-data analytics, and FinTech solutions transforms the structure of corporate governance and financial relations, ensuring a balance between efficiency, transparency, and accessibility of financial services. The central scientific question focused on how the interaction between contemporary technologies and regulatory practices creates a new paradigm of financial security that simultaneously contributes to economic resilience and social inclusion. This focus was operationalised through several analytical objectives:

1. Identifying structural correlations between the level of financial systems' digitalisation and institutional stability.
2. Assessing risks and barriers associated with the implementation of innovations in the financial sector (including cybersecurity threats, regulatory gaps, and inconsistencies between technological development and legal norms).
3. Analysing the dynamics of digital inclusion, measured by indicators of access to banking services, share of cashless operations, volume of mobile payments, and level of population's digital literacy.

Literature Review

Contemporary studies convincingly demonstrate that digitalisation, financial inclusion, and security are now much more closely interwoven than previously assumed. D. Basnayake *et al.* (2024) noted that digital financial services provide a new impulse for local economic development and, in many cases, help whole communities overcome poverty. Similar conclusions are reached by A. Demir *et al.* (2022) since they made a critical qualification: the benefits of FinTech depend primarily on the flexibility and efficiency of state institutions. From the point of view of sustainable development, O. Desyatnyuk *et al.* (2024a; 2024b) stressed that global digitalisation adds an extra layer of financial risk – one that requires strengthened control and more effective governance. At the corporate

level, J. Dong (2023) examined these risks further, showing that companies must learn to manage uncertainty in near real-time if they wish to remain competitive. C.A. Durigan Junior *et al.* (2024) saw open banking as a true catalyst for innovation and efficiency, while L. Kvasnii *et al.* (2023) and Q. Guo *et al.* (2024) warned that without inclusive regulation, tools designed to promote equality may, on the contrary, exacerbate inequality.

The issues of security and transparency are central to the studies of A. Krysovaty *et al.* (2024a; 2024b), as well as Yu. Skulysh & V. Fathutdinov (2022), who directly linked technological progress with the financial stability of the state. In a similar vein, T. Kukman & S. Gričar (2025) emphasised that traceability and trust embedded in blockchain significantly reduce the possibility of fraud. A. Kumar (2024) and L. Lee (2024) shifted the discussion to the sphere of artificial intelligence, demonstrating how AI and machine-learning systems gradually transform the logic of banking operations, decision-making, and risk assessment. At the same time, both researchers admitted that these technological leaps make regulatory and supervisory functions more complex.

At the household level, H. Skyba *et al.* (2023) and J. Liu *et al.* (2024) proved that digital inclusion can mitigate financial vulnerability, though the urban-rural divide remains apparent. N. Nagaaba *et al.* (2025) stressed that financial literacy and social trust are no less important than access itself, while P.K. Ozili (2021) considered inclusion within the context of the UN Sustainable Development Goals. This trend is extended by mobile technologies: A.A. Shaikh *et al.* (2023) identified mobile money as one of the key drivers of financial inclusion, while T. Xu *et al.* (2024) demonstrated that digital finance enhances the ability of enterprises to withstand and adapt to economic shocks.

The synthesis of these studies allows three key conclusions to be drawn. Firstly, digitalisation has become a powerful driver of inclusive growth. Secondly, it generates new, increasingly pressing challenges in the sphere of cybersecurity. Thirdly, digital technologies gradually transform the business environment through the interaction of AI, blockchain, and FinTech. Collectively, this corpus of evidence forms a cohesive understanding of how digital innovations can simultaneously strengthen financial stability and expand access for all participants in the contemporary interconnected economy.

Materials and Methods

The research was conducted in 2024-2025 within the framework of a broader interdisciplinary initiative dedicated to digital transformation, financial inclusion, and business-system security. The empirical base consisted of peer-reviewed scientific publications, international conference proceedings, analytical reports of financial institutions, and verified statistical databases. Key sources included the Global Findex Database of the World Bank (2023), reports of the UAFIC (2023) and the National Bank of Ukraine (2024). This complex of sources ensured

methodological consistency and increased the reliability of the results obtained.

The theoretical foundation of the research is based on the principles of institutional, systemic, and innovation economics, examined through comparative and mixed-approach paradigms (Fetters *et al.*, 2013; Zayed *et al.*, 2022). For gaining a comprehensive understanding of how digital transformation reshapes contemporary business practices, ten interconnected methods were adopted. The structural-logical method was applied to construct an integrated analytical model that explicates the interaction between technological, institutional, and socio-economic components of digital transformation, where digital technologies act as enabling drivers, regulatory mechanisms perform stabilising functions, and inclusion indicators reflect socio-economic outcomes. Comparative and analytical approaches enabled the comparison of financial inclusion levels between developed and developing countries, identifying their strengths and structural gaps in digital infrastructure. Within this framework, risks and barriers related to digital innovation were assessed using an indicator-based analytical approach, including cybersecurity vulnerability indicators, regulatory-alignment criteria, and institutional-capacity metrics, while the method of analytical synthesis helped to combine theoretical frameworks with empirical data, refining the correlations between inclusion and financial security in the transformation process.

The systemic approach, aligned with macro-institutional models developed by the OECD (2023), enabled the consideration of the digital economy as a dynamic network of technological, financial, and institutional components. Institutional stability within this framework was operationalised using indicators of regulatory effectiveness, financial-system resilience, and cybersecurity preparedness, including the stability of payment infrastructure, regulatory alignment with international standards, and the incidence of operational and cyber risks. Statistical analysis, conducted using standard analytical tools (IBM Corporation, n.d.), was applied to interpret trends in the development of cashless payments, FinTech adoption, and cybersecurity readiness based on data from the National Bank of Ukraine (2024), World Bank (2023), and UAFIC (2023). Correlation analysis was performed to quantify the relationships between digitalisation intensity (measured by the share of cashless transactions and digital payment penetration) and institutional stability indicators, directly addressing the first research objective. The historical-evolutionary method made it possible to trace the dynamics of financial digitalisation over the 2014-2024 period, while economic modelling and graph-analytical tools were used to visualise correlations between the intensity of digital transformation and digital inclusion indicators, including access to formal banking services, the share of cashless operations, the volume of mobile payments, and selected proxies of digital literacy.

Special attention was paid to two approaches. Firstly, the structural-functional method revealed internal interdependencies between business digitalisation, financial

inclusion, and security. Secondly, comparative institutional analysis, aligned with international methodological standards (OECD, 2023), provided the possibility to compare inclusion mechanisms and cybersecurity standards of different countries, defining Ukraine's position within the global context of digitalisation. Collectively, these methods formed a coherent analytical framework that allowed a comprehensive exploration of how innovative digital technologies transform business processes and contribute to achieving the dual goal of financial inclusion and security in a technologically oriented and sustainably developed economy.

Results

The conducted analysis showed that the transformation of business processes in the digital economy is a complex and multidimensional process. It does not unfold along a predictable linear trajectory but through the interaction of technological innovations, institutional changes, and human behaviour. Statistical data convincingly confirm that the level of financial inclusion and financial security depends directly on the speed and efficiency of integrating digital technologies into the economy.

According to the Global Findex Database of the World Bank (2023), about 76% of the adult population globally have access to at least one formal financial service, while ten years ago this figure was only 51%. This dynamic reflects the widespread adoption of digital accounts, mobile banking, and online payment platforms that have made financial services more accessible, convenient, and secure. Over time, these tools have become an integral part of business practices, transforming into true drivers of sustainable economic growth.

The development of Ukraine in this context demonstrates similar trends. According to the National Bank of Ukraine (2024), the share of cashless operations in 2023 exceeded 92%, and the number of active payment cards reached 115.1 million – about 5% more than the previous year. These figures indicate the high resilience and adaptability of Ukraine's financial system even under wartime conditions. The rapid expansion of digital infrastructure has not only ensured business continuity but also strengthened transparency and security of financial flows across the entire economy.

Correlation analysis performed using the IBM SPSS Statistics software (IBM Corporation, n.d.) confirmed a strong positive correlation ($r = 0.82$) between the growth of digital transactions and key macroeconomic stability indicators. This means that the expansion of cashless payments contributes to increased transparency of economic processes and strengthens systemic resilience. In practice, secure digital technologies increasingly function as stabilisers of economic activity and as instruments for maintaining social trust in the national financial system. These results empirically confirm the existence of a structural relationship between the level of financial-system digitalisation and institutional stability, directly addressing the first research objective.

A comparative analysis was conducted between Ukraine and developed economies to identify structural differences in access to digital finance. As shown in Table 1, the study covers indicators of digital account ownership, mobile payment activity, and access to online credit platforms. The results revealed a clear, though gradually

narrowing, inclusion gap between Ukraine and the average level of OECD countries. This convergence trend indicates that financial accessibility in Ukraine is gradually approaching that of developed states – driven by continuous technological progress and the consistent strengthening of institutional capacity.

Table 1. Comparative indicators of digital financial inclusion (2023)

Indicator	Ukraine	OECD Average	Gap, p.p.
Adults with digital payment accounts (%)	75	94	-19
Population using mobile payments weekly (%)	41	69	-28
SMEs with access to digital credit platforms (%)	38	72	-34
Women with access to digital banking (%)	67	89	-22

Note: “Gap, p.p.” denotes the absolute difference between the indicator values for Ukraine and the OECD average, expressed in percentage points. Negative values indicate a lower level of digital financial inclusion in Ukraine compared to OECD countries

Source: compiled by the authors based on World Bank (2023), OECD (2023)

The comparative analysis confirmed that inequality in access to digital financial services has not disappeared yet, although the gap is gradually narrowing due to the spread of mobile technologies and digital identification systems. According to the OECD (2023), countries that have implemented unified digital ID-platforms alongside open-banking standards usually achieve higher levels of financial inclusion while experiencing lower operational risks. This pattern underlines the institutional dimension of digitalisation: long-term stability depends not only on technological capacities but also on the quality of regulation, standardisation, and policy coherence that support them.

At the micro level, the impact of digital transformation is clearly visible in everyday business practices. Both enterprises and consumers are increasingly using digital tools that make payments faster, securer, and easier to track. According to the National Bank of Ukraine (2024), the number of contactless payment cards increased by 17.1% in 2023, while the number of tokenised cards reached 12.4 million. By the end of the year, around one in four active cards was tokenised, and nine out of ten retail transactions were completed using Near Field Communication (NFC) technology. This steady shift from cash to secure contactless payments has strengthened public trust and significantly improved data-protection mechanisms in the financial sector.

At the same time, the results allow identifying the key risks and barriers associated with digital innovations in the financial sector. Despite the positive dynamics of cashless and contactless payments, three groups of

constraints were revealed. First, cybersecurity and operational risks increase alongside the growing scale of tokenised and NFC-based transactions, expanding the digital attack surface and raising dependence on secure authentication and monitoring systems. Second, regulatory and institutional barriers persist, as the pace of technological adoption exceeds the harmonisation of consumer-protection rules, cybersecurity standards, and interoperability requirements. Third, inclusion-related barriers remain evident in segments with lower digital literacy and limited access to trusted digital financial services, particularly in rural areas. These results indicate that digital innovation, while enhancing efficiency and inclusion, simultaneously generates new risk configurations that require coordinated institutional and regulatory responses.

Statistical modelling performed in IBM SPSS Statistics (IBM Corporation, n.d.) revealed a clear quantitative relationship: every additional percentage point in the share of cashless operations corresponds on average to a 0.2% increase in GDP and a 0.3% reduction in operational losses. These findings confirm that digitalisation has a multiplicative effect – it simultaneously stimulates economic growth, improves efficiency, and strengthens security. For visualising these trends, Table 2 presents the key indicators of payment card circulation and the level of contactless technology adoption in Ukraine. All key parameters – card emission, tokenisation, and NFC usage – demonstrate a steady positive dynamic, indicating Ukraine’s growing digital maturity and the enhanced resilience of its financial system.

Table 2. Dynamics of cashless and contactless payments in Ukraine, 2022-2024

Year	Total cards (mln)	Share of cashless transactions (%)	Tokenised cards (mln)	NFC share in retail (%)
2022	109.6	87	7.9	82
2023	115.1	91	12.4	90
2024	121.3	94	16.8	93

Source: compiled by the authors based on National Bank of Ukraine (2024)

The observed trends indicate that Ukraine is gradually approaching the level of digital maturity characteristic of

OECD countries. At the same time, a clear infrastructural gap remains between urban centres and rural communities.

According to the World Bank (2023), only about 54% of rural residents regularly use mobile banking applications, while among urban population this figure reaches nearly 80%. Bridging this gap requires not only further technological development, but also long-term financial literacy programmes and the creation of decentralised digital platforms capable of providing affordable and convenient financial services across all regions of the country.

The current institutional transformation of Ukraine's financial ecosystem is closely linked to the dynamic growth of the national FinTech sector, which complements traditional banking by providing flexibility and innovation. These firms belong predominantly to the financial technology (FinTech) sector, encompassing payment services, digital lending, regulatory technologies, insurtech, and blockchain-based financial solutions, and operate at

the intersection of finance, information technology, and data-driven services. According to the UAFIC (2023), 204 companies are actively operating in Ukraine. About 45% of them specialise in payment processing and API solutions, 20% in peer-to-peer lending, and around 14% develop regulatory technologies (RegTech).

The analysis of this sector's structure showed growing technological diversity in Ukraine's financial services and strengthening of their role in digital transformation processes. As presented in Table 3, most FinTech companies are focused on payments and money transfers, while lending, RegTech, and blockchain solutions remain smaller but rapidly growing segments. Collectively, these shifts mark a decisive step toward building an adaptive, innovative, and inclusive financial environment where technological progress combines with accessibility, trust, and long-term resilience.

Table 3. Structure of FinTech activity in Ukraine (2023)

FinTech category	Share of firms (%)	Key applications
Payment and Money Transfers	45	API integration, contactless payments
Lending and Crowdfunding	20	P2P lending, credit scoring
RegTech and Compliance	14	AI risk monitoring, AML/KYC automation
InsurTech and WealthTech	11	Digital insurance, portfolio tools
Blockchain and Crypto Solutions	10	Smart contracts, asset tokenisation

Source: compiled by the authors based on UAFIC (2023)

Statistical results showed that companies operating under the "digital-first" principle exhibit greater flexibility and a higher capacity to adapt to market changes, while simultaneously reducing transaction costs compared to traditional financial institutions. When FinTech-platforms are integrated into state financial systems within a consistent regulatory framework recommended by OECD (2023), national financial stability is significantly strengthened. This interaction not only expands access to credit and minimises information asymmetry, but also creates a foundation for transparent, accountable, and trust-based financial cooperation.

In the methodological dimension, the study is based on a hybrid analytical approach combining quantitative analysis with institutional interpretation according to the mixed-methods framework proposed by M.D. Fetters *et al.* (2013). This approach provided not only empirical depth but also conceptual consistency of the results. The generalisation of the findings revealed that financial digitalisation reduces average operational costs for small and medium-enterprises while enhancing information security through multi-layer encryption and biometric identification. Moreover, digital tools enhance institutional transparency, contributing to improved fiscal discipline and reduction of corruption risks. Collectively, these trends indicate that digital transformation not only optimises economic processes but also improves managerial efficiency and the overall quality of corporate and government governance.

Additional analysis conducted under the OECD (2023) framework showed that countries where technological innovations are combined with efficient institutional regulatory

mechanisms usually recover from crises faster and gain higher levels of investor confidence. From this perspective, Ukraine's financial digitalisation appears not merely as a technical upgrade but as a stabilising factor strengthening the nation's financial security amid deep structural transformations. The aggregate results, drawn from international and national statistical sources (World Bank, 2023; UAFIC, 2023; National Bank of Ukraine, 2024) and processed using modern analytical tools (IBM Corporation, n.d.), convincingly demonstrate that digital transformation has gradually become the strategic core of economic resilience. The synergy of technological development, institutional reforms, and financial inclusion now forms the foundation for sustainable growth. In this context, financial digitalisation represents not only a technical innovation but a key element of systemic security and inclusive development in the modern digital economy.

Discussion

The obtained results convincingly confirmed that digital transformation has become a defining factor in the development of both financial inclusion and financial security within modern business ecosystems. The analysis showed that the coordinated interaction of financial technologies, regulatory reforms, and institutional mechanisms significantly enhances the resilience of financial systems. The expansion of digital infrastructure and the widespread diffusion of FinTech tools have made financial services more accessible to households and enterprises while reducing systemic risks and creating a more inclusive model of economic growth. This confirms the study's central thesis:

digitalisation and inclusion function as mutually reinforcing components of financial stability.

The observed correlation between the pace of digitalisation and inclusion indicators aligns with global trends. As noted by F. Yang & T.A. Masron (2023), in China's banking sector, digital transformation stabilises the link between inclusion and institutional efficiency even under technological turbulence. A similar dynamic is experienced in Ukraine, where the expansion of mobile and cashless payments has increased transparency and operational efficiency. The findings of W. Zhu (2023) also indicated that digital inclusion promotes a fairer income distribution by integrating previously excluded groups into the formal financial system. Collectively, these evidences prove that technological diffusion stimulates growth while simultaneously reducing inequality by broadening financial participation.

Despite this, Ukraine's trajectory remains shaped by structural constraints that distinguish it from OECD countries. Although the proportion of adults with digital financial accounts is steadily increasing, institutional and infrastructural barriers persist. This corresponds to the observations of P.K. Ozili (2021), who noted that progress in global financial inclusion remains uneven and largely depends on the quality of regulation, infrastructural readiness, and digital literacy. For Ukraine, the priority is to strengthen institutional trust, enhance cybersecurity, and improve consumer-protection mechanisms – components that form the foundation of a sustainable and inclusive financial system.

Another critical area is the role of FinTech in expanding business resilience. As explained by T. Xu *et al.* (2024), contemporary digital financial solutions increase enterprises' ability to withstand macroeconomic shocks, and this trend is confirmed by Ukrainian data. The study's results showed that institutions that have integrated digital platforms managed to maintain operations and retain clients during periods of instability. This finding aligns with P. Zhang & Y. Wang (2024), who emphasised that corporate digitalisation is not simply a technical upgrade but a comprehensive reengineering of financial management, risk assessment, and data operations. The structural-functional analysis conducted confirmed this standpoint, showing that effective digitalisation requires synchronising technological innovations with institutional changes, particularly in risk control and compliance.

In comparative terms, Ukraine's progress in digital financial inclusion can be described as transitional. The country is moving consistently toward OECD standards in technological implementation; however, it still lags in regulatory capacity and cybersecurity guarantees. This imbalance highlights the need for a balanced approach: technological modernisation must proceed in parallel with institutional reforms to maintain systemic stability. In this context, the study's conclusions P.K. Ozili (2021), who stressed that successful inclusion depends not only on technology but also on the quality of governance and intersector cooperation.

Combining empirical results with theoretical insights allows the identification of practical recommendations for policymakers and business leaders. FinTech innovations implemented within a sound regulatory environment improve transparency, enhance supervision in financial intermediation, and expand participation in economic life. Further improvement of digital literacy, strengthening of data-protection standards, and harmonisation of national legislation with international norms are essential for sustaining inclusion in the long term. As F. Yang & T.A. Masron (2023) noted, technological progress in the financial sphere should be seen not only as a means of cost optimisation but as a strategic path to social integration and restoring public trust in financial systems.

At the same time, certain limitations of the research must be acknowledged. The analysis relied mainly on secondary data and macro-level indicators which, although being reliable, do not fully capture behavioural aspects and internal corporate decision-making. In addition, differences in statistical approaches and terminology among international databases partly complicate the comparison of results. Future studies could overcome these limitations by applying panel or micro-level data to more accurately identify causal links between digitalisation, inclusion and financial security.

Overall, the discussion confirms that digital transformation performs a dual function – a catalyst and a protective mechanism of financial inclusion, strengthening systemic resilience while promoting social fairness. The results confirm the study's hypothesis and are consistent with the findings of W. Zhu (2023), T. Xu *et al.* (2024) and P. Zhang & Y. Wang (2024), while reflecting the specific challenges of Ukraine identified by P.K. Ozili (2021) and F. Yang & T.A. Masron (2023). In conclusion, it can be stated that the success of digitalisation policies depends on three interconnected factors: consistency of institutional design, inclusivity of financial innovations, and the capacity of governance systems to adapt to accelerated technological change.

Conclusions

The conducted research showed that digital transformation fundamentally reshapes the logic of modern business, establishing a strong interconnection between financial inclusion and financial security. The obtained results confirmed that technological innovations supported by institutional adaptation determine the long-term stability and sustainability of financial ecosystems. When managed effectively, digitalisation becomes not only a driver of economic growth but also a social mechanism that ensures fairness and balanced development across different sectors of the economy.

A clear conceptual and empirical link was identified between the development of digital financial infrastructure and the strengthening of institutional security. The spread of FinTech solutions, mobile and cashless payment systems, as well as regulatory technologies, contributes to the stability of the financial environment and reduces systemic risks.

However, technological progress alone does not guarantee inclusivity or resilience. Long-term success depends on institutional capacity, the quality of the regulatory environment, and the level of societal trust. In practical terms, this means that government policies should focus on improving financial literacy, enhancing cybersecurity standards, building open-data environments, and strengthening cooperation among regulators, financial institutions and technology companies. For businesses, digital transformation should run parallel to risk-management and transparent compliance mechanisms to ensure that innovations remain safe and accountable.

The scientific novelty of the present research lies in the integration of systemic, comparative and institutional approaches to explain the impact of digitalisation on inclusion at different economic levels. Although the analysis was mainly based on secondary data and did not cover micro-level behavioural aspects, the results provide a reliable foundation for future studies. A promising area of future research is the examination of social and ethical

dimensions of financial digitalisation – in particular, the responsible use of artificial intelligence, data ethical standards development, and the creation of comprehensive indicators that simultaneously reflect both inclusion and security levels. Ultimately, the sustainability of digital transformation depends not so much on the speed of technological implementation as on the quality of governance and the inclusivity of institutions. When these factors are in balance, innovation transforms from a technical achievement into a strategic path toward a fair, secure, and sustainable economic future.

Acknowledgements

None.

Funding

None.

Conflict of Interest

None.

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Цифрова трансформація бізнесу: інновації, фінансова безпека та інклюзивне зростання – досвід України

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Анотація. Прискорене поширення цифрових технологій упродовж 2015-2025 років суттєво трансформувало глобальні економічні системи, посиливши інтеграцію автоматизації, аналітики даних і цифрових фінансових сервісів у бізнес-процеси та водночас підвищивши рівень уразливості до кіберзагроз, регуляторної фрагментації й соціальної нерівності. В економіках, що перебувають у процесі структурної трансформації, забезпечення того, щоб цифрові інновації сприяли одночасно фінансовій безпеці та інклюзивному економічному зростанню, постало як нагальна наукова й політична проблема. Метою цього дослідження було виявлення та обґрунтування ефективних напрямів цифрової трансформації бізнесу, які одночасно посилюють фінансову безпеку та сприяють інклюзивному доступу до цифрових фінансових послуг. Для досягнення поставленої мети було застосовано змішану методологічну рамку, що поєднує системний та інституційний аналіз, порівняльний аналіз, статистичне й кореляційне моделювання, а також аналітичний синтез міжнародних і національних масивів даних Світового банку, Національного банку України та аналітичних напрацювань ОЕСР. Отримані результати засвідчили наявність тісного зв'язку між розширенням використання цифрових фінансових технологій та підвищенням рівня інституційної стабільності й економічної стійкості. Емпіричні дані по Україні за 2022-2024 роки показали, що кількість активних платіжних карток зросла більш ніж на 10 %, тоді як частка безготівкових операцій перевищила 90 %, що свідчить про стрімке поширення цифрових платіжних інструментів. Масове впровадження технологій ближнього бездротового зв'язку, токенизованих платіжних карток і хмарних фінансових сервісів сприяло прискоренню обробки транзакцій, підвищенню прозорості та поліпшенню захисту фінансових даних. Водночас у ході дослідження було ідентифіковано стійкі ризики й бар'єри, пов'язані з вразливостями кібербезпеки, регуляторною неузгодженістю та нерівномірним рівнем цифрової інклюзії серед різних груп населення, зокрема в сільській місцевості та серед осіб з обмеженим рівнем цифрової грамотності. Отримані результати підтвердили, що цифровізація одночасно генерує як і підвищення ефективності, так і нові конфігурації фінансових та інституційних ризиків. Практичне значення дослідження полягає в можливості використання його результатів органами державної влади, фінансовими регуляторами та менеджерами бізнесу для розроблення узгоджених стратегій цифровізації, що інтегрують технологічні інновації з вимогами кібербезпеки, регуляторної узгодженості та інклюзивного розвитку фінансової системи

Ключові слова: цифрова економіка; фінансові технології; кібербезпека; інституційна стійкість; безготівкові платежі

Scientific Bulletin of Mukachevo State University

Series

Economics

Volume 13, No. 1, 55-67

Journal homepage: <https://economics-msu.com.ua/en>

UDC 339.37:334.735:330.13

Doi: 10.52566/msu-econ1.2026.55

ISSN 2313-8114

E-ISSN 2518-1254

Regional consumer cooperatives vs international retail chains: A performance analysis

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Abstract. The rapid expansion of international retail chains in the Fast-Moving Consumer Goods sector raises concerns about the long-term viability of traditional regional consumer co-operatives, which play an important economic and social role in Czech regions. Understanding firm-level economic differences is essential for assessing sustainability, competitiveness, and policy implications. The article aimed to identify and explain differences in economic performance between regional consumer co-operatives and international retail chains in Czechia, with particular emphasis on market share dynamics and the determinants of competitive advantage. The study employed financial ratio analysis, correlation analysis, and fixed-effects panel regression. The dataset consisted of audited financial statements of seven major consumer co-operatives and seven leading international retail chains over the period 2005-2024. The results showed that international retail chains significantly outperformed consumer co-operatives in sales growth, labour productivity, and market share

Received: 27.10.2025, Revised: 20.03.2026, Accepted: 01.04.2026, Published: 06.04.2026

Suggested Citation: Froulík, R., Zdeněk, R., & Lososová, J. (2026). Regional consumer cooperatives vs international retail chains: A performance analysis. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 13(1), 55-67. doi: 10.52566/msu-econ1.2026.55.



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expansion. While co-operatives doubled their sales over the observed period, retail chains nearly tripled theirs. Labour productivity in co-operatives grew more slowly and remained less than half that of chains, contributing to persistently higher personnel cost ratios. Regression results confirmed a strong positive relationship between market share and labour productivity, as well as between market share and leverage, while higher cost ratios are associated with lower market shares. Co-operatives exhibit lower indebtedness, but their conservative capital structures result in lower returns on equity than international chains. Profitability improvements among co-operatives were driven by favourable macroeconomic conditions and extraordinary events, such as the COVID-19 pandemic, rather than structural efficiency gains. The findings can inform management strategies of regional co-operatives, highlighting the need for productivity-enhancing investments, digitalisation, and deeper integration in purchasing and logistics. Policymakers may also use the results when designing measures to support sustainable regional retail structures

Keywords: trade chain; sustainability; Fast-Moving Consumer Goods; productivity; profit; market share

Introduction

Sustainable food production, including transportation, retailing, and consumption, without increasing overall costs, is a key EU policy objective and part of the 2030 agenda. M. Dora *et al.* (2021) stated that around 33% of food is lost worldwide along the food supply chain. S. Rasool *et al.* (2021) found that food waste arises from multiple stages, including production, transportation, sale, and consumption. According to FAO (2020), minimising food losses means significant economic benefits, improved food availability, and a lower environmental burden. Reducing food waste can be achieved, according to S. Abbate *et al.* (2023), by simplifying the supply chain and increasing the consumption of regional products, thereby contributing to the development of a stable economic and social structure. Implementing a short supply chain model has the potential to promote sustainability, strengthen local economies, maintain traditions, and protect the environment by limiting long-distance transportation and chemical protection in food production and processing, as found, for example, by C. Fogarassy *et al.* (2020) and S. Abbate *et al.* (2023).

This study sought to clarify the factors behind the continued expansion and growing market share of transnational retail chains in the highly competitive Fast-Moving Consumer Goods (FMCG) market in Czechia. The literature, e.g., a work by A. Bhattacharya *et al.* (2022), showed a strong relationship between market share and other metrics; M. O'Connell & K. Smith (2024) saw a link between market share and profitability, driven by economies of scale or greater market power, which firms help bargain prices more effectively. According to Ya. Farenjuk (2022), the most likely explanation is the quality of management. S. Wilkins & J.J. Ireland (2022) claimed that market share and integration are associated with higher productivity and lower markups – market share positively affects business profitability. The extent of this relationship is influenced by measurement and sample characteristics. Capital structure affects a firm's performance, with the level of debt in the capital structure being crucial. Higher performance is also often associated with company size, e.g., S. Panchal & S. Chand (2025).

The aim of this study was to identify factors influencing the economic situation of the largest consumer co-operatives (companies with more than a century of tradition

that represent traditional retail in individual regions of Czechia) and to compare their economic performance with that of the largest retail chains in the FMCG sector. Thus, this research sought to 1) identify differences in the economics of traditional regional business firms and foreign business chains and their development; 2) clarify the reasons for the continued expansion and increase in the market share of international business chains on the highly competitive FMCG market in Czechia; 3) provide management recommendations for improving the economy of regional business firms.

Literature Review

Grocery shopping, as an inseparable element of consumer society, according to B.A. Mughairi *et al.* (2024), offers a lens into both the economic and cultural dimensions of retailing. Research on food retailing frequently highlights the crucial role of building sustainable agri-food chains, as emphasised by A. Bhavsar *et al.* (2021), as well as issues such as food waste, analysed by O. Eičaitė *et al.* (2022). Other scholars focused on partnerships between producers and retailers, including studies by M. Dai & L. Liu (2020), D.O. Ochieng & S.O. Ogutu (2022) and T.Y. Wang *et al.* (2023). Regulatory, political, and economic factors were discussed by A.N. Igwe *et al.* (2024), while X. Zhu (2024) examined the growing dominance of multinational corporations in the food retail sector. In addition, L. Hsiao & H. Xiong (2022) and C.S. Kumari *et al.* (2023) investigated the effects and mechanisms of promoting new products and promotional pricing on consumer preferences. The impacts of crises on accounting, controlling and management practices are addressed by E.E. Passetti *et al.* (2021) and further elaborated by L. Rinaldi (2023). Nevertheless, detailed firm-level analysis remain relatively rare in the literature, as noted by M.C. Patricia (2023). Some studies evaluate the efficiency and productivity of supermarkets, such as the analysis of the Brazilian market conducted by D.A. Gomes da Silva & D. Ferreira (2024). In the context of food production, distribution and consumption, A. Bonfrer *et al.* (2022) observed a strong trend towards the expansion of supermarkets, which have substantially reconfigured supply chains. According to D.K. Gauri *et al.* (2021), these changes have involved the development of

sophisticated store formats and distribution systems, including the large-scale import of goods. Retail chains have taken over traditional wholesale functions and have simultaneously increased their role in product assortment management by more accurately measuring demand, guiding suppliers and developing private-label product lines.

The expansion of international retail chains in the FMCG sector has been manifested in rapid growth in store numbers, turnover, and market dominance, as documented by R. Froulík *et al.* (2023). Given the influence of supermarkets on everyday life, the growing concentration of retail power has attracted criticism, particularly regarding food standard setting and ethical business relationships, as discussed by N.S. Koshy *et al.* (2021), as well as the displacement of small independent retailers, highlighted by D.K. Gauri *et al.* (2021). The international expansion of retail chains has significant implications for the economies of Central and Eastern Europe. As argued by A. Bonfrer *et al.* (2022), it profoundly reshapes retail landscapes, consumption patterns and regulatory frameworks, while also exerting intense pressure on local supply networks. The topic gained further momentum following boycotts of multinational retail chains in several former Yugoslav countries in 2025. Reports by France 24 (2025) and Hrvatska radiotelevizija (2025) indicated that political parties and civil society organisations in the Western Balkans called for boycotts in response to unethical behaviour and disproportionate price increases. These actions led to a reduction in turnover for the affected chains by more than 50% and to political measures expanding the list of price-regulated basic products from 30 to 70.

In Czechia, the number of multinational food chain stores with a sales area exceeding 400 m² has increased by 14% between 2016 and 2021, a trend that has persisted despite the pandemic, as reported by RetailNews (2022). The Union of Czech and Moravian Consumer Co-operatives (COOP Group) currently has 46 consumer co-operatives with more than 100,000 members, according to J. Divinová (2022). Although this represents the largest retail network in the country, it ranks only 7th in sales volume, between the Billa and Globus chains.

Historically, consumer co-operatives emerged as a response to exploitative pricing practices by investor-owned monopolies, a role described by J. Heath (2025). In Czechia, the co-operative tradition dates back to 1847, when the first co-operative was founded to address growing economic and social challenges. During World War I, consumer co-operatives played a key role in ensuring fair distribution of goods, which strengthened their social legitimacy and led to growth in both membership and number. The establishment of Czechoslovakia marked a further expansion of the co-operative movement, which became differentiated by professional orientation, nationality, political affiliation and religious belief. The Wholesale Company of Co-operatives emerged as a major supplier of food and industrial goods, operating an extensive network of factories and facilities. World War II resulted in violent reorganisation and significant material

losses for co-operatives. After the war, co-operatives participated in rebuilding the national economy, and a unified organisation, the Central Council of Co-operatives, was established. The 1950s brought partial nationalisation, with wholesale networks transferred to the state sector. Following 1989, consumer co-operatives underwent economic transformation. In response to the rapid expansion of foreign retail chains, they sought to create a counterbalance to increasing competitive pressure, as documented by COOP (n.d.).

Co-operatives are characterised by a specific management system, business model, and a long-standing socio-economic tradition rooted in values such as self-responsibility, equality, openness to the community and democratic governance. In the economic literature, the co-operative form is recognised as a viable alternative to profit-oriented firms. A. Piscitelli *et al.* (2025) argued that co-operatives are not exclusively focused on profit maximisation but rather on improving conditions in consumer trade. During periods of crisis and financial uncertainty, co-operatives represent a resilient form of market organisation that supports employment and exhibits a higher potential for social responsibility, as shown by S. Novković *et al.* (2023). Consequently, co-operative enterprises provide a valuable empirical setting for sustainability research, according to M. Battaglia & N. Annesi (2022). At the same time, consumer co-operatives are often perceived as financially weak and unable to thrive in competitive market environments, a view discussed by G. Patmore *et al.* (2023). However, J. Wanjare (2023) demonstrated that the competitive advantage of co-operatives derived from non-economic determinants of consumer demand can enhance their market position, although this advantage diminishes as relative prices increase.

Materials and Methods

The study was a comparative analysis of the economic performance of consumer co-operatives and retail chains in the Czech Republic. The data were based on published annual reports and audited financial statements (balance sheet, income statement and annex) of seven consumer co-operatives and seven companies operating individual retail chains in Czechia from 2005 to 2024. The temporal scope of the analysis was restricted due to the delayed availability of firm-level financial statements and officially processed macroeconomic data. The consumer co-operatives that were the subject of this study were: Coop družstvo HB; Jednota, spotřební družstvo České Budějovice; Konzum, obchodní družstvo v Ústí nad Orlicí; Jednota, spotřební družstvo v Mikulově; Jednota, spotřební družstvo v Hodoníně; Tempo, obchodní družstvo and Jednota spotřební družstvo v Uherském Ostrohu, as they represent the most important consumer co-operatives. The sales of the goods of these co-operatives represented 39.5% of the sales of the COOP Group, which represents a total of 46 Czech consumer co-operatives with more than 100,000 members and 2,459 shops (Froulík *et al.*, 2023). The companies that operate the largest retail chains (supermarkets, hypermarkets, and discounters) were Lidl (Schwarz Gruppe, Germany);

Kaufland (Schwarz Gruppe, Germany); Albert (Ahold Delhaize, Netherlands); Penny Market (Rewe, Germany); Tesco (Tesco PLC, Great Britain); BILLA (Rewe, Germany) and Globus (Globus SB-Warenhaus Holding, Germany).

To evaluate key economic indicators for the mentioned companies, the authors examined trends in sales, costs, cost ratios, profit and profitability, assets, and equity and debt, following the methodology of M.S. Fridson & F. Alvarez (2022). Indicators expressed in constant 2005 prices have been adjusted using the annual inflation rate (CZSO, 2024). The mutual dependence of financial indicators and dependence on macroeconomic variables was assessed using Pearson's correlation coefficient (r). To assess the significance of differences in financial ratios between regional co-operatives and supermarket and hypermarket chains and discounters, their average values in graphs were supplemented with 95% confidence intervals.

The relationship between market share and financial indicators was assessed using a linear regression model. Due to the longitudinal nature of the data, it was a panel regression model. In this case, the individuals (retailers) are not randomly drawn, so the fixed effect model is an appropriate specification. As explanatory variables, efficiency indicators (specifically partial cost-to-sales ratios), labour productivity and capital structure are assumed:

$$y_{it} = \alpha_i + x' \beta + u_{it}, \quad (1)$$

where y_{it} is the market share of firm i in period t ; α_i is firm-specific intercept; x is a K -dimensional vector of

explanatory variables (without a constant term); β is a ($K \times 1$) vector of regression coefficients; u_{it} is the error term. This methodological framework enabled a consistent comparison of the economic performance of consumer co-operatives and retail chains and allowed for identifying firm-level factors associated with differences in market share over time.

Results

When considered as a whole, the COOP cooperative chain represents the largest retail network by number of stores; however, in terms of sales volume, it ranks seventh, between the Billa and Globus chains. The sales of goods of the seven selected consumer co-operatives increased from CZK 7.15 billion in 2005 to CZK 14.46 billion in 2024, representing a growth of 102.2%. Over the same period, the sales of the analysed retail chains increased from CZK 140.47 billion to CZK 402.47 billion, corresponding to an increase of 186.5%, which indicates a substantially faster growth rate compared to consumer co-operatives. The correlation analysis between sales of goods and key economic variables demonstrated a significant influence of average wages ($r=0.98$), gross domestic product ($r=0.98$), and the unemployment rate ($r=-0.89$) on sales of goods of consumer co-operatives. To assess differences in operational efficiency between consumer co-operatives and international retail chains, labour productivity was measured as sales of goods per employee (Fridson & Alvarez, 2022) over the period 2005-2024. The development of labour productivity for both groups of firms is presented in Figure 1.

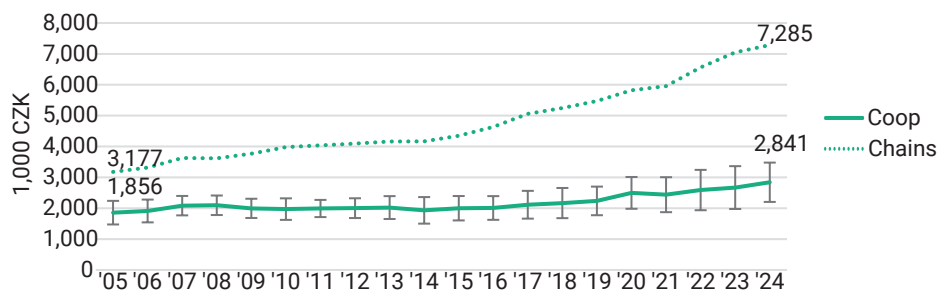


Figure 1. Sales of goods per employee

Source: calculated by the authors based on companies' financial statements

Figure 1 indicates a persistent and widening productivity gap between consumer co-operatives and retail chains. While labour productivity in co-operatives increased from CZK 1.86 million in 2005 to CZK 2.84 million in 2024 (by 53.1%), retail chains achieved substantially faster growth (129.3%) and reached CZK 7.29 million per employee in 2024. This represents a productivity level approximately 2.6 times higher than that of consumer co-operatives. When comparing the development of labour productivity at constant prices, consumer co-operatives saw a decrease of 17.7%. Only consumer co-operative Coop HB (by 3.4%) managed to increase sales of goods at constant prices per employee. Given the observed differences in labour

productivity between consumer co-operatives and international retail chains, it is also relevant to compare the development of average employee wages in both groups of firms. The evolution of the average monthly wage over the monitored period is shown in Figure 2. As illustrated in Figure 2, the average monthly wage in consumer co-operatives has remained consistently below the level observed in retail chains throughout the monitored period. This long-term wage gap corresponds with the lower labour productivity of co-operatives and may limit their ability to attract and retain more productive employees. Correlation coefficients confirmed the close link between labour productivity and wages. In the case of Coop HB, the correlation coefficient

between labour productivity and the average wage of employees has a value of $r = 0.96$. This dependence was also manifested in the Tesco, Albert, and Billa ($r = 0.98$ for all), as well as for Globus ($r = 0.97$) and Lidl ($r = 0.94$). To enable a more consistent comparison of pricing strategies between

consumer co-operatives and international retail chains, the trade margin was calculated as a share of total sales, defined as the sum of sales of goods and sales of products and services (Froulík et al., 2023). The development of this ratio over time is presented in Figure 3.

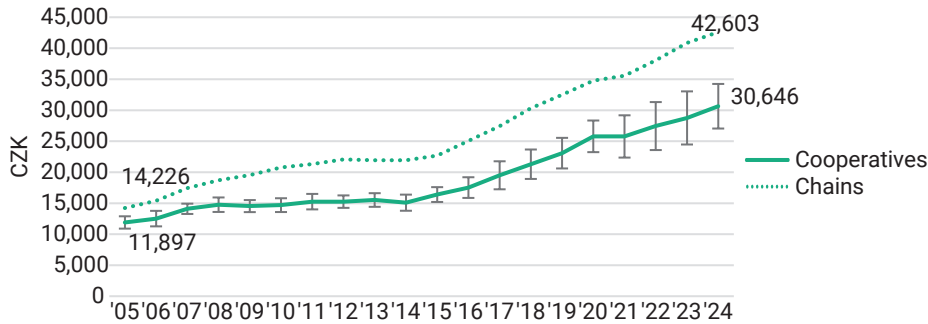


Figure 2. Average monthly wage

Source: calculated by the authors based on companies' financial statements

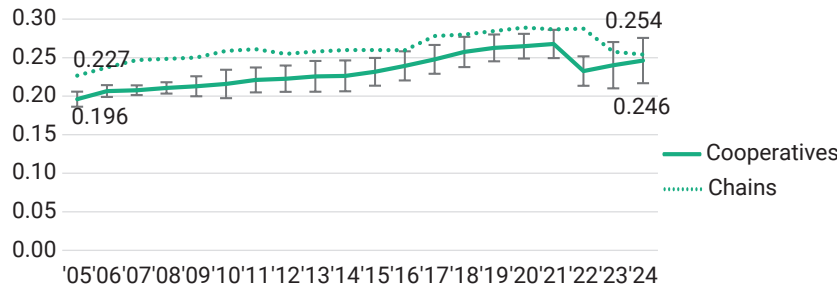


Figure 3. Share of trade margin to total sales

Source: calculated by the authors based on companies' financial statements

Figure 3 shows that the trade margin of consumer co-operatives has increased from 19.6% in 2005 to 24.6% in 2024. Although retail chains maintain a higher trade margin in the long term, the gap between the two groups has gradually narrowed, indicating partial convergence in pricing performance. Differences in trade margin are influenced by both purchase prices and pricing strategies applied in co-operative stores. In some consumer co-operatives, suppliers carry out part of the logistics (e.g., refrigerated assortment), which is included in the cost of goods sold rather than in material, energy, personnel, or depreciation costs. This can lower the apparent trade margin compared to co-operatives and chains that provide complete logistics. Comparisons of trade margins over time and between individual co-operatives are further complicated by bonuses, fees, marketing support, and other supplier services. A more realistic comparison uses trade margins derived from total sales, including goods, products, and services, which confirms the decreasing difference between retail chains and consumer co-operatives over the long term. Correlation analysis indicates that key economic variables significantly affect the trade margin of the largest consumer co-operatives: the correlation coefficient

with GDP is $r = 0.96$, with the average wage $r = 0.97$, and with the unemployment rate $r = -0.91$.

The share of material and energy consumption costs in sales of goods (Froulík et al., 2023) for consumer co-operatives increased from 3.93% in 2005 to 4.05% in 2024. The decrease occurred mainly in 2015-2019 in connection with a drop in the wholesale price of electricity on the European Energy Exchange. Compared to the retail chains, the unit costs of consumer co-operatives for materials and energy are higher in the long term. This difference in the unit costs of the largest co-operatives and retail chains has decreased in recent years. The share of service costs in the sales of goods of consumer co-operatives did not change significantly in the monitored period. In 2005, the value of this cost was 3.85%; in 2024, it was 4.29%. It is significantly less than for the largest retail chains, for which this indicator had a value of 10.03% in 2024. Similar to consumer co-operatives, the value of these unit costs remained at a similar level in 2005. Personnel costs represent the dominant cost component of consumer co-operatives and are closely linked to labour productivity. To compare cost structures between consumer co-operatives and international retail chains, Figure 4 presented the development of the share of personnel costs in sales of goods over the monitored period.

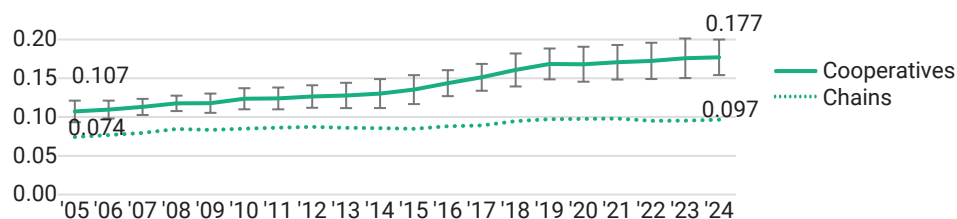


Figure 4. Share of personnel costs to sales of goods

Source: calculated by the authors based on companies' financial statements

Figure 4 shows that the share of personnel costs in sales of goods is consistently higher for consumer co-operatives than for retail chains and that the gap between the two groups has widened over time. Among consumer co-operatives, the share of personnel costs in sales increased from 10.7% in 2005 to 17.7% in 2024. Over the same period, the growth rate of personnel costs (65.1%) exceeded the growth rate of labour productivity (53.1%), contributing to the observed divergence. The rapid increase in the share of personnel expenses in sales halted in 2020, a year significantly affected by the COVID-19 pandemic, when consumer co-operatives recorded a substantial increase in sales (8.4%) alongside a reduction in the number of employees (2.9%). As a result, the difference in the share of personnel costs in sales between consumer co-operatives and retail chains more than doubled, rising from 3.3% in 2005 to 8% in 2024.

The depreciation to the sales of goods of consumer co-operatives increased from 1.86% in 2005 to 2.5% in

2011 and then gradually decreased to the original level. The depreciation to the sales of consumer co-operatives has been lower than that of retail chains in the long run, mainly due to the higher rate of depreciation of fixed assets of consumer co-operatives (51.3%) compared to retail chains (46.6% in 2024). It remains unclear to what extent the observed differences in depreciation reflect the age of fixed assets or differences in investment intensity and asset renewal. Differences in partial cost ratios reflect the different conditions and strategies of individual companies. To provide an overall comparison of cost efficiency between consumer co-operatives and international retail chains, aggregated costs were constructed as the sum of material and energy consumption, service costs, personnel costs and depreciation (Froulík *et al.*, 2023). Figure 5 showed the development of the share of aggregated costs in sales of goods for both groups of firms over time.

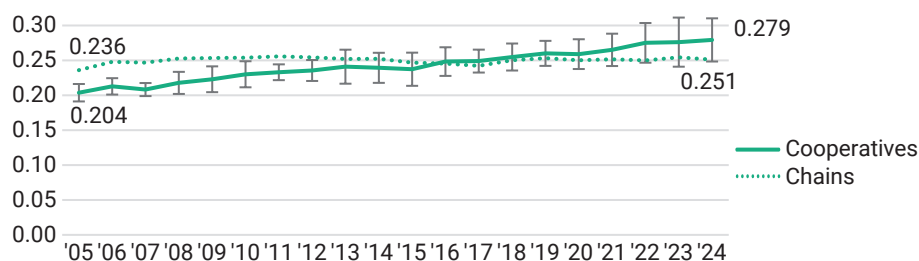


Figure 5. Share of aggregated costs to sales of goods

Source: calculated by the authors based on companies' financial statements

Figure 5 demonstrated that aggregated costs relative to sales of goods increased more rapidly in consumer co-operatives than in retail chains. Although consumer co-operatives began the period with a lower aggregate cost ratio, their costs gradually rose above the level observed for retail chains, indicating a deterioration in relative cost efficiency. The aggregate cost ratio for consumer co-operatives increased from 20.4% in 2005 to 27.9% in 2024, compared with an increase from 23.6% to 25.1% for retail chains. This development was primarily driven by rising personnel costs, whose share in aggregated costs of consumer co-operatives increased from 52.6% to 63.4%. The total profit before taxation of selected consumer co-operatives increased from CZK 61.35 million

to CZK 288.58 million in 2024. The profit in 2024 was thus almost than five times higher than in 2005. It is thus the indicator with the highest overall increase. Most of the profit before taxation (80.5% in 2024) was generated by Coop HB. The profit before taxation growth rate was significantly higher than the growth rate of sales for consumer co-operatives. Thanks to this, there was a significant increase in sales profitability. Speaking about the profitability, it represents a key indicator of economic performance and reflects the combined effects of cost structure, pricing and efficiency. To compare profitability between consumer co-operatives and international retail chains, Figure 6 presented the development of return on sales over the monitored period.

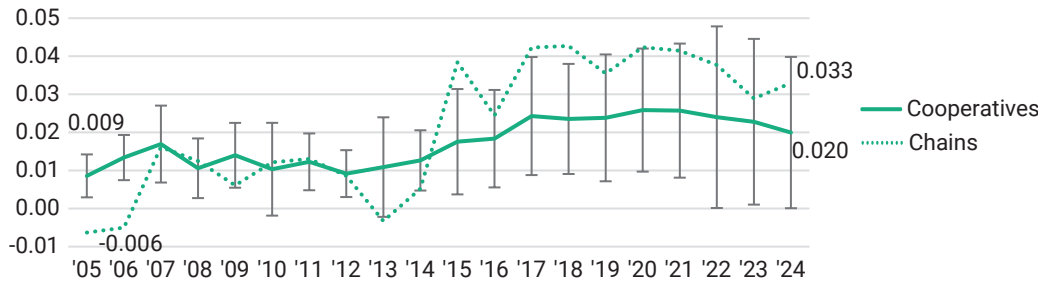


Figure 6. Return on sales

Source: calculated by the authors based on companies' financial statements

Figure 6 shows that the return on sales of consumer co-operatives has remained below that of retail chains since 2015. Co-operatives experienced an improvement in profitability over time, but retail chains consistently achieved higher returns, reflecting their lower cost ratios and greater operational efficiency. In 2005, return on sales in co-operatives was 0.86%, rising to 2.0% in 2024, compared to 3.3% for the largest retail chains. This difference results from higher cost of sales and a lower trade margin in consumer co-operatives. A significant part of the profit of consumer co-operatives (12.3%) was generated by the sale of fixed assets.

The correlation analysis between the profitability of the sales of goods and fundamental economic variables demonstrated a high influence of the average wage, GDP, and the unemployment rate on the profitability of the largest consumer co-operatives. The correlation coefficient of the profitability of sales and the GDP is $r = 0.77$; for the average wage, $r = 0.77$; and for the unemployment rate, $r = -0.92$. The record level of pre-tax profit and profitability of sales of consumer co-operatives in 2020 was affected by the COVID-19 pandemic. The year-on-year increase in profit before tax and profitability of sales was a logical consequence of the development of sales, costs, and trade margins. The closure of public catering establishments (restaurants and canteens) during the individual waves of the epidemic in Czechia impacted the record level of sales for goods sold by consumer co-operatives. While companies that operate wholesale food stores and supply these foods

to public catering establishments saw a drop in sales, sales at co-operative retail stores were at a record. The number of employees of consumer co-operatives decreased in 2020, and the value of the aggregate cost ratio also decreased.

The assets of co-operatives in net prices increased from 3.1 billion CZK in 2005 to 6.6 billion in 2024. The growth rate of the assets of consumer co-operatives (an increase of 116%) surpassed that of retail chains (an increase of 93%). The growth rate in consumer co-operatives' assets was higher than growth rate in sales of goods (an increase of 102%). Therefore, consumer co-operatives' asset turnover decreased from 2.33 to 2.18. The asset turnover of retail chains increased (from 1.69 to 2.49) due to the faster growth rate of sales (an increase of 187%), which outpaced the growth rate of assets (93%). Compared to consumer co-operatives, the growth rate of the assets of retail chains was influenced by the development of depreciation of fixed assets. The growth rate of depreciation was significantly higher for retail chains (an increase of 144%) than for consumer co-operatives (an increase of 105%). This, together with the dynamics of sales, had a significant effect on the increase in the turnover rate of the assets of retail chains. As inventories represent a key component of current assets in retailing, differences in asset turnover are partly explained by the effectiveness of inventory management. Inventory management is an important component of operational efficiency and liquidity in retailing. To compare differences in stock management, Figure 7 presented the development of the share of goods inventories in sales over the monitored period.

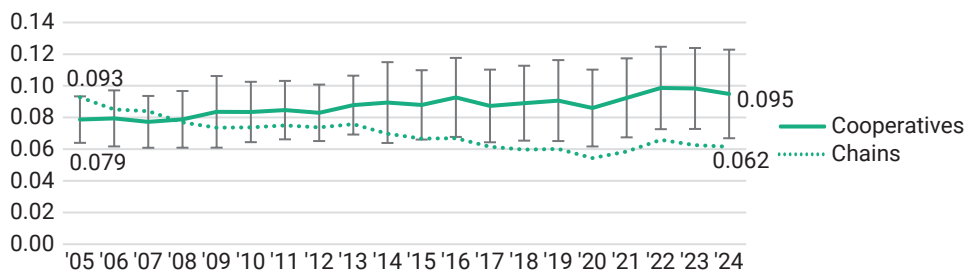


Figure 7. Share of stock of goods to sales

Source: calculated by the authors based on companies' financial statements

Figure 7 indicates that consumer co-operatives maintain a higher share of inventories relative to sales than retail chains, and this gap has widened over time,

reflecting less efficient inventory turnover in co-operatives. Stocks of goods in consumer co-operatives increased by 144%, with their share of sales rising by 20.6%

and their share of assets by 12.7%. In contrast, inventories in retail chains grew by 90.1%, while their share of sales declined by 33.6% and their share of assets remained unchanged. In 2024, the share of goods stocks in sales was 9.5% for consumer co-operatives and 6.2% for retail chains. These differences in inventory dynamics

are closely linked to broader financial policies, as capital structure reflects firms' financing strategies and risk preferences and differs substantially between consumer co-operatives and international retail chains. To illustrate these differences, Figure 8 presents the development of the debt ratio for both groups of firms.

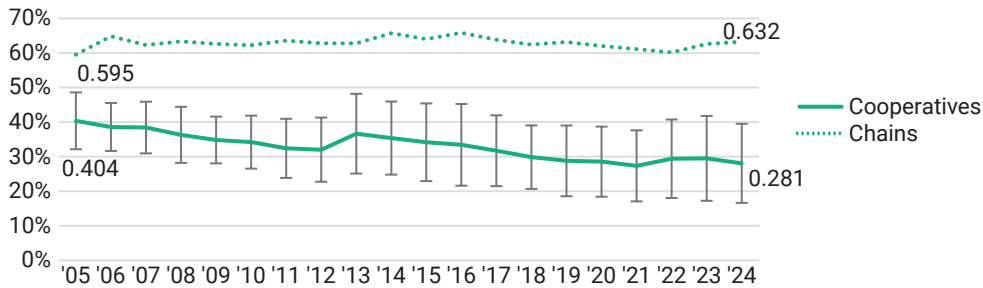


Figure 8. Debt ratio

Source: calculated by the authors based on companies' financial statements

Figure 8 showed that consumer co-operatives maintain a significantly lower debt ratio than retail chains throughout the monitored period, reflecting a more conservative financing strategy. The equity of consumer co-operatives increased by 160% during this period, compared to 76% for retail chains. This growth largely resulted from retained profits and transfers to funds from profit, whereas foreign chains typically distribute a higher share of profits to their owners. The share of equity in assets in 2024 was 71% for consumer co-operatives, compared to under 40% for retail chains, which is reflected in return on equity: 6.1% for co-operatives versus 22.6% for the largest retail chains.

There was also a different development between consumer co-operatives and retail chains in the liabilities. The liabilities of the largest consumer co-operatives to credit institutions increased from CZK 119.7 million in 2005 to CZK 151.1 million in 2024. Their share of debts decreased from 9.7% to 8.1% in the same period, and their share of assets from 3.9% to 2.3%. Liabilities of retail chains to credit institutions increased from CZK 9.78 billion to CZK 23.4 billion (i.e., 19.7% and 22.9% of debts; and 11.7% and 14.5% of assets). In the monitored period, short-term liabilities from trade relationships increased by 48% for consumer co-operatives. Due to the faster growth of stocks, the share of these obligations in the stocks of goods decreased from 114% in 2005 to 69% in 2024. The share of short-term liabilities on debts of consumer co-operatives stayed almost unchanged (52% in 2005, 51% in 2024). For retail chains, short-term liabilities from trade relationships increased

by 108%. The growth rate of large chains' inventories was slower. As a result, the share of short-term liabilities on inventories increased from 133% in 2005 to 146% in 2024.

The market share of individual traders is determined as the share of sales for the goods of the given trader to the sales of the sector "Retail with a predominance of food, beverages and tobacco products in non-specialised stores (CZ-NACE 47.11)". The share of selected consumer co-operatives increased from 2.35% (2010) to 2.73% (2024). International chains control a significant market share, 68% in 2010 or 76.1% in 2024. From the point of view of business formats, a significant growth in the market share of discount stores is noticeable (mainly Lidl, from 6.1% in 2010 to 18% in 2024). Data on sales in the industry are available from the statistical office from 2010; therefore, the regression analysis is performed on panel data from 2010 to 2024. The Interspar chain left the Czech market in 2013, it was dropped from the regression analysis, and the panel is balanced.

To identify firm-level factors associated with differences in market share between consumer co-operatives and international retail chains, a panel regression model with fixed effects was estimated. The explanatory variables include financial ratios discussed above, specifically labour productivity, partial cost-to-sales ratios (materials and energy, services, depreciation, and personnel costs), and the debt ratio (debt to total capital). The fixed effects specification is supported by the Hausman test (Baltagi, 2021), which rejects the null hypothesis of consistent and efficient random effects ($p < 0.001$). The regression results are presented in Table 1.

Table 1. Results of regression model

Variable	Coefficient	Standard error	t	p-level
Labour productivity	4.9e-06	1.21e-06	4.06	0.000
Material & energy cost ratio	-0.2914	0.1741	-1.67	0.096
Services cost ratio	-0.0714	0.1291	-0.55	0.581
Depreciation cost ratio	-0.1382	0.2132	-0.65	0.518
Personnel cost ratio	-0.0563	0.0508	-1.11	0.269

Table 1, Continued

Variable	Coefficient	Standard error	t	p-level
Debt ratio	0.0632	0.0105	6.02	0.000
const	0.0285	0.0143	1.98	0.049

Note: overall $R^2 = 0.70$

Source: calculated by the authors based on companies' financial statements

The results indicate a positive and statistically significant relationship between labour productivity and market share, highlighting the importance of efficiency in gaining market share. All partial cost ratios have negative coefficients, though none are statistically significant ($p > 0.05$), suggesting an inverse but weak relationship with market share. The debt ratio shows a highly significant positive coefficient, implying that firms with higher leverage tend to achieve a larger market share, whereas a higher degree of self-financing is associated with a lower market share. Overall, these findings suggest that market share differences are primarily driven by labour productivity, operational efficiency, and the degree of leverage.

Discussion

The previous chapter suggests that international business chains are growing significantly faster in the FMCG market in Czechia than traditional regional businesses and are further increasing their market share, as predicted by earlier studies, e.g., I. Kormakova *et al.* (2023) and T.P. Kohli *et al.* (2025). According to a study conducted in Greece by N. Zisoudis *et al.* (2020), the competitive advantage of large chains is most evident in crisis years. The group of large multinational chains in Czechia managed to increase year-on-year sales of goods over the whole period under review (from 2005 to 2024), including the global recession. While the retail chains increased their sales revenue by 10.2% in 2009 and 2010, the sales of consumer co-operatives decreased by 9.4% in the same period.

The COVID-19 pandemic period was very successful for FMCG companies in the Czech market, driven by increased sales of goods, significantly influenced by a shift in demand from canteens and restaurants to retail stores, as noted by J. Žurek & M. Rudy (2024). Retail chains' sales grew by 6.95% year-on-year in 2020. In 2020, the discount chains Lidl and Penny Market achieved the highest year-on-year sales increase (12.9%). Chains operating hypermarkets and large supermarkets increased sales by 3.5% year-on-year. The largest consumer co-operatives, which mainly operate medium-sized supermarkets and smaller stores, increased sales revenue by 8.4% in this period.

The return on equity of the largest consumer co-operatives has lagged significantly behind that of the largest retail chains, which were able to evaluate their capital much more effectively. The development of the stock of goods and their share in sales reveals a significant difference in logistics and stock management between consumer co-operatives and retail chains. According to, e.g., H. Sano & K. Yamada (2021) and M.J. Marzolf *et al.* (2024), the goods turnover is negatively correlated

with gross margin and positively correlated with capital intensity and sales surprise rate.

According to B. Derqui *et al.* (2022), productivity growth is primarily associated with technical development, and, according to E. Asgharizadeh *et al.* (2023), with the location and the type of chain. The low labour productivity and the high share of personnel costs in the sales of the consumer co-operatives compared to the international chains are one of the key factors due to which consumer co-operatives cannot build new stores and achieve high dynamics of sales growth and market share, as they do in a saturated market where the biggest retail chains are thriving. The lower productivity of co-operatives is also confirmed by F.J. Medina-Albaladejo (2025). The economy of consumer co-operatives has long been based on running their own walk-in stores built during socialist Czechoslovakia and located in traditionally residential areas. Most consumer co-operatives need better performance to profit from new commercial properties, such as newly built retail parks or stores located outside residential areas. Consumer co-operatives can achieve increased labour productivity and a reduced personnel cost ratio by introducing modern technologies such as self-service checkouts, self-scanning, electronic price tags and other forms of sales, storage and distribution automation. Also, N. Zisoudis *et al.* (2020) highlighted the advantage of large chains that reduce costs by investing in automated systems. The correlation coefficients indicate that consumer co-operatives can also increase labour productivity by raising average wages and attracting more efficient, better-motivated employees. This study has several limitations – it is based on financial data, and incorporating operational indicators, such as the sales area, would enhance the explanatory power of the results. However, such information is not typically disclosed by commercial companies.

Conclusions

The results of consumer co-operatives achieved in 2020–2024 years were significantly influenced by the economic climate, low unemployment rate, and average wage growth. The further development of the economy of consumer co-operatives is challenging to predict because of the high rate of inflation and the expected decline in real wages and living standards. In addition to macroeconomic influences, consumer co-operatives will have to deal with the further thickening of the market with new stores of expanding retail chains, which have significantly lower costs and higher labour productivity compared to consumer co-operatives, and at the same time with the growth of companies that specialise in online food sales.

A major challenge will be cost management, particularly personnel costs linked to lower labour productivity. An opportunity for co-operatives and their economy is the possibility of increasing the trade margin to the level of chains, primarily by reducing the purchase prices of goods. Purchase prices could be reduced through the merger of purchasing centres of Czech and Moravian co-operatives and the introduction of central logistics, which could also bring the co-operatives a decline in the stock of goods and an increase of goods turnover ratio. Developments in recent years has shown a big difference in the economy of the largest consumer co-operatives – Coop HB and Jednota České Budějovice – compared to other co-operatives. The further integration of the consumer co-operatives themselves also represents an excellent opportunity for the improvement and long-term sustainability of the economy of consumer co-operatives.

The main economic advantages of consumer co-operatives compared to retail chains are a high volume of equity capital and low indebtedness. The advantage of the availability of equity was insignificant when interest rates were very low. Taking advantage of the high volume of own resources for expansion and dynamic sales growth in a highly competitive market is also limited by consumer co-operatives' insufficient performance and efficiency compared to the largest retail chains. Consumer co-operatives will have to deal with a significant increase in energy prices and the costs of their consumption in the same way as retail

chains. Co-operatives and chains that purchase energy at a favourable price and reduce energy intensity and energy consumption can gain an attractive competitive advantage compared to others.

The conclusions of this study indicate several important areas that require additional investigation. First, future research should focus on the sensitivity of consumer co-operatives to macroeconomic shocks, particularly high inflation, declining real wages, and changing living standards. Second, the role of digitalisation and automation in narrowing the productivity gap between co-operatives and retail chains is important. Finally, with rising energy prices, it would be appropriate to investigate the potential of energy-saving technologies, renewable energy adoption, and collective energy purchasing as sources of competitive advantage for consumer co-operatives.

Acknowledgements

The authors thank Justin C Schaefer for English proofreading.

Funding

This research received no external funding. This research was supported by institutional funding from the University of South Bohemia, Faculty of Economics, Department of Accounting and Finances (RVO160).

Conflict of Interest

None.

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Регіональна споживча кооперація проти міжнародних роздрібних мереж: аналіз ефективності

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Анотація. Швидке розширення міжнародних роздрібних мереж у секторі товарів широкого вжитку викликає занепокоєння щодо довгострокової життєздатності традиційних регіональних споживчих кооперативів, які відіграють важливу економічну та соціальну роль у регіонах Чехії. Розуміння економічних відмінностей на рівні підприємств є важливим для оцінки стійкості, конкурентоспроможності та наслідків для політики. Метою статті було виявлення та пояснення відмінностей в економічних показниках між регіональними споживчими кооперативами та міжнародними роздрібними мережами в Чехії, з особливим акцентом на динаміці ринкової частки та визначальних факторах конкурентної переваги. У дослідженні було використано аналіз фінансових коефіцієнтів, кореляційний аналіз та регресію з фіксованими ефектами. Набір даних складався з аудитованих фінансових звітів семи основних споживчих кооперативів та семи провідних міжнародних роздрібних мереж за період 2005-2024 років. Результати показали, що міжнародні роздрібні мережі значно перевершили споживчі кооперативи за темпами зростання продажів, продуктивністю праці та розширенням частки ринку. Хоча кооперативи подвоїли свої продажі за спостережуваний період, роздрібні мережі майже потроїли свої. Продуктивність праці в кооперативах зростала повільніше і залишалася меншою за половину продуктивності мереж, що сприяло постійному підвищенню коефіцієнтів витрат на персонал. Результати регресійного аналізу підтвердили сильний позитивний взаємозв'язок між часткою ринку та продуктивністю праці, а також між часткою ринку та фінансовим важелем, тоді як вищі коефіцієнти витрат пов'язані з нижчими частками ринку. Кооперативи мають нижчий рівень заборгованості, але їх консервативна структура капіталу призводить до нижчої рентабельності власного капіталу, ніж у міжнародних мережах. Покращення прибутковості кооперативів було зумовлено сприятливими макроекономічними умовами та надзвичайними подіями, такими як пандемія COVID-19, а не структурним підвищенням ефективності. Ці висновки можуть бути використані для формування стратегій управління регіональними кооперативами, підкреслюючи необхідність інвестицій у підвищення продуктивності, цифровізацію та глибшу інтеграцію в сфері закупівель та логістики. Політики також можуть використовувати ці результати при розробці заходів для підтримки стійких регіональних структур роздрібно-торгівлі

Ключові слова: торговельна ланцюг; сталий розвиток; товари широкого вжитку; продуктивність; прибуток; частка ринку

The impact of economic digitalisation on the development of government strategies for youth employment

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Abstract. The purpose of the study was to evaluate the effectiveness of government strategies to promote youth employment in the context of the digital transformation of the economy. The methodological framework included an analysis of statistical data from international organisations, a content analysis of strategic documents, and an online survey of 512 respondents. The study used a comparative approach based on the analysis of the experience of Kazakhstan, the European Union, Ukraine, Georgia, and Moldova. The survey of young professionals revealed statistically significant differences in the level of digital competencies between the countries of the European Union and neighbouring countries: 7.8 points on a 10-point scale in the European Union and 6.3 points in Georgia, Moldova, and Ukraine ($U = 4,890$, $p < 0.01$), which

Received: 05.11.2025, Revised: 24.03.2026, Accepted: 01.04.2026, Published: 06.04.2026

Suggested Citation: Chechelashvili, M., Svanidze, A., Kavtadze, E., & Lagvilava, G. (2026). The impact of economic digitalisation on the development of government strategies for youth employment. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 13(1), 68-81. doi: 10.52566/msu-econ1.2026.68.



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confirmed the existence of a persistent gap in digital training and opportunities for integration into the labour market. The higher average score of digital skills and the share of positive assessments of government support measures in EU countries (62% vs 38%; $t(310) = 4.21$, $p < 0.001$; $\chi^2 = 24.7$, $p < 0.001$) indicate a synergistic effect of combining advanced digital infrastructure, educational initiatives, and institutional employment support mechanisms. A strong positive correlation has been established between digital skills and employment in the digital sector ($r_s = 0.62$, $p < 0.001$). In the European Union, digital components are integrated into 90% of strategies, institutional support measures, 80%, integration of education and the digital economy, 73%; in Georgia, Moldova, and Ukraine, these indicators were 60, 45, and 33%, respectively, indicating fragmented approaches and barriers, including lack of practical skills, limited access to targeted internships, and poor integration of educational programmes with the digital sectors of the economy. The practical significance lies in substantiating the priority of the systemic development of digital skills, the integration of educational and labour trajectories, and the expansion of grant, subsidy, and psychological support programmes for the development of sustainable youth employment in the digital economy

Keywords: digital literacy; integration into the labour market; post-Soviet space; institutional mechanisms; psychological stability; technological inequality; professional adaptation

Introduction

The digitalisation of the economy is one of the key factors in the transformation of the contemporary labour market, having a profound impact on employment processes, especially among young people. The introduction of automation, artificial intelligence, platform employment, and remote forms of work is changing not only the nature of work, but also the qualifications of employees. Young professionals find themselves at the centre of these changes, as they are the ones who adapt faster to digital technologies, but simultaneously are more susceptible to the risks of structural unemployment if their skills do not meet the needs of the digital economy. The research problem is related to the fact that in the context of the digital transformation of the economy, government employment strategies should not only create jobs, but also ensure the development of digital competencies, the adaptation of educational programmes, the development of flexible forms of employment and social protection mechanisms. The theoretical basis of the problem is based on the provisions of the theory of human capital and the concept of structural shifts in the labour market. According to these approaches, a sustained reduction in youth unemployment is possible if investments in education and skills are combined with the adaptation of employment institutions to technological changes.

M. Idris & J.M. Maikomo (2024) analysed the impact of the digital economy on youth unemployment in Nigeria. The researchers have identified a key relationship between the level of digital infrastructure and the employment rates of young professionals. The results showed that with insufficient digital literacy and limited availability of technology, digitalisation increases structural unemployment. This conclusion is important for comparative analysis, as similar limitations are evident in a number of Central Asian states.

A. Omarova et al. (2024) investigated the socio-economic development of youth policy in the context of digital transformation using the example of Kazakhstan and neighbouring countries. The researchers noted that the digitalisation of the labour market requires a review of the content of government youth employment programmes,

including the expansion of educational initiatives and the adaptation of the vocational training system to the digital sectors of the economy. Simultaneously, it was emphasised that the lack of an integrated approach to coordinating measures leads to limited effectiveness of strategies. The paper by W. Geza et al. (2022) provided an overview of the dynamics of youth employment and involvement in the agricultural sector in the context of sustainable development. The researchers have revealed that digital technologies can help attract young people to the agricultural sector through the introduction of innovative production methods and remote forms of interaction. Simultaneously, it was emphasised that without a parallel increase in the digital competencies of employees and the development of infrastructure, the effect of such measures remains limited.

The study by A. Barford et al. (2021) analysed government measures taken during the COVID-19 pandemic to reduce youth unemployment. The researchers concluded that programmes that combine financial support with the development of digital skills have the greatest potential for a sustained impact on employment. However, in most countries, such measures were short-term in nature and were not integrated into long-term labour market strategies. Analysis by S.K. Azar et al. (2025) focused on socio-cultural changes and related mental health issues of young people in Iran in the context of digitalisation. The researchers noted that the economic and cultural transformations caused by digital changes are accompanied by an increase in social instability among young people. These results allow expanding the understanding of the impact of digitalisation not only on the economic, but also on the psychosocial aspects of employment.

M. El Khatib et al. (2022) conducted a quantitative study (online survey of approximately 40 participants) aimed at clarifying the relationship between the effectiveness of digital programme management and their success. Although the sample size was smaller than recommended (≥ 63 for 95% confidence), the results showed a statistically significant positive correlation between digital

governance and programme success. The researchers pointed out the limitations, narrow geographical coverage, and small sample size, and suggested expanding the study to include macro factors and a larger sample. Conclusions by M. El Khatib *et al.* (2022) supplemented the research topic by showing that the success of government strategies in the context of digitalisation is largely determined by the quality of digital programme management. When it comes to youth employment support, this means the need for a centralised digital strategy, standardised processes, and transparent monitoring, without which even promising initiatives lose effectiveness.

The study by A. Turekulova *et al.* (2024) investigated the social, labour, and economic behaviour of young people in the context of the development of a digital society. The conclusions of the study indicated that digitalisation has an impact on employment preferences, increasing the attractiveness of flexible and remote forms of work. However, the researchers noted the risk of social segregation of young people depending on the level of digital skills and access to resources. Current research has revealed the ambiguous impact of digitalisation on the level of youth unemployment in the EU countries. In particular, O. Başol *et al.* (2023) noted that digitalisation acts both as a factor in creating new jobs focused on innovative sectors of the economy and as a source of threat to traditional professions, which leads to structural transformations in the labour market and requires adaptive government support strategies. The researchers emphasised that without adequate development of digital competencies and comprehensive institutional support, the risk of increased youth unemployment increases significantly. Thus, the results showed the need to integrate digital skills into educational programmes and build effective public policy measures aimed at minimising the negative effects of digital transformation and maximising its positive potential for youth employment in the EU.

An analysis of these studies showed that in most countries, a significant proportion of young people still lack digital competencies, which reduces their competitiveness in the labour market. Government measures to support employment are often fragmented and do not produce a long-term sustainable effect. The weak integration of educational and professional programmes with the digital sectors of the economy creates an additional difficulty, as a result of which graduates do not always have the required skills. In addition, employment strategies do not sufficiently consider the socio-psychological aspects of digital transformation, which leads to increased risks of social segregation and job insecurity among young people. In connection with the identified problems, the purpose of this study was to investigate and compare the effectiveness of government strategies to support youth employment in the context of digitalisation. To achieve this goal, the following tasks were set: to analyse existing government programmes to promote youth employment and their compliance with the challenges of the digital economy; to identify factors determining the success or inefficiency of such strategies.

Materials and Methods

The study was theoretical and applied in nature and was conducted between August and December 2024. Kazakhstan was considered as a separate analytical category, and the geographical framework for comparison included the EU states, Ukraine, Georgia, and Moldova. This allowed comparing the experience of highly developed digital economies with the dynamics of countries undergoing active digital transformation. The research database was formed based on statistical data from OECD (2023a; 2023b), World Bank (2023), and Eurostat (2024). Data and documents were used, including monitoring the digital progress of the EC member states (European Commission, n.d.a; n.d.b), the International Labour Organisation (2022) report reflecting the state of the youth labour market, and the global review of digital skills development policies (Miyamoto & Bashir, 2020).

To obtain the primary data, an online survey was conducted of young professionals aged 18 to 30 ($n = 512$) living in EU countries (Germany, Poland, Lithuania, Spain), and in Georgia, Moldova, and Ukraine. The toolkit included 18 questions, of which 12 had a closed form (alternative and scale selection), and 6 had an open form that allowed detailed answers. The topics covered three main blocks: (1) the level and structure of digital competencies, including basic and specialised skills; (2) experience and quality of interaction with government employment assistance programmes, including the use of digital services; (3) subjective assessment of the impact of digital skills on employment and career development.

The distribution of respondents by country was as follows: EU countries – 260 people (Germany – 70, Poland – 65, Lithuania – 60, Spain – 65); Georgia – 80, Moldova – 85, Ukraine – 33. Despite the imbalance in the number of respondents by country, the sample was considered acceptable for comparative analysis, since the study was focused on identifying qualitative trends and assessing the availability of key elements of digital education for young people, rather than strictly statistically generalising to the entire population of the country. Additionally, the survey included respondents from the Republic of Kazakhstan ($n = 55$), who were allocated to a separate analytical group. This allowed for a direct comparison of the indicators of the Republic of Kazakhstan with the results of the EU and other post-Soviet states, and the assessment of the specifics of the impact of national digital initiatives on the perception and level of digital competencies of young people. Inclusion criteria: the presence or receipt of higher or professional education, experience of job search in the digital economy over the past two years. Exclusion criteria: work in an industry that does not meet the stated qualifications, residence outside the specified countries, lack of experience in interacting with digital employment platforms. The sample was formed using the stratified random sampling method, considering the proportional representation of countries. The survey was conducted through the Qualtrics LLC (n.d.) platform, which ensured anonymity and data security.

Participation was voluntary, and each respondent signed an informed consent to data processing and publication of the results. All procedures were in accordance with the Code of Ethics of the American Sociological Association (1997).

Statistical data was processed and analysed using the IBM SPSS Statistics software package version 29 (IBM, 2022), which provided a wide range of tools for both descriptive and inferential statistics. First, the Shapiro-Wilk criterion was used to assess the normality of the distribution of quantitative variables, which allows for reliable testing of normality in medium and small samples. The results of this check served as the basis for the choice of subsequent methods of analysis. In cases where the data distribution corresponded to the normality law, the Student's t-test was used to compare the averages between two independent groups. This parametric test revealed statistically significant differences in the level of digital competencies and perceptions of government measures to support youth employment between respondents from different countries. If the normality check showed deviations from the normal distribution, the non-parametric Mann-Whitney U-test was used, which did not require assumptions about the shape of the data distribution and was suitable for comparing independent samples with an asymmetric distribution. Pearson's χ^2 criterion was used to analyse categorical variables, such as the distribution of responses by type of government support measures or by levels of digital literacy. This test allowed assessing the presence of a statistically significant relationship between categorical features and identifying the frequency distribution by groups.

Confidence intervals for key indicators were calculated at 95%, which ensured the reliability and accuracy of interpretation of the results. The significance level $p < 0.05$ was used to determine the statistical significance of the differences and correlations. To minimise the probability of errors of the first kind that occur with multiple comparisons, an adjustment using the Bonferroni method was applied, which increased the rigour and validity of the study's

conclusions. Thus, the choice of statistical methods was determined by the nature of the data and research objectives, which ensured the correctness, reliability and reproducibility of the results obtained. As part of the online survey, the level of digital competencies of young people was assessed on a 10-point author's scale developed specifically for this study. The use of this scale helped to quantify the respondents' skills and provide further comparative analysis of the data obtained. In the study, the assessment of the level of digital training of young people was carried out considering existing programmes and initiatives in different countries. For Kazakhstan, the analysis included the state programme "Digital Kazakhstan" (Ministry of Artificial Intelligence and Digital Development of the Republic of Kazakhstan, n.d.), national online learning platforms, and internship programmes in the IT sector (Aqyl Tech & IT-Aiel, 2025). Strategic documents and targeted digital learning programmes, including post-learning support measures, were considered for Georgia and Ukraine (European Union, n.d.; Osvita.Diiia, n.d.). The assessment was carried out on a 10-point author's scale developed to quantify the level of digital competencies of young people.

Results

In the course of the study, data was obtained on how effective government strategies for supporting youth employment are in the context of the digitalisation of the economy, taking into consideration the level of development of digital competencies and the perception of appropriate measures by young people. As can be seen from the data presented in Table 1, there is a significant difference in the average level of digital competence of young people between the EU countries, Georgia, Moldova, and Ukraine. The statistical significance of the differences was confirmed using the Mann-Whitney U-test ($U = 4,890$, $p < 0.01$), which allowed considering them as a stable interregional asymmetry caused by a complex of infrastructural, educational, and institutional factors.

Table 1. Average level of digital competence of young people in the EU and neighbouring countries

Group of countries	Average level of digital competence (on a 10-point scale)	Characteristics of the competence level
EU countries	7.8	High level of development of basic and specialised digital skills, including critical assessment of information, safe online behaviour, and the use of digital tools in professional activities.
Republic of Kazakhstan	6.9	Stable basic level of digital literacy and the availability of digital learning programmes, while regional differences in access to infrastructure and practical educational modules persist.
Georgia, Moldova, and Ukraine (average value)	6.3	Insufficient development of individual components of digital literacy, especially in terms of the practical application of technology outside of entertainment or household purposes.

Source: compiled by the authors based on V. Kruhlov (2021), International Telecommunication Union (2021), Asia Pacific Career Development Association (2025), Electronic Government of the Republic of Kazakhstan (n.d.), European Commission (n.d.a; n.d.b)

Thus, the recorded discrepancy in indicators of digital competencies of young people between the EU countries, Georgia, Moldova, and Ukraine should be considered not

only as an academically significant feature, but also as a challenge for national and transnational strategies in the field of digital development and education. The emerging

asymmetry requires a comprehensive response involving both increased institutional support and the development of digital inclusion programmes aimed at youth groups with a reduced level of digital literacy. Kazakhstan occupies an intermediate position: its indicators are higher than in Georgia, Moldova, and Ukraine, but lower than in the EU. This reflects the presence of well-developed elements of digital infrastructure and educational initiatives, while maintaining challenges related to regional accessibility and the integration of digital competencies into educational programmes.

The next area of research was the investigation of youth's subjective assessment of the effectiveness of government-implemented employment support measures in the context of the digital transformation of the labour

market. Such a comparative approach allowed identifying not only differences in the perception of specific policies, but also considering the deep structural characteristics of trust in the institutional environment in various digital and socio-economic contexts. As shown in Table 2, there is a significant difference in the proportion of positive assessments of the effectiveness of government programmes to promote youth employment between the EU, Georgia, Moldova, and Ukraine. The statistical significance of the revealed differences was confirmed using Student's t-test ($t(310) = 4.21$, $p < 0.001$) and Pearson's χ^2 -test ($\chi^2 = 24.7$, $df = 2$, $p < 0.001$), which indicates the presence of both quantitative and qualitative differences in the perception of programme effectiveness between the studied groups of countries.

Table 2. Share of positive assessments of the effectiveness of government programmes to promote youth employment

Group of countries	Percentage of positive scores (%)	Interpretation of results
EU countries	62	Relatively stable trust in government institutions in the field of youth employment promotion and high perceived effectiveness of programmes
Republic of Kazakhstan	49	Average level of confidence in employment support measures; targeted internships and digital learning programmes are positively assessed, but insufficient integration of education and the labour market is noted
Ukraine, Georgia, Moldova (average value)	38	More pronounced scepticism is probably related to the limitations of software implementation and the low level of digital maturity of employment institutions

Source: compiled by the authors based on the European Commission (n.d.a; n.d.b), EU NEIGHBORS east (2023), OECD (2023a; 2023b), Asia Pacific Career Development Association (2025), Electronic Government of the Republic of Kazakhstan (n.d.)

Based on the information received, it can be concluded that the institutional integration of digital tools into employment policy is uneven, which affects the perception and trust of the youth audience. The reduced level of positive scores in Georgia, Ukraine, and Moldova should be considered not as a local deviation, but as an indicator of systemic deficits in the field of digital coordination and effective communication between the state and youth as a key group of digital transformation. Kazakhstan shows higher performance than Georgia, Moldova, and Ukraine, but still lags behind the EU. This indicates the potential for improving the effectiveness of support measures through increased coordination between educational institutions, government agencies and the private sector.

A significant empirical result with theoretical and practical significance was the establishment of a statistically confirmed relationship between the level of digital literacy of young people and their actual employment in the segments of the digital economy. The analysis conducted using the non-parametric Spearman correlation allowed recording a positive correlation between the level of digital skills and employment in the digital sector ($r_s = 0.62$, $p < 0.001$). This indicator points to a high degree of correlation between the two variables and emphasises that digital competence is not just a factor in professional suitability, but one of the systemic predictors of young people's integration into modern forms of economic activity.

An in-depth analysis of the sample confirmed that respondents with a higher level of digital education are

significantly more likely to demonstrate sustainable employment in industries mediated by digital technologies: in the IT sector, e-commerce, digital marketing, data management, and related fields. The data obtained suggest that digital skills form competitive advantages in the labour market, especially in the context of the transformation of economic models and the increasing demand for flexible professional competencies adapted to work in a digital environment.

A comparative analysis performed using the Student's t-test confirmed a statistically significant difference in the age of starting work in the digital sector: young people with a high level of digital literacy begin professional activity significantly earlier on average ($t(450) = 3.56$, $p = 0.002$). This result can be interpreted as evidence of their higher adaptability to the demands of the digital economy and their ability to quickly learn new professional roles, which, in turn, helps to shorten the period of professional development and accelerate integration into high-tech market segments.

It should be emphasised that the revealed dependence is not solely a consequence of individual characteristics, it reflects the structural patterns of the functioning of the digital labour market, in which the ability to work with digital technologies becomes an essential condition for successful professional socialisation. Thus, youth digital literacy can be considered as a strategically important resource that determines not only individual employment trajectories, but also the overall dynamics of human capital development in the context of the digitalisation of the economy.

An analysis of the content of government strategies aimed at supporting youth employment in the context of digital transformation revealed significant differences in the approaches implemented by the EU countries, Georgia, Moldova, and Ukraine. The documents adopted within the framework of strategic planning in the EU countries emphasised the systematic and multidimensional development of digital competencies of young people as a key resource for ensuring sustainable employment (European Commission, n.d.b). Special attention is paid to institutionalising mechanisms to support youth employment, integrating formal education with the needs of the digital labour market, providing conditions for the socio-psychological adaptation of young people to the changing employment structure.

The results of a frequent content analysis of the strategy texts showed that more than 90% of the policy documents adopted in the EU contain provisions aimed at developing digital skills among young people, which indicates the priority of the digital component in public employment policy (European Commission, n.d.a; EU NEIGHBOURS east, 2023; OECD, 2023b; Asia Pacific Career Development Association, 2025; Electronic Government of the Republic of Kazakhstan, n.d.). These measures range from the inclusion of digital modules in basic education courses to the creation of national digital learning platforms and employment assistance in the digital economy. Such strategies are implemented in coordination with vocational education institutions, employers, and the IT sector, which ensures a high level of coherence between educational outcomes and the needs of the economy.

In Georgia and Ukraine, the situation appears to be less balanced. The share of strategies that include digital training components ranges from 60%, while in some cases these components are presented declaratively and are not supported by developed implementation tools (EU NEIGHBOURS east, 2023; European Union, n.d.; Osvita. Diia, n.d.). In particular, the strategic documents of Georgia and Ukraine record limited targeted digital learning programmes, the lack of sustainable interagency coordination mechanisms, and insufficient elaboration of post-training support models, including digital mentoring, skills certification, and employment support (Kruhlov, 2021; International Telecommunication Union, 2021). This fragmentation of approaches leads to the risk of increasing digital inequality among young people and reduces the effectiveness of measures taken in the field of employment promotion. Kazakhstan has institutionalised measures for digital youth training, including modular courses, national online learning platforms, and internship programmes in the IT sector. The state programme “Digital Kazakhstan” is being implemented, aimed at developing digital infrastructure and competencies, which has a positive impact on the level of digital literacy of young people. However, regional disparities persist, and social and psychological support measures are underrepresented, which reduces the overall effectiveness of employment strategies (Ministry of Artificial

Intelligence and Digital Development of the Republic of Kazakhstan, n.d.; Aqyl Tech & IT-Aiel, 2025).

A frequency-based content analysis of the EU strategic documents (European Commission, n.d.b), including national programmes of the member states, revealed that approximately 80% of the documents contain institutional measures to support youth employment, such as government internships, subsidies for employers, and grant support for digital initiatives. “Institutional measures” implied the existence of at least one of the listed tools. This indicator was calculated as the proportion of documents with these measures to the total number of strategic documents analysed. These mechanisms are usually integrated into the social policy system and work in cooperation with educational institutions, employment centres and the private sector, reflecting the high level of institutionalisation of approaches to the development of digital labour subjectivity of young people in the EU.

In Ukraine, Georgia, and Moldova, institutional measures of this kind are presented much less consistently: only about 45% of strategies contain provisions on practice-oriented employment promotion tools (Regional United Nations Group for Europe and Central Asia on Digital Transformation, 2022; OECD, 2023a). Even when such initiatives are mentioned, they often lack regulatory support, lack well-developed financing and implementation mechanisms, and, as a result, are limited in scope and effectiveness. This indicates an existing institutional deficit that prevents the establishment of sustainable channels for young people to enter the digital labour market.

A similar asymmetry can be traced in the aspect of the integration of educational programmes with the real sectors of the digital economy. In the strategic documents of the EU countries, integration measures are presented in 73% of cases and cover both the introduction of digital competencies into formal training courses, and the creation of mechanisms for dual education, internships, and partnership programmes with digital companies (European Commission, n.d.a). This allows students and graduates to form an idea of professional requirements and facilitates their transition to real employment. In Ukraine, Georgia, and Moldova, such measures are recorded in only 33% of strategies, and in some cases these are mainly pilot initiatives or short-term projects that are not supported by a long-term institutional framework.

Special attention in contemporary strategies is paid to the issues of socio-psychological adaptation of young people to the conditions of digital transformation. This area includes activities aimed at building resilience to rapid technological change, supporting mental health, combating digital stress, and developing self-regulation skills in remote or hybrid employment. Despite the importance of this area, frequency analysis has shown that even in EU countries, only 45% of strategies contain elements related to the psychological stability and mental health of young people (Regional United Nations Group for Europe and Central Asia on Digital Transformation, 2022; OECD, 2023b). In

the strategies of Georgia, Moldova, and Ukraine, this indicator is even lower and does not exceed 20% (European Commission, n.d.b). Such an underestimation of the psychosocial factors of digital employment can lead to the appearance of hidden risks associated with professional burnout, social isolation, and unstable career paths among young people in the digital economy.

At the subsequent stage of the analysis, special attention was paid to identifying the factors determining the subjective assessment by young people of the effectiveness of state support in the field of employment, with an emphasis on the relationship between this assessment and the level of individual digital competence. The data obtained confirmed the existence of a stable association between these two variables: according to the results of Spearman's correlation analysis, a statistically significant positive relationship was revealed ($r_s = 0.54$, $p < 0.01$), which indicates an internal correlation between the perception of government activity and development of digital skills among respondents. A more detailed interpretation of the results suggests that young people with a high level of digital literacy demonstrate a significantly higher propensity to positively evaluate existing government employment support programs. This may be conditioned by several interrelated factors: firstly, the availability of digital skills facilitates access to information about programs, their conditions and mechanisms of participation; secondly, it is digitally competent respondents who are more likely to become direct beneficiaries of digital government support tools, such as online job search platforms, electronic portals of public services, distance learning programmes and digital forms of internships.

The developed digital literacy also contributes to the more active involvement of young people in communication processes related to employment, and increases their ability to critically assess and rationalise the use of available resources. As a result, not only a positive attitude towards the programmes themselves is formed, but also confidence in government institutions operating in the digital space is strengthened. Thus, digital competence acts not only as an instrumental resource that ensures participation in the labour market, but also as a mediator that forms subjective perception and readiness for institutional interaction. The revealed pattern is of particular importance in the context of the digital transformation of employment, as it indicates the need to interpret the development of digital skills of young people not only as an element of vocational training, but also as a critical condition for the development of social inclusion and trust in public policy mechanisms. Therefore, measures to develop digital literacy should not be considered in isolation, but as an integral component of a broader strategy to strengthen interaction between the state and youth in the context of the transition to a digital economy model.

The analysis showed that comprehensive programmes that ensure a direct relationship between the stages of obtaining digital competencies and subsequent employment

demonstrate significantly higher effectiveness compared to scattered or episodic initiatives implemented outside of stable institutional coordination. The data suggest that the purposeful coupling of educational and labour practices forms structurally stable channels for the professional integration of young people into segments of the digital economy, reducing the risk of temporary or structural unemployment in this group. This comparison revealed significant differences in the degree of development, balance, and institutional integration of such approaches. In the EU countries, there is a higher level of coherence between the sectors of education, employment, and the digital economy, expressed in the presence of legally established mechanisms for interagency cooperation, comprehensive plans for the development of digital skills, and sustainable tools to stimulate youth employment in technologically intensive industries.

However, significant institutional and substantive limitations have been identified in Ukraine, Georgia, and Moldova. Among them, there is insufficient integration of educational programmes with practical employment channels, the limited presence of digital modules in vocational training, and the lack of systematic measures for long-term support of young professionals in the digital sector. In some cases, there is a fragmentation of strategic attitudes, when the digital component of employment policy is presented only declaratively and is not supported by effective implementation mechanisms. An additional limiting factor is the weak coordination between the authorities responsible for education, digitalisation and the labour market, which hinders the development of a unified institutional ecosystem capable of ensuring sustainable youth employment in the context of digital transformation.

The combined results of the analysis not only confirmed the empirical significance of the identified relationship between the development of digital competencies and the effectiveness of employment promotion mechanisms, but also revealed the need for an institutional review of strategic approaches in a number of national contexts. In particular, the data indicate that the optimisation of public policy towards a deeper and more functionally verified integration of digital education and labour market regulatory instruments is not only a desirable area for modernisation, but also a necessary condition for the development of an inclusive and sustainable model of youth employment in the digital economy.

The final generalisations, formed on the basis of quantitative and qualitative data, allowed systematically characterising the most significant structural constraints and institutional deficits that have a negative impact on the effectiveness of government policy in the field of youth employment promotion in the context of the digital transformation of the economy. Such deficits include both insufficient intersectoral coordination and the lack of long-term support programmes for young professionals in the process of their professional integration into the digital sector. Special attention was paid to the problem of the heterogeneity

of the level of digital competencies among young people from different countries and regions. This heterogeneity is complex and manifests itself both in differences in the basic level of knowledge of information and communication technologies, and in disparities in access to advanced skills in demand in high-tech segments of the labour market. The lack of a balanced training system leads to the reproduction of digital inequality, which is not only a consequence, but also a factor in the consolidation of socio-economic segregation in employment.

The greatest concern is the revealed limitations of digital competencies among young people in Georgia, Moldova, and Ukraine, where the development of digital literacy has not yet been consolidated as a priority area of national strategies for the growth of human capital. As a result, the digitalisation process in these countries is fragmented: educational programmes in the field of digital technologies are implemented pointwise and without systemic alignment with the requirements of the labour market, which reduces their integration potential and hinders the creation of sustainable professional growth channels. In addition, the lack of sustainable interagency mechanisms for implementing digital initiatives in the field of education and employment exacerbates imbalances, making it difficult to form a holistic training model for the digital economy.

Equally significant, in terms of the long-term effectiveness of employment promotion measures, is the continuing weak institutional connectivity between education systems and the labour market. This gap is manifested, in particular, in the absence of stable channels for translating the results of the educational process, both formal and informal, into specific and feasible employment trajectories. Graduates whose professional profiles were formed in conditions of limited access to applied digital skills and insufficient interaction with digital platforms providing modern forms of participation in economic activity are particularly vulnerable in this regard. This category of young professionals is often faced with the fact that the formally acquired qualifications are insufficient for effective inclusion in the segments of the labour market, where digital competencies are the basic condition for professional activity. In addition to these structural limitations, there is a lack of comprehensive socio-psychological support measures, which makes it difficult for young people to adapt to the rapidly changing conditions of the digital economy. The lack of such measures entails not only an extension of the period of professional integration, but also the development of a stable sense of institutional isolation among certain groups of graduates, when the education system and the labour market are perceived as poorly coordinated and functioning in isolation from each other.

The empirical data obtained during the study demonstrate that the combination of highly developed digital competencies with the availability of institutionalised support in the form of grants, subsidies, internship programmes, dual education, and career support significantly increases the likelihood of sustainable youth employment.

Moreover, this combination helps to smooth out structural imbalances manifested in regional and social inequalities, which allows considering digital skills not as an isolated component of educational policy, but as part of a multi-level strategy for the establishment of an inclusive model of youth participation in the digital labour market.

In the light of the results obtained for Georgia, Moldova, and Ukraine, the revision of existing approaches to the development of public policy in the field of comprehensive youth support is of particular relevance. The optimisation of this policy involves not only the adjustment of priorities, but also the institutionalisation of those elements, the effectiveness of which is confirmed by international practice. Such elements that have been tested in the EU countries include: creation of continuous digital education systems providing modular and hybrid learning formats that ensure flexibility and adaptability of educational trajectories; expansion of the range of internships and dual programmes integrated with key sectors of the digital economy; establishment of institutional mechanisms for socio-psychological support aimed at developing youth resilience to transformational changes and reducing the risks of digital alienation. Taken together, these measures can create conditions for a systematic increase in the employment rate of young professionals, and for the development of a stable human resource base capable of meeting the needs of the digital economy in the medium and long term.

Based on the results of the survey analysis, it was found that the average integral score of digital competencies was 7.8 in the EU countries and 6.3 in Georgia, Ukraine, and Moldova. 62% of respondents in the EU and 38% in Ukraine, Georgia, and Moldova gave a positive assessment of government measures to support employment. There was a positive and statistically significant correlation between the level of digital competencies and employment in the digital sector ($r_s = 0.62$), and between the level of digital literacy and a positive assessment of government support measures ($r_s = 0.54$). Qualitative responses revealed key barriers, among which respondents most often cited a lack of practical skills, limited access to targeted internships, and poor integration of educational programmes with digital sectors of the economy. Thus, the patterns identified in the course of the study not only reflect the current state, but also form the basis for developing recommendations for improving youth employment policy in the context of digital transformation, focused on the long-term and sustainable inclusion of youth in the digital economy.

Discussion

The results of empirical analysis confirm that the level of digital competencies of young people is a significant and statistically confirmed factor in their integration into the labour market. The recorded difference between the EU countries (7.8 points) and Georgia, Moldova, and Ukraine (6.3 points) demonstrates not only the difference in the degree of development of basic and specialised digital skills, but also reflects broader structural and institutional differences.

These data correlate with the conclusions of M. Raileanu Szeles & M. Simionescu (2022), who found that regional disparities in the development of digital infrastructure, access to contemporary educational resources, and coverage of the population with digital training programmes create a persistent gap in youth employment opportunities. The analysis of subjective assessments of the effectiveness of government employment assistance programmes, which record 62% of positive reviews among respondents from EU countries and 38% among young people from Georgia, Moldova, and Ukraine, is consistent with the observations of F. Simões & E. Marta (2024). The researchers emphasised that the level of trust of young people in government support measures is significantly higher in those institutional systems where employment services integrate digital tools and provide individualised support for applicants. This relationship is also confirmed by the results of a study by the International Labour Organisation (2022), which found that the effectiveness of employment measures increases with integrated digital services, including training, digital job search, platform mechanisms for selecting internships and support in the early stages of work adaptation.

The revealed positive and statistically significant correlation between the level of digital literacy and actual employment in the digital sector ($r_s = 0.62$) is consistent with the conclusions of F.Y. Mpofo & D. Mhlanga (2022), who showed that human capital in the digital economy is determined not only by the formal level of education, but also by the availability of applied digital skills that directly affect the likelihood of employment in technologically saturated market segments. An analysis of strategic documents conducted from a comparative perspective revealed marked differences in the degree of institutionalisation of digital components in national policies between EU countries, Georgia, Moldova, and Ukraine: in the first case, their integration is recorded in 90% of strategies, while in the second, only in 60%. This gap is interpreted as an indicator of the uneven distribution of institutional resources and confirms the conclusions of A. Zancajo *et al.* (2022) that the COVID-19 pandemic has acted as a catalyst for accelerated digitalisation of educational and labour policies in the EU countries. In states with less developed institutional infrastructure, there is a fragmented and unsystematic implementation of similar measures, which correlates with the findings of the E. Dovgal *et al.* (2021), who documented the lack of elaboration of digital transformation mechanisms in a number of post-Soviet countries, manifested in the absence of a comprehensive regulatory framework, lack of coordination between departments, and low sustainability of design solutions.

An analysis of the socio-psychological support components showed its limited presence in strategic documents: 45% in EU countries versus 20% in Georgia, Moldova, and Ukraine. Conclusions of S.K. Azar *et al.* (2025) pointed to an additional aspect of this problem, the relationship between the scale of digital change, the risks of social exclusion, and the dynamics of youth mental health, which, with

a lack of targeted measures, can increase the vulnerability of individual groups in the labour market. A statistically significant correlation between the level of digital competencies and a positive assessment of government employment support measures ($r_s = 0.54$) confirms the assumption of a mediating role of digital literacy in shaping perception and trust in institutional policy in this area. A comparative analysis of the strategic documents revealed significant differences in the degree of integration of educational programmes with the sectors of the digital economy: in the EU countries, this component was recorded in 73% of national strategies, while in Georgia, Moldova, and Ukraine – only in 33%. This imbalance reflects not only quantitative differences in the level of regulatory consolidation of the relevant initiatives, but also the structural features of the institutional environment that determine the possibilities of practical implementation of the concept of “education-employment” in the context of digital transformation. Similar trends were described in the study by A. Avagianou *et al.* (2022), where, despite the presence of targeted digital initiatives in a number of southern EU regions, institutional barriers remain that hinder the effective transition of graduates from the education system to the labour market. The existence of similar restrictions in Georgia, Moldova, and Ukraine was confirmed by the conclusions of D. Vasilescu & K. Sandroshvili (2021), which pointed to insufficient coordination between educational institutions and employment services, which reduces the effectiveness of measures aimed at reducing youth unemployment and increasing the adaptability of graduates to the demands of the digital economy.

Empirical analysis data supported the claim that the combination of digital skills development with institutionalised support in the form of grants, internship programmes, career support and integrated employment services ensures higher employment rates for young people. This conclusion is consistent with the results of D. Bickauske *et al.* (2021), who used the material of several European countries to show that it is the synergetic interaction of digitalisation processes and government initiatives that creates a long-term multiplier effect, expressed both in employment growth and in the structural stability of labour market segments focused on digital industries.

Conclusions of E.K. Buitek *et al.* (2025) complemented this picture by noting that in a digital economy, the attractiveness of an employer to a youth audience is determined not only by the level of wages or working conditions, but also by the availability of integrated professional development programmes, including digital learning, mentoring, and individual career support. Thus, an integrated approach based on the simultaneous modernisation of educational trajectories and the institutional infrastructure of employment can be considered as a key factor in reducing the structural gap between education and the digital economy in emerging economies. Comparison of the presented data with the results of the study by G. Liotti (2022) demonstrated that, along with digital determinants, the level of youth employment is largely determined by the institutional

characteristics of national labour markets. The key elements in this context are the degree of flexibility of employment contracts, the level of legal and social protection of employees, and the availability of incentive mechanisms aimed at encouraging the hiring of young professionals, including subsidised wages, tax incentives for employers, and accelerated employment programmes. These parameters form a different institutional environment in which digital skills are implemented in labour practice, thereby determining the effectiveness of measures to integrate young people into economic activity. The noted variability of institutional conditions partially explains the revealed differences in the perception of government support programmes between the EU countries, Georgia, Moldova, and Ukraine, where the level of regulatory and legal adaptation of the labour market to the challenges of digitalisation remains limited.

Analysis conducted by E.W. Liguori *et al.* (2024) confirmed the relationship established in the study between the level of digital competencies of young people and their integration into the labour market, and the researchers emphasise the need for ecosystem conditions, a developed educational infrastructure, a regulatory framework, and mentoring programmes. This is consistent with higher employment rates in EU countries where such conditions are institutionalised, unlike Georgia, Moldova, and Ukraine. Results obtained by D.E. Ufua *et al.* (2021) coincide with the identified fragmentation of digital transformation in Georgia, Moldova, and Ukraine, emphasising that the lack of interagency coordination and operationalised indicators reduces the effectiveness of implemented initiatives. Conclusions of J.C. Janampa & S. Dasgupta (2021) on the importance of comprehensive measures combining training, internships and digital job recruitment platforms confirm the correlation found between the level of digital literacy and trust in government employment support programmes.

X. Zhang *et al.* (2023) demonstrated that successful digital transformation is possible with a clear strategy and management consensus, which correlates with the recorded gap in the integration of educational programmes with the digital economy (73% in the EU versus 33% in Georgia, Moldova, and Ukraine). Furthermore, L. Zhang (2023) pointed to the instability of employment in digital sectors, which complements the conclusion about the importance of institutional characteristics of national labour markets for ensuring high-quality employment. M. Ridwan *et al.* (2025) confirmed the mediating role of psychological readiness and self-efficacy factors that enhance the impact of digital skills on career outcomes, which is consistent with the revealed relationship between the level of competence and the perception of government support measures.

Conclusions of D.S. Bakry *et al.* (2024) regarding the importance of university-industry-state ecosystem linkages coincide with the established synergy effect of digitalisation and government initiatives observed in EU countries. Research by C.Ø. Madsen *et al.* (2022) complemented the interpretation by noting the risk of increasing administrative burden on citizens during the transition to

digital self-service without adapting services to vulnerable groups, which may explain lower estimates of programme effectiveness in Georgia, Moldova, and Ukraine. The findings of Q. Yao *et al.* (2024) confirmed that the coherence of digital strategy and effective management of team diversity enhance the integration of educational and labour components, consistent with a higher level of strategic integration in the EU. J. Reed & C. Dunn (2025) pointed out that regulatory measures that do not consider the digital daily life of young people can undermine confidence in government initiatives, which correlates with a low proportion of socio-psychological support in the strategies of Georgia, Moldova, and Ukraine (20% vs 45% in the EU).

A summary analysis of the comparative data obtained indicates that digital competencies and institutional infrastructure function as complementary factors ensuring the successful inclusion of young people in economic processes. Their interaction is manifested in the fact that a high level of digital skills without an adequate institutional environment does not ensure sustainable employment, while the presence of a developed support infrastructure with low digital readiness of young people also does not lead to significant improvements in the labour market. The gap in the level of digital competencies, reinforced by differences in strategic planning and resource provision, forms a stable digital inequality with both economic and social dimensions. Overcoming this inequality is possible only within the framework of a comprehensive modernisation of educational programmes aimed at developing applied digital skills, expanding access to digital and hybrid employment services, and institutionalising social and psychological support measures that ensure the adaptation of young people to the structural changes of the digital economy and minimising the risks of professional marginalisation.

Conclusions

The conducted research helped to comprehensively assess the effectiveness of government strategies to promote youth employment in the context of the digital transformation of the economy, based on a comparative analysis of the EU and neighbouring countries. Empirical data confirmed the presence of statistically significant differences both in the level of digital competencies of young people and in the perception of the effectiveness of implemented support measures. In the EU countries, the average level of digital competence was 7.8 points on a 10-point scale, which corresponds to a high level of development of basic and specialised digital skills. In Georgia, Moldova, and Ukraine, the indicator reached only 6.3 points, which indicates the lack of readiness of a significant part of young people to integrate into the digital economy. The application of the Mann-Whitney U-test confirmed that the identified gap is systemic and is conditioned by differences in infrastructure, educational opportunities, and institutional priorities.

A similar asymmetry was found in assessing the effectiveness of government programmes: 62% of positive reviews were in the EU and 38% in Georgia, Moldova, and

Ukraine. The differences were statistically confirmed using the Student's t-test and Pearson's χ^2 -test, which indicates their stable nature and reflects both objective limitations of programme implementation and differences in the level of digital maturity of government institutions. Kazakhstan demonstrated intermediate indicators: the level of digital competence (6.9 points) and the share of positive assessments of support measures (49%) were higher than in Georgia, Moldova, and Ukraine, but lower than in the EU countries. Strengthening of the regional digital infrastructure, expansion of dual educational programmes in the IT sector and integration of systemic psychological support into strategic documents on youth employment remain key areas of development for the Republic of Kazakhstan.

An important result was the establishment of a positive correlation between the level of digital literacy and employment in the digital sector ($r_s = 0.62$), and between digital skills and a positive assessment of support measures ($r_s = 0.54$). This allowed considering digital competence as a key factor not only in professional integration, but also in building trust in government employment policy. The survey of young professionals ($n = 512$) revealed statistically significant differences in the level of digital competencies between the EU and neighbouring countries, which confirmed the existence of a persistent gap in digital training and opportunities for integration into the labour market. The higher average score of digital skills and the share of positive assessments of government support measures in EU countries indicated a synergistic effect of a combination of advanced digital infrastructure, educational initiatives, and institutional employment support mechanisms. The recorded correlation coefficients ($r_s = 0.62$ and $r_s = 0.54$) confirmed the

key role of digital literacy as a mediating factor in achieving successful employment and building confidence in government employment policy. The identified barriers, including a lack of practical skills, limited access to targeted internships, and weak integration of educational programmes with the digital sectors of the economy, indicated the need for a comprehensive modernisation of the institutional environment aimed at reducing the gap between the education system and the requirements of the digital economy.

An analysis of strategic documents showed that in the EU countries digital components were included in 90% of strategies, integration of education and the digital economy in 73%, and institutional support measures in 80%. In Georgia, Moldova, and Ukraine, these figures were significantly lower (60, 33, and 45%, respectively), indicating fragmented approaches and a lack of sustainable mechanisms for interagency cooperation. Special attention was drawn to the low representation of social and psychological support measures, which limits the adaptation of young people to transformational working conditions. The prospects for further research are related to the expansion of the sample and an in-depth analysis of the long-term impact of digital programmes on the sustainability of youth employment.

Acknowledgements

None.

Funding

None.

Conflict of Interest

None.

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Вплив цифровізації економіки формування державних стратегій працевлаштування молоді

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Анотація. Метою дослідження було оцінювання ефективності державних стратегій сприяння зайнятості молоді за умови цифрової трансформації економіки. Методологічна основа включала аналіз статистичних даних міжнародних організацій, контент-аналіз стратегічних документів та онлайн-опитування 512 респондентів. У дослідженні було використано порівняльний підхід, що передбачає аналіз досвіду Казахстану, Європейського Союзу, України, Грузії та Молдови. Проведене опитування молодих фахівців виявило статистично значущі відмінності у рівні цифрових компетенцій у цих країнах: 7,8 бала за 10-бальною шкалою в Європейському союзі та 6,3 бала в Грузії, Молдові та Україні ($U = 4\ 890$, $p < 0,01$), що підтвердило наявність сталого розриву у цифровій підготовці та можливостях інтеграції на ринок праці. Вищий середній бал цифрових навичок та частка позитивних оцінок державних заходів підтримки в країнах Європейського Союзу (62 % проти 38 %; $t(310) = 4,21$, $p < 0,001$; $\chi^2 = 24,7$, $p < 0,001$) вказують на синергетичний ефект поєднання розвиненої цифрової інфраструктури, освітніх ініціатив та інституційних механізмів супроводу зайнятості. Встановлено сильну позитивну кореляцію між цифровими навичками та зайнятістю в цифровому секторі ($r_s = 0,62$, $p < 0,001$). У країнах Європейського Союзу цифрові компоненти інтегровані у 90 % стратегій, заходи інституційної підтримки у 80 %, інтеграція освіти та цифрової економіки в 73 %; у Грузії, Молдові та Україні ці показники становили 60, 45 та 33 % відповідно. Це вказує на фрагментарність підходів та наявність бар'єрів, включаючи брак практичних навичок, обмежений доступ до цільових стажувань та слабку інтеграцію освітніх програм із цифровими секторами економіки. Практичне значення дослідження полягає в обґрунтуванні пріоритетності системного розвитку цифрових навичок, інтеграції освітніх та трудових траєкторій, розширення програм грантової, субсидної та психологічної підтримки для формування сталої зайнятості молоді у цифровій економіці

Ключові слова: цифрова грамотність; інтеграція в ринок праці; пострадянський простір; інституційні механізми; психологічна стійкість; технологічна нерівність; професійна адаптація

Scientific Bulletin of Mukachevo State University

Series

Economics

Volume 13, No. 1, 82-98

Journal homepage: <https://economics-msu.com.ua/en>

ISSN 2313-8114

E-ISSN 2518-1254

UDC 338.48:796

DOI: 10.52566/msu-econ1.2026.82

From crisis management to systemic resilience: Economic aspects of risk management in international sporting events in the post-pandemic era

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Abstract. The study aimed to provide an economic interpretation of the transformation of financial risk regulation mechanisms for international mega-sporting events following the pandemic shock. The study was analytical and comparative in nature and was conducted using financial and economic analysis of official reports, horizontal and vertical budget analysis, trend analysis of time series, structural decomposition of revenues and expenses, institutional analysis of financing models, and macroeconomic assessment of multiplier effects. The study established that broadcasting revenues from the Olympic Games amounted to USD 3.1 billion for Tokyo 2020, USD 1.5 billion for Beijing 2022 and USD 3.2 billion for Paris 2024, confirming the dominance of media rights. Total revenue from the Fédération Internationale de Football Association World Cup 2022 reached USD 5.769 billion, of which USD 2.958 billion came from television rights, whilst the net financial result stood at USD 2.368 billion, demonstrating the effectiveness of the commercially focused model. The Union of European Football Associations' 2024 European Football Championship generated approximately EUR 2.5 billion in revenue and a net profit of around EUR 1.2 billion, reflecting a model of balanced diversification. France's public expenditure on the Paris 2024 Olympic and Paralympic Games amounted to EUR 6.6 billion, with an operating budget surplus of EUR 76 million, which characterised an institutionally segregated model. The ticket market shrank from over USD 20 billion in 2019 to USD 5-6 billion in 2020, before recovering to over USD 22-24 billion in 2024-2025. In total, three models of financial sustainability for international mega-sporting events were identified: a centralised-redistributive model (the Olympic system), commercially concentrated, and balanced-diversified, which operated under conditions of institutional cost separation and formed different mechanisms for managing budgetary, security and market risks. The practical significance of the study is determined by potential use by federations and organising committees to improve financial planning and risk management for international sporting events

Keywords: budgeting; volatility; income; diversification; investment

Received: 24.10.2025, Revised: 18.03.2026, Accepted: 01.04.2026, Published: 06.04.2026

Suggested Citation: Wu., M. (2026). From crisis management to systemic resilience: Economic aspects of risk management in international sporting events in the post-pandemic era. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 13(1), 82-98. doi: 10.52566/msu-econ1.2026.82.



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Introduction

Between 2020 and 2025, international sporting events took place against a backdrop of the COVID-19 pandemic, mobility restrictions, rising security costs, increased cyber threats and supply chain instability. These factors influenced the structure of event budgets, contractual arrangements and approaches to insurance cover. Organisers were forced to reassess the balance between prevention costs and potential financial losses, create additional reserves and integrate risk monitoring procedures into strategic planning.

The lack of a comprehensive economic analysis of risk management and the assurance of financial stability for international sporting events in the post-pandemic period and amidst the challenges of war highlights the need to systematise scientific approaches to assessing their impact on national development. The socio-economic and cultural aspects of the impact of international sporting competitions on physical culture in Ukraine during the war were investigated by Y. Prystupa *et al.* (2024), who substantiated their significance for social cohesion, the formation of an international image and the development of sports diplomacy, and outlined the financial risks and challenges associated with organising such events. The study highlights the potential of international events as a tool for economic recovery, stimulating investment in infrastructure and strengthening diplomatic support for the state, and emphasises the need for strategic planning to prevent the inefficient use of facilities after the competitions have ended. A scoping review of 125 academic papers published between 1980 and 2023 was conducted by F. Genovard *et al.* (2025), who analysed how risk management is interpreted and classified within sports organisations. As a result, key dimensions of risk management were identified – operational, managerial, financial, legal and infrastructural – and the dominance of operational issues, particularly health and safety, was established, whilst financial and managerial aspects received limited attention. The authors also noted a lack of conceptual consistency in definitions and approaches, as well as a predominance of empirical studies focusing on specific types of organisations and events.

The growing scale and commercialisation of sporting events are accompanied by increased uncertainty, manifested in infrastructure failures, budget overruns, security incidents, reputational damage and inconsistencies in risk management procedures throughout the event lifecycle. Risk management strategies in the planning of sporting events, based on a literature review and a multi-case approach, were investigated by D. Li (2025), who systematised security, financial, operational and reputational risks and justified the development of an integrated model covering identification, assessment, response and monitoring. The author demonstrated that the effectiveness of control depended on matrix assessment methods, insurance instruments, combined response strategies, digital monitoring and inter-agency coordination. M. Barth *et al.* (2023) in an editorial for a special issue systematised research on risk-taking in elite sport, the organisation of mega-events

and the impact of external shocks, particularly COVID-19. The authors outlined areas of analysis covering policy-makers' management decisions during Olympic bids, financial risk-mitigation tools (including seasonal pricing), fan behaviour as a factor in overcoming clubs' financial difficulties, and the risks associated with event management under pandemic restrictions. The issue demonstrated that risk in sport is multidimensional and relates not only to operational safety but also to the managerial, financial and behavioural decisions of various stakeholders.

The intensification of biological threats after 2020 highlighted the insufficient integration of health control into the strategic planning of international sporting events and the limitations of traditional approaches to security. The evolution of risk control strategies during and after the pandemic was examined by M. Wu (2025), who justified the transition of health control from a supporting element to a component of strategic management, analysed examples from the 2021 Tokyo Olympic Games and the 2022 FIFA World Cup in Qatar, and demonstrated that effectiveness was achieved through a combination of digital monitoring, multi-tiered testing, vaccination and inter-institutional coordination, with active use of mobile applications and big data analytics. A summary of the World Health Organisation's risk-based approach during the preparation and staging of the 2021 Tokyo and 2022 Beijing Olympic Games was provided by A.F. Gabrielli *et al.* (2024), who outlined a three-tiered decision-making model (risk assessment, risk minimisation and risk communication), analysed tools for epidemiological monitoring, coordination and digital tracking, and emphasised the need to balance public health safety with socio-economic impacts, considering the context of the host country.

The increasing complexity of organising international sporting events in the post-pandemic period has been accompanied by growing uncertainty regarding financial stability, security challenges and the long-term economic consequences for host regions. These aspects were explored by X. Su *et al.* (2025), who analysed risk management mechanisms for major events with a focus on the integration of strategic planning, financial forecasting and multi-level coordination. The paper systematises approaches to risk assessment at various stages of event preparation and delivery, outlines the role of scenario analysis, digital monitoring and inter-institutional cooperation in mitigating critical deviations, and demonstrates the importance of adaptive management for event continuity. The authors emphasised the need to combine preventive measures with rapid response and strategic resource allocation. Risk management for sporting events within a constructivist approach was analysed by Z. Getu & S. Mengistu (2022), who systematised financial, managerial, health and safety, and environmental risks. The paper outlines a cyclical risk management model (identification, assessment, response, documentation), proposes a plan structure and principles for the distribution of

responsibilities between organisers and stakeholders, and examines crowd control tools, venue capacity determination and the management of alcohol-related risks.

At the same time, the integration of risk management into strategic planning, the quantitative assessment of costs and long-term consequences, and the development of a comprehensive economic model of the systemic resilience of international sporting events remained underdeveloped. The study aimed to conduct a comparative economic analysis of the transformation of risk management models in international mega-sporting events during the post-pandemic period. To achieve this objective, the following tasks were identified: to examine the dynamics and structure of revenues and expenses for international sporting events in 2020-2024; to conduct a comparative case study of the financial architecture and risk mitigation tools; and to identify the characteristics of institutional models for ensuring financial stability.

Materials and Methods

The study was analytical and comparative in nature and covered the period 2020-2024. At the same time, the study utilised selected sources from 2025-2026, which did not extend the empirical period of analysis but served to clarify the financial results, audit findings and final reports regarding events held in 2022-2024. The chosen period was determined by the fact that, from 2020 onwards, international sporting events operated under conditions of an unprecedented exogenous shock linked to the COVID-19 pandemic. The study examined the economic transformation of risk management approaches in international sporting events through the prism of the evolution of economic thought. The selection of materials was based on the use of official financial statements of organisers, audit reports, regulatory acts, summary reports from international organisations, and studies that directly reflect the financial parameters, institutional models, and risk management mechanisms of international sporting events in 2022-2024 and ensure the empirical and conceptual comparability of the cases studied.

A comparative analysis of classical, neoclassical and Keynesian theories of risk was conducted based on the following criteria: proponents, interpretation of risk, key focus and implications for international sporting events. An analysis of the works of N.W. Senior (1836) and J.S. Mill (1848) interpreted risk as a component of entrepreneurial income. A synthesis of the approaches of A. Marshall (1890) and F.H. Knight (1921) made it possible to distinguish between risk and uncertainty and link them to the variability of financial outcomes. The interpretation of the Keynesian approach, based on J.M. Keynes (1936) and S. Deng (2024), covered the role of expectations and macroeconomic instability in decision-making regarding the organisation of mega-events. The economic nature of risks and their impact on the financing of sporting events were examined based on the research of B.P. Soebbing (2018), Z. Bhimani & A. De Lisio (2023) and G. Castelblanco *et al.* (2025). This

systematised financial, institutional and urban risks, as well as the identification of their impact on budgetary parameters, the structure of state guarantees and mechanisms for the redistribution of resources.

The financial model of the Olympic Games post-2020 was examined using financial and economic analysis of official reports and the structural budget decomposition method, based on data from J. McBride & N. Berman (2026). The structural allocation of funds and the co-financing model of the World Anti-Doping Agency (WADA) (n.d.) were examined separately, which addressed the centralised nature of the financial architecture and its role in reducing budgetary volatility. The dynamics of the global market for tickets to sporting events in 2020-2025 were examined using trend analysis and time series comparison (Grand View Research, n.d.). To assess the sensitivity of ticket revenues to exogenous shocks and determine the depth of the crisis-induced decline in 2020, pre-crisis figures for 2019 were compared with data for 2020-2022, as well as with the recovery trends for 2023-2025.

A documentary analysis was used to examine the updated job mapping and employment forecasts relating to the preparation and staging of the Paris 2024 Olympic Games, based on official materials concerning the Games' legacy (IOC, 2024). The analysis covered the structure of employment sectors and the dynamics of their evolution following the COVID-19 pandemic to identify mechanisms for the labour market's adaptation to a large-scale international event. A policy and institutional analysis was used to examine the content and implementation tools of the "Job Challenges" initiative (SmartForum, 2023), including areas of vocational training, forms of candidate support, and interaction with educational institutions. This was used as an assessment of approaches to re-engaging the population and building a talent pool for temporary and permanent positions. A descriptive-comparative method was applied to analyse the mechanisms of inclusive recruitment, in particular the "From Stadium to Employment" format (Refugees.info, n.d.) and the "Parisian Employment Pacts" system (Business France, 2024), addressing their integration into partnerships with business and public employment services (El Kaoun-Gabelotaud, 2024). This approach traced the transformation of recruitment practices and the engagement of individuals distanced from the labour market in the context of preparations for a major event. FIFA (n.d.c), Union of European Football Associations European Football Championship 2024 (UEFA, n.d.a) and Olympic Games Paris 2024 (IOC, 2024) were selected for analysis as the three largest international sporting mega-events of the post-pandemic period, each with different scales, financial structures and risk management models, which compared a globally commercially-focused model, the continental diversified model and the institutionally distinct Olympic system within the single time frame of 2020-2024.

The analysis of UEFA EURO 2024 was conducted using financial and economic analysis of official financial statements and the method of structural decomposition of

revenue. The study examined the tournament's total revenue, the structure of its main revenue streams (media rights, marketing contracts, ticket sales, commercial programmes) and the mechanism for distributing funds to national associations, based on data from FoxSports (2024). Structural analysis was applied to identify the dominant source of funding and assess the concentration of revenue, which was used for an interpretation of the organiser's level of financial diversification and resilience. The economic impact on Germany and the ten host cities was examined using a secondary macroeconomic analysis and an interpretation of the multiplier effect based on A. Islam (2024). Indicators of gross value added, tourism revenue and consumer spending were analysed to assess the territorial impact of the event. This integrated the micro-financial and macroeconomic levels of assessment. The security component of UEFA EURO 2024 was analysed using a qualitative content analysis of management decisions in the field of public security, which determined the scale of resource mobilisation and coordination between institutions (Deutsche Welle, 2024). This addressed security costs as a component of the economic risk model. Accreditation procedures and cybersecurity (Dow Jones, n.d.) were examined using institutional analysis to assess digital access control mechanisms and the minimisation of cyber risks. This determined how digital security was integrated into the overall operational risk management system and influenced the financial stability of the event.

A documentary analysis was employed to examine the organisational model for engaging volunteers and staff during the preparation and staging of UEFA EURO 2024, based on official materials, with a view to identifying the principles underpinning the tournament's staffing structure, the mechanisms for mobilising human resources, and the integration of the volunteer component into the management system of this mega-event. Institutional analysis was used to examine the role of the specialised organisational structure of EURO 2024 Gesellschaft mit beschränkter Haftung (GmbH) as a joint venture between UEFA and the German Football Association (n.d.) in ensuring operational coordination, the distribution of functions and personnel management. This made it possible to evaluate the model of temporary expansion of employment and managerial responsibility under conditions of increased workload. A regulatory analysis was conducted to examine the application of provisions of German labour law regarding working hours, rest periods and the regulation of night shifts to ensure the organisation of the tournament complied with national standards for the social protection of workers (UEFA, n.d.b). A comparative-descriptive method was applied to assess the integration of social and human rights principles within the tournament's Environmental, Social and Governance (ESG) strategy, particularly regarding mechanisms for inclusion, the protection of human rights and the functioning of feedback procedures.

The organisation of the Paris 2024 Olympic Games was analysed using budgetary and institutional analysis. Total

government expenditure, organisational costs and security costs (Le Monde, 2025) were categorised using a budgetary classification method, distinguishing between the organising committee's operating budget and government infrastructure investments. The economic architecture of the games, the scale of audience reaches, broadcast and digital channels, and the management of operational risks were examined based on the International Olympic Committee (IOC)'s final report on Paris 2024 (IOC, 2024) using financial and functional analysis, which was used for an assessment of the degree of revenue centralisation and cost management mechanisms. The insurance component and climate risks were examined using risk hedging analysis to determine the role of insurance instruments in mitigating potential financial losses (Galy & Augros, 2024). The financial sustainability of Paris 2024 was assessed using an analysis of economic parameters (revenue, surplus/deficit, expenditure structure), whilst the social and labour aspects and manifestations of post-pandemic transformation were examined using a qualitative analysis of management practices and staffing models, which was used for the identification of changes in the organisation of work and contractual relationships.

The FIFA World Cup Qatar 2022 was analysed using comparative financial analysis of the 2021-2022 figures, based on the "2022 financial statements: consolidated statement of comprehensive income" (FIFA, n.d.a). The total volume of revenue and other income, net financial result, revenue from television rights, marketing programmes, ticket sales and licensing, as well as total expenses and operating result, were analysed. This approach was used for an assessment of the concentration of revenue and the tournament's profitability. The macroeconomic impact and gross value added were examined based on A. Bibolov *et al.* (2024) used a method of analysing the impact on the national economy. Digital exogenous risk and the security component via social media were analysed using a method involving the study of the implementation of artificial intelligence systems for monitoring cyber threats (FIFA, n.d.b).

As part of the study into the social and labour aspects of the preparations for the 2022 FIFA World Cup in Qatar, documentary and comparative statistical analysis were employed. The documentary analysis method was used to examine the scale of foreign labour recruitment and the structure of infrastructure projects (stadium construction, modernisation of transport, hotel and road infrastructure) to determine the extent to which the project relies on labour migration and to assess the socio-demographic structure of the workforce. In addition, an analytical report by Amnesty International (2022) was analysed to establish the institutional role of the tournament organisers in shaping labour standards and accountability mechanisms. A comparative-statistical method was applied to compare official government data on mortality and injuries in stadium construction to identify differences in the methodology for recording and classifying occupational risks (BBC, 2022; International Trade Union Confederation, 2022). A regulatory analysis was used to examine the content of labour law

reforms, in particular the provisions of Qatar Decree-Law “Amending Certain Provisions of Labor Law” (2020) regarding changing employers without prior permission, as well as the introduction of a minimum wage and compensation mechanisms, to assess the transformation of the regulatory model of the labour market.

Based on the results obtained, a comparative analysis of the economic impacts and risk management tools for international sporting events in 2022-2024 was compiled using the multi-criteria comparison method. The comparison was conducted based on indicators of the organiser’s total revenue, net financial result, dominant source of revenue, share of ticket revenue, macroeconomic impact, infrastructure model, budgetary risk, security and climate risks, and the availability of financial reserves and insurance mechanisms. The integration process within the case studies was assessed using institutional, financial, territorial, socio-labour and security-digital markers, which reflected the degree of integration of mega-events into national economic systems, resource redistribution mechanisms, the employment management model and the level of inter-institutional coordination. The comparability of indicators was ensured by standardising the analytical framework and bringing the data into comparable categories. Financial indicators were analysed at the organiser level (revenue, financial result, revenue structure), which prevented confusion with government expenditure. For events of varying scales, both absolute and structural indicators were applied (dominant source of income, proportion of ticket sales, booking model). The macroeconomic impact was assessed in terms of gross value added and the effect on gross domestic product, without making direct comparisons of absolute figures between countries of differing economic scale. Risks were analysed within a single classification framework, ensuring conceptual consistency in the comparison for the period 2022-2024. This made it possible to generalise a model of financial sustainability for international sporting events in the post-pandemic period.

Results

Economic transformation of risk management approaches in international sporting events

In economic theory, risk is defined as the probability of losses, a deviation of actual results from expected ones, or a shortfall in profits under conditions of uncertainty. For international sporting events, this concept takes on

practical significance, as these are large-scale projects characterised by a high concentration of capital, a complex revenue structure, and significant dependence on external factors. In this context, risk refers not only to the possibility of budget overruns, but also to the probability of low returns, unstable cash flows and long-term debt burdens (Skavronska, 2012).

Classical economic theory viewed risk primarily as the possibility of losses within the profit structure. N.W. Senior (1836) and J.S. Mill (1848) interpreted risk as an integral part of entrepreneurial activity, reflecting the expectation of financial losses resulting from decisions taken. In this logic, profit includes compensation for potential losses, and the economic agent accepts uncertainty only on condition of receiving an appropriate “risk premium”. This approach forms the basis for the analysis of government investment in large-scale projects, particularly major sporting events, as investments with a higher expected rate of return. The neoclassical school, represented by A. Marshall (1890) and F.H. Knight (1921), significantly expanded this interpretation. F.H. Knight (1921) proposed a fundamental distinction between measurable risk and uncertainty, where risk is subject to probabilistic assessment, whereas uncertainty is not. A. Marshall (1890) emphasised the variability of returns as a key characteristic of economic choice. Given the same expected return, rational agents prefer alternatives with lower volatility, as income stability increases marginal utility. Thus, within the neoclassical approach, risk is associated not only with the possibility of loss but also with the dispersion of outcomes.

The theory of risk was further developed by J.M. Keynes (1936), incorporating a behavioural component into the model. They emphasised that economic agents may take on greater risk in pursuit of higher expected returns, particularly in conditions of limited information and unstable expectations. In the concept of “animal spirits”, investment activity is determined not only by calculations, but also by confidence and expectations regarding the future. This is relevant to decisions regarding the hosting of international sporting events, where economic logic is combined with image-related, political and strategic motives. In the field of international sporting events, these approaches explain why states and organisers agree to high budgetary commitments, counting on the multiplier economic effect and image benefits (Deng, 2024). A summary of the evolution of theoretical approaches to determination of risk is systematised in Table 1.

Table 1. A comparative analysis of economic theories of risk

Theoretical approach	Representatives	Interpretation of risk	Key point	Implications for international sporting events
Classical theory	N.W. Senior (1836), J.S. Mill (1848)	Expectation of financial losses; risk as a component of profit	Compensation for potential losses	The government includes a “risk premium” in its calculation of the expected economic benefits of holding the event
Neoclassical theory	A. Marshall (1890), F.H. Knight (1921)	Measurable risk is the variability of outcomes, distinguishing between risk and uncertainty	Advantage of less volatile alternatives with the same return	Selecting funding models with lower variance in budgetary indicators, developing hedging mechanisms

Table 1, Continued

Theoretical approach	Representatives	Interpretation of risk	Key point	Implications for international sporting events
The Keynesian approach	J.M. Keynes (1936)	Risk as a function of expectations and trust; the behavioural component	Willingness to take on increased risk for the sake of strategic advantage	Submitting applications to host major events during periods of instability with a view to achieving long-term reputational benefits

Source: compiled by the author

The classification presented in Table 1 illustrates the gradual transformation of the economic interpretation of risk from a static category of potential losses to a dynamic element of strategic choice. A comparison of these approaches traced the shift in emphasis from the compensatory logic of the classical school to the quantitative measurement of variability in neoclassical theory and subsequent integration of behavioural factors into the Keynesian model. This evolution has practical significance for the analysis of international mega-sporting events, as their financial architecture combines budget planning, the assessment of revenue volatility, and the consideration of the strategic expectations of states and organisers. Thus, theoretical approaches to risk form the conceptual basis for interpreting contemporary models of financial sustainability of sporting events in the post-pandemic period.

A distinction must be made between the concepts of uncertainty, threat and financial risk. Uncertainty, in the sense of Knightian uncertainty, refers to a situation where the probabilities of events cannot be quantified, particularly in cases of unpredictable shifts in audience demand or the scale of reputational crises (Dizikes, 2010). A threat is a specific potential danger – a doping scandal, a security breach, or protests. Financial risk, unlike uncertainty, can be quantified through the probability of losses associated with fluctuations in revenue from ticket sales, sponsorship contracts or broadcasting rights. For international competitions, these categories are interrelated, as uncertainty exacerbates financial risk, and the materialisation of threats translates into direct budgetary losses (Premier Sports Network, n.d.).

The classification of risks in the sports industry covers financial, operational, macroeconomic, political and reputational aspects. The risks of financial loss relate to the credit risks (debt burden), market risks (currency, interest rates) and operational-financial risks (revenue shortfall) (Pakhucha *et al.*, 2021). Operational risks relate to both internal factors (staffing, management) and external factors (weather). Macroeconomic risks relate to economic cycles and inflation in the cost of constructing the venues. Political risks are linked to factors such as political sanctions, boycotts or changes in regulations. Finally, reputational risks relate to scandals in the media and the resulting loss of trust in the organising team for the events (Castelblanco *et al.*, 2025).

International sporting events differ from other infrastructure projects in several ways. First, the revenue streams are more volatile – they are based upon ticket sales, sponsorships and media rights. Second, the assets generated by

these projects have a limited useful life after the sporting events have occurred. Third, the factors related to the sporting events itself impact risk – the results of the sporting events, the actions of fans and publicity campaigns. Each of these factors necessitates the setting aside of funds for covering the potential financial risk (Soebbing, 2018).

Major international sporting events involve various financial risks, but they also relate to the financialisation of urban development. Rio de Janeiro, for instance, transformed its urban area into a financial asset following its Olympic Games. The future development of the area, the capitalisation of the area and the growth of property values in the area were all considered financial assets. Thus, the risk of international sporting events is not just related to the financial management of the construction of the areas required for the sporting events but also related to the management of the financial expectations of investors. The state often incurs financial risks to guarantee the events, but the potential losses are faced by the government and its budget. Thus, risk is related to infrastructure building for international sporting events but also related to financial risks for developing financial assets out of these infrastructures, leading to financial bubbles, increased debt and increased socio-economic inequality. The risks of infrastructure development for international sporting events have undergone a transformation like the risks of the financial markets in the post-pandemic era (Bhimani & De Lisio, 2023). Thus, risk in international sporting events fulfils a dual function. In the short term, it leads to budgetary shortfalls and financial losses; however, in the long term, it stimulates the evolution of financial models and the development of tools for insurance, provisioning and income diversification. The transition from reactive crisis management to systemic financial stability for sporting events in the post-pandemic era is shaped by a definition of the economic nature of risk.

Since 2020, the financial model of the Olympic Games has shown a clear trend towards rising revenue from media rights and a simultaneous strengthening of the redistributive role of the IOC (2024). It was the broadcasting contracts that became the key stabilising factor during the pandemic and the post-pandemic recovery. For the Tokyo 2020 Games, broadcasting revenue amounted to USD 3.1 billion, for Beijing 2022 – USD 1.5 billion, and for Paris 2024 – already USD 3.2 billion (McBride & Berman, 2026). Thus, even amid limited spectator attendance and high uncertainty in the global environment, media rights have ensured billions in stable revenue, confirming their role as the primary anti-crisis financial mechanism for modern mega-events.

The IOC operates as a non-profit organisation, which determines how the revenue it generates is allocated. Around 90% of all revenue from the Games is channelled directly back into the sporting system – to support international federations, National Olympic Committees, organising committees and athlete development programmes. In total, approximately USD 2.8 billion of each Olympic cycle is allocated to organising the Games, which reduces the financial burden on host cities. In the post-pandemic period, IOC contributions remain substantial: USD 1.892 billion was allocated for Tokyo 2020 (including costs associated with the postponement of the Games), and USD 970 million for Beijing 2022 (IOC, 2025). This means that the central body of the Olympic Movement effectively acts as a stabilisation fund, mitigating exogenous shocks for organisers.

The allocation of funds has changed since 2020. Amid global instability, the IOC has stepped up its support for athletes and development programmes. Under the current Olympic Solidarity plan for 2021-2024, USD 590 million will be allocated to international and continental programmes, which is 16% more than in the previous four-year period. The funds are used to develop athletes, train coaches and administrators of the sport, and to implement educational programmes related to the Olympic values. The funds allow for less financially capable countries to receive the necessary support and to enhance the Olympic ecosystem as a whole. Additionally, the Olympic Solidarity Foundation has also begun to pay for athletes through scholarship and grant programmes. For example, Olympic Solidarity funded 285 training courses for 133 National Olympic Committees, and 393 coaches from 140 National Olympic Committees (NOCs) received special scholarships. Furthermore, since 2020, Olympic Solidarity has also continued to fund the anti-doping programmes for Olympic athletes. For example, the IOC covers 50% of the budget for the World Anti-Doping Agency (n.d.), with the remaining 50% of the budget being funded by individual governments. These governments share the responsibility of funding this anti-doping agency with the IOC, which helps to ensure that athletes are treated honestly and fairly within the Olympic competitions (IOC, 2025). Finally, another of the main purposes of Olympic Solidarity is to provide financial and operational support to the National Olympic Committees (NOCs) that organise their respective Olympic Games. However, hosting these Olympic Games incurs expenses for the NOCs organising the games. According to an analysis from the University of Oxford, the last three Summer Olympic Games to occur before the Paris Games cost around USD 51 billion in total, excluding infrastructure costs, and often exceeded their initial costs by an average of 185% (Inside FIFA, n.d.).

The COVID-19 pandemic that erupted in 2020 worsened the risk of cost overruns. The postponement of the Tokyo 2020 Olympic Games resulted in additional costs amounting to USD 2.8 billion. These costs were distributed between the Tokyo, Japanese governments and the organising committee; each of them contributed around USD 1.1

billion, USD 1 billion and USD 700 million, respectively (Pavitt, 2020). The high costs of organising these games are a well-known fact. Tokyo spent USD 150 million on its bid for the 2016 Summer Games, which were ultimately held in Rio de Janeiro. However, the city spent half that amount on its bid for the 2020 Summer Games. Additionally, Toronto had to withdraw as one of the candidates to host the 2024 Games due to the high cost of USD 60 million. This demonstrates a growing trend of increasing costs and a decline in the number of cities willing to assume such financial risks (HLB International Limited, n.d.). Another cost that is typically associated with Olympic Games is capital expenditure. The budget for the Paris 2024 Olympic Games is expected to exceed USD 8 billion and is primarily spent on constructing sports and transport facilities for the Games. The 2016 Summer Olympic Games in Rio de Janeiro cost around USD 20 billion to host, and the 2022 Winter Olympic Games in Beijing are estimated to have cost around USD 39 billion. The construction and transport of Olympic Games facilities typically account for the largest portion of the budget allocated to these Games. For instance, USD 7 billion was invested in transport infrastructure in preparation for the 2012 Summer Olympic Games in London (HLB International Limited, n.d.). The ticketing market for Olympic Games experienced both declines and growth between 2020 and 2025. The ticketing market for Olympic Games was valued at USD 20 billion in 2019. However, it dropped to between USD 5 billion and USD 6 billion in 2020. The market value remained at around USD 6 billion in 2021 due to Olympic Games postponements and spectator restrictions. However, the market value of Olympic tickets grew to USD 15.5 billion in 2022. The market reached USD 19.3 billion in 2023, and it grew again to exceed USD 22 billion and USD 24 billion between 2024 and 2025. Thus, there was a decline in the ticketing revenue for Olympic Games between 2020 and 2022, after which there was a recovery of the market. The ticketing revenue for North America accounts for the lion's share of Olympic ticketing revenue. However, the ticketing revenues of Europe and the Asia-Pacific regions have been growing since 2022. The changes in the size of the Olympic ticketing market in 2020 and 2021 indicate that Olympic Games revenue relies on the physical presence of spectators in the stadiums. The growth of media rights revenue for Olympic Games in the post-pandemic period indicates its growing influence on the funding of Olympic Games (Grand View Research, n.d.). After 2020, media rights revenue is central to ensuring financial stability. During the 2017-2020/21 period, which included the 2018 Winter Games in PyeongChang and the Summer Games in Tokyo, total revenue from the sale of broadcasting and marketing rights amounted to USD 7.6 billion (IOC, 2024; 2025). Thus, the centralised funding model serves a stabilising function, offsetting the volatility of revenue from tickets and tourism, which saw a significant decline in 2020-2021.

To summarise, economic risk theory suggests that international sporting events can be viewed as complex

financial systems that are highly sensitive to uncertainty and external shocks. The evolution of theoretical approaches – from viewing risk as a potential loss to interpretation as a tool for strategic choice – reflects the transformation of mega-event financing models in the post-pandemic period. The practice of hosting the Olympic Games since 2020 demonstrates the growing role of revenue diversification, centralised resource reallocation and the increasing importance of media rights as a stabilising financial mechanism. At the same time, the persistence of the trend towards budget overruns and the socialisation of costs confirms the systemic nature of the risk, necessitating a shift from reactive crisis management to a model of long-term financial sustainability for international sporting events.

A comparative analysis of economic effects and risk management tools

UEFA EURO 2024 has become a central component of the Union of European Football Associations' two-tier financial strategy, aimed at rebuilding cash reserves following their depletion due to the pandemic. By early 2020, reserves exceeded EUR 575 million, but by the end of the 2023 financial year, they had fallen to EUR 360 million, with a financial stability target set at EUR 500 million. The tournament in Germany was seen as a key instrument for restoring financial equilibrium, returning reserves to pre-crisis levels and ensuring their subsequent growth to over EUR 550 million.

The tournament's gross revenue was close to EUR 2.5 billion. Income was earned through media rights sales, sponsorship agreements, ticket sales, hospitality sales and licensing for the 51 matches staged between 14 June and 14 July 2024. According to UEFA's financial estimates, almost half, or around EUR 1.2 billion, would be earned as net profit, which is used to finance UEFA's work in the subsequent four-year cycle and replenish its reserve fund. The financial model allowed for a large-scale, centralised redistribution of funds. The prize pool for the 24 national associations totalled EUR 331 million, of which EUR 222 million was distributed as guaranteed entry fees (EUR 9.25 million per association) and EUR 109 million in performance-related payments for the group stage and play-offs. Prize money for the champion team was capped at EUR 28.5 million, conditional on winning all matches. An additional EUR 240 million was made available for more than 600 clubs as compensation for releasing players to their national teams. Of this amount, EUR 140 million was allocated to players participating in the tournament's final stages and 100 million was distributed on a per-call-up basis over two years. Revenues from the tournament also finance the HatTrick (n.d.) programme, through which each member association can receive up to EUR 17 million in the 2024–2028 cycles for infrastructure projects, operating costs, the training of national teams and educational courses. Therefore, the financial outcome of EURO 2024 had both short-term implications for replenishing reserves and long-term implications for establishing a financial basis for the systemic financing of European football (FoxSports, 2024).

The financial model of the tournament exhibited the predominance of pre-contracted revenue sources such as media rights and sponsorship revenues, reducing reliance on the uncertain attendance at stadiums. This model was inspired by the outcome of EURO 2020, which took place later than planned with limited permitted attendance. After its conclusion, EURO 2024 operated as a stabilising financial mechanism that combined high profitability with large-scale redistributions of resources between national associations and clubs, ensuring that the organisation's reserves were replenished and that financial stability was restored to the post-pandemic football landscape. The economic benefit for Germany and the ten host cities is estimated at EUR 7.44 billion. The direct benefit was calculated at EUR 2.1 billion, generated by the spending of 2.7 million spectators, who included people from 44% foreign countries. The indirect and induced effects of supply chains and what employees spend totalled an additional EUR 4.7 billion. Media coverage was also valued at EUR 571 million, while social impact was estimated at 95 million EUR. The costs of staging the tournament amounted to EUR 649.6 million, of which 55% was absorbed by the local organising committee and UEFA and the remainder by the host cities. None of the stadiums used in the tournament was built specifically for UEFA EURO 2024, which limited infrastructural risks and liabilities (Islam, 2024).

The security arrangements for UEFA EURO 2024 were set up with awareness of increased geopolitical and terrorist threats in Europe as well as potential threats based on previous experience with mass events. The chances of large-scale incidents remain low; nevertheless, German authorities put in place an extensive package of preventative measures. The main threats they planned for were terrorism, hooliganism, violent crime, cyber operations and logistical disruptions. Consideration was given to public fan zones in city centers rather than stadiums, which were regarded as potentially more vulnerable because they would concentrate large numbers of people outside controlled access perimeters. The tournament drew around 2.7 million fans to 51 matches in ten German cities from 14 June to 14 July 2024 whilst public viewings could account for a further 12 million people, creating pressure on transport systems and urban infrastructure. Among the measures adopted were tightened border controls around transport hubs and an increased police presence there, the establishment of an international security coordination centre, the deployment of about 580 law enforcement officials from abroad, a ban on drones, airspace monitoring and emergency planning exercises based on various scenarios (Deutsche Welle, 2024). Background checks were carried out when issuing accreditations to personnel attending mass events; one such accreditation application was reportedly rejected on grounds that its applicant had potential links with radical organisations. At the same time, cyber-related threats were also anticipated; this included attacks directed at ticketing systems, personal data and tournament infrastructure (Dow Jones, n.d.). The security model therefore combined centralised coordination

with decentralised implementation from federal to municipal levels, avoiding operational issues for a smooth-running tournament despite its elevated levels of uncertainty. The financial structure of EURO 2024 showed a contraction of ticket revenue in the balance sheet and an increasing dominance of pre-guaranteed contracts. Compared to previous cycles, the lower share of variable revenue and cost control created profitability without state subsidies or centralised loans. Alongside extensive redistribution of funds from the tournament between associations and clubs, this suggested an evolution of the tournament's financial model towards cash flow predictability and reserve fund revival.

The social and labour aspect of UEFA EURO 2024 in Germany featured large-scale volunteer mobilisation, temporary employment, and compliance with national labour law. The volunteer initiative became the core of the event's social component. A total of 16,000 volunteers were recruited from 146,000 applications, reflecting strong civic engagement. The average age was 37, 32% were first-time participants in the tournament, and the volunteers were of 124 nationalities. As part of the ESG programme, 100% of volunteers received training on sustainable development and social responsibility, linking the labour aspect to the management standards. For the operational management of the tournament, a separate legal entity EURO 2024 GmbH was formed as a joint venture between UEFA and the German Football Association (n.d.). Six months before the tournament, the workforce grew to over 800 employees (54 nationalities, average age 33) in the Organising Committee, 80% of whom worked directly in stadiums and operational areas in host cities. This model showed flexible mass employment in peak periods (Union of European Football Associations, 2024).

The conditions of employment were established according to German labour law: maximum working time was 8 hours per day (10 hours per day with extension allowed at a 10 hour a day average), 48 hours per week on average over 24 weeks. Standard regulations also applied for breaks and at least a 11-hour gap between shifts. Separate limits were set for night workers. This made working conditions predictable and helped avoid staff burnout (UEFA, n.d.b). The social aspect also included inclusion and human rights protection mechanisms: 10,000 disabled people attended matches, 41,000 users had audio description available, and in 91% of cases of online abuse publicised on social media dedicated response mechanisms were activated. The feedback handling system recorded 529 cases, indicating formalisation of abuse reporting channels. Thus, the social and labour framework for UEFA EURO 2024 combined volunteer mobilisation, temporary employment, compliance with national labour laws and incorporation of ESG objectives (Union of European Football Associations, 2024).

The Paris 2024 Olympic and Paralympic Games were conducted against the backdrop of pandemic-driven transformation of governance models for international sporting events based on fiscal discipline, shared institutional

responsibility for budgetary risks, diversified revenue sources, enhanced security arrangements and incorporation of insurance mechanisms (IOC, 2024). The state's total spending amounted to 6.6 billion EUR, exceeding the previous estimate of EUR 5.9 billion; however, it was not classified as budget overrun. The shares of each expense item were EUR 3.02 billion for operational costs (EUR 1.44 billion for security), and EUR 3.63 billion for infrastructure expenditures: renovation of venues, ensuring that the River Seine was suitable for open water swimming and triathlon events. The Organising Committee for the Olympic Games (OCOG) operated with a budget of EUR 4.4 billion sourced mainly from private funds; its surplus was EUR 76 million, indicating structural separation of public and private financial flows (Le Monde, 2025).

The 2024 Summer Olympics in Paris became the first Games to be fully implemented under the Olympic Agenda and the "New Norm" concept, which aims to minimise capital risks for the Games by making the maximum use of existing infrastructure and temporary facilities. The organisational model for the Games was based on the division of responsibilities between the Olympic Committee (OCOG) and the Olympic Works Delivery Company (SOLIDEO (n.d.)), allowing each organisation to separate its operational risks from those related to urban development. This model for the Paris Olympics minimises the risk of budget overruns for the Games (IOC, 2024).

The revenue for the Olympics was derived from ticket sales (12 million tickets sold for the Olympic and Paralympic Games), media rights, sponsorships and Olympic Partners Programme (TOP) (IOC, 2025). These revenue streams enabled the Olympic organisers to reach around 5 billion people globally. Such revenue diversification is a response to the risks of the COVID-19 pandemic between 2020 and 2021, during which revenue from spectators was significantly reduced for various sports organisations around the world. The Games were held under the principle of "Games wide open". Spectators attended 2.6 million free events in total, visited 7.9 million people visited festival venues in France, and 45,000 volunteers were integrated into the Olympic Games operational model. The opening of these free events and spectator zones significantly reduced the risks of social tensions between spectators and organisers of the Olympic Games, and improved the legitimacy of the Olympic expenditure. The budgeting of security expenditure for the Games was not as consistent as other components of the budget, which is reflective of the high volatility of security risks in relation to the geopolitical instability of the world today. The Olympic organisers worked with 22,000 private security guards, 45,000 members of internal security forces and 18,000 members of the military to ensure the security of the Olympic Games, leading to the increased proportion of expenditure for security for the Olympic organisers (IOC, 2024). Insurance companies provided insurance for the Olympic Games organisers for liability insurance, directors and officers liability insurance (D&O), property insurance, third-party liability

insurance, cyber insurance and personal insurance for the athletes entering the Olympic Games. Additionally, risks related to climate change were taken into consideration for the Olympic Games in Paris. The average temperature in Paris has risen by 3.1°C above the average temperature since 1924 (Galy & Augros, 2024).

Financial stability was complemented by environmental parameters: 100% energy from renewable sources and a stated 50% reduction in carbon emissions compared to the organisation's previous models. The use of 95% existing or temporary facilities reduced investment risk and long-term debt burden. In the post-pandemic economy, such a model reduces regulatory risks, risks of ESG criticism and risks of losing corporate partners. The social and labour aspect is integrated into the risk management system through the broad participation of 206 National Olympic Committees, 85 NOCs with medals, 32 sports, 48 disciplines and 15 new events, full gender parity and the involvement of 169 delegations in the Paralympic Games. 78% of suppliers were small and medium-sized enterprises, which contributed to the territorial distribution of the economic impact. Independent estimates projected a net economic impact of up to EUR 11.1 billion for the Île-de-France region, although the short-term macroeconomic impact is assessed as limited, reflecting the temporal asymmetry of the benefits of mega-events. The post-pandemic transformation manifested itself in the digitalisation of audience engagement (6.7 billion digital interactions via Olympic channels) and the integration of long-term physical activity programmes (EUR 300 million in public funding to improve the population's physical activity levels). This reflects a shift in focus from a one-off event-driven impact to institutionalised socio-economic influence and the development of a sustainable risk management model (IOC, 2024).

The social and labour dimension of the preparations of the Paris 2024 Olympic Games relates to the massive efforts to employ individuals in the preparation of the Games. The job mapping of the Games, which was updated in both 2021 and 2023 to account for the impact of the COVID-19 pandemic, indicated that the total number of jobs to be created during the Games would be 2,181,100. Furthermore, 89,300 jobs were to be made available for the organisation of the Games (and its suppliers), 61,800 jobs would be required in the tourism and hospitality sector, and 30,000 would be required in the construction of facilities for the Games (OECD, 2025).

To ensure that there were enough individuals to staff these various positions during the Games, the city implemented the "Job Challenges" initiative (SmartForum, 2023). This initiative, which began in 2018 with a budget of EUR 4 million, was intended to encourage candidates to seek employment in the Games in fields like event management, security, construction, and sport. In order to do this, the candidates were to partner with local training organisations to develop their soft skills and their motivation to participate in the Games. Another initiative that was established to provide more employment opportunities for

candidates was the "From Stadium to Employment" events (Refugees.info, n.d.). These events included sporting activities for the participants, as well as provided opportunities for job seekers to interact with employers without revealing their identities. Since 2022, there have been 23 of these events, which have attracted around 2,000 job seekers and 206 participating companies. Additionally, on average 60% of job seekers who participated in these events were employed by the companies represented. Furthermore, there have also been the "Parisian Employment Pacts", in which over 30 companies, including several official partners of the Olympic Games, have committed to employing job candidates who are distanced from the labour market, as long as those companies receive support from the Olympic Games organisers to host recruitment events for these candidates (Business France, 2024; El Kaoun-Gabelotaud, 2024).

Beyond the management of the budget for the Games, there were additional efforts to ensure that the Games would remain financially resolute. For instance, efforts were made to manage the risks that could threaten the financial stability of the Games. These efforts included not only establishing the security of the Games, insurance for the Games, and the climate and cyber security of the Games, but also in the establishment of controls over the public expenditure of the Games and the prevention of any spending that would occur beyond the established budget. Thus, the management of the risks of the Games was managed in the post-pandemic era, indicating that the successful management of international sporting events is related to the management of those risks.

The FIFA World Cup Qatar 2022 took place in the context of various external challenges: economic challenges after the pandemic, changes to the calendar of international sporting events, geopolitical tensions, challenges caused by the climate and the potential impact of digital reputational risks on the organisation. Unlike previous World Cups, the risks that emerged for the organisation were not limited to operational risks. Financial, operational and reputational risks had to be integrated into one system when organising such an event. The financial figures for the World Cup 2022 indicated that the tournament was the main source of revenue for the country in the year in which it was held. The revenue for the tournament was USD 5.769 billion in comparison to only USD 766 million in 2021. The net result for the country for 2022 was a profit of USD 2.368 billion in comparison to the loss of USD 312 million in 2021. These figures indicate that the tournament is primarily dependent upon the year in which it is held for its revenue and that it has high levels of success in generating financial results for the nation despite the challenges facing the global economy. The revenue for each component of the tournament included television rights (USD 2.958 billion), marketing rights (USD 1.425 billion), hospitality and tickets (USD 929 million), licensing revenue (USD 270 million) and other revenue (over USD 180 million). Television rights accounted for the majority of the revenue for the tournament, indicating the centralisation of the

tournament around media rather than the physical presence of spectators at the games. However, the revenue from tickets has increased in comparison to 2021 indicating the return of spectator activity following the pandemic. The costs of the tournament were primarily incurred in the categories of competitions and events (USD 2.005 billion) and the development and education of players (USD 1.038 billion). The remaining costs were related to administration of the tournament. The profit of the tournament before taxation was USD 2.359 billion indicating the high level of profitability of organising the tournament. Thus, the model upon which the tournament was held and the control of its costs enabled the organisation to minimise the impact of external challenges upon its financial results. Additionally, the decision to allocate part of the tournament's net profit to restricted reserves indicates a strategy to enhance its financial sustainability (FIFA, n.d.a).

One of the main decisions made by the organisation of the tournament was to move the tournament to November and December 2022 in order to avoid extreme temperatures in the summer and to avoid any additional costs related to spectator safety. The tournament was also relatively small in relation to other competitions in terms of the risks related to the infrastructure of the teams and the costs of transportation of the spectators to the games. The short-term economic impact of the tournament upon Qatar was estimated to be between 0.7 and 1.0% of the GDP of Qatar in 2022, or between USD 1.6 and USD 2.4 billion. During the tournament, Qatar was attended by around one million international visitors. While not a major economic impact upon Qatar, the economic impact upon the country was both significant and predictable. Finally, Qatar has developed infrastructure in previous years that was to be utilised for the development of the nation's economy, which helped to reduce any risk of over-investment in the development of this singular economic activity (Bibolov *et al.*, 2024).

The 2022 FIFA World Cup was also the first of these tournaments to adopt a systematic model for the protection of digital information. The Social Media Protection Service analysed 19.6 million social media posts, identified 19,000 instances of abusive content and hidden over 286,000 comments made by users publishing such content. Additionally, over 12,000 accounts were identified that published content that was offensive to players from various nations. The implementation of AI to scan social media spaces in real time in addition to the work of digital monitoring services to reduce the likelihood of such challenges reduced the potential impact of these digital exogenous risks upon the tournament organisation (FIFA, n.d.b). The social and labour dimension of the preparations for the 2022 FIFA World Cup involved the recruitment of foreign labour and the transformation of the regulatory framework governing the labour market. To implement the programme for the construction of infrastructure for the World Cup, seven stadiums were built, and the transport system, airport, road network and hotel facilities were modernised. According to official data, around 30,000 migrants worked in the construction

of these stadiums. The foreign workers came predominantly from Bangladesh, India, Nepal and the Philippines.

The mortality and injury rates among those constructing the stadiums became the subject of international debate. The Qatar government stated that 37 deaths occurred during the construction of these stadiums between 2014 and 2020, three of which were related to the working conditions of the workers. Various international organisations and the media reported significantly higher figures for the number of deaths among the workers during the construction of the stadiums for the FIFA World Cup 2022, although the Qatar government attributed these differences to the different methodologies used to record these statistics (BBC, 2022). According to the International Labour Organisation (ILO), in 2020, 50 workers died during the construction of these stadiums, 506 of them sustained serious injuries, and over 37,000 of them suffered minor and moderate injuries (International Trade Union Confederation, 2022).

In the run-up to the tournament, labour law reforms were introduced. Qatar Decree-Law No. 18/2020 (2020) provided for the possibility of changing employers without prior authorisation, effectively dismantling key elements of the kafala system. A non-discriminatory minimum wage was established, a fund was set up to support workers in the event of non-payment of wages, inspection controls were strengthened, and sanctions against employers who violated the law were expanded. In the two years following the reform, around 370,000 workers exercised their right to change jobs. The institutional changes were accompanied by the formation of joint committees within enterprises and the development of tripartite dialogue involving the Qatari Ministry of Labour, the ILO and international trade union organisations. Thus, the social and labour aspects of hosting the World Cup combined the large-scale use of migrant labour with the gradual institutionalisation of worker protection mechanisms, which became part of a broader transformation of the industrial relations system during the run-up to the mega-event (Amnesty International, 2022).

In 2020-2021, the global pandemic led to crisis management mechanisms dominating international sport. The staging of the 2022 World Cup demonstrated the possibility of transitioning to a systematic planning model, where contractually fixed revenues, diversification of funding sources, calendar adaptation, centralised coordination, accumulation of reserves and the institutionalisation of digital safeguards functioned as interlinked elements. A positive financial outcome, a stable revenue base and the absence of operational disruptions demonstrate the organisation's ability to minimise the impact of external shocks and ensure the restoration of financial equilibrium following a period of global instability. As part of the case analysis, three models for organising international mega-sporting events in the post-pandemic period were examined: UEFA EURO 2024 (Germany), Paris 2024 (Olympic and Paralympic Games) and the FIFA World Cup 2022 (Qatar). A comparison of their financial architecture, revenue structure, budgetary parameters, risk mitigation tools and institutional coordination mechanisms is summarised in Table 2.

Table 2. Comparative characteristics of the economic impacts and risk management tools for international sporting events (2022-2024)

Criteria	FIFA World Cup 2022 (Qatar)	UEFA EURO 2024 (Germany)	Paris 2024 (France)
Total revenue of the organiser	USD 5.77 billion	≈EUR 2.5 billion	Operating budget: EUR 4.4 billion
Net financial result	USD 2.37 billion in profit	≈EUR 1.2 billion in expected net profit	Surplus of EUR 76 million for the OCOG
Main source of income	Television rights (USD 2.96 billion)	Media rights and sponsorship	Media rights, TOP partners, tickets
Share of ticket revenue	USD 929 million	Limited share in the structure	12 million tickets sold
Macroeconomic impact on the country	0.7-1% of GDP; USD 1.6-2.4 billion in gross value added	EUR 7.44 billion in total impact	Up to EUR 11.1 billion for the Île-de-France region
Infrastructure model	Previously implemented diversification strategy	Use of existing stadiums	95% of existing or temporary facilities
Budgetary risk	Centralised model, reserve formation	No new stadiums, cost control	Distinction between OCOG and SOLIDEO
Security risks	Digital monitoring, AI moderation of 19.6 million posts	Tighter border controls, international coordination	22,000 security guards, 45,000 security personnel
Climate risk	Postponing the tournament until winter	Standard summer conditions	Adaptation to heat stress, climate protocols
Financial reserves	Profit has been allocated to restricted reserves	Restoration of UEFA's reserves to over EUR 500 million	Budget without a formal deficit
Insurance mechanisms	Institutionalised digital protection	Government and inter-agency coordination	D&O, cyber, property and casualty, and weather insurance
Stability model	Centralised business model	Reserve-and-redistribution model	An institutionally differentiated model

Source: compiled by the author based on FIFA (n.d.b), UEFA (n.d.a), IOC (2024; 2025)

A comparative analysis shows that between 2022 and 2024, international sporting events were no longer organised as short-term crisis responses, but within structured risk management models integrated into financial and strategic planning. The 2022 FIFA World Cup implemented a centralised commercial model dominated by media rights, which accounted for over half of revenues and generated a net profit of USD 2.37 billion. This structure minimised dependence on ticket sales and the physical presence of spectators, a direct consequence of the lessons learned from the pandemic. Channelling profits into reserves strengthened the organisation's financial autonomy and created a buffer against future shocks. At the same time, the institutionalisation of digital security (AI moderation, social media monitoring) demonstrated the integration of reputational and cyber risks into the overall event management architecture.

UEFA EURO 2024 demonstrated a model for restoring financial balance through cost control, the absence of new capital-intensive infrastructure projects, and a predominance of pre-contracted revenue. The use of existing stadiums reduced investment risk, whilst the expected net profit of approximately EUR 1.2 billion restored the organisation's reserves following the pandemic-induced decline. In this case, sustainability was achieved through increased cash flow predictability and a large-scale redistribution of funds between associations and clubs, thereby strengthening the financial ecosystem of European football. Paris 2024 developed an institutionally differentiated model under which operational and infrastructure risks were allocated between the OCOG and SOLIDEO. This approach reduced the

likelihood of uncontrolled budget overruns and completed the operational cycle with a surplus. At the same time, insurance mechanisms, climate adaptation, safety reserves and ESG parameters were integrated. The high proportion of existing or temporary facilities reduced the long-term debt burden, indicating a transformation of the infrastructure model towards the minimisation of structural risks.

Thus, in the post-pandemic era, the economic resilience of international sporting events is shaped by a combination of three complementary elements: diversification and contractual revenue protection, the setting aside and reallocation of financial resources, and the institutional integration of new types of risk – digital, climatic and reputational. The transition from crisis management to systemic resilience signifies a paradigm shift: risk is viewed not merely as a source of potential losses, but as a structural factor that determines the financial architecture, budgetary discipline and long-term stability of international sporting events.

Discussion

The growing scale and cost of international sporting events, combined with the effects of the pandemic, climate challenges and geo-economic instability, have highlighted the need for a comprehensive analysis of their economic resilience. A comparative analysis of the results showed that the study by P.A. Murtono *et al.* (2024) and this work converged in their conclusions regarding the economic significance of international sporting events, yet demonstrated differing scales of impact. In both cases, an increase in tourist flows, a boost to the service sector and a rise in the

international profile of the regions were recorded, as well as infrastructure and environmental pressures. However, P.A. Murtono *et al.* demonstrated a predominantly local economic effect for Bali through the development of sports tourism and support for small businesses, whereas this study identified systemic budgetary deviations associated with mega-events, an increased role of media rights, and the formation of long-term debt obligations.

A similar logic regarding the relationship between local and systemic dimensions was demonstrated by a comparison with M. Luskova *et al.* (2023). Both studies noted an increase in the vulnerability of the sports sector following COVID-19; however, M. Luskova *et al.* (2023) emphasised organisational readiness and the need for comprehensive risk management programmes. In this study, the consequences of the pandemic were interpreted more broadly – as a transformation of the financial model of mega-events, increased dependence on media rights, and a trend towards the socialisation of costs. Compared to S. Cerezo-Estevé *et al.* (2022) and F. Bazzanella *et al.* (2023), a common approach to interpretation of sporting events as complex systems with multiplier effects for local areas was evident. At the same time, the aforementioned studies focused predominantly on managerial, tourism and image-related outcomes, whereas this study centred on indicators of financial volatility, budget overruns and changes in revenue structure in the post-pandemic period.

A comparison of this study with the work of G. Tsekouropoulos *et al.* (2022) revealed a common recognition of the need for the strategic integration of risk management into the sports event management system, but a difference in the economic focus of the findings. The study by G. Tsekouropoulos *et al.* (2022) demonstrated that the effectiveness of sports organisations depended to a significant extent on the implementation of structured procedures for identifying, assessing and monitoring risks, as well as on the use of digital tools for managing and coordinating stakeholders. The authors emphasised the importance of systematic approaches, institutional interaction and a sustainable approach to event management as prerequisites for enhancing organisational resilience. This study also confirmed the need for integrated risk management; however, the findings focused on the macro-financial dimension: rising budget overruns, the socialisation of costs, the volatility of ticket revenues, and the strengthening of the role of media rights as a stabilising mechanism post-2020. It was demonstrated that risk had become systemic in nature and influenced the configuration of financial models for international mega-events. The same logic was evident in comparison with Q. Chen *et al.* (2023). The authors demonstrated that the sustainability of large-scale events depended on the adaptability of structures, coordination among stakeholders, and strategic planning, combined with risk hedging instruments. This study also highlighted the need to move from a reactive approach to a long-term strategy; however, the findings revealed a more profound

financial restructuring: risk was becoming systemic in nature, affecting the architecture of budgeting and the redistribution of responsibilities between international organisations and states. Whilst Q. Chen *et al.* (2023) analysed adaptation tools, this study highlighted the consequences of the structural financialisation of events.

A different perspective was proposed by D. Cook *et al.* (2023), who viewed the event as an ecosystem for the creation of shared value between sponsors and organisers. Their findings demonstrated that partnerships generated long-term benefits for local areas. In contrast, this study showed that even in the presence of multi-level interaction, the financial stability of mega-events remained dependent on centralised flows and risk compensation mechanisms. The socio-institutional dimension of sport development is presented in I.H. Ismael *et al.* (2025), who demonstrated that resource and cultural barriers determined the dynamics of women's sport at the national level. In this context, the results of this study broadened the scope of the analysis, demonstrating that, at the global level, similar constraints manifested themselves through budgetary imbalances and the uneven distribution of financial risks.

A comparison of this study with the work of A.C.T. Smith & J. Skinner (2022) revealed a common conclusion regarding the need to transform models for managing major sporting events in the context of increasing risks. A.C.T. Smith & J. Skinner (2022) found that scaling down infrastructure projects, utilising existing facilities, and redistributing responsibilities between international organisations and host cities helped to reduce the investment burden. This study also confirmed a trend towards reduced infrastructure risks and the strengthening of centralised financial mechanisms; however, the main focus was on financial volatility, budget overruns and the socialisation of costs after 2020. Thus, whilst A.C.T. Smith & J. Skinner (2022) focused on the organisational transformation of event formats, this study highlights findings regarding the economic sustainability and changes in the financial architecture of mega-events.

The external economic perspective outlined by R. Wang & T. Liang (2024) demonstrated the positive impact of government policy on exports of sporting goods. However, whilst their study was dominated by a narrative of expanding trade activity, in this case, the opposite trend was identified: an increase in the financial vulnerability of mega-events and dependence on media rights. F. Rejón-Guardia *et al.* (2020) demonstrated the local tourism impact of a medium-sized sporting event without significant infrastructure costs. A comparison with the results of this study highlighted that the scale of the event is a determining factor in economic risk: whilst regional events are capable of generating a moderate positive effect, international mega-events are characterised by structural financial challenges that require a long-term model of economic sustainability.

A comparison of this study with the work of L.E. Pedauga *et al.* (2020) revealed a common recognition of the multidimensional nature of risks associated with sporting events and the need to integrate them into strategic management. Both studies emphasised the importance of preventive mechanisms, adaptability and inter-institutional coordination in the context of post-crisis uncertainty. At the same time, the differences concerned the focus of the analysis. L.E. Pedauga *et al.* focused on organisational and managerial tools for improving the efficiency of events and reducing risks through process optimisation. In contrast, in this study, risk was interpreted as a financial-systemic phenomenon: attention was paid to budget overruns, revenue volatility, the socialisation of costs and the growing role of media rights after 2020. Thus, whilst the previous work emphasised managerial efficiency, this study focuses on the transformation of the financial model and the long-term economic sustainability of mega-events.

A similar pattern was observed when comparing the findings with those of M. Orr *et al.* (2022). Their study addressed climate challenges for organised sport, the typology of environmental threats and adaptation mechanisms, including a review of the criteria for selecting host cities and infrastructure requirements. The analysis centred on environmental vulnerability and the security parameters of the long-term suitability of venues. In contrast, this study focused on the economic aspect: revenue structure, the level of revenue concentration, the volatility of cash flows, and models of financial sustainability for international mega-events. Thus, whilst M. Orr *et al.* (2022) examined risk through the prism of climate adaptation in sport, this study interpreted it as an element of financial and institutional transformation in the post-pandemic era.

Overall, the comparative analysis demonstrated that international sporting events function as complex, multi-level systems within which economic, managerial, social and environmental factors are closely intertwined. Most studies confirmed the presence of positive effects – an increase in tourist flows, revitalisation of the service sector, enhanced international recognition of regions, and the creation of added value for local economies. At the same time, the results demonstrated that the scale of an event determines not only the potential for benefits but also the extent of financial risks. In contrast to studies focusing primarily on organisational efficiency, image outcomes or the local tourism effect, this research has revealed the structural nature of the financial vulnerability of mega-events. Systemic budgetary deviations, a tendency towards the socialisation of costs, an increase in the debt burden and a growing dependence on centralised revenue from media rights were identified. The COVID-19 pandemic acted as a catalyst for the transformation of the financial architecture of events, shifting the risk from the operational level to the realm of the budget model and the inter-institutional redistribution of responsibility.

Conclusions

To summarise the findings of the study, it is worth noting that between 2020 and 2024, international sporting events demonstrated a shift from reactive crisis management towards institutionalised models of financial sustainability integrated into strategic planning. The data confirmed the structural tendency of mega-events to exceed budgets: the average cost overrun for the Summer Olympic Games was 185%, and the three previous Summer Games collectively cost around USD 51 billion, excluding additional infrastructure. The postponement of Tokyo 2020 resulted in additional costs of USD 2.8 billion, illustrating the mechanism of risk socialisation between the state and organisational structures.

The analysis of the financial structures of different events indicated that their revenue from media rights is often contracted in advance to provide them with a more stable financial future. For instance, the broadcasting revenue from the Olympic Games in Tokyo 2020, Beijing 2022, and Paris 2024 amounted to USD 3.1 billion, USD 1.5 billion, and USD 3.2 billion, respectively, ensuring them a stable source of revenue regardless of the number of spectators attending the games. The FIFA World Cup 2022 received total revenue of USD 5.769 billion, of which USD 2.958 billion was from television rights. Additionally, the event made a net profit of USD 2.368 billion, which it used to replenish its reserves. Furthermore, tickets for the events generated revenues of over USD 20 billion for 2019, which reduced to USD 5-6 billion in 2020. However, it took until 2024-2025 for the ticket revenue to rise to over USD 22-24 billion. Thus, the revenue from tickets is highly volatile and must be diversified for event organisers.

The UEFA EURO 2024 case demonstrated the effectiveness of a cost-control model and the use of existing infrastructure: with revenue of around EUR 2.5 billion, the expected net profit was approximately EUR 1.2 billion, which replenished the reserves. Paris 2024, in turn, implemented an institutionally segregated model with an operating budget of EUR 4.4 billion and a surplus of EUR 76 million, against total public expenditure of EUR 6.6 billion and 12 million tickets sold. The FIFA World Cup 2022 operated within a commercially focused model dominated by media rights and high margins, whilst the Olympic system post-2020 retains a centralised redistributive model, and continental tournaments such as UEFA EURO implement a balanced and diversified model with the replenishment of reserves through the cyclical redistribution of revenues. Thus, the statistical results have confirmed that the economic sustainability of international sporting events in the post-pandemic era is shaped by a combination of centralised-redistributive, commercially-concentrated and balanced-diversified models, the setting aside of financial reserves, revenue diversification and institutional risk sharing. Risk is transformed from a factor of short-term losses into a structural element of the financial architecture of events, determining their long-term stability and ability to adapt to external shocks.

A limitation of this study is its focus on a macro-level comparative analysis of the financial models of international mega-events, without moving on to micro-level contract modelling of individual agreements and the organisers' internal financial mechanisms. Prospects for further research relate to the development of quantitative models for assessing the long-term sustainability of various financial architectures for mega-events, using dynamic scenarios and extended panel samples.

None.

None.

None.

Acknowledgements

Funding

Conflict of Interest

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Від кризового управління до системної стійкості: економічні аспекти управління ризиками в міжнародних спортивних заходах у постпандемічну епоху

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Анотація. Метою даного дослідження було економічно інтерпретувати трансформацію механізмів фінансового регулювання ризиків міжнародних спортивних мега-заходів після пандемічного шоку. Дослідження мало аналітично-порівняльний характер і здійснювалося із застосуванням фінансово-економічного аналізу офіційної звітності, горизонтального та вертикального аналізу бюджетів, трендового аналізу часових рядів, структурної декомпозиції доходів і витрат, інституційного аналізу моделей фінансування та макроекономічної оцінки мультиплікативних ефектів. Встановлено, що доходи від трансляцій Олімпійських ігор становили 3,1 млрд дол. США для Токіо-2020, 1,5 млрд дол. для Пекіна-2022 та 3,2 млрд дол. для Парижа-2024, що підтвердило домінування медіаправ. Сукупні доходи Fédération Internationale de Football Association World Cup 2022 досягли 5,769 млрд дол. США, з яких 2,958 млрд дол. припадало на телевізійні права, а чистий фінансовий результат становив 2,368 млрд дол., що засвідчило ефективність комерційно-концентрованої моделі. Union of European Football Associations European Football Championship 2024 забезпечив близько EUR 2,5 млрд доходу та близько EUR 1,2 млрд чистого результату, що відображало модель збалансованої диверсифікації. Державні витрати Франції на Olympic Games and Paralympic Games Paris 2024 становили EUR 6,6 млрд, при профіциті операційного бюджету EUR 76 млн, що характеризувало інституційно-розмежовану модель. Ринок квитків скоротився з понад 20 млрд дол. у 2019 році до 5-6 млрд дол. у 2020 році з відновленням до понад 22-24 млрд дол. у 2024-2025 роках. Загалом було виокремлено три моделі фінансової стійкості міжнародних спортивних мега-заходів – централізовано-перерозподільчу (олімпійська система), комерційно-концентровану та збалансовано-диверсифіковану, що функціонували в умовах інституційного розмежування витрат і формували різні механізми управління бюджетними, безпековими та ринковими ризиками. Практичне значення дослідження полягає у можливості використання нього федераціями та організаційними комітетами для вдосконалення фінансового планування й управління ризиками міжнародних спортивних заходів

Ключові слова: бюджетування; нестабільність; доходи; диверсифікація; інвестиції

**НАУКОВИЙ ВІСНИК
МУКАЧІВСЬКОГО ДЕРЖАВНОГО УНІВЕРСИТЕТУ
СЕРІЯ «ЕКОНОМІКА»**

Науковий журнал

Том 13, № 1. 2026

Заснований у 2014 р. Виходить чотири рази на рік

Оригінал-макет видання виготовлено
у редакційно-видавничому відділі Мукачівського державного університету

Відповідальний редактор:
К. Мовчан

Підписано до друку 01.04.2026 р.
Формат 60*84/8
Умовн. друк. арк. 11,7
Наклад 300 примірників

Адреса видавництва:
Мукачівський державний університет
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**SCIENTIFIC BULLETIN
OF MUKACHEVO STATE UNIVERSITY
SERIES “ECONOMICS”**

Scientific Journal

Vol. 13, No. 1. 2026

Founded in 2014. Published four times per year

The original layout of the publication is made
in the publishing department of Mukachevo State University

Managing Editor:
K. Movchan

Signed for print 01.04.2026.
Format 60*84/8
Conventional printed pages 11.7
Circulation 300 copies

Publishing Address:
Mukachevo State University
89600, 26 Uzhhorodska Str., Mukachevo, Ukraine
Tel.: +38 (03131) 21109
E-mail: info@economics-msu.com.ua
<https://economics-msu.com.ua/en>