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C O N T E N T

SOCIAL AND ECONOMIC TRANSFORMATIONS

DIGITAL SPASE

INNOVATIONS IN THE TRADE BUSINESS

З М І С Т

СОЦІАЛЬНО-ЕКОНОМІЧНІ ТРАНСФОРМАЦІЇ

ЦИФРОВИЙ ПРОСТІР

ІННОВАЦІЇ В ТОРГОВЕЛЬНОМУ БІЗНЕСІ

SOCIAL AND ECONOMIC TRANSFORMATIONS

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WORLD ECONOMIC FORUM 2026

The global economic system is undergoing structural and institutional transformations driven by technological advances, the intensification of sustainable development challenges, and increasing energy and geopolitical instability. In this context, research into the mechanisms of influence of supranational platforms on the formation of states' macroeconomic policies becomes especially relevant, particularly the role of the World Economic Forum as a catalyst for structural reforms. The study is based on the hypothesis that the World Economic Forum functions as an institution of global macroeconomic transformation, whose influence varies depending on the direction of transformation and

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ВСЕСВІТНІЙ ЕКОНОМІЧНИЙ ФОРУМ 2026

Глобальна економічна система переживає структурно-інституційні трансформації, зумовлені технологічними зрушеннями, загостренням викликів сталого розвитку, посиленням енергетичної та геополітичної нестабільності. У цих умовах набуває актуальності дослідження механізмів впливу наднаціональних платформ на формування макроекономічної політики держав, зокрема ролі Всесвітнього економічного форуму як каталізатора структурних реформ. Дослідження ґрунтується на гіпотезі про те, що Всесвітній економічний форум функціонує як інститут глобальної макроекономічної трансформації, вплив якого є диференційованим залежно від вектора трансформації й інституційного статусу країни в *a country's institutional status within the system of supranational associations. The methodological basis of the study comprises the concepts of institutional isomorphism, diffusion policies, and varieties of capitalism. To achieve the objective, systemic, institutional, and index methods were applied, as well as content analysis of World Economic Forum reports. Based on the study's findings, theoretical approaches to analysing the normative influence of the World Economic Forum, which is realized through the formation of epistemic communities, the ranking of national economies, and soft power mechanisms have been systematized. Three key vectors of macroeconomic transformation have been identified: competitiveness, digitalization, and the energy transition, and their systemic interrelationship has been characterized. Using the example of the countries of the Lublin Triangle, it has been established that the trajectories of the Energy Transition Index for Poland and Lithuania are predominantly upward, while Ukraine demonstrates volatile dynamics due to the destruction of its energy infrastructure amid the war. The proposed hypothesis has been confirmed: Ukraine's acquisition of candidate status for European Union membership creates synergy between the World Economic Forum's normative benchmarks and the requirements of European integration, reinforcing transformational impulses. A scientific novelty is the author's Macroeconomic Policy Coherence Index, which enables a quantitative assessment of the alignment of national economic policy with the recommendations of the World Economic Forum. The practical value of the results lies in their applicability by government authorities for monitoring and justifying the strategic reform priorities. Prospects for further research are associated with the empirical testing of the proposed index and an in-depth analysis of the energy transition in the context of Ukraine's post-war recovery.*

Keywords: transformation, competitiveness, economic policy, energy transition, digitalization.

системі наднаціональних об'єднань. Методологічну основу дослідження становлять концепції інституційного ізоморфізму, політики поширення та різновидів капіталізму. Для досягнення мети застосовано системний, інституційний та індексний методи, а також контент-аналіз доповідей Всесвітнього економічного форуму. За результатами дослідження систематизовано теоретичні підходи до аналізу нормативного впливу Всесвітнього економічного форуму, який реалізується через формування епістемічних спільнот, рейтингування національних економік та механізми м'якої сили. Ідентифіковано три ключові вектори макроекономічної трансформації: конкурентоспроможність, цифровізацію й енергетичний перехід, охарактеризовано їхній системний взаємозв'язок. На прикладі країн Люблінського трикутника встановлено, що траєкторії Індексу енергетичного переходу Польщі та Литви є переважно висхідними, тоді як Україна демонструє волатильну динаміку внаслідок руйнування енергетичної інфраструктури в умовах війни. Висунута гіпотеза підтвердилася: набуття Україною статусу кандидата на членство в Європейському Союзі створює синергію між нормативними орієнтирами Всесвітнього економічного форуму та вимогами євроінтеграційної зумовленості, підсилюючи трансформаційні імпульси. Науковою новизною є авторський Індекс узгодженості макроекономічної політики, що уможливлює кількісне оцінювання відповідності національної економічної політики рекомендаціям Всесвітнього економічного форуму. Практична цінність результатів полягає у можливості їх застосування органами державного управління для моніторингу та обґрунтування стратегічних пріоритетів реформ. Перспективи подальших досліджень пов'язані з емпіричною апробацією запропонованого індексу та поглибленим аналізом енергетичного переходу в контексті повоєнного відновлення України.

Ключові слова: трансформація, конкурентоспроможність, економічна політика, енергетичний перехід, цифровізація.

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Introduction

The global economic system at the current stage of social development is characterized by structural and institutional transformations caused by technological shifts, the aggravation of sustainable development challenges, and increased energy and geopolitical instability. The described processes necessitate a scientific rethinking of conceptual approaches to assessing macroeconomic policy. In this context, the analysis of the mechanisms through which supranational institutions, in particular the WEF, influence macroeconomic transformations becomes especially important.

Simmons et al. (2008) argue that macroeconomic transformations are determined not only by the decisions of national governmental institutions but also by the deliberate influence of international organizations, transnational networks of experts, and the mechanism of reform diffusion. The mentioned approach forms the conceptual basis for analysing the impact of the WEF on the transformation of socio-economic systems.

Beckert (2010), rethinking the concept of institutional isomorphism, argues that the mechanisms of institutional homogenization can equally produce both convergence and divergence depending on the configuration of the economic environment, which explains different trajectories of macro-economic transformations as reactions to WEF recommendations in different countries. This allows interpreting the influence of the WEF not as uniform, but as a contextually conditioned process.

Susskind and Vines (2024) argue that the modern system of international economic coordination is experiencing a structural crisis due to the rise of economic nationalism and the devaluation of liberal internationalism, which significantly reduces the effectiveness of the normative influence of international platforms. In view of these challenges, the effectiveness of the WEF's normative influence should be considered in the broader context of the transformation of the global economic order.

Hurrell (2024) emphasizes that geopolitical fragmentation significantly complicates the normative influence of non-state institutions on the economic policy of states, although it does not eliminate it.

Ikenberry (2024) focuses on a process-oriented approach to the transformation of the liberal international order, strengthening the role of alternative mechanisms of global governance in conditions of geopolitical instability. In these conditions, the importance of flexible and informal coordination mechanisms, including the WEF, increases.

Rodrik and Walt (2024) justify the concept of a "meta-regime" as an alternative architecture of global cooperation that ensures the coordination of states' economic policies without unifying their national interests and value orientations. Conceptually, this brings the WEF closer to coordination formats that do not imply rigid institutional unification.

Draghi's report on the future of European competitiveness notes the insufficient level of EU macroeconomic transformations in the areas of digitalization, energy transition, and human development, and substantiates the need for structural reforms (Draghi, 2024).

The purpose of the article is to develop theoretical provisions and practical recommendations aimed at improving the informational and methodological support for the analysis of vectors of macroeconomic transformation in the context of WEF recommendations. Achieving the stated goal involves solving specific tasks:

- systematize conceptual approaches to analysing the impact of the WEF on macroeconomic policy;

- identify and characterize the key vectors of macroeconomic transformation that correlate with the WEF's recommendations;
- justify conceptual approaches to assessing the compliance of changes in macroeconomic policy with the WEF's recommendations;

The study is based on the hypothesis that the WEF functions as an institution of global macroeconomic transformation, whose influence on the economic policy of states is differentiated depending on the vector of transformation and the institutional status of a country within the system of supranational associations.

The methodological basis of the study consists of the works of leading scholars in the field of macroeconomic policy. The reliability of the scientific results is ensured by the application of general scientific and special methods of cognition: systemic (for revealing the mechanisms of the influence of WEF on the macroeconomic policy of states); institutional (for assessing the interaction between the processes of European integration and WEF guidelines); index (for constructing an integral indicator of the consistency of macroeconomic policy); content analysis (for typifying WEF guidelines according to the key vectors of macroeconomic transformations).

The limitations of the study are due to the specificity of methodlogical approaches used by different institutions, the frequency of updates, and the degree of data aggregation for conducting a comparative analysis of macroeconomic transformations.

The prospects of further scientific developments are related to the study of the energy transition as a factor of macroeconomic transformation.

The main part of the article consists of three sections: institutional foundations of macroeconomic transformation; key vectors of macroeconomic transformation; conceptual approaches to the analysis of macroeconomic policy consistency.

1. Institutional foundations of macroeconomic transformation

The WEF was founded in 1971 as a non-profit foundation with a defined vision of rethinking the role of business in the development of society. Subsequently, the WEF underwent an institutional transformation from a regional discussion platform to a global platform for multilateral interaction, consolidating representatives of business, governments, international organizations, civil society, and the academic community. (WEF, n. d. a).

The theoretical foundation of the analysis of macroeconomic transformations is built at the intersection of a triad of scientific concepts:

I. The concept of *"institutional isomorphism"* explains the logic by which international organizations develop mechanisms of institutional practices of macroeconomic regulation through coercive, mimetic, and normative pressure (DiMaggio & Powell, 1983). According to the outlined approach, the WEF positions itself as a developer of "best practice" standards in the field of macroeconomic policy.

II. The concept of *"policy diffusion"* (Shipan & Volden, 2023) identifies key mechanisms of reform dissemination such as coercion, competition, learning, and emulation, which allows for the identification of the implementation of the WEF's recommended toolkit along the relevant vectors of macroeconomic transformation (Simmons et al., 2008).

III. The concept of *"Varieties of Capitalism"* explains the structural differences in the responsiveness of different types of market economies to external imperative signals, which is critically important for the comparative analysis of the directions of economic macroeconomic policy (Hall & Soskice, 2001).

In connection with the growing critical assessments of the effectiveness of the functioning of traditional interstate institutions for coordinating economic development, in particular the International Monetary Fund (IMF), the World Trade Organization (WTO), and the Group of Twenty (G20) (Susskind & Vines, 2024), the need to form a new global order based on "meta-regimes" of communication and interaction is becoming increasingly important (Rodrik & Walt, 2024).

Under such conditions, the analysis of the functioning of the WEF as an institutional platform, which determines the key directions of macroeconomic transformation, becomes particularly significant. In conditions of macroeconomic instability, it is precisely the WEF that establishes itself as an influential institution, whose guidelines shape the priorities of macroeconomic policy of states. The mission of the WEF is defined as "Improve the state of the world through public-private cooperation" and is realized through the consolidation of interaction in the areas of economic growth, resilience, and innovation, as well as the coordination of actions regarding key global challenges of macroeconomic instability. (WEF, n. d. b).

The strategizing of WEF activities was largely based on the concept of stakeholder capitalism by Schwab (Schwab & Vanham, 2021), according to which the responsibility of corporations goes beyond the interests of shareholders and extends to society. This concept positions the WEF as an actor in global macroeconomic policy (WEF, 2023, September 6). At the same time, its institutional status remains a subject of scientific debate: researchers note an ambivalence between the significant influence of the WEF, which is implemented through the consolidation of the ideas of interested parties, analytical activities, and public-private interaction mechanisms, and the lack of formal accountability mechanisms (McNeill, 2023).

The WEF 2026 in Davos witnessed the expansion of institutional functions beyond the analytical-recommendatory mandate: within the framework of the 56th annual meeting, for the first time during the period of russia's full-scale armed aggression against Ukraine, negotiations took place between the presidents of Ukraine and the USA regarding the initiation of peace consultations (WEF, 2026, January 29).

At the same time, the institutional potential of the WEF in the context of Ukraine's post-war recovery remains structurally limited by its normative, rather than coercive, nature of influence. The WEF can strengthen reformist impulses through rating mechanisms and network cooperation, but it cannot replace European integration as the primary determinant of macroeconomic transformation. A conceptual analysis of the WEF's role in transforming state strategies involves studying a multi-level system of instruments.

Unlike the IMF or the World Bank, the WEF does not apply conditional mechanisms for compliance with recommendations, as it does not provide funding and does not impose mandatory requirements. The influence of the WEF is primarily normative in nature and is implemented through key vectors of macroeconomic transformations that correspond to the typology of isomorphic pressure (DiMaggio & Powell, 1983).

The regulatory toolkit of macroeconomic transformations lies in the formation of epistemic communities (Haas, 1992). In the context of our study, this means that systematic business meetings in Davos contribute to the development of shared norms, values, and standards of behaviour, the consolidation of the interests of political, business, and academic elites, as well as the development of global networks for the dissemination of WEF economic ideas.

The toolkit for emulating best practices in competitiveness management is implemented through the ranking of national economies using appropriate indicators, in particular the Global Competitiveness Index, published by the WEF from 1979 to 2019–2020, (WEF, 2019; WEF, 2020) and the Future of Growth Index, published since 2024 (WEF, 2024, January), which encourage national governments to analyse, adopt, and adapt the economic policy tools of leading countries in order to improve their own positions in global rankings.

The toolkit of soft power has an indirect character and is implemented through institutional interaction between WEF recommenddations and the requirements of European integration policy. The implementtation of relevant reforms is driven not by direct pressure from the WEF, but by the alignment of its normative guidelines with the formalized requirements of integration processes, creating a mutually reinforcing effect and increasing the likelihood of their incorporation into national policies. Such a mechanism aligns with Nye's approach (2004), which defines "soft power" as the ability to achieve desired outcomes through attraction and shaping preferences, rather than through coercion.

Schimmelfennig (2005), studying the European integration processes in the countries of Central and Eastern Europe, proves that a high and credible prospect of EU membership, combined with low adaptation costs, is a sufficient condition for fulfilling external regulatory requirements.

Global Cooperation Barometer, prepared jointly by the WEF and McKinsey & Company, records an increase in the fragmentation of global cooperation, while the WEF mechanism becomes more complicated in the context of geopolitical turbulence, which increases the normative value of the WEF as a coordination platform amid the devaluation of traditional mechanisms of international interaction (WEF, 2025, January).

The implementation of WEF recommendations into the national economic system corresponds to the mechanisms of state policy diffusion (Simmons et al., 2008). In particular, the coercion mechanism is minimal and indirect, while the determining role is played by competition (for investments and positions in international rankings), learning (through the exchange of best practices) and emulation (imitating successful development models).

The conceptual scheme of the institutional foundations of macro-economic transformation under the influence of the WEF is summarized in *Figure 1*.

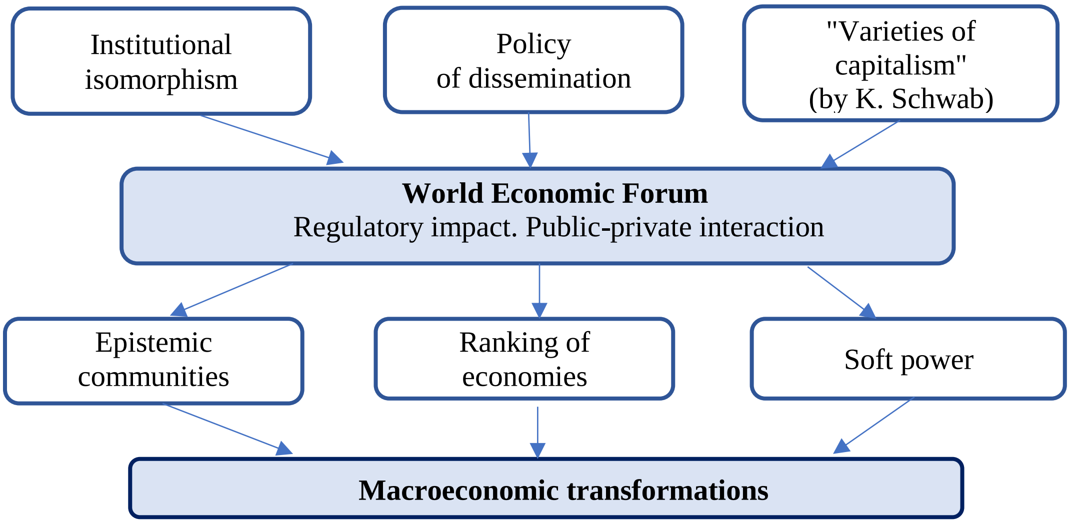

Figure 1. WEF as institutional platform for macroeconomic transformations

Source: developed by authors.

Therefore, the WEF functions as a supranational institutional platform that exerts regulatory influence on the macroeconomic policy of countries through rating mechanisms, the formation of epistemic communities, and soft power.

2. Key vectors of macroeconomic transformation

The content analysis of reports and analytical briefs from the WEF (WEF, 2019; WEF, 2023, January; WEF, 2023, June; WEF, 2024, January; WEF, 2025, June; WEF, 2025, January) allows for the identification of key vectors of macroeconomic transformation that shape the current agenda of global economic development. The structuring of these vectors reflects a shift in emphasis from traditional factors of economic growth to complex development models of intricate socio-economic systems.

The founder of the WEF, Schwab (2016), considers the Fourth industrial revolution as a fusion of technologies of physical, digital, and biological worlds, which transforms not only production processes but also the fundamental principles of the functioning of the economy and the state.

The annual WEF reports Global Competitiveness Report during 1979–2019 formed the factual basis for analysing the competitiveness of national economies. The final 2019 edition presented the economic situation of 141 countries, and the Global Competitiveness Index (GCI) provided the informational foundation for comparative analysis of countries based on the system of structural-institutional determinants of their economic development (WEF, 2019). The evolution of the WEF's conceptual approaches to assessing macroeconomic transformations along the competitiveness vector was reflected in the publications Future of Growth Report 2024 (WEF, 2024, January) and Global economic futures: Competitiveness in 2030 (WEF, 2025, June).

The competitiveness vector is transversal: it encompasses recommendations on deregulation, anti-corruption reforms, the development of human capital, and innovative ecosystems. It is competitiveness, in the extended interpretation of the WEF, that is the integral indicator of macroeconomic transformation (WEF, 2024, January; WEF, 2025, June).

An analysis of the vectors of macroeconomic transformation indicates a change in approaches to assessing national competitiveness, in particular, it refers to the country's ability to "maintain stable positions in certain segments of the global market due to significant economic potential, stable GDP growth on an innovative basis, a developed system of market institutions, possession of intellectual capital and investment resources, a flexible system for responding to changes in the world market situation, and diversification of the national economy" (Umantsiv & Zolina, 2022).

The regional vector of macroeconomic transformation involves the decomposition of the global WEF benchmarks to the level of territorial systems. In this regard, the spatial disparities in the development of the Lublin Triangle countries through the stimulation of regional competitiveness are highlighted in the work "Stimulation of Regional Competitiveness" (Humeniuk & Betlej, 2025). The mentioned approach allows for identifying the specifics of transformational processes taking into account the potential of cross-border cooperation between Ukraine, Poland, and Lithuania.

The institutional basis of the vector of digitalization of national economies is formed by the Centre for the Fourth Industrial Revolution, which functions as a global platform for technological governance of the WEF (WEF, 2017), the analytical reflection of which is the Digital Transition Framework – a framework document that determines the strategic priorities of digital transformation for governments and businesses in the context of macroeconomic dynamics (WEF, 2023, January).

In this context, one of the basic vectors of macroeconomic transformation is digitalization, which encompasses recommendations for the development of digital infrastructure, the implementation of artificial intelligence in public administration, the formation of digital skills of the workforce, and the regulation of digital markets.

Justifying the strategic significance of the outlined processes, Herasymenko (2025) notes that it is precisely digitalization that is the key trend of changes in contemporary history: "Increasing data accessibility, the growth of information circulation speed, the spread of digital goods – all these changes have had a fundamental impact on the development of society, creating new markets and changing the competitive landscape in existing ones by altering typical business models."

Accordingly, the Digital Transition Framework systematizes key recommendations for the digitalization of socio-economic systems as a comprehensive framework strategy for governments and businesses, aimed at achieving digital transition goals under conditions of macroeconomic instability through mechanisms of public-private cooperation (WEF, 2023, January).

The level of digital transformation in EU countries and Ukraine is assessed using various institutional and methodological approaches. In particular, the EU digital transformation framework applies an integrated indicator, the Digital Economy and Society Index (DESI), which aggregates indicators of digital infrastructure, human capital, internet usage, the integration of digital technologies in business, and the development of digital public services (European Commission, n. d.).

Ukraine applies adapted tools for assessing the digital development of the national economy, in particular the Regional Digital Transformation Index, which is based on the assessment of institutional capacity, digitization of public services, and the development of digital infrastructure (Ministry of Digital Transformation of Ukraine, 2026, April 6). Thus, the specifics of indicative systems reflect the differentiation of institutional integration into the EU digital space and the different architecture of measuring digital transformation.

The energy transition vector is presented in the annual WEF report "Fostering Effective Energy Transition" and the corresponding index Energy Transition Index (ETI). This toolkit allows for the evaluation of national economies according to the system of indicators of the efficiency of energy systems and their readiness to transition to renewable sources (WEF, 2021).

The factual basis for assessing energy systems is formed by the report "Fostering Effective Energy Transition 2025" (WEF, 2025). The use of the interactive tool Country Dashboard (WEF, 2025, June 18), makes it possible to verify the static index values and the intensity of their dynamics using the example of the countries of the Lublin Triangle (*Table 1*).

Table 1

Energy transition index of the Lublin triangle countries
in dynamics for 2020–2024

Country	Values of *ETI* (0–100) for the respective years and its chain growth / decrease rates, %								
	2020 ETI	2021		2022		2023		2024	
		ETI	%	*ETI*	%	*ETI*	%	*ETI*	%
Poland	55.0	57.6	4.73	59.4	+3.13	59.3	–0.17	61.3	+3.37
Lithuania	59.5	60.8	2.18	62.3	+2.47	61.4	–1.44	65.7	+7.00
Ukraine	56.7	56.7	0.00	58.8	+3.70	55.3	–5.95	56.2	+1.63

Source: systematized and calculated by the authors based on WEF data.

Taking into account the WEF methodology, the dynamics of the ETI reflects the degree of coherence of key components such as Energy Security, Environmental Sustainability and Energy Equity. Poland and Lithuania generally show an upward trajectory of the ETI, indicating a gradual strengthening of the institutional capacity to ensure the balanced development of energy systems, although this dynamic is uneven; in particular, the decline of the ETI in 2023 reflects the impact of exogenous shocks. According to Fostering Effective Energy Transition 2024, the increase in energy security risks has led to the prioritization of energy supply stability, which in some cases was achieved by reducing indicators of environmental sustainability and economic energy affordability, as well as intensifying the use of fossil resources (WEF, 2024, June).

Ukraine is characterized by a more volatile ETI trajectory, where the 5.95% decline in 2023 reflects a critical weakening of the Energy Security component in the context of the war with russia, particularly due to the destruction of energy infrastructure, which has shifted priorities from long-term energy transition to ensuring the basic resilience of the energy system's functioning.

The institutional foundation for implementing the trajectory of post-war recovery and modernization of Ukraine's energy sector is the "Strategic Orientations of the Ukraine Investment Framework", which determines the priorities of investment support aimed at revitalizing the infrastructure damaged by russia and strengthening the resilience of our country's energy system. (European Commission, 2025).

The identified features of the energy transition indicate that its implementation depends on the ability of national economies to maintain a balance between the key components of the ETI under external shocks.

The implementation of the energy transition vector is associated with new challenges in the Middle East amid geopolitical turbulence in 2026. An armed conflict between the USA, Israel, and Iran, and the subsequent blockade of the Strait of Hormuz as a transit corridor through which 25% of the world's seaborne oil trade and about 20% of liquefied natural gas trade pass, have caused a threat to global energy security. WEF analysts noted a systemic paradox: despite increasing geopolitical fragmentation, the global energy system remains deeply integrated, resulting in disruptions in one region resonating instantly in global markets, while transit routes turn into instruments of geopolitical pressure. (WEF, 2026, April).

The events around the Strait of Hormuz in 2026 caused a chain institutional reaction, representing the depth of contradictions between the national interests of countries and the goals of global macroeconomic coordination of the world order. In order to stabilize the global oil market, the Trump administration temporarily eased sanctions on russian oil. The positive financial effect of this decision in favour of russia, which "does not contribute to peace," was estimated at 10 billion USD. (PBS News, 2026, March 13).

On April 28,2026, the UAE announced its exit from OPEC and OPEC+ (Bloomberg, 2026). This precedent indicates the growing role of flexible platforms, in particular the WEF, in the context of the devaluation of the influence of traditional institutions of collective energy market regulation.

The processes observed in the Middle East are empirical evidence that, in conditions of geopolitical shocks, short-term national imperatives of energy security systematically prevail over long-term goals of the energy transition and mechanisms of global coordination.

Based on a comparative analysis of Central and Eastern European countries, László (2025) proves that the trajectories of macroeconomic convergence of post-socialist economies are significantly determined by their institutional status in relation to the EU, since full membership generates qualitatively different transformational impulses compared to the status of a candidate or associated partner.

Ukraine's acquisition of candidate status for EU membership (European Council, 2022) and the introduction of the Ukraine Facility 2024–2027 (European Commission, 2025) created a unique macroeconomic conjuncture, in which the vector of European integration-oriented determination (ISPI, 2024) in such important areas as digitalization, the energy transition, and institutional reforms is conceptually aligned with the regulatory agenda of the WEF.

Thus, the institutional status of countries in the European integration system determines the differentiation of macroeconomic convergence trajectories. For Ukraine, the synergy of key vectors of macroeconomic transformation will have a significant strategic importance in the context of post-war recovery; it also ensures the coherence of WEF regulatory benchmarks with the requirements of the European integration process and creates opportunities to improve the effectiveness of macroeconomic policy.

3. Conceptual approaches to the analysis of the consistency of macroeconomic policy

3.1. Institutional constraints on the influence of the WEF

The limits of the regulatory influence of the WEF are determined by its structural inability to replace formalized mechanisms of international economic coordination, which are based on intergovernmental agreements

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and institutionally established decision-making procedures. Under such conditions, the strengthening of the fragmentation of the global economic order and the devaluation of the principles of liberal internationalism systematically reduce the effectiveness of the normative influence of non-state communication platforms, limiting their ability to form universal benchmarks for economic policy (Susskind & Vines, 2024). At the same time, the need for alternative models of global cooperation is actualized, which ensures the coordination of states' economic policies without their unification and the levelling of national institutional and strategic interests, which emphasizes the growing role of differentiated models of international interaction (Rodrik & Walt, 2024).

An additional institutional constraint is the problem of the democratic legitimacy of the multi-stakeholder WEF model, which involves engaging representatives of business, governments, the academic environment, and public organizations in global economic dialogue processes outside of formalized intergovernmental decision-making mechanisms. Such a governance configuration causes scientific debates regarding the degree of its institutional accountability and representativeness. In particular, the Transnational Institute critically assesses this model as an attempt to partially replace the intergovernmental decision-making process with a system of self-selected global elites operating outside traditional mechanisms of democratic control and accountability (Transnational Institute, 2016). This creates an additional level of conceptual tension around the role of the WEF in global economic governance, intensifying the debate over the normative status of its recommendations within the framework of contemporary macroeconomic policy.

At the same time, countries with a transformational economy form a specific institutional environment in which processes of structural economic restructuring, institutional modernization, and European integration adaptation are combined. Within this space, Central and Eastern European countries occupy a special place, as they are characterized by an increased level of security risks due to russia's full-scale war against Ukraine. Under such circumstances, a specific institutional environment is formed, in which macroeconomic and structural transformations occur under the influence of external shocks and heightened dependence on international coordination mechanisms. This determines the differentiated nature of the response of these countries to the impulses of international institutions, especially in the areas of economic policy reform, energy security, and institutional adaptation (Humeniuk, 2025).

The need to take into account increased security risks reinforces the role of external integration mechanisms in determining national development priorities. In the context of the dominance of the European integration vector for Ukraine, the prioritization of reforms is primarily determined by EU requirements. Accordingly, WEF recommendations regarding digitalization (Digital Transition Framework) are implemented by central executive authorities to the extent that they align with the objectives of forming a Single EU Digital Market. The implementation of relevant transformational measures is carried out within the framework of the *Ukraine Facility* software toolkit, which provides proper financial support for digital reforms (Economic Support Program, n. d.).

In this context, the WEF functions not only as a system of external determinants of macroeconomic transformation, but also as an institutional catalyst for reforms, capable of enhancing and modifying the intensity of transformational impulses depending on the configuration of the national institutional environment and its level of receptiveness to global regulatory guidelines. Such influence is predominantly indirect and is realized through the formation of interpretative and analytical frameworks within which economic and political actors make sense of global challenges. The WEF contributes to the construction of so-called "cognitive frames" ("Cognitive frames"), specific mental structures that determine the ways of perceiving and interpreting economic reality (North, 2012).

The institutional influence of the WEF on the macroeconomic policy of states is limited by the lack of formal regulatory powers and the dominance of national security and European integration priorities. The WEF does not exert a direct regulatory influence on macroeconomic policy; however, it shapes a system of analytical guidelines that indirectly determine the directions of economic decision-making at the national level.

3.2. Assessment of macroeconomic policy consistency

Assessing the consistency of macroeconomic policy with the recommendations of international institutions is an element of the analysis of structural transformations of economies during periods of institutional changes. In this context, the degree of correspondence between the strategic guidelines of economic policy and the dynamics of key macroeconomic parameters is examined.

The concept of cohesion policy is applied in the context of European integration to assess the degree of approximation of national policies in the process of institutional adaptation and implementation of reforms (Radaelli, 2003).

The OECD institutional approach to ensuring policy coherence in the interest of sustainable development defines it as the integration of policies and the minimization of conflicts between sectoral development goals (OECD, 2005).

The methodological basis of the quantitative analysis of the institutional quality of state economic regulation is formed by the Worldwide Governance Indicators, which is based on a composite approach to assessing the effectiveness of public governance and administration (Kaufmann & Kraay, 2024). Taken together, these tools create a methodological foundation for analysing the coherence of macroeconomic policy as a multidimensional process. Measuring the degree of correspondence between WEF recommendations and changes in macroeconomic policy is an important methodological task, which necessitates the development of conceptual and methodological approaches for analysing the coherence of economic policy, which will reflect the dynamic connection between WEF normative guidelines and the corresponding macroeconomic transformations.

The conceptual basis of macroeconomic policy alignment (Macroeconomic Policy Alignment, MPA) is based on the methodology of constructing composite indices, which is carried out according to a specific algorithm (*Figure 2*).

Figure 2. Algorithm of the methodology for calculating composite indices to determine the consistency of macroeconomic policy

Source: developed by the authors.

The selection of macroeconomic dynamics indicators is governed by basic criteria such as conceptual compliance with WEF recommendations according to the relevant vector; availability of data for forming the factual basis of analysis; consistency of methodological approaches to calculation for the group of countries under study.

The Macroeconomic Policy Alignment Index (*MPAI*) is based on comparing the dynamics of selected indicators of a country's economic policy with the dynamics of the WEF's strategic recommendations, which will be determined as a weighted sum of normalized coefficients of compliance of macroeconomic dynamics along key vectors of transformation:

$$MPAIit = \sum_{j=1}^{n} w_j \cdot A(i,j,t) \quad , \tag{1}$$

where: *MPAIit* – consistency index of the macroeconomic policy of country *i* in period *t*;
n – number of transformation vectors;
j – transformation vector;
w_j – the weight of the vector, which is determined based on the content analysis of the WEF recommendations;
A(i,j,t) – the coefficient of consistency of the macroeconomic policy of country *i* along vector *j* in year *t*.

Accordingly, the consistency coefficient *Ai,j,t* for each macroeconomic transformation vector is calculated as:

$$Ai,j,t = \frac{\Delta Pi,j,t\ /\sigma j}{\Delta Rj,t/\ \sigma Rj}\quad , \tag{2}$$

where: $\Delta Pi,j,t$ – change of the economic policy indicator of country *i* in vector *j* between periods *t-1* and *t*; indicators are selected and, if necessary, inverted in such a way that their increase corresponds to a strengthening of consistency with WEF guidelines along vector *j*.
$\Delta Rj,t$ – change in the intensity of WEF benchmarks in vector *j* over the corresponding period (year), which is calculated through frequency content analysis of WEF key recommendations;
σj and *σRj* – the standard deviation of *ΔP(i,j,t)* across the entire studied set of countries for the entire analysed period; *σRj* – the standard deviation of *ΔR(j,t)* for the analysed time series, which ensures the comparability of the scales of changes between different vectors.

When *MPAIit* > 1 a leading correspondence is recorded; *MPAIit* = 1 – synchronous correspondence; *MPAIit* < 1 – partial correspondence: the country is developing in the outlined direction, but with less intensity; *A(i,j,t)* ≤ 0 – discrepancy: the dynamics of the country's indicator is opposite or neutral regarding the WEF benchmarks.

In cases where *ΔR(j,t)* = 0 (the intensity of WEF reference points along vector *j* has not changed in year *t*), the coefficient *A(i,j,t)* is excluded from the calculation with the corresponding weight adjustment.

Thus, the *MPAI* will reflect the extent to which economic policy changes are aligned with the respective vectors of transformation, recording their synchronicity, leading, lagging, or inconsistency.

The proposed methodological approach to assessing the consistency of macroeconomic policy allows linking WEF recommendations with the actual dynamics of indicators, providing comparison between countries and identifying the features of adaptation trajectories.

Conclusions

The systematization of conceptual approaches to the analysis of the WEF's influence on macroeconomic policy has proved that the theoretical foundation of the study is built at the intersection of the concepts of institutional isomorphism, spread policy, and varieties of capitalism. Unlike the IMF or the World Bank, the WEF primarily exerts normative, rather than coercive, influence through the formation of epistemic communities, the ranking of national economies, and soft power mechanisms.

Based on the results of the content analysis of WEF reports and analytical reports, a triad of key vectors of macroeconomic transformation has been identified: competitiveness, digitalization, and the energy transition. Their systemic interconnection has been established: digitalization increases productivity and competitiveness; the energy transition creates new competitive advantages and simultaneously requires institutional capacity to manage the transformation. A comparative analysis of the energy transition vector using the example of the Lublin Triangle countries revealed that Poland and Lithuania generally demonstrate an upward trajectory in ETI, while Ukraine shows a more volatile one, with a significant decline in 2023 caused by the destruction of energy infrastructure due to russia's armed aggression.

The scientific hypothesis underlying the study – that the WEF functions as an institution of global macroeconomic transformation, whose impact is differentiated depending on the vector of transformation and the institutional status of a country within the system of supranational associations – has been confirmed. In particular, it has been established that for candidate countries for EU membership, including Ukraine, the WEF recommendations acquire an enhanced transformational effect due to their conceptual alignment with the requirements of European integration in the areas of digitalization, energy transition, and institutional reforms. At the same time, the regulatory influence of the WEF remains secondary to euro-integration obligations and is implemented to the extent that it aligns with the formalized requirements of the EU.

The scientific novelty of the study lies in substantiating a conceptual approach to the quantitative assessment of the conformity of macroeconomic policy with WEF recommendations based on the author's Macroeconomic Policy Alignment Index (MPAI). The proposed index is defined as the weighted sum of normalized conformity coefficients for key transformation vectors and provides the possibility for comparative analysis of countries, as well as the identification of synchronicity, leading, or lagging of macroeconomic transformations relative to WEF regulatory guidelines.

As an unplanned additional result of the study, it was revealed that the WEF 2026 forum in Davos went beyond the traditional analytical-recommendatory mandate, becoming a platform for direct negotiations between the presidents of Ukraine and the United States, which attests to the transformation of the WEF's institutional functions under conditions of geopolitical instability. The results of blocking the Strait of Hormuz confirmed the fact of a systemic interdependence between geopolitical fragmentation and global energy integration. The UAE's exit from OPEC and OPEC+ is additional empirical evidence of the progressive institutional devaluation of traditional international mechanisms for coordinating energy markets.

The practical value of the obtained results lies in the possibility of their application by government authorities for monitoring the compliance of national macroeconomic policy with international standards; for substantiating the strategic priorities of reforms in the context of Ukraine's European integration course; and for increasing the efficiency of using WEF analytical tools in the process of developing and implementing post-war recovery programs.

The prospects for further scientific research are associated with the empirical testing of the proposed MPAI on a representative sample of countries, as well as with an in-depth study of the energy transition as an independent and priority vector of macroeconomic transformation in the context of Ukraine's post-war recovery and European integration.

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INSTITUTIONAL TRANSFORMATION OF PUBLIC-PRIVATE PARTNERSHIPS IN UKRAINE

Large-scale destruction of infrastructure capital and the growing need for its restoration in the context of the post-war transformation of Ukraine's economy have exacerbated the problem of limited budgetary resources and the declining effectiveness of traditional financing mechanisms for projects. The investment needs identified in the Fourth Rapid Damage and Needs Assessment (RDNA4) substantially exceed the capacities of budgetary and donor financing, which underscores the need to attract long-term private capital to Ukraine's green recovery process. In this context, the institutional transformation of the public-private partnership (PPP) model in Ukraine becomes decisive. The study is based on the assumption that the institutional changes enshrined in the new Law of Ukraine "On Public-Private Partnership" (2025) transform PPP from a quasi-off-budget instrument for financing individual projects into a managed mechanism for long-term investment, capable of simultaneously enhancing the fiscal sustainability of the state and attracting private capital to green infrastructure projects.

To verify this assumption, institutional-economic and reproduction approaches were applied, supplemented by a comparative analysis of the previous and updated regulatory PPP model and an analytical interpretation of sectoral recovery needs based on RDNA4 data. The results indicate that the institutional renewal of PPP is accompanied by a reduction in transaction costs, increased predictability of risk allocation,

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ІНСТИТУЦІЙНА ТРАНСФОРМАЦІЯ МОДЕЛІ ПУБЛІЧНО-ПРИВАТНОГО ПАРТНЕРСТВА В УКРАЇНІ

Масштабні руйнування інфраструктурного капіталу та зростання потреб у його відновленні в умовах повоєнної трансформації економіки України загострили проблему обмеженості бюджетних ресурсів та зниження ефективності традиційних механізмів фінансування проєктів. Зафіксовані у четвертій Спільній швидкій оцінці завданої шкоди та потреб на відновлення (RDNA4) обсяги інвестиційних потреб істотно перевищують можливості бюджетного й донорського фінансування, що актуалізує необхідність залучення довгострокового приватного капіталу до процесів зеленої відбудови України. У цьому контексті визначальною стає інституційна трансформація моделі публічно-приватного партнерства (ППП) в Україні. Дослідження ґрунтується на припущенні, що інституційні зміни, закріплені новим Законом України "Про публічно-приватне партнерство" (2025 р.) трансформують ППП з квазіпозабюджетного інструменту фінансування окремих проєктів на керований механізм довгострокового інвестування, здатний одночасно підвищувати фіскальну стійкість держави та забезпечувати залучення приватного капіталу до зелених інфраструктурних проєктів. Для перевірки зазначеного припущення застосовано інституційно-економічний та відтворювальний підходи, доповнені порівняльним аналізом попередньої й оновленої нормативної моделі ППП та аналітичною інтерпретацією секторальних потреб відновлення на основі даних RDNA4. Отримані результати свідчать, що інституційне оновлення ППП супроводжується зниженням транзакційних витрат, підвищенням передбачуваності розподілу ризиків, інтеграцією *integration of long-term commitments into the budget planning system, and a decrease in the cost of capital for infrastructure projects with long payback periods. Under such a configuration, PPP acquires significant potential for the structural modernization of Ukraine's economy and the implementation of green recovery objectives.*

Keywords: public-private partnership, institutional transformation, green recovery, infrastructure investment, fiscal sustainability.

довгострокових зобов'язань у систему бюджетного планування та зменшенням вартості капіталу для інфраструктурних проєктів з тривалим строком окупності. У такій конфігурації ППП набуває мультиплікативного потенціалу для структурної модернізації економіки України та реалізації цілей зеленої відбудови.

Ключові слова: публічно-приватне партнерство, інституційна трансформація, зелена відбудова, інфраструктурні інвестиції, фіскальна стійкість.

JEL Classification: M21, O10, Q32.

Introduction

Ukraine's post-war reconstruction will take place under conditions of sharply increasing investment demand for the restoration of infrastructure capital and, at the same time, severely constrained budgetary capacity. Estimates provided in the fourth Joint Rapid Damage and Needs Assessment (RDNA4) indicate that total recovery and reconstruction needs amount to USD 524 billion over the next decade, while the financing gap for 2025 alone remains substantial, underscoring the limits of direct budgetary and donor support and the need to mobilize long-term private capital. This structural mismatch between the scale of investment needs and the volume of available public resources reveals the limitations of traditional infrastructure financing models and objectively increases the importance of institutional mechanisms capable of attracting private investment into reconstruction processes. In this context, transforming the public-private partnership (PPP) model emerges as one of the key priorities of contemporary economic policy.

At the same time, previous experience with PPPs in Ukraine has demonstrated their limited effectiveness as an instrument for infrastructure development. These shortcomings stemmed not so much from a lack of private-sector interest as from high transaction costs, regulatory uncertainty, non-transparent risk allocation, and a tendency to generate hidden fiscal liabilities. Under such conditions, PPPs often functioned as a quasi-off-budget source of financing rather than as an instrument integrated into a coherent system of public investment and budgetary risk management (Kondratov, 2019; General Overview of Public-Private Partnership, n. d.).

In international academic discourse, PPPs have traditionally been examined from several conceptual perspectives. A substantial body of research considers PPPs as a mechanism for improving the efficiency of infrastructure projects through optimized risk allocation, lower life-cycle costs, and better-quality public services (OECD, n. d.; EIB, 2023). Another strand of scholarship focuses on the fiscal dimension of PPPs, emphasizing their implications for public debt, contingent liabilities, and macro-financial sustainability (Duarte et al., 2023, April 13; IMF – PPPs and PFRAM, n. d.). More recent studies link PPPs to the achievement of sustainable development objectives, treating them as a mechanism for mobilizing private capital for projects characterized by high upfront costs and long payback periods (UNECE, 2019, May; International Monetary Fund, 2022). At the same time, many studies analyze PPPs either at the level of individual projects or through the prism of contractual and financial arrangements, while their macroeconomic and reproduction-related dimensions remain insufficiently explored.

In Ukrainian scholarship, PPPs have been addressed primarily through legal analysis or as an auxiliary instrument of state budgetary and investment policy, with emphasis on the procedural aspects of project implementation, fiscal risks, and debt obligations (Kovbas, 2025; Krylova & Hlushchenko, 2025). However, the institutional transformation of PPPs as part of the economic model of post-war green reconstruction and as a mechanism for the reproduction of infrastructure capital has not yet received sufficiently systematic scholarly attention, particularly from the standpoint of reconciling investment feasibility with the constraints of fiscal sustainability and long-term budget planning (Havrysh et al., 2024; Venger & Kushnirenko, 2025).

Against this background, the central scholarly problem addressed in this article is to assess the economic substance of the institutional changes introduced by the new Law of Ukraine "On Public-Private Partnership" (2025, June 19) (hereinafter, the Law) and to determine their implications for scaling investment in the green reconstruction of transport, energy, and housing and communal infrastructure (Diachek, 2025).

The author's previous research examined the institutional preconditions for PPP development in Ukraine and the behavioral models of interaction between the state and the private sector in the implementation of infrastructure projects (Ilchenko, 2025). Its findings demonstrated that PPP effectiveness largely depends on the quality of the institutional environment and the mechanisms for risk sharing between partners. The adoption of the new Law creates fundamentally new conditions for the functioning of partnership mechanisms, which require further economic analysis of their effects on investment incentives and the scaling of infrastructure investment in the process of green reconstruction.

The aim of this research is to provide an economic rationale for the institutional transformation of the PPP model in Ukraine in the context of green recovery and to assess its effects on investment incentives, risk sharing, and fiscal sustainability in strategic sectors of the economy.

The research is based on the hypothesis that the institutional changes enshrined in the new legislation transform PPPs from an instrument that does not encompass the full life cycle of infrastructure assets into a managed long-term investment mechanism capable of combining private capital mobilization with control over fiscal effects.

This hypothesis is tested through a combination of institutional-economic and reproduction approaches, supplemented by a comparative analysis of the previous and updated PPP regulatory models and an analytical interpretation of sectoral recovery needs based on RDNA4 data. The empirical basis of the study consists of official materials produced by international financial institutions, regulatory acts, and statistical assessments of recovery needs. The study is limited by the aggregated character of the available data and by the lack of complete information on the practical implementation of the new PPP mechanisms.

The structure of the article reflects the logic of the analysis. The first section substantiates the economic rationale for the key institutional changes introduced by the new Law of Ukraine "On Public-Private Partnership" (2025, June 19). The second section examines their impact on fiscal mechanisms and the associated regulatory framework. The third section assesses the economic effects of the institutionally updated PPP model for the green reconstruction of key sectors of the Ukrainian economy on the basis of RDNA4 data.

1. The economic rationale for the key institutional changes introduced by Ukraine's new law "on public-private partnership"

The institutional changes enshrined in the new Law are systemic in economic nature and are intended to transform PPPs from a formally permissible method of attracting private capital into a full-fledged institutional and economic mechanism for long-term investment with manageable fiscal consequences. These changes are not merely isolated procedural improvements; rather, they reflect a shift in the approach to creating investment incentives for the private sector through the redistribution of infrastructure project risks and the clearer specification of the state's budgetary obligations.

The establishment of PPPs as a special legal regime has a clear economic rationale. By separating the procedures for the preparation, appraisal, and selection of PPP projects from general public procurement legislation, the new framework reduces institutional uncertainty, which in earlier practice led to duplication of regulatory requirements, delays in decision-making, and higher non-financial costs for private investors (UNCITRAL, 2020; Duarte et al., 2023, April 13).

From an economic perspective, such institutional unification helps lower entry barriers for private capital, shortens the pre-investment phase, and increases the predictability of competitive selection outcomes (Kim et al., 2020; Pavlenko & Kravchenko, 2022). Taken together, these effects reduce the regulatory risk premium in the capital structure, which is of fundamental importance for infrastructure projects characterized by high capital intensity and long payback periods. The economic effect of lower regulatory uncertainty is manifested not only in a qualitative improvement in the investment climate, but also in a measurable reduction in the cost of capital. For a typical infrastructure project valued at USD 1 billion with a

25-year concession period, a 1 percentage point reduction in the weighted average cost of capital (WACC) may reduce total discounted costs by approximately USD 120–150 million, which is equivalent to 12–15% of the initial investment.

One of the key institutional innovations of the new Law is the regulatory consolidation of requirements for the identification and allocation of risks at all stages of the PPP project life cycle. The economic logic of this approach is grounded in contract theory and assumes that each type of risk should be assigned to the party best able to manage it at the lowest total cost. The new Law substantially expands the list of forms of state support for PPPs while also changing their economic meaning. Availability payments, minimum revenue guarantees, and compensation mechanisms are interpreted not as subsidies to the private partner, but as instruments for correcting market failures in sectors of high social importance and limited solvent demand (IMF – PPPs and PFRAM, n. d.).

By reducing demand-related risks for private investors, smoothing cash flows over the implementation period, and improving the creditworthiness of project companies, this approach becomes economically justified. In this configuration, state support is aimed primarily at lowering the cost of capital rather than directly replacing private financing, which is consistent with the principles of fiscal prudence.

Another important institutional shift is the integration of PPPs into the system of budget planning and fiscal control. The mandatory approval of PPP projects by bodies responsible for budget policy, together with the introduction of accounting for long-term and contingent liabilities, changes the economic nature of PPPs from institutionally detached project financing into a component of the state's unified fiscal space.

By limiting the accumulation of hidden debt obligations, enabling assessment of the cumulative impact of PPPs on public finances, and strengthening the confidence of creditors and international financial institutions in the state's budgetary policy, these institutional arrangements reinforce the functional role of partnership mechanisms. Under such conditions, PPPs are transformed from a tool for postponing budget expenditure into a managed mechanism for long-term investment.

In international practice, lower regulatory uncertainty in infrastructure projects is associated with a 10–30% reduction in transaction costs and a 100–300 basis-point decline in the regulatory risk premium embedded in the cost of capital (Yescombe, 2018; Akomolehin, 2025).

In the context of green recovery, the institutional transformation of PPPs acquires an additional dimension associated with the integration of environmental and climate criteria into the financial logic of projects. Requirements related to energy efficiency, emissions reduction, and environmental sustainability affect both technical solutions and the structure of costs and revenues throughout the life cycle of infrastructure assets.

The transfer of part of environmental costs to the investment phase, combined with lower operating costs over the longer term, increases the overall social return on PPP projects. In this sense, PPPs should be viewed not as neutral financial instruments, but as mechanisms for aligning private investment incentives with the objectives of sustainable development and green reconstruction.

2. The strategic impact of Ukraine's new law "on public-private partnership"

The adoption of the new Law of Ukraine "On Public-Private Partnership" (2025, June 19) has systemic implications not only for the legal architecture of PPPs, but also for the economic logic governing the entire body of subordinate legislation and related regulations that support infrastructure investment. This is not merely a formal change in the hierarchy of legal acts, but a deeper restructuring of the mechanisms through which investment incentives, risk sharing, and fiscal responsibility are distributed between the state and the private sector. International experience suggests that contingent liabilities associated with PPPs can become a significant source of fiscal risk if they are not integrated into medium-term budget planning and properly monitored. In the Ukrainian context, these fiscal parameters require quantitative specification in light of the scale of the economy and existing debt constraints (International Monetary Fund, 2016; 2022). Against this background, a fiscally prudent PPP portfolio for Ukraine in the medium term may be estimated at approximately 1–1.5% of GDP, which is equivalent to about USD 2.5–4 billion in annual long-term budgetary liabilities without creating an excessive debt or deficit burden on the public finance system.

The new Law effectively reorients subordinate regulations from a fragmented set of autonomous and often poorly coordinated procedures into instruments for implementing a single economic model of partnership. The diminished role of outdated procedural rules, particularly in the areas of competitive selection and project preparation, means the elimination of regulatory duplication that previously generated additional transaction costs and created opportunities for regulatory arbitrage.

Such institutional recentralization reduces the administrative costs of PPP implementation, improves the predictability and uniformity of investment conditions across sectors, and minimizes the risk of delays caused by procedural conflicts. At the same time, it establishes a single institutional framework within which subordinate legislation performs a supporting function rather than independently defining the economic model of PPPs.

The strengthening of budget legislation and related by-laws, particularly with respect to accounting for long-term and contingent liabilities, the provision of state support, and the control of fiscal risks, fundamentally changes the economic status of PPPs. Subordinate acts cease to serve merely as instruments for individual projects and instead become part of a broader system for managing aggregate fiscal risks associated with partnership initiatives. The economic effect of this transformation lies in constraining institutionally detached project financing, increasing the transparency of the state's long-term and contingent liabilities, and creating opportunities to integrate PPPs into medium-term budget planning. In this context, budget-related by-laws acquire the status of instruments of macro-financial stability rather than remaining a purely technical appendage to investment projects.

Sector-specific regulations in transport, energy, housing and communal services, and social infrastructure also undergo an indirect but economically significant transformation. The new Law changes their functional role from detailed procedural regulation of interaction with private partners to the establishment of stable economic parameters for sectoral activity, including tariff policy, quality standards, and technical and environmental requirements. This creates a clearer distinction between regulatory and contractual logic, reduces the risks of discretionary interference in financial models, and strengthens investor confidence in the stability of sectoral conditions. Under this logic, sectoral legislation primarily performs the role of a framework economic regulator, while PPP contracts concentrate the financial and risk-related obligations of the parties.

An important economic consequence of these institutional changes is the transformation of the role of secondary legislation in shaping the cost of capital for PPP projects. Methodologies for assessing efficiency, risk, and budgetary impact remain relevant, but they are now embedded in a new institutional logic aimed at project bankability and the financing of infrastructure initiatives. For private investors and lenders, this reduces information asymmetry, improves the comparability of infrastructure projects, and lowers the institutional risk premium. Taken together, these effects indirectly influence the cost of debt financing, which is crucial for large-scale infrastructure and green projects with long payback horizons (World Bank, 2017; EIB, 2023).

In the context of green recovery, the strategic impact of the Law lies in the gradual reorientation of subordinate legislation and related regulations away from short-term budget savings and toward the generation of long-term social returns. This creates institutional preconditions for the implementation of projects characterized by high upfront costs but substantial environmental, social, and economic benefits. In economic terms, such a transformation enables the scaling-up of investment in green infrastructure, reduces pressure on current budgets, and increases the multiplier effects of public spending, as each hryvnia of public resources committed through an institutionally configured PPP mechanism generates a cumulative economic effect exceeding its nominal value. This should be understood not as a classic

Keynesian consumption multiplier, but as an investment and institutional scaling effect arising from the combination of budget support, private capital mobilization, lower financing costs, and the creation of long-term replicable outcomes in key sectors of the economy. Under these conditions, PPPs acquire strategic importance as a mechanism for reconciling fiscal sustainability with the objectives of long-term green reconstruction in Ukraine.

3. The economic impact of the institutional transformation of PPPs on the green recovery of key sectors of Ukraine's economy

The institutional transformation of the PPP model, as enshrined in the new Law, acquires practical economic significance above all in the context of post-war reconstruction. Its core function is to expand investment capacity beyond the limits of budget financing, reduce the cost of capital, and redistribute financial and operational risks across the sectors with the greatest recovery needs.

The scale of recovery and reconstruction needs in Ukraine, estimated at approximately USD 524 billion, objectively necessitates the use of PPPs as an economic mechanism for mobilizing long-term private capital for infrastructure and green projects, given the substantial constraints facing public finances (World Bank, 2025).

To illustrate the investment effect of institutionally updated PPP mechanisms, it is useful to employ a simplified analytical representation of investment leverage:

$$I_{tot} = B \cdot L,$$

where: I_{tot} denotes the total investment mobilized through PPP mechanisms;
B denotes the volume of the government's budgetary commitments;
L denotes the investment leverage ratio, reflecting the relationship between private and public resources.

According to the World Bank and the OECD (World Bank Group, 2024; OECD, 2018), private financing in infrastructure PPP projects typically accounts for approximately 70–85% of total investment, corresponding to an investment leverage ratio of roughly 3–5, depending on the sector, risk profile, and quality of the institutional environment. If budgetary commitments amount to 2% of GDP and the leverage ratio equals 4, the cumulative investment effect reaches 8% of GDP, which is comparable to annual gross fixed capital formation in the pre-war period. Under a leverage ratio of 1:4, even a relatively limited public contribution of USD 10 billion through PPP mechanisms could mobilize up to USD 40 billion in total investment, potentially covering more than half of the transport sector's needs, about 60% of the energy sector's needs, or nearly half of the needs of the housing and communal services sector, depending on sectoral prioritization.

The *Table* below presents the sectoral distribution of the expected economic effects of PPPs during Ukraine's post-war reconstruction.

Table

The economic impact of the institutional transformation of PPPs on the green recovery of Ukraine's key sectors

Sector	Estimated recovery needs (RDNA4), USD billion	The role and impact of PPPs	Expected economic results
Transport infrastructure	78	Attracting long-term private capital to rehabilitate roads, bridges, ports, and railways; using concessions and life-cycle contracts; redistributing construction and operational risks	Reduction of budget burden; improvement of infrastructure quality; reduction of logistics costs; growth of transit and export potential
Energy	68	Implementing projects to restore generation, grids, and energy storage systems through partnership models; increasing the investment attractiveness of decentralized and green solutions	Increase in energy sustainability; reduction of import dependence; reduction of system losses; stabilization of tariff burden in the medium term
Housing and communal infrastructure	84	Using PPPs to rebuild and modernize housing, heating, and water supply systems; introducing long-term payment mechanisms and energy efficiency standards	Acceleration of housing stock recovery; reduction of socio-economic risks; improvement of energy efficiency and quality of life; multiplier effect for local economies

Source: Compiled by the author based on (World Bank, 2025; UNDP, 2025).

The data presented indicate that in each of the key reconstruction sectors, PPPs perform distinct but economically complementary functions. In the transport sector, the principal effect is associated with greater efficiency in the use of capital and lower logistics costs, which directly influence export competitiveness and Ukraine's integration into international logistics chains. In the energy sector, PPPs serve as an instrument for reducing systemic risks and increasing the resilience of the energy system, thereby generating macroeconomic effects through lower losses from shortages and supply instability. In the housing and communal services sector, partnership models make it possible to combine social objectives with economic rationality, distribute investment costs over time, and reduce fiscal pressure on budgets at different levels. Overall, the institutional transformation of PPPs, aligned with the scale of needs identified in RDNA4, creates an economically grounded mechanism for shifting from one-off budgetary decisions toward systemic investment in green reconstruction.

International experience with infrastructure PPPs suggests that institutionally robust partnership models can achieve investment leverage ratios of 1:3 to 1:5, meaning that each unit of public resources can mobilize 3–5 units of total investment. In this sense, PPPs become integrated into the system of post-war economic policy as a structurally formative mechanism rather than merely an auxiliary financing instrument.

Conclusions

The institutional transformation of the PPP model enshrined in the new Law of Ukraine "On Public-Private Partnership" (2025, June 19) reflects a transition from the episodic use of PPPs as formally permissible instruments to their recognition as a systemic mechanism for long-term investment and risk management in the process of post-war green reconstruction. The key result of this transformation is a change in the economic logic of PPPs – from an emphasis on minimizing current budget expenditures to the establishment of a managed model for attracting private capital with predictable fiscal consequences. Clarifying the fiscal parameters of PPP implementation makes it possible to treat PPPs as an instrument of managed investment policy: in the medium term, a fiscally prudent PPP portfolio for Ukraine may be estimated at 1–1.5% of GDP, allowing investment to scale up without generating excessive contingent liabilities or undermining debt sustainability.

The analysis demonstrates that the institutional transformation of the PPP model reduces not only transaction costs but also the cost of capital. For typical infrastructure projects, this may translate into a 12–15% reduction in discounted costs if the weighted average cost of capital (WACC) declines by 1 percentage point. At the same time, these changes improve the transparency of risk allocation and strengthen budgetary discipline by integrating partnership projects into the state's unified fiscal space. Under such conditions, PPPs cease to function as a form of institutionally detached extra-budgetary financing and acquire the features of a full-fledged instrument of economic development policy aligned with medium-term budget planning. On the basis of World Bank data (2025), the article substantiates that the scale of reconstruction needs in transport, energy, and housing and communal infrastructure significantly exceeds the capacity of direct budget financing. A more precise specification of the fiscal parameters of PPP use makes it possible to identify a fiscally safe range for its application. Within this range, Ukraine's medium-term PPP portfolio may amount to 1–1.5% of GDP, equivalent to approximately USD 2.5–4 billion in annual long-term budgetary liabilities, without imposing an excessive debt or deficit burden on the public finance sector. In such a configuration, PPPs function not as a source of hidden obligations, but as a tool for the managed mobilization of investment resources.

The sectoral analysis confirms that institutionally updated PPP mechanisms generate an investment-fiscal multiplier, whereby each unit of public commitment can mobilize 3–5 units of aggregate investment. This is of critical importance for scaling the green reconstruction of transport, energy, and housing and communal infrastructure without imposing excessive pressure on current budgets. In the medium and long term, this creates preconditions for expanding potential GDP by increasing the productivity of infrastructure capital, improving the logistics and energy efficiency of the economy, and strengthening the state's fiscal sustainability. Under conditions of an institutionally coordinated and fiscally controlled partnership model, PPPs move beyond the realm of institutional experimentation and become a macroeconomic mechanism for managing the reproduction of infrastructure capital in the context of post-war green reconstruction, thereby confirming the hypothesis advanced in this study.

Overall, the institutional transformation of PPPs creates the preconditions for a transition from one-off recovery measures to a reproducible model of green reconstruction in which private investment is integrated into the state's strategic objectives. This makes it possible to view PPPs not only as a tool for implementing individual projects, but also as an important component of a new post-war economic development model for Ukraine.

Further research should focus on the quantitative assessment of the macroeconomic effects of PPPs in the reconstruction process, particularly their impact on economic growth, employment, investment dynamics, and environmental outcomes, as well as on the analysis of practical experience in implementing partnership projects across specific sectors and regions.

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PLACE BRANDING WITHIN THE WELLNESS ECONOMY

The article explores the transformation of territorial wellness assets into a strategic resource amid intensifying global competition for tourism, investment, and human capital. The relevance of the study is driven by the ongoing transformation of the modern economy, characterized by the growing importance of quality of life, well-being, and sustainable development, necessitating a rethinking of traditional approaches to place branding. The wellness economy is examined as a new strategic resource capable of shaping a territory's value-oriented image and enhancing its competitiveness. The research hypothesis posits that the integration of wellness economy principles into place branding fosters the growth of territorial brand strength by shaping a value-oriented image, strengthening emotional engagement with stakeholders, and enhancing the multidimensional competitiveness of the territory. The paper highlights the role of

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ТЕРИТОРІАЛЬНИЙ БРЕНДИНГ У СИСТЕМІ ВЕЛНЕС-ЕКОНОМІКИ

Досліджено проблему перетворення територіальних велнес-активів на стратегічний ресурс в умовах зростання глобальної конкуренції за туристичні, інвестиційні та людські ресурси. Актуальність дослідження пов'язана з трансформацією сучасної економіки у напрямі підвищення ролі якості життя, добробуту та сталого розвитку, що потребує переосмислення традиційних підходів до територіального брендингу. Велнес-економіку розглянуто як новий стратегічний ресурс, здатний впливати на формування ціннісно орієнтованого образу території та підвищення її конкуренто-спроможності. Висунуто гіпотезу, що інтеграція принципів велнес-економіки у брендинг територій забезпечує зростання сили територіального бренду завдяки формуванню ціннісно орієнтованого образу, посиленню емоційної взаємодії зі стейкголдерами та підвищенню багатовимірної конкурентоспроможності території. Розкрито роль велнес-економіки у *the wellness economy in shaping the competitive identity of territories. It is argued that a wellness-oriented approach ensures a hierarchical logic in the formation of a territorial brand's value proposition, enabling territorial competitiveness to be interpreted as a derivative of the depth and consistency of its brand value. The essence and determinants of territorial brand strength are defined. The methodological framework of the study includes place branding concepts, brand equity theory, approaches to assessing territorial competitiveness, as well as systemic and causal approaches to modeling the relationships between wellness economy development and territorial brand strength. The hypothesis was empirically tested based on an analysis of countries with varying levels of wellness economy development and through an assessment of an integral indicator of territorial brand strength. The results confirm that countries with a more developed wellness economy demonstrate higher levels of place brand strength. It is shown that place brand strength is formed as an integrated effect of the interaction between the functional, emotional, and symbolic characteristics of a territory.*

Keywords: place competitiveness, strategic orientations, value proposition, brand strength, intangible assets.

формуванні конкурентної ідентичності територій. Обґрунтовано, що велнес-орієнтований підхід забезпечує ієрархічну логіку формування ціннісної пропозиції територіального бренду, що дозволяє інтерпретувати конкурентоспроможність території як похідну від глибини та узгодженості її брендової цінності. Визначено сутність та детермінанти сили територіального бренду. Методологічну основу дослідження становлять концепції територіального брендингу, теорії бренд-капіталу, підходи до оцінювання конкурентоспроможності територій, а також системний і каузальний підходи до моделювання взаємозв'язків між розвитком велнес-економіки та силою територіального бренду. Емпірична перевірка гіпотези здійснена на основі аналізу країн з різним рівнем розвитку велнес-економіки та оцінювання інтегрального показника сили територіального бренду. Отримані результати підтвердили, що країни з більш розвиненою велнес-економікою демонструють вищі значення сили територіального бренду. Доведено, що сила територіального бренду формується як інтегральний ефект взаємодії функціональних, емоційних та символічних характеристик території.

Ключові слова: конкурентоспроможність територій, стратегічні орієнтири, ціннісна пропозиція, сила бренду, нематеріальні активи.

JEL Classification: I12, I31, M31, O18.

Introduction

In the contemporary context of global economic transformation and intensifying competition among territories for resources, investment, and human capital, the role of intangible factors in shaping competitiveness is increasing. The wellness economy is emerging as one of these key factors, as the growing demand for quality of life, health, and well-being is shifting consumer priorities from material consumption toward investment in one's psychophysiological state. This enables us to consider the transformation of territorial wellness assets into a strategic resource and a foundation for generating high-value-added regional products.

The complexity of the wellness economy determines the multi-vector nature of its scientific investigation, which stems from the intersectoral character of wellness-related industries and their integration into various spheres of social life. Since the wellness economy encompasses individuals' physical, mental, social, and environmental well-being, no single dominant approach to its study exists in the scientific literature. Particularly valuable in this regard is the study by Putrevu and Mertzanis (2025), which analyzes 407 Scopus-indexed publications in the field of wellness. Based on this analysis, the authors propose a classification of wellness research, grouping it into five broad thematic areas: corporate wellness, digital health, wellness tourism, public policy, and functional medicine. On the one hand, this classification consolidates fragmented research and facilitates the identification of general trends and interdisciplinary relationships. On the other hand, it highlights critical research gaps and helps bridge the divide between wellness studies and public policy.

Consequently, research directions are often formed around specific sectors of the wellness economy, with a significant number of studies focusing on individual components such as wellness tourism, healthy eating, physical activity, mental health, sustainable lifestyles, and quality of life. For instance, according to Semantic Scholar (n. d. a), more than 17 million publications directly or indirectly relate to wellness tourism. Current research trends in this field are systematized by Martins et al. (2025), who demonstrate that wellness tourism is becoming one of the most dynamic sectors of the wellness economy, influencing destination image, shaping the emotional perception of territories, and serving as a tool for destination differentiation. Their findings suggest that wellness tourism is no longer limited to spa services or recreation but is evolving into a broader concept of wellbeing-oriented travel associated with physical and mental recovery, holistic well-being, mindfulness, sustainable lifestyles, emotional experiences, and enhanced quality of life.

Research on other components of the wellness economy is also extensive: healthy eating and nutrition are covered in more than 2.6 million publications, physical activity in over 15 million, mental well-being in more than 18 million, sustainable lifestyles in nearly 4 million, and quality of life in about 4 million studies (Semantic Scholar, n. d. b). These figures indicate the existence of distinct, relatively autonomous, yet globally significant areas of research.

Furthermore, the scientific literature emphasizes the importance of distinguishing between the concepts of *well-being economics* and the *wellbeing economy* (McCartney et al., 2025). While well-being economics primarily focuses on measuring subjective well-being and happiness, the wellbeing economy represents a broader transformation of the economic system aimed at achieving social, environmental, and human well-being. In this context, traditional macroeconomic indicators–particularly GDP – are increasingly criticized for their inability to adequately reflect the true quality of life of the population. Accordingly, scholars are exploring new approaches to assessing economic development, including the clustering of countries based on development patterns influenced by digitalization. For example, Al-Ababneh et al. (2022) propose a conceptual model of sustainable economic development that integrates political, social, economic, and environmental dimensions under the influence of the global macroenvironment.

At the same time, despite its large-scale impact, the wellness economy remains relatively underexplored. As noted by Crisp et al. (2024), there are currently almost no precedents for the comprehensive implementation of systemic policies that fully reflect the concept of a wellbeing economy. As a result, the assessment of its cumulative effects is characterized by a high level of uncertainty.

Sectoral fragmentation is also evident in Ukrainian scholarship. The majority of studies focus on wellness tourism, sanatorium and resort activities, and the hospitality sector (e.g., Boiko, 2025; Parfinenko, 2023; Sylchuk et al., 2023), while significantly less attention is devoted to other components, such as wellness infrastructure or wellness branding.

Within the field of place branding, Cristófol et al. (2024) highlight the social role of place brands under conditions of globalization and territorial competition, viewing them as tools for sustainable development, social integration, and stakeholder engagement. However, most contemporary research primarily addresses tourism branding, city branding, destination marketing, and smart cities, whereas the integration of the wellness economy into the formation of place brand strength remains insufficiently explored.

Therefore, the literature review indicates that despite the growing body of research on the wellbeing economy, wellness tourism, healthy cities, and quality-of-life approaches, comprehensive studies on integrating the wellness economy into place branding and assessing its impact on place brand strength and territorial competitiveness are virtually absent. Existing research in this area remains fragmented and tends to focus on specific domains such as wellness tourism, healthy cities, quality-of-life branding, or sustainable urban development.

This gap underscores the need to develop a wellness-oriented approach to place branding, in which wellness is viewed not merely as a sector of the economy, but as a strategic factor in shaping the reputational, emotional, and symbolic capital of a territory.

The aim of the article is to develop theoretical and methodological foundations for integrating the principles of the wellness economy into place branding and to assess their impact on shaping the competitiveness of territorial brands.

To achieve this aim, the following tasks have been defined:

- to clarify the essence of the wellness economy as a strategic resource and determine its role in the transformation of place branding;
- to substantiate a wellness-oriented approach to shaping a territorial brand.

The research hypothesis is based on the assumption that the integration of wellness economy principles into place branding ensures an increase in brand strength by forming a value-oriented image of the territory, enhancing emotional interaction with target audiences, and strengthening the multidimensional competitiveness of the territory.

Testing the hypothesis involves: an analysis of development trends in the wellness economy and the transformation of contemporary consumer values using comparative and trend analysis methods to identify the growing role of wellbeing, quality of life, and wellness-oriented consumption in the global environment; determining the relationship between the development of the wellness economy and the brand value of countries using correlation analysis; identifying the features of integrating wellness principles into place branding using methods of theoretical generalization and systematization to form a hierarchical model of the value proposition of a wellness-oriented territorial brand; clarifying the essence of place brand strength using structural-functional analysis to isolate the components of a territory's brand strength; as well as substantiating a causal model of place brand strength formation using economic-mathematical modelling to determine the direct and indirect impact of the wellness economy on the competitive identity and brand of a territory.

The information base of the research consists of statistical data and analytical reports from the World Bank Group, the World Economic Forum, and the Global Wellness Institute, as well as scientific works by Ukrainian and foreign scholars on the relevant topic.

Structurally, the article consists of two sections: the first of which reveals the conceptual foundations of integrating wellness into place branding, while the second presents a theoretical comprehension of place brand strength and modelling its formation under the influence of wellness.

1. Wellness in the capital of place brands

1.1. Wellness as a social and economic phenomenon of modernity

The significance of wellness in economic life began to grow in 2000 (Gülenç & Saraç, 2026), when it started to transform from a narrow concept associated primarily with a healthy lifestyle into a large-scale social and economic driver determining new consumption models, behavioural practices, and societal development priorities. The growing role of wellness is driven by a complex of global transformations, including urbanization, digitalization, shifts in employment structures, the accelerating pace of life, population aging, the aftermath of the COVID-19 pandemic, as well as increased attention to mental health, environmental sustainability, and quality of life. As a result, human well-being is increasingly viewed not merely as a medical or psychological category, but as an integral indicator of socio-economic development.

According to the approach of the Global Wellness Institute (Johnston, 2026), wellness is defined as the active pursuit of activities, choices, and lifestyles that lead to a state of holistic health. In contrast to the traditional approach, which focuses primarily on treating illnesses, the concept of wellness is based on a preventive model that involves maintaining an individual's physical, mental, emotional, and social well-being. This is why wellness encompasses a significantly broader range of fields – from healthcare, nutrition, and physical activity to the ecological environment, urban wellness, workplace wellness, psychological comfort, and a sustainable lifestyle.

A special role in shaping the contemporary vision of wellness is played by the concept of the wellness economy, which the Global Wellness Institute (Johnston, 2026) interprets as a collection of economic sectors that enable consumers to integrate wellness practices and healthy lifestyles into their daily lives. The structure of the wellness economy covers a wide range of interconnected sectors, including wellness tourism, healthy eating, physical activity, public health, wellness real estate, mental wellness, spa economy, thermal and mineral springs, workplace wellness, personal care and beauty, as well as traditional and complementary medicine. At the same time, the contemporary significance of wellness goes far beyond individual sectors of the economy, as it is increasingly integrated into the system of social values, behavioural models, and socio-economic development strategies.

In fact, wellness is emerging as a new social paradigm within which human well-being is transformed into a key value of economic development. This is manifested in the transformation of consumer priorities: growing demand for eco-friendly products, organic food, wellness tourism, digital services for mental health support, the fitness industry, green urban spaces, and lifestyle-oriented consumption. Different hypotheses exist regarding the factors contributing to the expansion of the wellness sector; for the most part, it is explained by anomie, prevalent in Western capitalist cultures, the fading of traditional beliefs, and societal fragmentation (Smith & Kelly, 2006). The rising attention to wellness is also explained by increased consumer awareness, technological innovations, and the general transition of society toward the concept of holistic well-being (Gülenç & Saraç, 2026).

Research by the Global Wellness Institute (Johnston, 2025) demonstrates that the global wellness economy is one of the most dynamic components of the world economy. Its volume has reached USD 6.8 trillion and continues to grow, encompassing a wide range of areas – from tourism and real estate to corporate wellness programs. In terms of scale, the wellness economy already exceeds many traditional industries, including sports, pharmaceuticals, and certain segments of the tourism industry. The fact that its volume is so much larger than the global green economy testifies to the scale and strategic significance of wellness-oriented sectors in the structure of the modern economy (*Figure 1*).

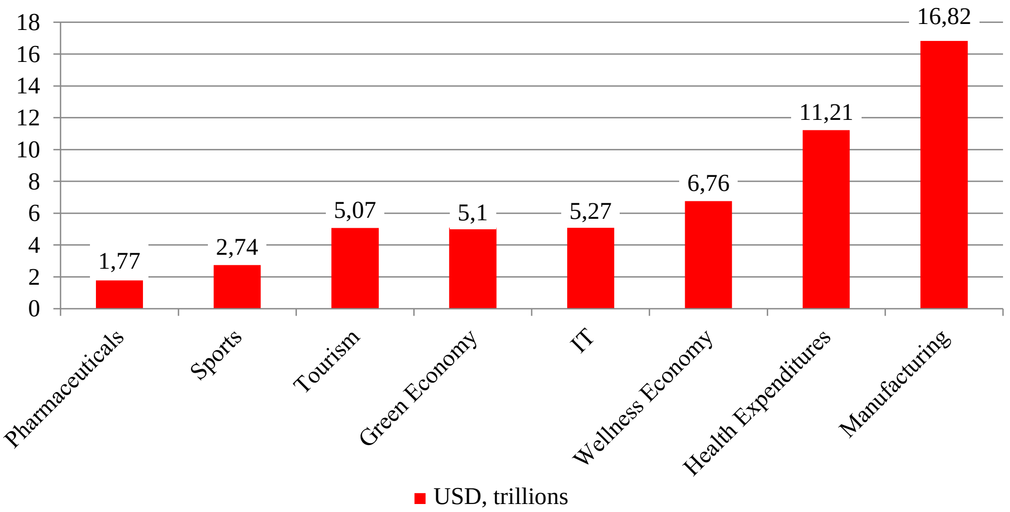

Figure 1. Global wellness economy versus other major industries, market size in 2024

Source: (Johnston, 2025).

Moreover, by 2027, the global wellness economy is expected to account for 6.6% of global GDP, compared to 5,6% in 2022 (Gülenç & Saraç, 2026).

Significantly, wellness is increasingly influencing the development of global consumer markets. In particular, current trends in the field of healthy eating demonstrate a reorientation of manufacturers toward clean label concepts, the reduction of sugar, salt, and saturated fats, as well as increased transparency regarding product composition. According to a study (Euromonitor, 2025), in 2025, one of the key trends is the formation of "healthy eating" as a long-term consumption model rather than a short-term lifestyle trend. Stricter regulatory requirements for ultra-processed foods, the use of the term "natural," and the evidence base for health claims further stimulate manufacturers to reformulate products and focus on transparency and consumer trust.

As a result, wellness is gradually integrating into public policy, urban planning, the healthcare system, tourism, place marketing, and corporate strategies. Contemporary cities compete not only on the level of economic development but also on the quality of public spaces, environmental sustainability, accessibility of recreational infrastructure, the level of psychological comfort, and opportunities for maintaining a work-life balance. For instance, in EU countries, the development of grassroots sports has become one of the most important priorities of social development. At the level of local government in European cities, mass events are held to promote sports among citizens (Borodin & Makashov, 2020).

Importantly, the development of the wellness economy is accompanied by the formation of an appropriate infrastructure that ensures the realization of wellness-oriented consumption models and lifestyles. The core components of the wellness industry include natural resources, balneological and SPA complexes, wellness hotels, health facilities, fitness centres, yoga studios, sports grounds, massage parlours, beauty salons, salt caves, recreational areas, parks, natural landmarks, and healthy eating establishments (Lukianets & Antoniuk, 2023). It is precisely the complexity of such infrastructure that forms the basis for the development of wellness-oriented territories and the creation of a corresponding environment of well-being.

Consequently, wellness transcends the boundaries of the health industry and encompasses the transformation of consumption models, territorial development, international competitiveness, and the system of social values. Under such conditions, it becomes one of the key factors in forming a new economy oriented toward quality of life, human well-being, and sustainable development.

1.2. The role of the wellness economy in shaping the competitive identity of territories

Place branding is viewed as a multifactorial subsystem, the structure of which is formed through a combination of socio-political, cultural-ideological, and economic components. The formation of the socio-political component is a complex process of interaction between central executive authorities and local self-government bodies, aimed at creating an institutional and infrastructural environment that ensures a favourable investment climate, the development of a tourist destination, and an increase in the population's quality of life. The cultural-ideological component is realized through the personification of the territory's uniqueness, its historical heritage, cultural codes, traditions, and symbols. The economic component reflects the specialization of the territory, its competitive advantages, development trends, and strategic guidelines for economic growth (Biliavskyi, 2019). However, the intensification of global competition between territories drives the transformation of the very essence of place branding. While previously territories competed mainly based on resource potential, geographical location, or infrastructure, today intangible characteristics gain key importance: lifestyle, safety, environmental friendliness, emotional attractiveness, and the capacity of a territory to form a positive experience of interaction with target audiences. In this context, a place brand is increasingly linked to the concept of "soft power", which is understood as the ability of a state or territory to achieve desired outcomes through the attractiveness of its culture, values, lifestyle, and policies, rather than through coercion or economic pressure (Nye, 2004). Examples of the implementation of "soft power" include the spread of American mass culture, the German educational model, Japanese animation, and European democratic values. In the context of place branding, "soft power" is transformed into the ability of a territory to shape a positive international image, attract tourists, investors, and talent, and create stable emotional associations with a certain lifestyle. That is why the strategic guidelines of place branding rely increasingly not only on promoting the territory as a place for conducting business or tourism, but also on forming a value-oriented image of the territory. In this context, it is appropriate to consider a place brand as an integrated system of symbolic, reputational, cultural, and social assets that form a unique value proposition of the territory. Unlike material resources, intangible assets possess a complex reputational and emotional nature, and their value is formed through the perception of target audiences. They cannot be quickly copied by competitors, which makes them the strategic foundation for the long-term competitiveness of a territory.

Since various entities act as segments of place branding – such as countries, cities, regions, nature reserves, parks, tourist sites, and other territories – their branding can differ. The most widespread approach to researching the image of countries is the analysis of competitive identity (Anholt, 2005, May), according to which a national brand is formed through six interconnected dimensions: tourism, exports, governance, investment and immigration, culture and heritage, and people. At the same time, for city brands, this methodology is adapted and takes into account the city's international reputation, quality of life for residents, attractiveness to tourists, business and investment opportunities, cultural offering, as well as educational and innovative potential. Regarding regions, the works of

(Biliavskyi, 2019; Kapuza, 2025) generalize branding models of territories at this level based on indicators such as natural resources, an iconic figure, an infrastructural structure, a major event, and the specialization of the region.

Despite the differences in approaches to branding different types of territories, contemporary trends indicate the emergence of a common vector in their development, associated with the actualization of the values of well-being, quality of life, and human-centricity. Regardless of whether it concerns a country, city, region, or tourist destination, the competitiveness of a place brand is increasingly determined not merely by the presence of resources or infrastructure, but by the territory's capacity to provide a comfortable, safe, and harmonious environment for living, working, recreation, and self-realization. As a result, wellness is gradually integrating into various levels of place branding: at the country level – through the formation of an international image as a quality-of-life destination; at the city level – through the development of urban wellness, environmental friendliness, and the comfort of urban space; at the regional level – through the utilization of the natural-recreational, health-improving, and cultural potential of the territory. Accordingly, in our view, it is entirely justified to speak of the appropriateness of distinguishing a wellness model capable of converting passive natural and infrastructural resources into active reputational capital. While traditional models focus primarily on objects of attraction, the wellness model concentrates on human states – physical and mental well-being, safety, harmony, and life balance, which have acquired the status of key societal priorities after 2020 (OECD, 2021).

In fact, the wellness economy shapes a value-oriented image of a territory by creating stable associations with a high quality of life, physical and mental well-being, environmental friendliness, safety, and a harmonious lifestyle. In scientific literature, a place brand is also considered a tool for forming positive associations and the competitive identity of a territory (Logar, 2025). Analytical tools, including surveys, focus groups, sociological research, and the analysis of digital communications, allow for the determination of which characteristics of a territory are most significant for different target audiences (Boguslavska et al., 2024). At the same time, the wellness characteristics of a territory are acquiring ever-greater significance. For tourists, safety, environmental friendliness, and wellness infrastructure may be decisive; for investors, the quality of human capital and the comfort of the urban environment; for digital nomads, the balance between the cost of living, psychological comfort, and opportunities for self-realization. Within modern place branding, a territory competes not only for resources or investment, but also for symbolic value, emotional perception, and the capacity to respond to new social demands of society. This is precisely why the wellness economy becomes an important factor in differentiating territories within the global competitive environment and reinforcing their "soft power".

Indicative in this context are the results of international rankings of place brands. For instance, at the national level, the Brand Finance ranking (Brand Finance, 2025) demonstrates that the United States in 2025 continued to hold the position of the world's most valuable national brand due to a combination of economic power, high innovativeness, consumer activity, and global cultural influence. Meanwhile, Spain rose from 12th to 10th place, demonstrating brand development largely due to strong positions in tourism, healthcare, the service sector, and a comfortable lifestyle – that is, those components that directly form the wellness image of a territory. In other words, alongside economic characteristics, a territory's brand begins to be associated with well-being, life balance, environmental responsibility, and human care. This is most noticeably manifested in the field of wellness tourism, which increasingly acts as a tool for the international positioning of territories. Thus, Thailand consistently occupies high ranks in the "Destination I Would Like to Visit" category and is associated with hospitality, health improvement, and wellness recreation. Bali systematically figures among global leaders according to the criteria of "Outdoor Activities" and "Mindfulness", which shapes its brand as the "Island of the Gods" and a global centre for spiritual renewal (Indotravelteam, 2018). The most popular countries for medical tourism among international patients are Israel, Germany, Turkey, and South Korea (Stenka & Chestneysha, 2023). This indicates that the quality of medical services, the development level of wellness infrastructure, and the reputation of the healthcare system are becoming important elements of the international competitiveness of territories. Furthermore, wellness is being integrated ever more actively into urban environment development and urban branding. For example, London topped the rankings of the world's best cities for the eleventh consecutive year due to a combination of economic prosperity, liveability, and global attractiveness. The development strategy of this city is focused on creating a "fairer, safer, and greener" urban environment, with environmental sustainability and achieving net-zero carbon emissions as priorities. Another example is Singapore, which demonstrates the effective integration of environmental policy and urban wellness into its place brand. Over 40% of the city's territory is occupied by green zones, the Park Connector Network is actively developing, and vertical gardens and ecological urban solutions are being implemented (World's Best Cities Report, 2026). On the one hand, this enhances liveability, and on the other, it shapes Singapore's international image as an innovative, safe, and ecologically oriented city. Famous resorts of Ukraine that utilize the healing properties of mineral waters, such as Truskavets, Myrhorod, Khmilnyk, and Morshyn, can also serve as examples of wellness-oriented city branding (Zavadynska, 2021).

The aforementioned emphasizes that the wellness economy performs a significantly broader function than a single economic sector. It acts as the strategic value core of a territory's brand, integrating characteristics of quality of life, health, safety, environmental friendliness, and well-being into the system of international territorial positioning. The development of wellness sectors positively influences tourist and investment attractiveness, social well-being, the territory's reputation, and the quality of human capital, and therefore reinforces its multidimensional competitiveness.

1.3. Wellness-oriented approach to place brand formation

The integration of wellness economy principles into place branding is based on the assumption of its cross-cutting impact on shaping the value of a territorial brand by improving the quality of life, increasing the attractiveness of the territory, and forming positive associations among target audiences. Accordingly, the study proposes to consider the wellness economy as an integrative factor that modifies all dimensions of a place brand, reinforcing its perception and competitive positions.

Further research focuses on the national dimension of place brands. To confirm the influence of wellness on national brands, an evaluation of the relationship between the development of the wellness economy and the brand value of countries was conducted using Pearson correlation analysis in the Microsoft Excel environment. The countries for the analysis were selected based on the highest brand value. GDP was also chosen among the control variables to ensure that wellness truly impacts the country's brand rather than being merely a consequence of general economic development.

The results of the analysis revealed a very strong direct relationship between the volume of the wellness market and a country's brand value (*Table 1*, *Figure 2*).

Table 1

Correlation matrix of wellness economy indicators

Country	Wellness market, USD billion	Brand value, USD billion	GDP, USD billion	Travel & Tourism development Index, score	Quality of life index	Investment in brands, USD billion
United States	2140.39	32271.14	29.3	5.24	174	565.1
China	950.19	19960.02	19.16	4.94	116.4	115.56
Germany	281.38	4985.35	4.67	5	176.5	87.7
United Kingdom	261.19	4036.79	1.1	4.96	160.3	124.5
Japan	262.44	4406.09	4.19	5.09	177.6	107.9
France	210.85	3522.36	3.16	5.07	152	66.2
India	180.14	2944.48	6.4	4.25	111.8	n.d.
Canada	159.16	2670.82	1.97	4.81	150.2	n.d.
Italy	140.64	2326.27	2.35	4.9	139.1	52.9
Spain	106.17	2200.00	1.73	5.18	176.5	41.7
Correlation with national brand value	0.986	–	0.986	0.357	0.024	0.884

Source: calculated by the authors based on (Brand Finance, 2025; Johnston, 2026; Euromonitor International, 2025; Numbeo, 2024; World Bank Group, n. d. a; World Economic Forum Travel & Tourism Development Index, 2024; WIPO, 2025).

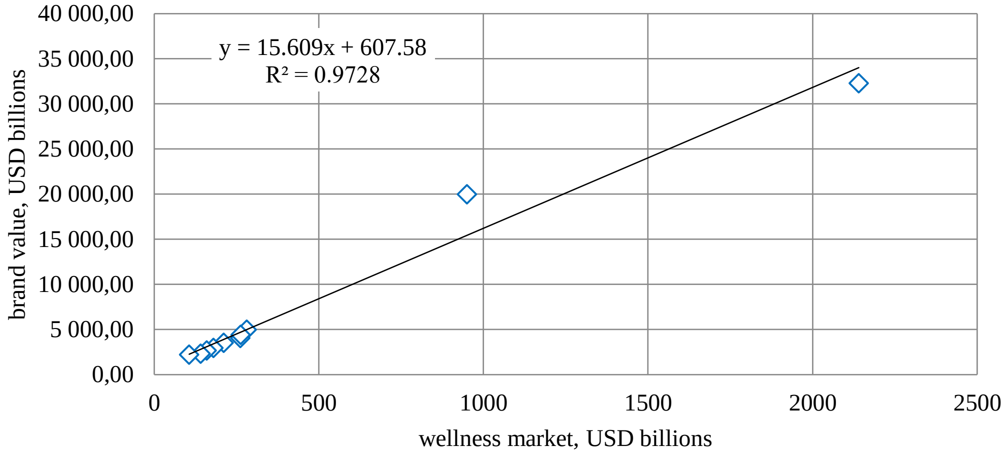

Figure 2. Correlation field of wellness economy indicators

Source: built by the authors in Microsoft Excel based on data from *Table 1*.

This allows for the assertion that countries with a large wellness market have a significantly higher national brand value; that is, the more developed a country's wellness economy is, the stronger its national brand. Moreover, the strength of the identified relationship exceeds the correlation of brand value with tourist attractiveness and the quality of life index, which confirms the transformation of wellness from a narrow economic sector into a comprehensive tool for contemporary place branding.

At the same time, establishing a statistical relationship does not in itself explain the mechanisms of place brand value formation under the influence of the wellness economy. This necessitates further systematization of its components from the perspective of their functional and value-based impact on the place brand.

In turn, the systematization of the wellness economy components within the context of place branding requires a transition from a sectoral approach to a value-oriented one. While in the traditional sense, the wellness economy is viewed as a collection of sectors related to health and well-being, within the system of place branding, its components perform the function of shaping the territory's value proposition. In other words, each element of the wellness economy creates a specific type of consumer, emotional, or social value that influences the perception of the place brand by target audiences.

The systematization is based on the approach of the Global Wellness Institute (Johnston, 2025), according to which the wellness economy includes eleven interconnected sectors mentioned in subsection 1.1 of this article. However, within place branding, it is appropriate to interpret them not merely as economic sectors, but as tools for creating the symbolic and functional value of a territory. Thus, wellness tourism shapes the value of a territory through associations with recovery, safety, recreation, and emotional comfort. The territory begins to be perceived as a space for relaxation, harmony, and psychological reboot. This is particularly characteristic of resort regions, natural destinations, and cities with a developed wellness infrastructure.

Public health and medical wellness create value by increasing trust in the territory, shaping the perception of a high level of medical services, safety of residence, and care for the population. In contemporary post-COVID-19 conditions, the very perception of a territory as a "healthy and safe environment" has become one of the key factors of international competitiveness.

Mental wellness forms the emotional and psychological component of the place brand through associations with mindfulness, a harmonious lifestyle, low stress levels, and a comfortable urban environment. It is this component that largely determines the attractiveness of a territory for digital nomads, creative industries, and highly qualified human capital.

Healthy eating and organic food reinforce the environmental and lifestyle-oriented component of the place brand. They form associations with naturalness, eco-friendliness, sustainable consumption, and a high quality of life. For certain territories, culinary culture can become an independent element of international positioning.

Physical activity and recreational infrastructure create value through the promotion of an active lifestyle, the accessibility of sports infrastructure, public spaces, parks, bicycle routes, and urban comfort. As a result, the territory is perceived as a modern space for self-realization and health maintenance.

Wellness real estate performs a strategic function in shaping the place brand through the integration of ecological architecture, smart-city solutions, green infrastructure, and a comfortable living environment. This directly affects the investment attractiveness of the territory and its ability to attract talent.

Spa economy, thermal / mineral springs, and traditional and complementary medicine form the historical-cultural and authentic component of the brand. They allow territories to transform natural resources and local practices into a competitive advantage, enhancing tourist attractiveness and international recognition.

Workplace wellness creates value through associations with modern corporate culture, work-life balance, and a high-quality working environment. This is especially important for cities and regions seeking to position themselves as centres of the innovative economy and creative industries.

Not all territories are capable of being simultaneously competitive in all components of the wellness economy, as their natural resource potential, infrastructure development level, demographic characteristics, economic specialization, and socio-cultural identity differ. That is why, in the process of place branding, it is advisable to choose a priority wellness direction that best matches the unique competitive advantages of the territory and is capable of forming its differentiated value proposition. Such an approach ensures a strategic concentration of resources, increases the authenticity of the place brand, and contributes to the formation of clear associations in the minds of target audiences. The choice of a wellness direction can be based on various dominants of territorial development: medical and wellness tourism, eco-friendliness and a sustainable lifestyle, an active lifestyle and sports infrastructure, mental well-being, wellness education, healthy eating, SPA and recreational resources, digital wellbeing, etc. In this case, wellness ceases to be just an individual element of positioning and transforms into the strategic foundation of the place brand, integrating into its economic, social, and cultural policies.

In this regard, the formation of the value proposition of a wellness-oriented territorial brand should be viewed according to a hierarchical principle, since the perception of a place brand is formed gradually – from basic rational characteristics to deeper emotional and symbolic associations (*Figure 3*).

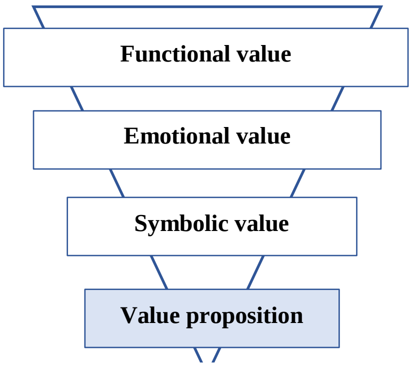

Figure 3. Components of a place brand value proposition

Source: developed by the authors.

The primary level is functional value, which creates the foundation of trust in the territory through safety, infrastructure quality, accessibility of medical services, environmental friendliness of the environment, and liveability. Without ensuring this level, a territory is incapable of forming a sustainable wellness positioning, as the basic needs of target audiences remain unmet.

At the next level, the emotional value of the territory is formed, which manifests itself through creating a sense of harmony, psychological comfort, emotional safety, and a positive experience of interaction with the territory. It is this level that ensures the emergence of an emotional bond between an individual and the place brand, increases the loyalty of residents, tourists, and investors, and enhances the subjective perception of the quality of life.

The highest level is symbolic value, where the territory is perceived not merely as a comfortable place to live or visit, but as the bearer of a certain philosophy of life. Within this level, the territory is associated with a sustainable lifestyle, a wellness-oriented identity, and a modern humanistic way of life, reflecting the global trend of transitioning from a consumer economy to a wellbeing economy. It is the symbolic level that shapes the long-term uniqueness of a place brand and its capacity to integrate into the value system of modern society.

Thus, the hierarchical structure of the value proposition of a wellness-oriented territorial brand ensures a logical sequence in shaping a territory's competitiveness: from creating basic conditions for well-being to forming emotional attachment and symbolic identification with the place brand.

2. Conceptual foundations of shaping place brand strength

2.1. The essence and determinants of place brand strength

The concept of brand strength is defined by scholars as a measure of its ability to dominate in a specific category of goods (or business circles) (Bogomaz & Zozulov, 2002), the level of brand popularity among buyers, or a complex of unique competitive advantages and target audience loyalty (Chervona & Hopka, 2024). The brand strength of products or enterprises depends not only on objective knowledge about them and the performance results of enterprises, but also on impressions, capabilities, and the satisfaction expected from brands in the process of interacting with them (Iastremska, 2021). Practitioners (International Marketing Group Ukraine, n. d.) imply that brand strength is an indicator of how close the connection is between a company and its audience. Brand Finance (n. d.) defines brand strength as the total awareness and perception of functional trust and emotional appeal in the brand's addressable market, which is used to create economic value through increased demand or willingness to pay. Consequently, in contemporary research, brand strength encompasses cognitive, emotional, reputational, and behavioural aspects of interaction with stakeholders.

The transference of these approaches into the sphere of place branding leads to the formation of the concept of place brand strength as an integrated characteristic of the territory's perception by various target audiences – residents, tourists, investors, business, and the international community. Moreover, relying on the research of Esselment (2018), it can be argued that place brand strength is determined by how consistently and synchronously different stakeholders describe and promote this territory in their official communications. A high level of alignment of key concepts, descriptors, and associations among various institutions indicates a strong, well-formed, and valid territorial brand. Conversely, if organizations utilize completely distinct narratives, the brand is considered weak or blurred. In turn, the research of Iastremska (2022) allows us to state that the basis of place brand strength is its core identity, which is most often based on historically established associations of the territory and possesses specific symbols. On the other hand, it is appropriate to interpret place brand strength not merely as a communication or image indicator, but as a result of the complex interaction of tangible and intangible factors of territorial development.

In this context, particular importance is acquired not only by the formation of a positive image of the territory, but also by the brand's ability to ensure the sustainability of this image in a dynamic competitive environment, socio-economic transformations, and shifts in the value orientations of society. Unlike product or corporate brands, a place brand is shaped by a significantly broader range of factors, among which an important role is played by the population's quality of life, the level of safety, environmental conditions, cultural authenticity, institutional trust, social cohesion, and the emotional experience of interacting with the territory. That is why place brand strength is determined not only by the intensity of communications or the level of awareness, but also by the territory's capacity to form long-term positive associations, maintain stakeholder trust, and stimulate desired behavioural reactions – from repeat tourist visits to investment activity, entrepreneurial interaction, and migration attractiveness.

Under the conditions of the wellness economy development, the essence of place brand strength expands significantly, as the competitive advantages of territories are increasingly linked not only to economic indicators but also to the ability to ensure the physical, psychological, social, and environmental well-being of a person. In this case, the territory's brand becomes an indicator of the quality of the living environment and a symbolic marker of comfort, safety, harmony, and sustainable development of the territory. Accordingly, wellness-oriented characteristics of the territory – a developed recreational infrastructure, eco-friendliness, availability of medical and wellness services, opportunities for a healthy lifestyle, psychological recovery, and social well-being – begin to act as important drivers for reinforcing the place brand.

Thus, place brand strength is an integral characteristic of a territory's ability to form stable positive cognitive, emotional, associative, and behavioural reactions of target audiences on the basis of a unique identity, consistency of communications, reputational trust, and the quality of the living environment, which ensures the competitive attractiveness of the territory for residents, tourists, investors, and business.

Having reviewed the definitions of various types of place branding, Kolesnytska (2012) concludes that it is precisely competition that determines the necessity of forming a brand for territories. Accordingly, the competitiveness of a territory can be interpreted as the behavioural manifestation of brand strength, which is expressed in the growth of various types of attracttiveness, in particular, the wellness attractiveness of the territory. By the latter, we mean the capacity of a territory to create and maintain conditions for ensuring the physical, psycho-emotional, social, and environmental well-being of a person, shaping a positive experience of interaction with the territory and stimulating its choice as a place of residence, recreation, investment, or professional activity.

2.2. Forming place brand strength under the influence of wellness

To substantiate the mechanism of the wellness economy's impact on shaping the competitiveness of a place brand, we apply a causal approach, which allows for viewing the territorial brand as a result of the interaction of socio-economic, reputational, and value-based factors. Within such an approach, place brand strength is formed under the influence of two intercomnected components: first, the characteristics of the territory's competitive identity, reflected in S. Anholt's hexagon model; second, the development level of the wellness economy, which forms the contemporary wellness-oriented value proposition of the territory. That is, within the framework of the model, each of the six dimensions of the place brand (tourism, investment attractiveness, exports, governance, culture, and people) is viewed as a function of the core components of brand strength, modified by the impact of the wellness economy.

The database for constructing the wellness economy indicator consists of data from the Global Wellness Institute, specifically the report Global Wellness Economy: Country Rankings (2026). In this study, an aggregated indicator of the country's wellness economy volume (in USD) or per capita expenditures is utilized.

In order to ensure data comparability across countries, the indicator is normalized using the min-max method (1).

$$W_i = \frac{W_i^{raw} - W^{min}}{W^{max} - W^{min}}, \tag{1}$$

where W_i^{raw} – the actual value of a country's wellness economy;

W^{max}, W^{min} – minimum and maximum values in the sample.

An integral index has been formed to quantitatively reflect the Anholt hexagon (2).

$$H_i = \frac{T_i + I_i + E_i + G_i + C_i + P_i}{6}, \tag{2}$$

where T_i – number of international tourist arrivals or tourism receipts (source: World Bank);

I_i – foreign direct investment (source: UNCTAD);

E_i – export of goods and services (% GDP);

G_i – governance efficiency index (source: World Governance Indicators);

C_i – number of cultural heritage sites or proxy of cultural activity (source: UNESCO);

P_i – human development index or happiness index (source: World Happiness Report).

All indicators are pre-normalized using the min-max formula, which allows them to be brought to a single scale [0;1].

The strength of a place brand can be represented by the formula (3).

$$BS_{T_i} = H_i \cdot (1 + W_i), \tag{3}$$

where BS_{T_i} – the strength of the country's territorial brand *i*;

H_i – integral index of brand dimensions;

W_i – normalized wellness economy index.

A multiple regression model is used to test the hypothesis about the impact of the wellness economy on the strength of the territorial brand (4).

$$BS_{T_i} = \beta_0 + \beta_1 W_i + \beta_2 H_i + \varepsilon_i, \tag{4}$$

where β_1 – reflects the direct impact of the wellness economy;
β_2 – characterizes the role of structural brand factors;
ε_i – random error.

To test the model, a sample of 5 countries was formed, which differ in the level of development of the wellness economy and the positioning of the territorial brand (*Table 2*).

Table 2

Calculation of the wellness economy index*

Country	Volume of the wellness economy, USD billions	W	H	BS_T
USA	2000	1.00	0.89	1.78
China	950	0.47	0.84	1.07
Germany	280	0.13	0.73	0.95
India	200	0.09	0.61	0.66
Iceland	30	0.00	0.85	0.85

*W^{max} = 2000 (USA), W^{min} = 30 (Iceland). Iceland has a very low W due to its small market, but a high per capita W (model limitation)

Source: calculated by the authors.

As an approbation for calculating the integrated index of brand dimensions, four of the six dimensions were selected: Tourism (T) – tourist receipts / GDP, Investment (I) – FDI inflows (% of GDP), Governance (G) – Government Effectiveness, and People (P) – Happiness Index. The baseline statistical data for constructing the index of place brand dimensions were obtained from international databases, including the Global Wellness Institute (2026), World Bank Group (n. d. b), Helliwell et al. (2025), UN Tourism (n. d.), World Bank (2025, December), World Intellectual Property Organization (2025), OECD (n. d.), and Anholt (2005). Since the indicators have different dimensions and measurement scales, min-max normalization was applied to ensure their comparability. As a result, each indicator was brought to the interval of [0, 1], which allowed for the formation of an integrated index based on the average value of the normalized indicators. Consequently, the model demonstrates that an increase in the development level of the wellness economy is accompanied by an increase in the integrated strength of the place brand.

Conclusions

Recently, wellness has transcended the boundaries of the health industry and evolved into a comprehensive social and economic concept focused on ensuring the quality of life and well-being of the population. This shift significantly influences the transformation of social value systems, production and consumption models, and approaches to territorial development.

Despite differences in approaches to branding various types of territories, contemporary trends indicate the emergence of a common value vector in their development, associated with the growing importance of human-centricity, well-being, and quality of life. In this context, wellness is increasingly being integrated into different levels of place branding, shaping a value-oriented image of a territory through associations with physical and psychological well-being, environmental sustainability, safety, and balanced lifestyles.

Consequently, the wellness economy should be considered not merely as a separate economic sector, but as the strategic value core of a place brand, integrating key dimensions such as quality of life, health, well-being, safety, and environmental sustainability into the territory's positioning system.

The research results indicate a relationship between the level of wellness economy development and national brand strength: countries with larger and more developed wellness markets tend to demonstrate higher levels of brand value and strength. A wellness-oriented approach provides a coherent hierarchy for shaping a territory's value proposition–from ensuring basic conditions for well-being and quality of life to fostering emotional attachment and symbolic identification of stakeholders with the territory. In this context, territorial competitiveness can be interpreted as a function of the depth, integrity, and consistency of its brand value.

The specific nature of a place brand determines the distinctive features of its formation mechanisms. Unlike product or corporate brands, a place brand is shaped by a significantly broader set of factors, including quality of life, safety, environmental conditions, cultural identity, institutional trust, social cohesion, and the emotional experience of interaction with the territory.

Accordingly, in addition to brand awareness, place brand strength depends on the territory's ability to build stable positive associations, maintain stakeholder trust, and stimulate desired behavioral responses, including tourism flows, investment engagement, entrepreneurial activity, and migration attract-tiveness. In this regard, the impact of the wellness economy on place brand strength is both direct and indirect. The direct effect is realized through the formation of a wellness-oriented image of the territory associated with quality of life, harmony, safety, and well-being. The indirect effect manifests through the reinforcement of the core components of the territory's competitive identity. As a result, place brand strength emerges as an integrated effect of the interaction between the territory's functional, emotional, and symbolic charac-teristics. Empirical support for these propositions was obtained through the testing of the place brand strength formation model.

The findings confirm the hypothesis regarding the positive impact of integrating wellness economy principles on place brand strength. It was established that countries with higher levels of wellness economy development demonstrate higher values of the composite indicator of place brand strength.

Furthermore, the results suggest that the wellness economy contributes to shaping a value-oriented image of a territory based on associations with quality of life, health, and well-being. At the same time, within the scope of this study, the component of emotional interaction with target audiences is validated primarily at the conceptual level and requires further empirical verification using behavioral and communication metrics, which constitutes a direction for future research.

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DIGITAL FINANCIAL SERVICES IN THE FACE OF CONTEMPORARY CHALLENGES

The development of the digital financial services market in the context of the digital transformation of the economy has been studied, taking into account current challenges related to martial law, the needs of post-war recovery, and the deepening of Ukraine's European integration. The study is based on the hypothesis that Ukraine's digital financial services market has already formed a basic infrastructural and behavioural foundation for further growth; however, its strategic potential in post-war recovery and EU integration depends on the transition from the quantitative expansion of digital services to their qualitative, safe, inclusive, and regulatory-compatible development. The methodological basis of the study is formed by a systemic approach, comparative analysis, statistical methods for assessing macroeconomic, financial, and financial-infrastructural indicators, as well as structural-functional and cause-and-effect analysis.

The study systematized the key statistical trends in the development of digital financial services, analysed the segmental structure of digital payments, remote identification, and digital lending, and also conducted a comparison of Ukrainian indicators with relevant benchmarks of European Union countries. Particular attention was paid to the role of cashless payments, the BankID system, digital government services, FinTech solutions,

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ЦИФРОВІ ФІНАНСОВІ ПОСЛУГИ В УМОВАХ СУЧАСНИХ ВИКЛИКІВ

Досліджено розвиток ринку цифрових фінансових послуг в умовах цифрової трансформації економіки з урахуванням сучасних викликів, пов'язаних із воєнним станом, потребами повоєнного відновлення та поглибленням європейської інтеграції України. Дослідження ґрунтується на гіпотезі, що ринок цифрових фінансових послуг України вже сформував базову інфраструктурну й поведінкову основу для подальшого зростання, однак його стратегічний потенціал у повоєнному відновленні та інтеграції до ЄС пов'язаний з переходом від кількісного поширення цифрових сервісів до їх якісного, безпечного, інклюзивного та регуляторно сумісного розвитку. Методологічну основу дослідження формують системний підхід, порівняльний аналіз, статистичні методи оцінювання макроекономічних, фінансових та фінансово-інфраструктурних показників, а також структурно-функціональний і причинно-наслідковий аналіз.

У ході дослідження систематизовано ключові статистичні тенденції розвитку цифрових фінансових послуг, проаналізовано сегментну структуру цифрових платежів, дистанційної ідентифікації та цифрового кредитування, а також здійснено порівняння українських показників з релевантними орієнтирами країн Європейського Союзу. Особливу увагу приділено ролі безготівкових платежів, системи BankID, цифрових державних сервісів, *and digital interaction tools between the state, businesses, and the population. It was determined that in 2020–2025, the Ukrainian market underwent a stage of rapid digital adaptation and formed a basic digital financial infrastructure; however, its further development requires a transition from quantitative growth to improving the quality, security, inclusiveness, and European compatibility of digital services.*

The main barriers to market development remain regulatory fragmentation, insufficient completeness in the statistical measurement of certain segments, cyber risks, uneven access of the population to digital services, as well as the need to strengthen users trust in digital financial products. Practical directions for state policy and market actions have been proposed, including harmonization of regulation with EU requirements, development of open banking, improvement of digital identification, strengthening cyber resilience, formation of a reserved digital financial infrastructure, and support for comprehensive digital solutions for small and medium-sized enterprises, relocated businesses, and households. It has been established that digital financial services can become one of the important instruments of Ukraine's post-war economic recovery, provided that they are developed responsibly, securely, and in strategically coordinated manner.

Keywords: digital financial services, digital economy, FinTech, cashless payments, remote identification, BankID, digital lending, financial inclusion, post-war recovery, European integration.

FinTech-рішень та інструментів цифрової взаємодії між державою, бізнесом і населенням. Визначено, що у 2020–2025 рр. український ринок пройшов етап швидкої цифрової адаптації та сформував базову цифрову фінансову інфраструктуру, однак подальший його розвиток потребує переходу від кількісного зростання до підвищення якості, безпеки, інклюзивності та євросумісності цифрових сервісів. Головними бар'єрами розвитку ринку залишаються регуляторна фрагментарність, недостатня повнота статистичного вимірювання окремих сегментів, кіберризики, нерівномірність доступу населення до цифрових сервісів, а також потреба в посиленні довіри користувачів до цифрових фінансових продуктів. Запропоновано практичні напрями державної політики та ринкових дій, зокрема гармонізацію регулювання з вимогами ЄС, розвиток відкритого банкінгу, удосконалення цифрової ідентифікації, посилення кіберстійкості, формування резервованої цифрової фінансової інфраструктури та підтримку комплексних цифрових рішень для малого й середнього підприємництва, релокованого бізнесу та домогосподарств. Встановлено, що цифрові фінансові послуги можуть стати одним із важливих інструментів економіки України у повоєнний період за умови їх відповідального, безпечного та стратегічно скоординованого розвитку.

Ключові слова: цифрові фінансові послуги, цифрова економіка, *FinTech*, безготівкові платежі, дистанційна ідентифікація, *BankID*, цифрове кредитування, фінансова інклюзія, повоєнне відновлення, європейська інтеграція.

JEL Classification: G20, G21, G28, O33, E42.

Introduction

In the current conditions of rapid development of the digital economy, digital financial services (DFS) are becoming one of the key drivers of economic growth, improving the efficiency of financial markets, and expanding public access to financial resources. The active implementation of financial technologies (FinTech), mobile banking, electronic payments, and digital platforms is transforming the traditional financial system, creating new opportunities for businesses and citizens.

For Ukraine, the issue of developing digital financial services is becoming increasingly relevant amid the digital transformation of the economy and integration into the global financial space. In recent years, there has been significant growth in the sector: the number of users of online banking, cashless payments, digital wallets is increasing, and the range of financial services available through digital channels is expanding. Between 2020 and 2025, the number of issued payment cards in Ukraine grew from 73.4 million to 148.5 million, active cards – from 40.4 million to 65.4 million, and the number of successful identifications through the NBU BankID – from 7.6 million to 109.4 million. Alongside this, the number of users of the Diia app increased from 2.5 million in 2020 to over 23 million by the end of 2025 (National Bank of Ukraine, 2021, 2026). In particular, digital finance is no longer an "additional service" but a basic infrastructure for access to payments, remote identification, lending, public disbursements, and citizens' interaction with the state and financial institutions. At the same time, the digitalization of the financial sector promotes increasing financial inclusion, especially in remote regions.

The development of digital financial services takes on particular significance in the context of Ukraine's post-war economic recovery. Digital tools ensure the transparency of financial flows, the effective distribution of state aid, support for small and medium-sized businesses, and also contribute to attracting investments. They also play an important role in enhancing the resilience of the financial system in the face of crisis challenges.

Despite the positive dynamics in the development of digital financial services in Ukraine, there are a number of problems that hinder their full implementation and effective use. Among the key challenges, it is worth highlighting the insufficient level of digital and financial literacy of the population, uneven access to digital infrastructure, as well as issues of cybersecurity and personal data protection.

In addition, there is a need to improve the regulatory and legal support for the functioning of digital financial services, to harmonize legislation with international standards, as well as to develop institutional support for innovations in the financial sector. It is also an important task to ensure users' trust in digital financial instruments, which is a critical determinant of their widespread adoption.

In the conditions of Ukraine's post-war reconstruction, the issue of integrating DFS into economic recovery mechanisms will require special attention, particularly to ensure the effective allocation of financial resources, support for entrepreneurship, and stimulation of economic activity. Therefore, there arises an objective necessity for a comprehensive study of current trends in the development of DFS, identification of key challenges, and justification of prospects for their further development in Ukraine, taking into account the needs of post-war economic recovery.

The issues of digital finance have been widely studied in recent years by both foreign and domestic scholars. In particular, the results of the study by Bontadini et al. (2024) are useful in terms of justifying the macroeconomic importance of digital finance, since the authors, based on new indicators of financial sector digitalization for 21 OECD countries for 1995–2018, prove that the digitalization of financial services has a direct positive connection with productivity, eases credit constraints for SMEs and industries with a high share of intangible assets. The work of Anton and Afloarei Nucu (2024) presents the results of a study on how traditional and digital financial inclusion affect the stability of banks in a sample of 81 countries. The authors use quantile regression and show a nonlinear relationship: at lower levels, inclusion can increase risks, but beyond a certain threshold, it has a positive effect on banking stability. In turn, Xie and Wu (2024), analysing panel data of 30 provinces in China for 2011–2021, prove that the development of digital finance promotes the commercialization of R&D results. At the same time, the positive effect of digital finance depends on the effectiveness of financial regulation. The publication by Meng and Xiao (2025) is dedicated to the impact of digital finance on the development of cross-border e-commerce in China based on provincial data for 2013–2023. The authors found that digital finance significantly stimulates cross-border e-commerce, particularly through the growth of technology markets, internet penetration, and investments in innovation. In the work by Dias and Perera (2026), a systematic literature review using the PRISMA methodology is presented, which analysed 50 Scopus articles from 2013 to 2025. Therefore, the authors summarize that digital financial methods increase the accessibility, availability, and quality of financial services for marginalized groups, but their development is hindered by digital financial illiteracy, regulatory barriers, infrastructure limitations, and socio-economic inequality.

It is also worth noting the studies of the European Central Bank (ECB) (European Central Bank, 2024; 2025), which demonstrate how card payments, online payments, credit transfers, and cash coexist in mature European markets. The authors emphasize that digitalization in Europe is not limited to the "abandonment of cash", but involves changes in consumer habits and infrastructure. According to Eurostat (2025), official data on internet banking, e-governance, e-commerce, and digital skills have been systematized. The use of these data allows for comparing Ukraine’s indicators with the European context of citizens’ digital behaviour.

Among domestic scholars, the authors Bondaruk T. and Bondaruk O. (2025) can be noted, who prove that banks with higher digital efficiency demonstrate stronger competitive advantages, greater adaptability to market changes, improved risk management capabilities, and a higher level of economic security. The researchers conclude that digital banking products and technologies are a strategic tool for strengthening the economic security of banks, provided they are integrated into a comprehensive system of managerial and informational-analytical support. The study by Yefymenko and Dmytrenko (2025) is dedicated to digital currencies, CBDCs[1], e-hryvnias, stablecoins, cryptocurrencies, and virtual assets. The authors emphasize the need to develop the e-hryvnia project, legalize the

[1] CBDC (Central Bank Digital Currency) – central bank digital currency.

virtual assets market in accordance with FATF[2] standards, strengthen AML/CFT-procedures[3] and integrate digital assets with banking and payment infrastructure.

The research by Kornivska (2025) is useful in terms of revealing the social risks of financial digitalization. The author considers digital finance not only as a technological or economic phenomenon but also as a factor of social, psychological, and institutional changes. The impact of digital financial technologies and digital credit on consumer behaviour, financial discipline, responsibility, and an individual's economic freedom is also analysed. In the work by Hniezdovskyi et al. (2024), the role of the digital financial space in ensuring Ukraine's economic growth is substantiated. In particular, a SWOT analysis and a time series analysis regarding cashless transactions and GDP were applied. The authors argue that the growth of cashless transactions has a moderate positive impact on GDP, and digital finance has the potential to stimulate economic growth. The article by Hlushchenko and Veriutin (2025) is dedicated to the development of digital financial services in Ukraine, as well as the analysis of current trends, risks, and regulatory issues.

At the same time, the issue of post-war use of digital finance as a tool for recovery, especially in terms of digital lending to SMEs and households, remains studied fragmentarily.

Overall, based on the results of the analysis of available scientific publications, it can be concluded that the digital financial services market is growing faster than its institutional bottlenecks are being eliminated. Ukraine demonstrates a very rapid digitalization of payments, identification, and government services, but at the same time it faces a deficit of harmonized statistics for certain segments, high concentration of certain markets, increasing cyber risks and fraud, uneven digital and financial literacy, as well as the need to align regulation with European rules. Therefore, the main scientific and practical question is not only how fast the market is growing, but also whether this growth is transforming into a sustainable, safe, and inclusive model of financial digitalization.

The purpose of the article is, based on official and authoritative sources, to assess the dynamics, structure, problems, and prospects of the digital financial services market in Ukraine over the past years and to identify areas that have the greatest potential for post-war economic recovery and European integration.

The study put forward the hypothesis that the market for digital financial services in Ukraine has already formed a basic infrastructural and

[2] FATF (Financial Action Task Force) – an international organization that sets standards for combating money laundering, terrorist financing, and other financial crimes. In the context of digital finance, FATF develops recommendations for regulating cryptocurrencies, virtual asset exchanges, and other financial intermediaries.

[3] AML (Anti-Money Laundering) – anti-money laundering; CFT (Countering the Financing of Terrorism) – countering the financing of terrorism.

behavioural foundation for further growth; however, its strategic potential in post-war recovery and integration into the EU depends on the transition from the quantitative spread of digital services to their qualitative, safe, inclusive, and regulatory compatible development. In particular, the greatest effect for the economy can be achieved by combining digital payments, remote identification, digital lending, insurance, and government services into unified client-oriented ecosystems.

The structure of the main part of the article consists of four interrelated sections: the first one systematizes the key statistical trends of the Ukrainian DFS market, assesses the segmental structure of payments, remote identification, and digital lending; the second section compares Ukrainian DFS market indicators with relevant benchmarks of EU countries. The third section is devoted to identifying regulatory, infrastructural, and behavioural barriers to market development, and the fourth – outlines scenarios for the development of the DFS market and summarizes recommendations for state policy and the market.

1. The state of the digital financial services market in Ukraine

Since 2020, the development of the Ukrainian DFS market has had a wave-like character, but overall it has demonstrated an upward dynamic. The pre-war period of 2020–2021 was a phase of rapid expansion of the card market, active migration of payments online, and explosive growth of BankID and Diia. 2022 has become a test of resilience: the terminal network has shrunk, but cashless payments and remote identification have not stopped. 2023–2025 showed not just recovery, but a transition to a qualitatively higher level, which consisted of growth in the share of NFC payments, a sharp increase in BankID, the restoration of the terminal network above the pre-war level, and a further shift in consumer demand towards online and mobile channels (*Table 1*).

Table 1

The state of the digital payment transactions market in Ukraine

Year	Issued cards, million	Active cards, million	POS-terminals in the commercial and service network	Cashless transactions, million	Cashless transactions, billion UAH	Successful BankID NBU identifications, million	Users of "Diia", million people
2020	73.4	40.4	375.0	5211.2	2208.7	7.6	2.5
2021	89.1	46.3	426.5	7039.7	3090.9	30.2	12.0
2022	109.8	46.3	359.2	6997.4	2996.3	32.8	18.5
2023	115.1	52.1	449.5	7397.2	3980.0	42.9	20.0
2024	132.0	58.8	496.6	8184.8	4243.5	87.7	21.0
2025	145.8	65.4	558.6	9184.9	4684.8	109.4	23.0

Source: National Bank of Ukraine (2021, March 3), official announcements of the Ministry of Digital Transformation and the "Diia" portal.

Over six years, the number of issued cards has practically doubled, while active ones have increased by almost 62%. This means not just an increase in the number of payment instruments, but a deeper inclusion of the population into the digital payment ecosystem. An even more pronounced growth is observed in the NBU’s BankID: from 7.6 million successful identifications in 2020 to 109.4 million in 2025, which is approximately 14 times more. The number of Diia users over the same period increased from 2.5 million to over 23 million people, making it a key platform for digital interaction between citizens and the state and, indirectly, with financial services.

The analysis results of the Ukrainian DFS market by segments demonstrate that it has already passed the phase when the main digital driver was P2P-transfers. In 2020–2022, card-to-card transfers dominated in terms of cashless transaction amounts, but from 2024, the leadership by both volume and amount has shifted to payments in trade and service networks. That is, this trend is in the "maturity" stage. Digital finance increasingly serves not only "money transfers" but also everyday consumption, retail payments, and integrated services. Online payments remain a consistently important segment, although their share by volume has decreased compared to 2020 due to the faster growth of POS/NFC-payments[4] (*Table 2*).

Table 2

Structure of the Ukrainian digital services market

Year	Retail network		Internet		P2P	
	% of quantity	% of the amount	% of quantity	% of the amount	% of quantity	% of the amount
2020	49.8	26.9	36.5	29.1	12.6	42.8
2021	52.4	28.4	25.9	23.3	12.7	43.6
2022*	52.0	23.1	27.0	15.6	15.6	58.3
2023	66.9	40.4	17.9	16.2	10.1	37.1
2024	73.4	46.8	13.6	14.7	8.2	31.1
2025	74.3	50.9	13.9	16.4	7.3	26.3

* *for 2022, NBU published these shares in the format "May–December 2022"*

Source: National Bank of Ukraine (2021, March 3, 2026, February 16).

The most difficult segment to assess is digital lending, because Ukraine’s official statistics still do not provide a complete annual series of "all digital loans in the economy". However, available indirect data indicate a clear increase. In 2023, more than 4 million identifications for financial services were carried out through the NBU’s BankID; in 2024 – over 5 million; and in 2025, the number of commercial identifications exceeded 6 million (*Figure 1*). At the same time, the NBU notes that in 2024, the volume of retail loans provided by financial companies increased by

[4] POS/NFC-payments — this is a contactless method of paying for goods or services, in which data is transmitted from a device (smartphone, watch) to a terminal via technology Near Field Communication (NFC).

a quarter compared to 2023. Therefore, the non-bank segment, integrated with remote identification and scoring models, remains the main driver of digital lending (National Bank of Ukraine, 2026, February 3).

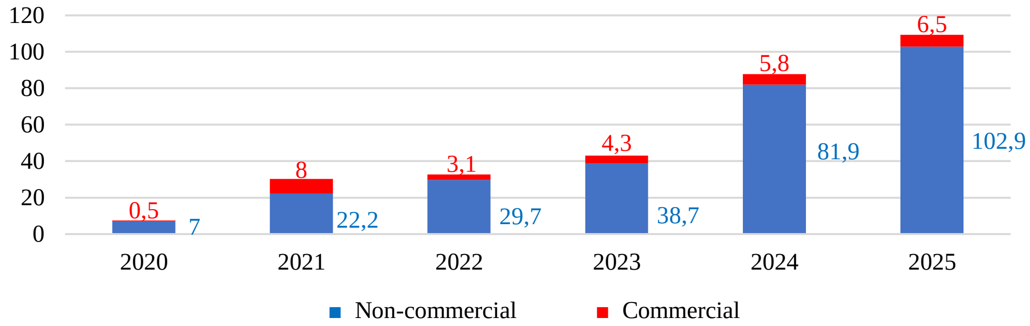

Figure 1. Dynamics of identifications in the BankID NBU system, million units

Source: National Bank of Ukraine (2026, February 3).

It is also important to note that in 2024–2025, new commercial participants of the NBU BankID continued to join the system specifically with online lending services. This does not provide an exact measurement of the volume of digital loans, but it confirms that remote identification and digital credit onboarding remain one of the most dynamic segments of the market (BankID, 2025).

Overall, in Ukraine, compared to other European countries, the FinTech market is developing more slowly, has certain legislative restrictions, is weakly capitalized, and is concentrated in narrow niches – mainly payment services and online lending.

Although there is no official statistics in Ukraine on the volumes of P2P loans for business, an analysis of indirect indicators allows us to assert that the market scale is currently small. In 2016, at the initial stage of the segment's development, the National Bank estimated the total volume of P2P loans at approximately UAH 5 billion (Interfax, 2016, December 15). This is a very modest amount for Ukraine's economy – experts emphasized that it is significantly lower than the funding needs of SMEs. Subsequently, from 2018 to 2021, the P2P market in Ukraine developed slowly. In 2022, the impact of the war became a significant shock to it: investors sharply reduced their activity due to increased risks, and many business borrowers ceased operations. In that same year, the volumes of new crowdlending practically froze. Only in 2023–2025, along with the stabilization of the economy, there was some revival, but even by the end of 2025, the volumes of P2P loans for SMEs remain minimal compared to bank lending or government support programs. For example, in 2022, only 20% of Ukrainian SMEs had access to favourable lending (Medko, 2025), and the P2P sector has had little impact on this situation so far.

According to the Ukrainian Association of FinTech and Innovative Companies (UAFIC), in 2025 there were 257 FinTech companies operating in the market (in 2024 – 260), 38% of which operate in the international market, and 78% are based in Kyiv. As of 2024, the total market valuation amounted to USD 1.5 billion.

As noted by the Deputy Governor of the NBU, O. Shaban, in 2025 another key trend was clearly outlined – the active implementation of artificial intelligence (AI) in financial services. AI is gradually being integrated into financial processes, opening up new opportunities for automation and improving the level of customer service, increasing the accuracy of creditworthiness assessments, enhancing compliance and risk monitoring processes, combating fraud, and increasing the efficiency of the operational activities of financial institutions. The National Bank considers AI not as a one-time initiative, but as an infrastructural innovation that should support the effectiveness of the regulator's functions and the innovative development of Ukraine's financial ecosystem as a whole (UAFIC, n. d.).

If we consider the structure of the *FinTech* market in 2025 compared to the previous year, some changes can be observed (*Figure 2*).

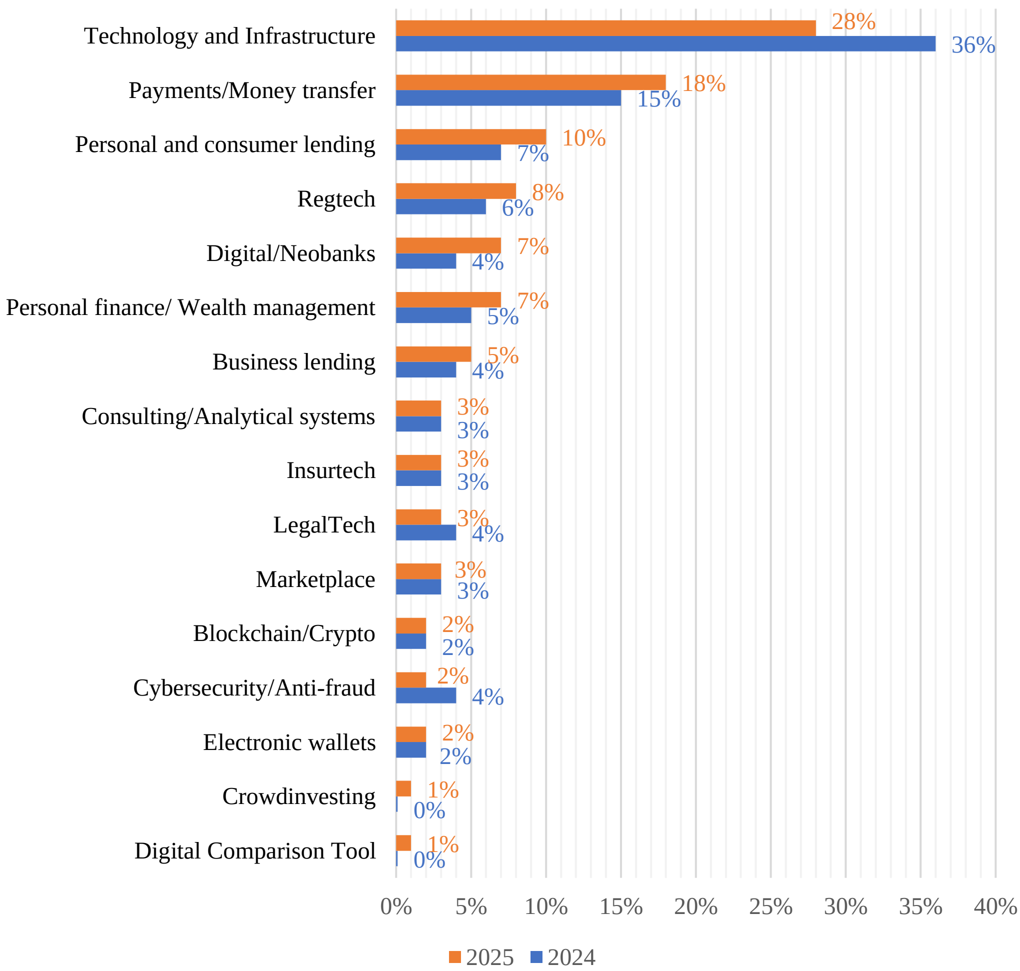

Figure 2. Distribution of FinTech companies by areas of activity in 2024–2025

Source: created by the author based on data from UAFIC (n. d.).

The largest market share in 2025 was held by technology infrastructure, indicating a stable demand for IT solutions for financial institutions. Payment services and money transfers remained in second place, with a 3% growth compared to 2024. The analysis based on NBU data showed that the growth of user trust in cashless payments and the increasing popularity of contactless payments stimulate the creation of innovative solutions in this area. The third place, with a slight growth rate, was occupied by the consumer lending segment.

RegTech[5] demonstrates steady growth, which may be associated with strengthening regulatory requirements and the need to automate compliance processes. Neobanks and personal finance management companies have also shown growth. The areas of LegalTech, InsurTech, marketplaces, and blockchain/cryptocurrencies remain at a stable level. Cybersecurity and fraud prevention remain relevant, although their share has decreased. Taking into account the increasing cyber threats, this area is relevant and requires attention. New areas have emerged, such as crowdinvesting and digital comparison tools, each of which has a minimal market share. This indicates a search for new financing models and increased transparency of financial services.

2. Comparison of the DFS market in Ukraine with European countries

To understand the current state of the digital financial services (DFS) market in Ukraine and identify gaps in its development, it is worth comparing the indicators of internet banking usage by the population, the maturity of digital payment behaviour, and institutional readiness for remote interaction with EU countries: Germany, Lithuania, and Romania. The expediency of choosing these particular countries is explained by the fact that Germany has a large, mature DFS market and serves as a benchmark for large-scale digital banking. Lithuania is one of the most digitally developed small markets in the EU and is close to Ukraine in terms of eID/fintech-first logic. Romania is a convergent country with a lower level of digital penetration than Western European countries, which makes it a useful reference for Ukraine.

As of 2025, the level of internet banking usage in the European Union remains one of the highest in the world and continues to grow, remaining significantly higher than in Ukraine (*Table 3*). In EU countries in 2025, 68.7% of the population aged 16–74 used internet banking (Eurostat, 2025, March); among internet users, this indicator was 80–90%. According to Eurostat, in Germany, the internet banking usage rate in 2024 was about 80.7%, while in Romania it was about 47.1%. In the Baltic countries,

[5] RegTech (Regulatory Technology, regulatory technologies) — is a set of tools and software solutions based on the latest technologies (artificial intelligence, Big Data, blockchain, cloud computing) that help financial institutions and companies fulfil regulatory requirements faster, more efficiently, and more cheaply.

particularly in Lithuania, most regions also showed high indicators – at least 80%. Therefore, this means that the EU already has a clearly defined "digital corridor" of mature online banking markets. Ukraine does not yet have a direct Eurostat-compatible estimate of this indicator, but its indirect data, in particular 95.2% of cashless card transactions by number in 2025, a high number of identifications through BankID, and over 23 million users of Diia, indicate a very high actual digital activity in payment and identification services.

Table 3

Comparison of the DFS market in Ukraine and some EU countries

Indicator	Ukraine	Germany	Lithuania	Romania
Market volumes / scale of digital payments	UAH 7.157 trillion (9.512 billion card transactions)	USD 2.12 trillion (mobile payments)	EUR 166 billion (EMI/PI[6]payments)	USD 38.31 billion (digital payments)
Share of the population aged 16–74 who used internet banking in 2025, %	61.00	70.71	79.28	30.97
Cashless card operations, 2025	9.512 billion transactions worth UAH 7.157 trillion; share – 65.4% by amount	15.55 billion – payment transactions; 45.34% – share of card payments; 7.23 billion – number of card transactions	2.285 billion – number of payment transactions; 72.84% – share of card payments; 1.66 billion – number of card transactions	1.986 billion – number of payment transactions; 76.31% – share of card payments; 1.516 billion – number of card transactions
Remote digital identification	109.4 million electronic identifications – NBU BankID, over 23 million Diia users	eID – functions of the ID-card / e-residence permit and the AusweisApp application, effective since 2017	1.36 million Smart-ID users	National SSO-solution – ROeID; issuance of the digital ID-card CEI started on March 20, 2025, and nationwide implementation – from June 2, 2025

Source: compiled by the author based on data from the NBU and other open sources (Eurostat, 2025; Zholobetskyi, February 16, 2026; MordorIntelligence, February 9, 2026; Invest Lithuania, n. d.; Vorniceanu, 2025, April 4; ECB, n. d.; 2026, January 29; AusweisApp, n. d.; Roeid, n. d.).

According to *Table 3*, Ukraine demonstrates a very high level of digital banking usage among card users and rapid growth of BankID/"Diia". Lithuania stands out among the compared EU countries with the highest share of internet banking and developed digital identification. Germany has the largest absolute scale of digital/mobile payments, but the share of card payments is lower than in Lithuania. Romania is growing rapidly; however,

[6] EMI (Electronic Money Institution) – electronic money institution; PI (Payment Institution) – payment institution

in terms of internet banking and digital identification, it still noticeably lags behind Germany and Lithuania. Thus, Ukraine has already achieved a high degree of digital intensity in payments and remote identification, but it lacks harmonized statistics and full-fledged regulatory and institutional frameworks at the EU level. That is, technologically Ukraine is moving very quickly in certain areas, but for full integration into the European financial space, a deepening of security standards, open banking, eIDAS compatibility (European regulation), and consumer protection is needed.

3. Problems and challenges of the development of the digital financial services market in Ukraine

A thorough analysis of the current state of the DFS market in Ukraine has made it possible to identify the main problems and challenges that hinder the full development of the market and integration into the digital financial space of Europe.

The most systemic problem is *regulatory*. The digital financial services market in Ukraine is developing rapidly, but unevenly: standards for payments, open banking, remote identification, electronic money, and non-bank lending are advancing at different speeds. The National Bank of Ukraine (NBU) already explicitly sets the task of integrating into the EU financial services market and developing modern financial services, and the preliminary assessment of NBU's BankID for compliance with eIDAS requirements is an important step; however, the very fact of such an assessment shows that the harmonization process is not yet completed.

The second problem is *infrastructure resilience*. The war has shown that digital finance depends not only on banks and payment companies but also on electricity, communication, cloud resilience, cybersecurity, and the ability to quickly restore the network of terminals. In 2022, the number of payment terminals decreased to 359.2 thousand, but then the market recovered to 496.6 thousand in 2024 and 558.6 thousand in 2025. This to some extent demonstrated the resilience of the terminal system, however, it does not eliminate the risk of local disruptions, especially for frontline, rural, and de-occupied territories (National Bank of Ukraine, 2023, March 3).

Another important issue is *cybersecurity and fraud*. According to the NBU, the amount of losses from fraudulent card transactions in 2024 increased by 37% – to UAH 1.1 billion, and in 2025 it increased further by 24% – to UAH 1.4 billion. At the same time, the number of incidents decreased in 2025, but the average amount of a single fraudulent transaction increased to UAH 5,536 (National Bank of Ukraine, 2026, April 17). That is, the risks are becoming not so much more widespread as more costly for users and the system as a whole.

We should also note another set of issues in the form of *inclusion, trust, and competence*. A 2021 study by the NBU and USAID showed that the financial literacy index of Ukrainians was 12.3 out of 21 points – below the basic OECD benchmark of 14 points. This means that the rapid growth of digital services is occurring against the backdrop of insufficient readiness of a significant part of the population to make informed product choices, manage risks, protect personal data, and understand the cost of credit. That is why the NBU has identified digital financial literacy and payment security as separate priorities in the strategy until 2030. (USAID, 2021).

Another problem can be singled out, which significantly complicates the task of researching such a rapidly developing digital services sector – *the insufficient transparency of certain segments of public statistics*. For payments, cards, and infrastructure, the NBU publishes detailed and high-quality series. In contrast, for digital lending, it is necessary to combine materials from annual reports, quarterly reviews of the non-banking sector, BankID statistics, and appendices to xlsx reviews. For academic research and the development of evidence-based policy, this is a significant limitation.

4. Prospects and development scenarios of the Ukrainian DFS market

The analysis of the current state of the digital financial services market in Ukraine, its comparison with the practices of EU countries, as well as the identification of key problems and challenges, indicate the presence of significant potential for further digital transformation of the financial sector, provided that institutional capacity, regulatory coherence, and technological resilience are strengthened. In this context, the *development of scenarios and the determination of the prospects* for the development of the DFS market acquire particular scientific and practical significance, as they make it possible to outline possible trajectories of its evolution, assess risks and opportunities, and form strategic guidelines for Ukraine's integration into the European digital financial space.

Based on the conducted analysis, it has been established that Ukraine has the greatest potential in five segments.

The first is digital payments for everyday consumption: POS/NFC payments already prevail in number and amount, and the share of tokenized cards has increased to 16.5 million in 2024 and 20.7 million in 2025, meaning that the digital wallet has effectively become a mass tool.

The second is remote identification as an "infrastructure linking" for all other financial services.

The third is digital lending to the population and small businesses, primarily at the intersection of non-bank financial companies, scoring, and remote onboarding.

The fourth is embedded financial services, that is, the integration of payments, lending, insurance, instalments, account opening, or other financial services directly into non-financial digital platforms (embedded finance) at the intersection of government services, marketplaces, telecom channels, and banking APIs.

The fifth is convergence with European eIDAS frameworks and the future open banking (National Bank of Ukraine, 2023, August 10).

In the context of post-war recovery, the rapid development of these segments can become a significant driver of growth for Ukraine's economy. The logic of the impact of digital financial services (DFS) on socio-economic development should be considered through the prism of the sequential deployment of digital interaction between the consumer and the financial system: from remote identification and digital onboarding to accessing payment, credit, insurance, and investment services. As summarized in *Figure 3*, it is precisely the combination of the availability of digital channels, reduced transaction costs, expanded financial inclusion, and simplified access to financing that creates a multiplicative effect, which promotes the activation of economic activity and creates prerequisites for the restoration of economic dynamics.

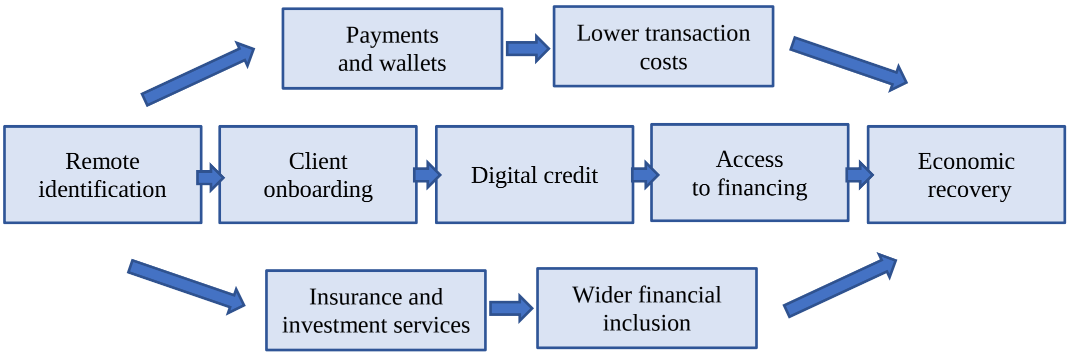

Figure 3. Mechanism of the impact of digital financial services on the recovery of Ukraine's economy

Source: created by the author.

In terms of the impact on economic growth in the future, several scenarios for the development of the DFS market in Ukraine can be considered.

The inertial scenario foresees the preservation of positive dynamics in digital payments and the further expansion of the use of remote identification systems, in particular BankID, but without a qualitative breakthrough in the field of digital lending, open banking, and full integration with the European financial space. Under such conditions, the main drivers of market development will remain payment services, state digital platforms, and consumer FinTech, while the potential of more complex financial products will be realized slowly and fragmentarily.

The scenario of accelerated integration can be implemented provided that the national regulatory environment actively aligns with EU requirements, open banking standards are introduced, the level of cyber resilience of the financial infrastructure is increased, and the quality statistical base for monitoring digital financial services is expanded. In this case, Ukraine will have the opportunity to transition from a market model of fast and predominantly applied digital services to the formation of a full-fledged ecosystem of standardized, safe, and interoperable European-style digital finance.

The reconstruction leap scenario is associated with post-war economic recovery, within which digital financial channels can become a key infrastructure for carrying out social and compensation payments, microloans, insurance of war and property risks, reimbursement for damaged property, as well as financial support for small and medium-sized enterprises. This conclusion is based on the already formed role of "Diia", BankID, and digital payments during the war period as tools for ensuring the continuity of financial interaction between the state, businesses, and the population.

Regarding the development of effective steps in state policy, the following priority areas can be identified. *Firstly*, introduce a separate public statistical series on digital lending – by sales channel, type of product, groups of borrowers, and loan value. *Secondly*, accelerate the harmonization of BankID, the payment market, and future open banking with European standards. *Thirdly*, make payment security and digital financial literacy part of mass recovery programs, not just educational initiatives. *Fourthly*, to develop and maintain infrastructural *redundancy* – backup, duplicate, or alternative elements of digital financial infrastructure that ensure the continuity of payment, banking, identification, and other financial services in case of technical failures, cyberattacks, system overloads, or physical damage to the infrastructure, namely: backup power, communication, terminal networks, cloud resilience – as an element of financial security.

Conclusions

The conducted study provides grounds to assert that in 2020–2025, the Ukrainian digital financial services market underwent a stage of intensive digital adaptation and gradually moved towards the formation of a basic digital financial infrastructure. During this period, cashless payments established themselves as the dominant form of card transactions, remote identification acquired the characteristics of a mass tool for access to financial and state services, and digital platforms, primarily Diia, became an important element of the everyday financial behaviour of the population. This overall confirms the proposed hypothesis regarding the presence of a basic infrastructural and behavioural foundation for the further development of the digital financial services market.

At the same time, the study confirmed that the mere fact of the widespread use of digital services is not a sufficient condition for realizing their strategic potential in post-war economic recovery and Ukraine’s European integration. For the further development of the DFS market, the priority should be not only expanding the client base but also moving towards responsible design of digital financial products. This involves the implementation by banks and FinTech companies of more understandable and accessible interfaces, more transparent disclosure of the full cost of credit products, strengthening anti-fraud mechanisms (tools and procedures that help detect, prevent, and minimize fraud in digital financial services), the application of personalized risk limits, as well as wider use of digital identification tools and data to reduce the cost of onboarding and subsequent customer service.

A particularly promising direction is the development of comprehensive digital solutions that combine lending, insurance, and government services for the needs of small and medium-sized enterprises, relocated businesses, as well as households that are restoring housing, property, or sources of income. In this format, digital financial services can perform not only a service, but also a restorative function, providing faster access to financial resources, reducing administrative barriers, and increasing the targeting of government and market support.

The author connects the prospects for further research primarily with the development of a unified methodology for measuring digital lending in Ukraine, which would be suitable for international comparisons and would allow for an accurate assessment of the scale, structure, and risks of this segment. Equally important as a scientific task is the formation of approaches to assessing the contribution of digital financial services not only to increasing payment convenience but also to the growth of productivity, investment activity of SMEs, the speed of community recovery, and long-term financial inclusion. Solving these research issues will make it possible to move from merely recording the high dynamics of the market to a more complete, systemic, and internationally comparable measurement.

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ASSESSING INFORMATION EFFICIENCY IN THE IRAQI STOCK MARKET

This study examines the ISX in weak-form market efficiency from August 2014 to August 2024 by testing the random walk hypothesis using daily data for the 57 individual constituents of the ISX60. The paper applies a number of statistical techniques, including unit root tests (Augmented Dickey-Fuller and Phillips-Perron), autocorrelation (Ljung-Box Q-statistic), and variance ratio and runs tests. We report evidence of statistically significant bias against the random walk hypothesis. While all stocks demonstrate stationarity, 70–79% of the stocks are stated to have violated the hypothesis of the random walk on several tests at the 5% significance level. The index also exhibits particularly strong evidence of market inefficiency, with variance ratio metrics falling within the 0.50–0.75 range, demonstrating evidence of market inefficiency and significant mean reversion. This information suggests that empirical data from prior prices can indeed predict possible returns, thus demonstrating a weakness in the weak-form efficiency of the market. In combination with evidence from prior research on border markets, attributed to thin trading, limited market liquidity, information asymmetry, herding behavior, and a lack of strong market infrastructure, this research helps to identify the potential for technical trading and suggests that transaction costs may hinder market inefficiency. The research also identifies several areas of focus for market infrastructure, such as enhanced liquidity, improved frameworks for disclosures, and a greater role for institutional

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ОЦІНЮВАННЯ ІНФОРМАЦІЙНОЇ ЕФЕКТИВНОСТІ НА ІРАКСЬКОМУ ФОНДОВОМУ РИНКУ

Дослідження оцінює інформаційну ефективність ринку ISX за період з серпня 2014 р. по серпень 2024 р. шляхом перевірки гіпотези про випадковий характер зміни цін з використанням щоденних даних для 57 окремих складових ISX60. Застосовано низку статистичних методів, зокрема тести на одиничні корені (розширений тест Дікі-Фуллера та П. Гіллінса-Перрона), автокореляцію (Q-статистика Люнга-Бокса) та коефіцієнт дисперсії, а також проводиться тестування. Виявлено статистично значущі докази відхилення від гіпотези стохастичної динаміки цін. Хоча всі акції демонструють стаціонарність, 70–79% акцій, як стверджується, порушили гіпотезу стохастичної динаміки цін за кількома тестами на рівні значущості 5%. Індекс демонструє особливо вагомі докази неефективності ринку, причому показники коефіцієнта дисперсії перебувають у діапазоні 0,50–0,75, що свідчить про відхилення від гіпотези ефективності та наявність ефекту повернення до середнього значення. Це вказує на те, що емпіричні дані з попередніх прайсів дійсно можуть передбачати можливу прибутковість, демонструючи таким чином слабкість ефективності ринку. У поєднанні з даними попередніх досліджень прикордонних ринків, які пояснюються слабкою торгівлею, обмеженою ліквідністю ринку, інформаційною асиметрією, стадною поведінкою та недостатньо розвиненою ринковою інфраструктурою, дослідження допомагає визначити потенціал для технічної торгівлі та приводить до припущення, що транзакційні витрати можуть стримувати прояви ринкової неефективності. Дослідження визначає кілька напрямів розвитку ринкової інфраструктури, *investors to foster market stability. The proof aids in the comprehension of the efficiency dynamics of frontier markets and the Iraqi equity market's impact on economic growth.*

Keywords: random walk hypothesis, market efficiency, Iraqi Stock Exchange, frontier markets, variance ratio test, emerging markets.

зокрема підвищення ліквідності, вдосконалення систем розкриття інформації та посилення ролі інституційних інвесторів у сприянні стабільності ринку. Отримані результати дають змогу краще зрозуміти динаміку ефективності прикордонних ринків та вплив іракського фондового ринку на економічне зростання.

Ключові слова: гіпотеза випадкового блукання, ефективність ринку, іракська фондова біржа, прикордонні ринки, тест на коефіцієнт дисперсії, ринки, що розвиваються.

JEL Classification: G14, G15, C58, C12, O16.

Introduction

In the domain of finance, Fama (1970) developed the efficient market hypothesis, which posits that all available information is incorporated into asset prices. For the weak-form market efficiency hypothesis, which is the focus of this study, the current price captures all available information on previous price series, meaning that the price can be analyzed to make abnormal returns. This is tested through the random walk hypothesis (RWH), which presumes that price changes are independent and come from the same distribution. When stock returns are analyzed to determine whether they follow a random walk, we arrive at weak-form market efficiency, a paradigm shift in the understanding of investment, regulation, and financial theory.

Theoretically, there has been a lot of work done on the efficiency of markets in developed economies; on the other hand, frontier markets are still relatively unexplored despite their increasing significance in worldwide capital investment. Frontier markets are smaller in size, have less liquidity and lower institutional participation, and have unformed regulatory frameworks. These characteristics present unique obstacles for efficient price discovery. These markets are very useful for testing different combinations of variables, such as institutional and market microstructure, resulting in various levels of efficiency. In particular, the Middle East and North Africa (MENA) regions have varying degrees of efficiency, with some markets exhibiting developmental characteristics and others remaining significantly inefficient.

The Iraqi Stock Exchange (ISX) began operations in 2004. The exchange is one of the smallest and underdeveloped stock markets in the Middle East, with a market capitalization of less than 1% of the Arab Financial Markets. The daily trades of ISX show typical characteristics of frontier markets; these include limited liquidity, more retail investors than institutional, greater trading volatility, limited foreign investors, and political and economic risk. The ISX is vital in distributing economic resources related to the reconstruction of Iraq. The market infrastructure has been adapted to facilitate electronic trading, introduced in 2009, and the ISX60 index. However, the efficiency of the market continues to be in question.

The most recent research publications indicate that analyses of studies concerning the Iraqi stock exchange (ISX) have temporal limitations (2004–2020) and certain limitations (Kaehler et al., 2014; Asaad et al., 2015;

Asaad & Al-Delawi, 2022; Saleem et al., 2023). To date, no study has conducted a multi-method, longitudinal analysis that spans a decade and examines the universe of ISX 60 constituents, including the COVID-19 crisis. The literature on frontier markets, unlike the ISX, shows chronic weak-form inefficiencies due to insufficient trading, asymmetric information, and poorly developed structures (Lee & Choi, 2023; Said et al., 2024).

The aim of the article is to assess Weak Form Market Efficiency on the Iraqi Stock Exchange by analyzing the Random Walk Hypothesis. The study employs a robust dataset consisting of daily records from August 2014 to August 2024, spanning 10 years and covering 57 constituent stocks of the ISX60 index and the ISX market index.

The central hypothesis of this research is that daily stock returns on the Iraqi Stock Exchange follow a random walk – that is, successive price changes are independent and identically distributed – consistent with weak-form market efficiency. This hypothesis is tested, and its validity is assessed through the convergent application of multiple statistical tests.

The approach for this investigation begins with the logarithmic daily returns and attempts sequentially the following: (1) unit root tests (Augmented Dickey-Fuller and Phillips-Perron) to determine if the data exhibits stationarity; (2) for some levels of serial correlation, we do an autocorrelation (Ljung-Box Q-statistic) at lag 5, 10, and 15; (3) Variance ratio tests (Lo & MacKinlay, 1988) for the holding periods of $k = 2, 4, 8$, and 16 days to determine any predictability of returns; and (4) to determine the presence of non-parametric runs (Wald & Wolfowitz, 1940) to determine if there is randomness with no distributional assumptions. Official records of daily closing prices from the Iraqi Stock Exchange are the source of data for this study. The primary limitation of this research is the fact that non-linear dependencies and transaction costs are modelled implicitly.

Though research regarding the Iraqi market is quite sparse, it shows the same market inefficiencies. A majority of the studies, however, focus on shorter time horizons and/or use simplistic approaches. This study strengthens the literature by presenting updated and detailed evidence of weak-form market inefficiencies in the Iraqi equity market. Concretely, we examine the ISX60 Index's 57 constituent stocks, and we assess and analyze the market's 10-year daily data from the time period of August 2014 through August 2024, which is characterized by distinct and diverse sets of economic and political events, inclusive of the COVID-19 pandemic, from which we draw the greatest amount of time-domain variance. To analyze the Iraqi stock returns, which reflect the independence and the unpredictability, we use the Random Walk hypothesis, through the use of rigorous statistical unit root tests (Augmented Dickey-Fuller and Phillips-Perron), the autocorrelation tests (Ljung-Box Q-statistic), the variance ratio tests, and the non-parametric runs tests.

There are three contributions to the research. First, it delivers the latest and most detailed analysis on the current ISX60 constituents by providing an extension on previously done work, including updated data until the year 2024. Second, the application of various complementary methodologies (both parametric and non-parametric; time and frequency domain) offers supporting findings on market efficiency, reinforcing the conclusions beyond a single-test approach. Third, by assessing efficiency on the individual stock and the overall index levels, the analysis ascertains whether diversification impacts efficiency characteristics, a query that has clear implications for the construction of portfolios in frontier markets.

The remainder of the paper is organized as follows: section 1 discusses the market efficiency theories and reviews the relevant empirical research available for the MENA region and for Iraq in particular as an atypical representative of the emerging and frontier markets. In Section 2, the author outlines the data and the techniques employed to evaluate the random walk hypothesis. In Section 3, the author presents the results of the random walk hypothesis, which are exemplified by descriptive statistics, unit root tests, autocorrelation tests, variance ratio tests, and runs tests. In Section 4, the author outlines the results of the random walk hypothesis, provides an analysis of the results, compares the findings to those from other markets, and examines the results from the perspective of practitioners and policymakers.

1. Literature review

1.1. Theoretical framework

Market efficiency as a concept and area of inquiry begins with the Efficient Market Hypothesis (EMH). Its origin can be traced back to the work of Fama (1970). In Fama's definition of an efficient market, he states that an efficient market is one where "security prices fully reflect all available information". Fama introduced this formulation of the market efficiency criterion together with the now-common classifications of weak-form, semi-strong, and strong-form market efficiencies. Under the criteria of weak-form efficiency, prices are said to fully reflect all information contained in past prices, and thus, the practice of technical analysis will never succeed in generating positive abnormal returns. The Random Walk Hypothesis (RWH) is the articulation of this concept in which it is alleged that successive price changes will be a series of independent and identically distributed random variables.

The source of the mathematics behind the random walk for the first time was Samuelson (1965), who showed that in an informal efficient market and rational expectations, anticipated prices will have to vary randomly. Subsequently (Fama, 1991), accepted that there are some predictable features of returns, but he brought in the "joint-hypothesis problem": market efficiency cannot be tested without an asset pricing model. This theoretical warning is particularly pertinent for an efficiency test, since the rejection of a random walk could be an indication of model misspecification or real inefficiency.

1.2. Methodological developments

Of the many possible ways to test the random walk hypothesis, the most popular is most likely the variance-ratio test, as proposed by Lo and MacKinlay (1988). Lo and MacKinlay, in constructing their test, state that, in the case of RWH, the variance of k-period returns must equal k times the variance of 1-period returns. Subsequent improvements include the multiple variance ratio test by Chow and Denning (1993), which aims to eliminate the bias of sequential testing, and Wright (2000), a non-parametric test that employs ranks and signs to obtain the exact null distribution.

Another critical aspect of the methodology is the use of unit root tests. The ADF test (Dickey & Fuller, 1979) determines whether a given time series has a unit root, with a random walk in prices/returns being the stationarity condition. The non-parametric, serial correlation robust corrections of Phillips and Perron (1988) and the reverse null hypothesis of stationarity proposed by Kwiatkowski et al. (1992) – the KPSS test – were applied to the series. The Ljung-Box Q-statistic (Ljung & Box, 1978) offers direct proof of serial correlation by analyzing whether the past returns can predict the future returns.

1.3. Evidence from emerging and frontier markets

Numerous studies confirm that less developed markets show less efficiency than developed ones. (Bekaert & Harvey, 2003) provided one of the first and most complete studies of the characteristics of emerging markets, where they highlighted greater volatility, lower liquidity, and higher segmentation. More recently, Lee and Choi (2023) analyzed 60 markets using multifractal detrended fluctuation analysis, and they showed that all frontier markets possess Hurst exponents that are significantly greater than 0.5, indicating persistent and non-random behavior in the markets.

Specific emerging markets have predominant studies that show the rejection of the random walk hypothesis. (Nazlioglu et al., 2024) say that sharp structural breaks seem to reject the inefficiency, and these breaks test gradual shifts, so the authors provide more support for the EMH and state that there is a methodological point to consider. For Asian markets, for example, Shamshir et al. (2018) document strong serial dependence in Pakistan, as Elangovan et al. (2022) also find India’s inefficiency in the Bombay Stock Exchange. On the other hand, Jr. & Camba (2020) find the Philippine market efficient using the Chow-Denning test, and provide an example. (de Villiers et al., 2020) is the one study for inefficient African Frontier Markets. Using a non-linear ESTAR model on the eight African Markets, de Villiers finds mean reversion and an asymmetric adjustment that does not fit the random walk hypothesis.

1.4. MENA region evidence

The majority of research pertaining to the MENA markets shows MENA markets as inefficient in the weak-form. Multiple variance ratio tests by Al-Ajmi and Kim (2012) applied to all GCC markets show RWH to be rejected for Saudi Arabia, UAE, Kuwait, Oman, Qatar, and Bahrain, even after accounting for thin trading. Jamaani and Roca (2015) built on this analysis and documented inefficiency in the GCC markets, both in isolation and in unison. More specifically for Saudi Arabia, Al-Faryan and Dockery (2021) contend that although the RWH was rejected in total for the Saudi market over the period of 1994–2016, efficiency did seem to improve post the 2007 corporate governance reforms, thus supporting the notion of increasing efficiency.

Markets in Turkey are a notable exception (Gozbasi et al., 2014), who conducted non-linear unit root tests on Borsa Istanbul and found that although there is non-linear behavior, the market follows a random walk, which is in line with weak-form efficiency. Evidence for the remaining MENA markets is distinctly negative. Obeidat et al. (2021) do not support RWH for the Amman Stock Exchange in Jordan, whereas Ananzeh (2021) identified inefficiency in Jordan, Egypt, Saudi Arabia, the UAE, Bahrain, and Oman, and concluded that the absence of regulatory reform is a cause. Al-Khazali et al. (2007) provide a significant methodological caveat, as they showed that thin trading adjustments of a particular kind can change outcomes, and they found efficiency in eight MENA markets after bias correction.

1.5. Iraqi stock exchange research

Although the Iraqi Stock Exchange is relatively young (established in 2004; electronic trading 2009) and research on the Exchange is still at a primary level, studies have been describing the market as inefficient. (Kaehler et al., 2014) was the first to study the ISX, and it was based on a 2004–2013 data time frame. The study utilized variance ratio tests and GARCH modeling to analyze the market, and subsequently was one of the first to reject RWH. He also mentioned the lack of liquidity as a dominant factor. The study noted ISX movement as being dominated by changes in the market exchange rate, security situation, and electricity, and not by changes in fundamental information.

Subsequent studies confirm inefficiency. Asaad et al. (2015) analyzed data from every day of the period 2010–2014 using several techniques; all tests led them to reject the RWH. All of the previous studies on RWH cite Asaad et al. (2015), and this individual bank stocks survey covers the years 2004–2014 and concludes that every single one of the bank securities is inefficient; this was the first study of a single sector for the ISX. Asaad and Al-Delawi (2022) cite RWH as rejected for 2019-2020 industrial companies for the most recent studies, and Saleem et al. (2023) cite inefficiency for all years to 2023 for ISX and the Arab Federation of Exchanges index.

Studies conducted during the COVID-19 pandemic corroborated these findings. Asaad (2021) applied the ARDL methodology to the ISX60 index and confirmed its inefficiency, experiencing significant effects from oil prices and no significant effects from gold and the exchange rate, consistent with the local, insulated market. Marane (2022) synthesized the literature on the Iraq stock exchange (ISX), noting that its market capitalization accounts for less than 1% of the total market capitalization of the Arab financial markets and describing the persistent low liquidity, high political risk, and illiquid information/research dissemination environment.

1.6. Explanations for market inefficiency

From the literature, there are many mechanisms that describe the mismatches in the efficiency of frontier markets. Due to a lack of volume or liquidity constraints, dead/stale prices create a false autocorrelation; however, Loc et al. (2010) showed that inefficiencies in the Vietnamese market continued to exist despite thin trading corrections. Said et al. (2024) show that, across five emerging markets, the most important factors influencing the time-varying efficiencies are liquidity, volatility, and transaction costs.

Institutional elements are crucial. Weak property rights inhibit informed arbitrage, resulting in greater price synchronicity in emerging markets (Morck et al., 2000). In South Korea and Taiwan, but not in more developed markets, Chang et al. (2000) attributed significant non-linear herding to poor disclosure. Lesmond (2005) found that transaction costs in emerging markets are, on average, about double compared to developed markets. Saffi and Sigurdsson (2011) showed that obstacles to short-selling inhibit the assimilation of negative information, which worsens price efficiency.

Focusing specifically on Iraq, in one of the previous studies, the author identified the lowest earnings quality in the region and linked poor disclosure to inefficiency in the market (Hassan, 2018). Negative disclosure, low market liquidity, weak institutional structure, limited analyst coverage, high cost of transactions, and information asymmetry all combine to create difficulty in the environment of price discovery, affirming the inefficiency that is documented across all ISX studies.

1.7. Research gap and contribution

While prior research has confirmed the inefficiency of the Iraqi Stock Exchange, this study has several novelties. First, it provides the latest detailed analysis of all constituents of the ISX60 index, having revised the data through 2024, and thus extended previous studies. Second, it uses a wide range of complementary tests, such as the unit root, autocorrelation, variance ratio, and runs tests, thus offering a multi-faceted, though convergent, evidence across different methods. Third, by examining both individual stocks and the index, it assesses inefficiency across different levels of aggregation. Lastly, the 10-year sample period (2014–2024) incorporates recent trends, including the COVID-19 period, which provides recent evidence on the efficient dynamics of this frontier market.

2. Methodology

2.1. Data description

The current paper utilizes an extensive dataset comprising all 57 constituent stocks of the Iraq Stock Exchange Index (ISX60). The dataset spans 10 years, from 3rd August 2014 to 1st August 2024, resulting in 2.304 daily observations for each stock and the market index. The ISX60 is the main benchmark index for the Iraqi Stock Exchange and includes stocks from all seven economic sectors. These include: 6 in agriculture, 16 in banking, 8 in hotels and tourism, 16 in industry, 4 in insurance, 5 in services, and 2 in investment.

The dataset includes the closing prices for the stocks in the dataset and the closing values of the ISX60 index in Iraqi Dinars (IQD) for each day. This dataset covers a sufficiently long period of time that encompasses numerous cycles of stability and unrest in the political and economic climate of Iraq and includes a range of ISX60 components, so that the dataset is complete, eliminating any potential selection bias and capturing the efficiency features of the Iraqi equity market.

2.2. Variable construction and return calculation

Following standard practice in financial economics literature (Fama, 1965; Harvey, 1995), daily stock returns are computed as continuously compounded (logarithmic) returns. The log return for stock *i* at time *t* is calculated as:

$$ri,t \ = \ln \frac{Pi,t}{Pi,t-1} \cdot 100 \qquad (1)$$

where: *Pi,t* represents the closing price of stock i on day *t*, and *Pi,t*-1 denotes the closing price on the previous trading day. Returns are expressed in percentage terms by multiplying by 100.

Theoretical and practical reasons support the selection of log returns in comparison to simple returns. First, log returns are time additive, which allows for the computation of multi-period returns via simple summation of single-period log returns. Second, log returns often meet the normality assumption for parametric statistical tests. Third, logarithmic returns demonstrate symmetry, whereby price increases and subsequent decreases of the same magnitude yield log returns of the same absolute value and opposite sign (Tsay, 2010). The same methodology for calculating returns was employed for the ISX60 market index to derive market-level returns.

2.3. Statistical tests for the random walk hypothesis

For a thorough examination of the random walk hypothesis, the study applies a set of additional statistical tests. Using several tests is important as the tests possess different powers to detect specific deviations from randomness (Harvey, 1995; Lo & MacKinlay, 1988). A mix of parametric and non-parametric approaches is the best way to evaluate the efficiency of the market.

2.3.1. Descriptive statistics and normality tests

Before hypothesis testing can be conducted, stock returns are examined over the mean, standard deviation, skewness, and other moments to gain a basic understanding of the distributional characteristics. These moments shape the test selection and interpretation, and return behavior understanding. The Jarque-Bera test (Jarque & Bera, 1987) tests the null hypothesis of normality formally:

$$JB = \frac{n}{6} \cdot \left[S^2 + \frac{(K-3)^2}{4}\right] \quad , \qquad (2)$$

where: n is the sample size, S is the sample skewness, and K is the sample kurtosis. Under the null hypothesis of normality, the JB statistic follows a chi-square distribution with two degrees of freedom. Significant departures from normality have implications for the validity of parametric tests and may signal the presence of nonlinear dependencies or extreme events.

2.3.2. Unit root tests

Unit root tests are designed to determine whether a time series is stationary or has a unit root, which directly relates to the random walk hypothesis. One such test is the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979; Said & Dickey, 1984), which tests whether the return series contains a unit root. The ADF test regression with a constant term is represented as follows:

$$\Delta r_t = \alpha + \beta r_{t-1} + \Sigma \gamma_j \Delta r_{t-j} + \varepsilon_t \quad , \qquad (3)$$

where: Δ denotes the first difference operator, rt is the return at time t, α is a constant, and ε_t is a white noise error term. The null hypothesis H0: $\beta = 0$ (unit root exists) is tested against the alternative H1: $\beta < 0$ (series is stationary). The lag length p is selected using the Akaike Information Criterion (AIC) to ensure that the residuals are free from serial correlation.

Along with the ADF test, I also use the Phillips-Perron (PP) test (Phillips & Perron, 1988). The PP test employs a non-parametric correction for the serial correlation and heteroskedasticity, which makes it more robust to such specification issues. The test adjusts the Dickey-Fuller t-statistic:

$$PP = t\beta \cdot (\frac{\sigma^2}{\lambda^2})^{\frac{1}{2}} \quad , \quad (4)$$

where: *tβ* is the t-statistic from the simple Dickey-Fuller regression, σ^2 is the variance of the error term, and λ^2 is the long-run variance estimate using the Newey-West procedure. Consistency between ADF and PP results provides confidence in the stationarity findings. Rejection of the null hypothesis in both tests indicates stationarity in returns, which would contradict a pure random walk in price levels.

2.3.3. Autocorrelation tests

The random walk hypothesis implies that returns should be serially uncorrelated. The presence of significant autocorrelation in returns indicates predictability and thus represents a violation of market efficiency (Fama, 1970). The Ljung-Box Q-statistic (Ljung & Box, 1978) provides a formal test of the joint hypothesis that all autocorrelation coefficients up to *lag* m are simultaneously zero:

$$Q(m) = n(n + 2)\sum\left[\frac{\rho k^2}{(n-k)}\right] \quad , \quad (5)$$

where: *n* is the sample size, ρk is the sample autocorrelation at lag k, and the summation is over $k = 1$ to m. Under the *null* hypothesis of no autocorrelation, the Q-statistic follows a chi-square distribution with *m* degrees of freedom. This study computes the Ljung-Box statistic for lags m = 5, 10, and 15 to test for both short-run and longer-term dependencies in returns.

2.3.4. Variance ratio test

The variance ratio test, developed by Lo & MacKinlay (1988), has become one of the most widely used and powerful tests of the random walk hypothesis. The test exploits a fundamental property of random walks: if returns are serially uncorrelated, the variance of k-period returns should be k times the variance of one-period returns. The variance ratio for holding period *k* is defined as:

$$VR(k) = \frac{Var[rt(k)]}{k} \cdot Var[r_t] \quad , \quad (6)$$

where: *rt(k)* denotes the k-period return from $t - k + 1$ to t, and rt is the one-period return. Under the random walk hypothesis, *VR(k)* = 1 for all k. Deviation from unity indicates predictability: *VR(k)* < 1 suggests mean reversion (negative serial correlation), while *VR(k)* > 1 indicates momentum or positive feedback trading (positive serial correlation).

Lo and MacKinlay (1988) derived test statistics under different assumptions. The homoskedastic test statistic assumes constant variance:

$$z(k) = \left(\frac{[\mathrm{VR}(k) - 1]}{[\varphi(k)]}\right)^{\frac{1}{2}}, \qquad , \tag{7}$$

where: $\varphi(k)$ is the asymptotic variance of the variance ratio under homoskedasticity.

The heteroskedastic-robust test statistic is:

$$z*(k) = \left(\frac{[\mathrm{VR}(k) - 1]}{[\varphi*(k)]}\right)^{\frac{1}{2}}, \tag{8}$$

where: $\varphi^*(k)$ is the heteroskedasticity-consistent asymptotic variance. Both test statistics follow a standard normal distribution under the null hypothesis. Since financial returns typically exhibit time-varying volatility, the heteroskedastic-robust statistic is considered more reliable. This study computes variance ratios for k = 2, 4, 8, and 16 days, corresponding to approximately 2 days, 4 days, 1.5 weeks, and 3 weeks of trading.

2.3.5. Runs test

As a complement to the parametric tests described above, the non-parametric runs test provides a distribution-free method for testing randomness(Wald & Wolfowitz, 1940). A "run" is defined as a sequence of consecutive returns of the same sign (either all positive or all negative). Under the random walk hypothesis, the number of runs should follow a predictable distribution. Let N_+ denote the number of positive returns and N_- the number of negative returns. The expected number of runs under randomness is:

$$E(R) = 1 + \frac{2N_+N_-}{N_+ + N_-} \qquad , \tag{9}$$

with variance:

$$Var(R) = \frac{2N_+N_-(2N_+N_- - N_+ - N_-)}{(N_+ + N_-)^2(N_+ + N_- - 1)} \qquad . \tag{10}$$

The standardized test statistic is:

$$Z = \frac{R - E(R)}{\sqrt{Var(R)}} \qquad , \tag{11}$$

where R is the observed number of runs. For large samples, this statistic approximately follows a standard normal distribution. Too few runs (negative Z-value) suggest positive serial correlation or trending behavior, while too many runs (positive Z-value) indicate negative serial correlation or mean reversion.

2.3.6. Analytical approach

By applying all the statistical tests described above to the return series of all 57 individual stocks and the ISX60 market index. This allows us to assess efficiency for each security, as well as for the market as a whole. Results for each test are provided at standard levels of significance (1%, 5%, and 10%) to gauge the evidence against the random walk hypothesis.

Instead of delivering findings individually for every stock, the examination presents summary metrics demonstrating the overarching trend across the sample. More precisely, a count of stocks failing to accept the random walk hypothesis for each level of significance is tabulated for every test. This serves to illustrate the extent to which the Iraqi equity market exhibits a lack of randomness. Furthermore, to evaluate the efficiency at a market level, the results pertaining to the ISX60 index are provided in detail.

In order to reinforce conclusions regarding market efficiency, the author checks the reliability of the results across different tests. The results obtained from multiple tests are more trustworthy than those obtained from a single test. The author conducted all the statistical analyses using the Python programming language, specifically using NumPy, Pandas, SciPy, and Statsmodels, which offer extensive implementations of the described econometric techniques.

3. Empirical results

This section provides empirical results after analyzing the random walk hypothesis for the entire 57 constituent stocks of the ISX60 index and for the market index itself. Based on the previously described methodology, the findings start with descriptive statistics, followed by more advanced analyses of market efficiency.

3.1. Descriptive statistics

Table 1 shows summary statistics for the daily returns of the 57 individual stocks and the ISX60 index. The daily return average across all stocks is –0.0041%, suggesting a slight average decline over the sample period. Daily average volatility across stocks is 3.21%, with substantial heterogeneity between 1.18% and 10.20%. The distributional characteristics are grossly non-normal, with a mean kurtosis of 171.98, which is much larger than the 3 expected under normality.

Table 1

Descriptive statistics of daily returns

Statistic	Mean	Std Dev	Minimum	Maximum	JB Reject, %
Mean return (%)	–0.0041	0.0446	–0.1234	0.0746	–
Volatility (%)	3.2068	1.7677	1.1840	10.1968	–
Skewness	0.2070	2.6373	–	–	–
Kurtosis	171.98	214.72	–	–	–
Normality (JB Test)	–	–	–	–	**100**
ISX60 Index	–0.0059%	1.62%	–1.32	107.31	Yes***

Note. Statistics represent cross-sectional means across 57 stocks.
*** indicates significance at 1% level.

The Jarque-Bera test formally rejects normality for all 57 stocks at the 1% level. The ISX60 index also strongly rejects normality (JB = 1 004 318, $p < 0.001$). This universal rejection suggests extreme events and non-standard distributions characterize Iraqi stock returns.

3.2. Unit root test results

Table 2 presents the results from the Augmented Dickey-Fuller test. All 57 stocks reject the null hypothesis of a unit root at the 1% significance level, indicating stationarity. The ISX60 index similarly exhibits strong stationarity.

Table 2

Augmented Dickey-Fuller unit root test results

Significance level, %	Stocks rejecting	Percentage, %
1	57 / 57	**100.0**
5	57 / 57	**100.0**
10	57 / 57	**100.0**
ISX60 Index	ADF = –16.55	$p < 0.001$***

Note. Null hypothesis: the series has a unit root (non-stationary).
*** indicates significance at 1% level.

While stationarity is consistent with a random walk in prices, it does not confirm the hypothesis. A random walk requires stationary and serially uncorrelated returns. Universal stationarity satisfies the first condition but requires further testing for serial independence.

3.3. Variance ratio test results

The variance ratio test offers strong evidence against the hypothesis of a random walk. *Table 3* shows the variance ratios for the 2, 4, 8, and 16-day holding periods. The mean variance ratios are less than one, which suggests mean reversion.

Table 3

Variance ratio test results

Period (k)	Mean VR	1% Reject	5% Reject	10% Reject	ISX60 VR
2 days	0.961	64.9%	73.7%	80.7%	0.747***
4 days	0.959	**70.2%**	**78.9%**	80.7%	0.603***
8 days	0.952	71.9%	77.2%	82.5%	0.548***
16 days	0.946	61.4%	70.2%	75.4%	0.532***

Note. Null hypothesis: VR(k) = 1. Rejection percentages based on 57 stocks.
*** indicates significance at 1% level.

At the 5% level, 70–79% of stocks reject the random walk hypothesis across all holding periods. The ISX60 index shows dramatic departures (VR = 0.53–0.75), indicating strong mean reversion in the aggregate market. These variance ratios–roughly half the expected value–represent substantial violations of market efficiency.

3.4. Runs test results

The non-parametric runs test complements parametric tests by examining randomness without distributional assumptions. *Table 4* presents the results. At the 5% level, 42.1% of stocks reject randomness, with 50.9% at the 10% level.

Table 4

Runs test results

Significance level	Stocks rejecting	Percentage	Mean Z-stat
1%	19 / 57	33.3%	—
5%	24 / 57	**42.1%**	–0.460
10%	29 / 57	50.9%	—
ISX60 Index	Runs: 824 / 950	p < 0.001***	–5.802

Note. Null hypothesis: returns are random. Negative Z-statistic indicates too few runs (positive correlation).
*** indicates significance at 1% level.

The mean Z-statistic of –0.46 indicates a tendency toward too few runs, suggesting positive serial correlation. The ISX60 index strongly rejects randomness (Z = –5.80, $p < 0.001$), with observed runs (824) substantially below expected (950), confirming momentum effects at the aggregate level.

3.5. Overall assessment

Table 5 synthesizes results across all tests at the 5% significance level. The evidence overwhelmingly indicates Iraqi stock returns do not follow a random walk. While all stocks exhibit stationarity, the vast majority show significant departures in serial correlation and predictability.

Table 5

Summary of random walk hypothesis tests
at 5% significance level

Test	Percentage Rejecting RWH
Unit root (ADF)	100.0% (stationary)
Variance ratio (k = 4)	78.9%
Runs test	42.1%
ISX60 Index	**Rejects in all tests*** **

Note. Rejection percentages based on 57 stocks.
*** indicates all ISX60 tests are rejected at 1% level.

The convergence of evidence across multiple methodologies – parametric and non-parametric – provides robust support that the Iraqi equity market is not weak-form efficient. The ISX60 index consistently rejects the random walk hypothesis across all tests, showing stronger violations than individual stocks. This suggests diversification effects or market-wide factors contribute to aggregate-level predictability, with strong mean reversion (VR ≈ 0.50–0.75) persisting across different time horizons.

4. Discussion

4.1. Interpretation of findings

The Iraqi stock market does not demonstrate weak-form market efficiency, which is the most reliable and consistent observation from the data. The random walk hypothesis has been conclusively rejected in a variety of statistical analyses, both at the level of individual stocks and at the level of the market as a whole. Although all stocks demonstrate stationarity- a condition necessary for random walk behavior- the widespread presence of serial correlation, mean reversion, and other predictable patterns demonstrates that prior price data is useful in predicting future returns. This result is in line with what one would expect of the Iraqi stock market, given the condition of many other so-called inefficient frontier markets. It is consistent with the expected theoretical condition for markets with poor liquidity, information divergence, and rudimentary institutional arrangements.

The ISX60 Index shows violations of the random walk hypothesis more than individual stocks, which is noteworthy. Compared to individual stocks having average mean values of individual stocks of about 0.95, the index shows variance ratios of 0.50 to 0.75. This means inefficiencies at the aggregate level are higher than at the individual security level. This result may be due to index tracking by institutions, aberrant sentiment, under or overreaction to macroeconomic info, or tracking by institutions.

4.2. Explanations for Market Inefficiency

Three main reasons can help understand why the Iraqi equity market operates inefficiently. First, sporadic trading and low market liquidity cause stickiness and serial correlation of market prices. Although in theory prices should adjust to new information, in practice, this gradual adjustment process can cause autocorrelation. Second, irrational retail behavior via herding, momentum trading, etc., leads to inefficient predictability in the prices via similar behavior in the market.

Third, in developed markets, information diffuses more efficiently than in frontier markets. There may be a lack of consistency in corporate disclosures, scant financial media coverage, and limited coverage of financial analysis. These barriers to information flow delay the price reaction to new information. Fourth, with respect to Iraq's oil price reliance, geopolitical issues, and weak institutions, the overall macroeconomic and political conditions may lead to widespread shocks and systematized patterns of returns as the markets slowly diffuse ambiguous information.

Finally, with no institutional investors and minimal foreign involvement, the market lacks the sophisticated arbitrageurs who usually act to remove any patterns that can be exploited. The absence of mechanisms for short-selling and no market for derivatives means that informed traders also face restrictions to arbitrage mispricings, and therefore, the market can be inefficient for arbitrage.

4.3. Comparison with other markets

The results are consistent with previous research on frontier and emerging markets. Research on other MENA markets demonstrates similar occurrences of weak-form efficiency violations, although in the magnitude of departure, there are significant differences. The Iraqi stock market, in comparison to Egypt and Jordan, seems to exhibit inefficiencies similar to or more than those of Jordan and Egypt. However, recent studies using the same methodologies and the same research questions are lacking, which makes benchmarking difficult. The differences in random walk behavior between the Iraqi market and more developed emerging markets such as Turkey or South Africa are considerable and validate the Iraqi market being classified as a frontier market rather than an emerging market.

4.4. Practical implications

The rejection of the random walk hypothesis implies that, at least before transaction costs, the frictionless environment allows investors to earn positive abnormal returns using technical trading strategies based on serial correlation, mean reversion, and the like. However, these strategies come with great execution and operational costs, the former of which are particularly relevant for frontier markets. In addition, the descriptive statistics reveal extreme returns and high volatility, requiring significant risk and position sizing, which, to some, is considered operational risk.

The findings emphasize a few areas for improving market efficiency that policymakers and market regulators need to focus on first. It appears that improving market liquidity through market-making schemes, lowering transaction costs, increasing disclosure requirements, and encouraging institutional investors and the direct market potential of derivatives would help the market discover prices more efficiently. Increased and developed investor education would help in reducing the behavioral biases that strengthen predictable price patterns. Developing more efficient equity markets would improve capital allocation, corporate financing, and the greater economic development of Iraq.

The Iraqi market shows strong potential from an Academic standpoint, particularly focusing on the market microstructure and efficiency under extreme conditions. The market inefficiencies and the way information is adjusted in the Iraqi market can be investigated, given the market's substantial deviation from the random walk hypothesis. Using the Iraqi market as a study can help further understand the inefficiencies and information adjustment mechanisms within the context of a market with extreme institutional constraints.

Conclusions

The main hypothesis of the research, which in this case is that the daily stock returns of the Iraqi Stock Market are a random walk, and therefore demonstrates weak-form market efficiency, is contradicted by the evidence. From the period of August 2014 to August 2024, I was able to prove that the Random Walk Hypothesis is overwhelmingly and statistically significant at the 57 constituent stocks of the ISX60, as well as the Market Index. This is done by applying a uniform approach to the four converging methodologies, which are the unit root test, the Ljung-Box test, Lo-MacKinlay Variance Ratio tests, and the non-parametric runs tests. I was able to get 70–79% rejection at the 5% in the index level. The results are consistent in 57 constituent stocks of ISX60. This proves that weak-form market efficiency is not present in the Iraqi Stock Market.

This paper shows that the Iraqi Stock Exchange is able to demonstrate constructive inefficiency. Through the application of the random walk hypothesis to the 57 stocks in the ISX60, using daily record data from August 2014 to August 2024, rejections were received through multiple statistical processes. Stationarity was the only consistent characteristic of all stocks, but the majority also recorded high serial correlation, mean reversion, and predictability, which all contradict the random walk theory. The most noteworthy evidence was provided by the variance ratio tests. 70–79% of the stocks in the ISX60 provided evidence in support of the random walk theory, and even the index itself demonstrated a high level of inefficiency. The results of this study fit the profile of previous studies done on frontier markets and also provided proof that, in the Iraqi equity market, prices from previous time periods held information that was useful in forecasting future returns.

The rejected weak form efficiency postulates that technical trading strategies based on pattern recognition and predictive mean reversion may lead to positive returns, although the high transaction costs associated with this particular marketplace may limit the potential for practical gains. These findings underscore the importance of prioritizing the development of marketplaces in Iraq, specifically in the implementation of market-making programs to enhance liquidity, lower transactional costs, increase the enforcement of mandatory disclosures, promote intermediation by financial institutions, and the growth of derivative markets. All of these efforts to improve the efficiency of the marketplace in Iraq will lead to more optimal allocation of resources, reduce the cost of capital for Iraqi companies, and promote economic development in the country.

Several constraints deserve to be noted. First, thin trading in the ISX may cause spurious autocorrelation due to stale prices; however, this reveals genuine market microstructure, and not a statistical artifact. Second, our tests center on linear relationships; non-linear relationships may be present, which are beyond the scope of our approach. Third, while high, we do not directly factor in the transaction costs in assessing profitability. Fourth, the sample period, while broad, may not be comprehensive of all market regimes or structural shifts in this developing frontier market.

Several avenues remain open to future research in this analysis. Understanding the determinants of efficiency would be enriched by examining whether the degree of inefficiency varies by industry or by the characteristics of the firm. This will be particularly informative for the evaluation of policy effectiveness in examining whether efficiency has changed over time, especially in the aftermath of policy reforms or changes in infrastructure. Analyzing the speed of information assimilation to test semi-strong form efficiency through event studies would be appropriate. Analyzing the profitability of trading strategies in the presence of realistic transactional costs would determine whether there are readily actionable trade-offs. Finally, research of a comparative nature across other MENA frontier markets would widen the scope of the study of the efficiency of the markets of Iraq. It is important, however, as markets of Iraq continue to approximate frontier status, that there be ongoing research to capture the emerging patterns of efficiency that will reflect the country's position within global capital markets.

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CONCEPTUAL MODEL FOR THE DEVELOPMENT OF UKRAINE'S DIGITAL ECONOMY

The formation of effective methods and tools for management in the digital age involves the comprehensive use of digital technologies and data, which makes it possible to conduct a comprehensive assessment of the current state of social and economic systems, identify the most influential challenges, and develop strategic development prospects. A theoretical assumption has been formulated regarding the introduction of advanced management methods based on artificial intelligence and machine learning algorithms, big data, and digital platforms, which allows for a comprehensive and prompt assessment of transformation processes, overcoming negative manifestations in the digital economy, and will contribute to increasing the level of competitiveness of national economic systems in the global digital dimension. The research used general scientific methods of analysis and synthesis to characterize the conceptual foundations of the digital economy and identify its role in overcoming a complex of negative environmental factors; a comparative method and system-structural analysis to study the best practices of developed countries of the world; and conceptual analysis and theoretical

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КОНЦЕПТУАЛЬНА МОДЕЛЬ РОЗВИТКУ ЦИФРОВОЇ ЕКОНОМІКИ УКРАЇНИ

Формування ефективних методів та інструментарію управління в цифрову епоху передбачає комплексне застосування цифрових технологій та даних, що дає можливість провести всебічне оцінювання поточного стану соціально-економічних систем, визначити найвпливовіші виклики та ідентифікувати стратегічні перспективи розвитку. Сформульовано теоретичне припущення щодо запровадження передових методів управління на основі алгоритмів штучного інтелекту та машинного навчання, великих даних та цифрових платформ, що дозволяє всебічно та оперативно оцінювати трансформаційні процеси, подолання негативних проявів у цифровій економіці та сприятиме підвищенню рівня конкурентоспроможності національних економічних систем у глобальному цифровому вимірі. Використано загальнонаукові методи аналізу та синтезу для характеристики концептуальних основ цифрової економіки та ідентифікації її ролі при подоланні комплексу негативних факторів зовнішнього середовища; порівняльний метод та системно-структурний аналіз для вивчення передового досвіду розвинених країн світу; концептуальний аналіз та теоретичне моделювання для розробки моделі *modeling to develop a model for the development of the digital economy in Ukraine by 2030. The feasibility of developing national digital strategies to drive intensive growth in line with sustainable development goals is substantiated.*

The feasibility of implementing advanced management methods in the conditions of globalization and digitalization is substantiated, which involves adapting the business environment to a set of factors and the need to improve the analysis methodology. A conceptual scheme of the four main directions of the digital transformation of Ukraine and the system-forming factors of the digital economy is presented. A formation study of a comprehensive digital transformation management system, considering factors at the meso and macro levels, is conducted. The feasibility of using the Internet, digital platforms, and big data to form an up-to-date information base about international markets, national systems, and types of economic activity is substantiated. The need to use modern artificial intelligence and machine learning algorithms to assess trends, conduct prospective analysis, identify risks, and search for optimal management solutions in the business environment and the public administration sector is substantiated. The scientific novelty lies in the systematization of conceptual principles and the theoretical substantiation of the role of innovative digital management tools in optimizing the digital economy and implementing best practices in Ukraine, considering military operations.

Keywords: digital economy, management, optimization, Internet, information technology, digital technology, global economy, strategy.

розвитку цифрової економіки в Україні до 2030 р. Обґрунтовано доцільність формування національних цифрових стратегій для забезпечення інтенсивного зростання у відповідності з цілями сталого розвитку і впровадження передових методів управління в умовах глобалізації та цифровізації, що передбачає адаптацію бізнес-середовища до комплексу факторів та необхідність удосконалення методології аналізу. Представлено концептуальну схему чотирьох основних напрямів цифрової трансформації України та системо-утворюючі фактори цифрової економіки. Розглянуто особливості формування комплексної системи управління цифровою трансформацією з урахуванням факторів на мезо- та макрорівнях. Обґрунтовано доцільність використання інтернету, цифрових платформ та великих даних для формування актуальної інформаційної бази про міжнародні ринки, національні системи, види економічної діяльності; необхідність використання сучасних алгоритмів штучного інтелекту та машинного навчання для оцінювання тенденцій, проведення перспективного аналізу, визначення ризиків та пошуку оптимальних управлінських рішень у бізнес-середовищі та секторі державного управління. Наукова новизна полягає у систематизації концептуальних засад та теоретичному обґрунтуванні ролі інноваційних цифрових інструментів управління з метою оптимізації цифрової економіки та впровадженні передового досвіду в Україні з урахуванням воєнних дій.

Ключові слова: цифрова економіка, управління, оптимізація, інтернет, інформаційні технології, цифрові технології, глобальна економіка, стратегія.

JEL Classification: O32, O33, O38, M15.

Introduction

The post-industrial era is characterized by the development of the electronic environment and the transition to information civilization. In this context, one of the main drivers of revolutionary transformations in the global economic system and changes in the hierarchy of global centers of power is the development of the digital economy, based on the fourth industrial revolution, which is based on cyber-physical systems, the merger of advanced digital, physical, and biological technologies. Today, the struggle is intensifying between developed countries for control over the sphere of material production, for the return (restoring) of production capacities, previously distributed by global economic leaders from the USA and the EU in developing countries to their historical homeland. The reason is that it is the industry that is the main generator of innovation in the modern world, which provides a unique combination of technological process, increasing returns, and perfect competition, which, in general, is the basis of the success of developed countries. Digital technologies are necessary for the growth of efficiency in many sectors of the economy, and in some sectors, they become the basis of product and productive strategies. Digital technologies help to find sources of efficiency improvement and opportunities for rapid competitive development of enterprises (companies, corporations, and entities of the business sector). At the same time, they require changing existing management models, reformatting communications, technologies, and organizational structure of companies based on new values, priorities, and guidelines based on partnership, customer orientation, innovation, and synergy.

Domestic and foreign researchers have paid considerable attention to the problems of the digital economy and the transformation processes taking place in the economic complexes of countries and their regions under its influence.

Nambisan et al. (2019) note the emergence of modern digital technologies and their active implementation at micro, macro, and meso levels. Digital technologies provide companies with a new level of value, allowing them to strengthen competitiveness in the country and international markets. The transformation of companies in the new reality will contribute to the establishment of close communications with the target audience. Image management in the digital environment is caused by the reorientation of modern users to the use of the Internet in everyday life.

Eller et al. (2020) examine the management challenges for small and medium-sized enterprises in the context of digitalization, as well as the resources necessary for successful transformation. IT is considered the most important factor in qualitative transformations and the construction of modern management systems. Digital technologies allow optimizing business processes, including increasing the efficiency of using available financial resources.

Verhoef et al. (2021) presented interdisciplinary approaches to the digital transformation of companies, which is associated with innovative changes in technologies based on big data, digital competition, and growing demand among consumers for goods and services on the Internet. The team of authors identified three stages of digital transformation: digitalization, digitization, and digital transformation. Companies need to accumulate digital assets, developing through the analysis of big data based on modern mathematical algorithms.

Hanelt et al. (2021) conducted a systematic review of the impact of digitalization on strategic management and organizational change in companies. The authors proposed a multidimensional framework for the synthesis of digital technologies and identified the main patterns. Digital technologies contribute to the transition of enterprises to flexible organizational structures that allow them to adapt to a changing external environment. Digital business ecosystems are becoming a new reality for successful entrepreneurial activity and the formation of user loyalty in the long term.

Mikalef et al. (2021) consider artificial intelligence as a tool for managing the B2B sector of the digital economy. Digitalization and the accumulation of significant amounts of information open significant opportunities for companies, influencing the optimization of various processes, among which marketing plays a key role. The authors identified the main factors (corporate, business, and individual) that affect the provision of value using artificial intelligence.

Makedon et al. (2023) investigate the main approaches to managing the value of international corporations according to the characteristics of the formation of digital assets. The digital environment is considered a space for the realization of competitive advantages by market participants. Factors of value growth in the context of digitalization are identified based on a modified approach.

Raihan (2024) assesses the relationship between the paradigms of the digital economy and sustainable development. The development of renewable energy sources is important for ensuring a safe environment for humanity, which is actively introducing digital technologies into economic systems. Along with this, it is emphasized that there is a complex of risks for the digital economy at the global and national levels.

Dimitrova et al. (2025) conduct a comprehensive analysis of factors that, in the context of digitalization, create the prerequisites for the intensive development of enterprises. The authors pay considerable attention to proving the feasibility of modeling business processes based on the cost indicators of scientific and research work. The process of creating a technological map of innovations at industrial enterprises, taking into account regional factors, is presented.

Entezami et al. (2025) analyze key criteria based on artificial intelligence for the development of the digital economy in accordance with the multi-criteria decision-making method. The authors identified 20 criteria for artificial intelligence, which were combined into four groups: structural, organizational, technological, and economic. It is argued that an emphasis on innovation and processing of large data sets contributes to increased productivity and business sustainability in digital transformation.

The analysis of scientific works shows that most of the research is focused on the corporate level of digital transformation, while the issues of systematization of conceptual ambushes at the national level remain insufficiently developed. Despite the presence of works on national strategies of individual countries, there is a lack of comprehensive models adapted to the specifics of Ukraine in war conditions. Thus, the identified gap in the systematization of conceptual approaches determines the need for this study.

Management of modern digital systems at the national and global levels involves the use of large volumes of information, which acts as a valuable resource for the formation of effective management decisions.

Processing large amounts of information involves the use of modern mathematical algorithms, among which artificial intelligence and machine learning occupy an important place. Thanks to the implementation of these approaches in information processing, it is possible to identify hidden relationships.

The aim of the article is to systematize and theoretically substantiate the prospects for using new methods and tools of digital management in the digital economy, including in the conditions of the Ukrainian economy.

Under the aim, a theoretical hypothesis is formulated that a comprehensive understanding of the conceptual foundations of the digital economy and its role in the process of solving social and economic problems at the global and national levels allows for harmonious transformations in accordance with the goals of sustainable development.

The formation of a complex system of digital transformation management based on digital platforms, cloud computing, and big data processing makes it possible to make effective management decisions regarding the use of available digital resources. Along with this, the implementation of digital strategies by countries in accordance with national characteristics creates the prerequisites for maintaining a high level of competitiveness, contributing to accelerated economic growth.

The theoretical and methodological foundations for writing the article were the works of domestic and foreign researchers. The research was carried out using the methods of theoretical generalization and systematization of scientific literature, comparative analysis and synthesis (to clarify the contradictions between traditional types of resources and digital data), conceptual modeling (to develop a model of the development directions of the digital economy of Ukraine for the period of 2030), and the method of comparative analysis of international experience.

The activation of digitalization processes for national economic systems, types of economic activity, and companies involves the use of innovative methods and tools for management. The modern digital economy is characterized by a significant level of turbulence due to the presence of a significant number of external environmental factors that can have a positive or negative impact in the long term.

The three sections of the main part of the article present the conceptual principles of the digital economy as a complex, innovative system of communications between stakeholders based on modern technologies. Economic systems in the conditions of the fourth industrial revolution are undergoing radical transformations that occur on a qualitatively new basis with an orientation towards flexibility, dynamism, and manageability of economic processes. A comprehensive analysis of digital data as an important resource that is growing exponentially due to the generation of diverse information by stakeholders has been carried out. The feasibility of developing national digital strategies to optimize the integration of innovative technologies, increase the efficiency of social and economic systems, and ensure information security in the presence of a significant number of cyber risks is substantiated. The international experience of forming effective digital development strategies in countries such as the USA and China has been studied. The characteristic features of the above-mentioned highly developed countries are revealed, taking into account the specifics of their development of social and economic systems. A conceptual model of the development of the digital economy of Ukraine by 2030 is presented, which contains four basic directions of transformations, considering global forecasts of the spread of digital infrastructure. The features of changing the business environment in the digital era due to the emergence of new segments of the economy and changing relationships with business entities are revealed. Key factors for the development of the digital economy have been identified, including electronic technologies, big data, institutional development, ensuring sovereignty and security to achieve modern living standards, and protecting personal information.

1. Conceptual ambushes of the digital economy and their role in the modern world

The digital economy is a holistic, systemic relationship between a significant number of stakeholders (users, companies, national and international institutions), which is compatible with digital technologies and other high technologies of the 21st century, including within the framework of the fourth industrial revolution, and, in its formation, development, and implementation, must ensure the achievement of an objectively set goal. Thanks to digitized, networked, and intelligent technologies, modern economic activity has become more flexible, dynamic, and manageable. Most developed countries, such as the USA, Japan, Germany, France, Canada, Singapore, China, consider the formation of conditions for the development of the digital economy as a strategic goal for the coming decade, the achievement of which is impossible without the large-scale use of IT. The emphasis on the priority areas of digital development of the modern economy, which contribute to economic growth, increasing budget sustainability, and strengthening social cohesion, indicates the importance of the digital economy, which should play a certain role in achieving sustainable development of social and economic systems, carrying out structural reforms and progressive transformations around the world.

The digital economy accumulates various types of economic activity in which the use of digital data plays the role of a key factor of production and its competitiveness. Modern information networks are the infrastructure for data exchange, and the effective use of information and communication technologies is an important driving force for increasing the effectiveness and efficiency of the functioning of the national economy, as well as optimizing its structure.

The digital economy is formed in the process of informatization, which is understood as the social, economic, scientific, and technological process of mass application of digital technologies in all spheres of human activity to radically improve working conditions and the quality of life of the population, and significantly increase production efficiency. The increasing importance of digital data in relation to traditional types of resources is due to their specific properties, as well as the currently exacerbated contradictions in the development of the economies of different countries of the world.

The basis for the formation of these contradictions, according to some well-known scientists, is primarily that humanity has practically exhausted extensive development paths (Su et. al., 2022; Rong, 2022). The use of traditional technologies and methods of production inevitably leads to a rapid depletion of resources and deterioration of the ecological situation, which threatens the very existence and further development of civilization. That is why the search for and large-scale involvement in social production in the world economy of new resources that would allow to level out negative environmental and economic effects on the one hand and ensure the progressive development of the modern economy on the other, is considered one of the most important strategic tasks of the new millennium (Makedon et. al., 2023).

One of such resources can be attributed to data in digital form, which have such properties that distinguish them from other factors of production, namely:

- digital data is a practically inexhaustible resource in the sense that, in the process of use, they do not decrease, while it is easily replicated and distributed;
- digital data has resource-saving properties: its use allows institutions to reduce the consumption of other resources and create resource-saving and environmentally friendly technologies and production.
- the production and use of digital data do not entail environmental pollution;
- universal means of production should be created to work with digital data, forming the basis of information and digital technologies (Yeganeh et. al., 2024, October).

Awareness of the relationship between the need for digitalization and the search for solutions to these contradictions has contributed to the development in many countries of the world of digital strategies aimed at introducing innovative digital technologies to increase the efficiency of the functioning of national social and economic systems. Within the framework of these strategies, the use of digital technologies, primarily the Internet, is considered the basis for economic modernization and structural changes in the real sector of the economy, and the target areas of development vary from climate change to increasing the efficiency of the functioning of state structures, the use of resources, or the creation of new jobs.

Therefore, it is also necessary to emphasize that to achieve the set goals, digital development strategies should be much broader than digital technology development strategies. To maximize the effect of the digital economy, governments need to create appropriate conditions for comprehensive social and economic development based on the large-scale use of digital technologies, which include:

- mechanisms for developing competition;
- the formation of skills that allow for the profitable use of the opportunities of the digital economy;
- the formation and further development of effective institutions.

The implementation of these conditions should accelerate the pace of development in national economies and help overcome the basic contradiction of modern development using digital technologies. In addition, most countries have created national programs to protect network infrastructure, which define technical and functional criteria for digital technologies and contribute to identifying potentially vulnerable elements by developing rules and procedures to ensure access to them. It should also be noted that the security of information systems is an increasingly urgent problem for the economy and society.

Information systems security – primarily ensuring trust and security on the Internet – is one of the keys and "cross-cutting" areas of managing the digitalization of economies and requires adequate measures to protect users.

2. International Evidence on the Formation of National Strategies for Digital Development

It should be noted that many countries adopt a digital security strategy as a holistic document related to ensuring national security. At the same time, most recognize that the scale of information threats and risks of the digital economy goes beyond the boundaries of individual organizations and becomes global.

Typical goals of these strategies are:

- detection and response to cyberattacks;
- threat prevention, support, and development of reliable service products for state structures and economic entities;
- support for state institutions and infrastructure operators;
- promotion of education in the field of digital technologies.

In our opinion, the implementation of the digital economy development strategy also requires a transformation of the entire social and economic system, within which conditions must be created, including for the development of culture.

The development of the digital economy gives rise to new, previously non-existent problems and risks, in particular:

- transformation of the role of state structures, the need to expand the spectrum of their activities;
- high risk of interference in the private lives of citizens and a decrease in the level of information and information-psychological security;

- increasing unemployment due to structural changes in the economy associated with the introduction of modern digital technologies, as well as the impact of the consequences of the global coronavirus pandemic on national economies;
- increased competition in all areas of economic activity, which leads to the complication of existing economic models;
- the need to improve the regulatory framework and form a new institutional framework in terms of developing rules and mechanisms for the functioning of the digital economy.

Work to eliminate problems is actively underway around the world. Thus, the USA seeks to become a leader in international trade using digital technologies. According to the Digital Economy Agenda, the United States will support the expansion of the Internet as a global digital platform for communications, trade, innovation, and civic engagement.

The strategy outlines four key areas:

- a free and open Internet for expanding international trade, minimizing barriers from countries that set rules to mitigate risks of reducing the competitiveness of American and foreign companies;
- trust and security, ensuring privacy, and protecting consumers' intellectual property on the Internet;
- accessibility to the Internet by eliminating uneven infrastructure development and ensuring fast access to the network with minimal barriers to data flow, as well as training American workers in the skills of working in a digitized global economy;
- innovation and new technologies in the digital economy that open new opportunities for their commercialization.

Another clear leader in the global digital space is China. This country is aimed at increasing the quality of life through effective production (for example, digitalization of transport), while digital technologies are considered one of the main tools for increasing the efficiency of the national economy. Strategically, China expects to transform from a global factory of goods into a "planetary" laboratory by 2030 and, to this end, to intensify informatization using digital technologies, primarily in three areas – industry, finance, and trade.

To bring the country's economy to a new level of development, China has adopted a plan for the reindustrialization of the country, "Made in China 2025", aimed at building a "smart" economy, the technological base of which is digital technologies within the framework of national digital platforms (Li & Branstetter, 2024). As a result, it is planned that, even taking into account some damage to the economy caused by the global coronavirus pandemic, China will become a world power with a full cycle of industrial production, an important component of which is the production of its own innovative products, which indicates the country's orientation towards economic growth based on the consistent development of digital technologies. According to many experts, an important aspect of development is the independence of the Chinese economy from other countries in the field of digital technologies as a guarantee of strategic security (Nawaz et al., 2025).

The analogues of the largest American companies and a kind of other foreign companies in the digital technologies in the field of telecommunications, and consumer electronics created in the country are considered the basis for the country's further innovative development. Significant attention is paid to the problems of digital technologies in Ukraine. There are certain achievements, although the gap between developed countries of the world is quite large. Thus, information systems, social media, access to which is carried out using the Internet, have become part of the everyday life of Ukrainians. However, several problems in the field of digitalization of Ukraine and its regions require their solution. In our opinion, among the main restraining factors of the spread and use of digital technologies in the socio-economic sphere, in public administration and business, we can note: a shortage of financial resources; extremely weak development of domestic industries to create an elemental base for modern digital systems; the level of use of many public services in digital form remains quite low; a shortage of qualified personnel for the sphere of the digital economy, including due to the negativity of the education reform and the lack of modern means and technologies related to the educational process, etc.

Certain technological achievements in the field of digital economy and information technologies are not properly supported by changes in the regulatory framework for a more complete realization of the potential of the digital economy in Ukraine. Most often, digital technologies are still not actively implemented in internal administrative processes. Due to the lack of proper funding in the conditions of war in the country, the solution to certain problems of implementing elements of the digital economy and implementing information technologies has not been implemented in practice to a sufficient extent. The presence of Diia and other digital services does not fully meet the modern requirements of highly developed countries of the world, especially in the economic sphere. The objective reasons are, in fact, a full-scale invasion, crisis phenomena in the economy, a decline in domestic production volumes, the consequences of the coronavirus pandemic, and low computer literacy of the population. The conceptual model of the direction of development of the digital economy of Ukraine for the period until 2030, proposed by the authors, contains four basic directions of digital transformation:

- sectors of the economy and cross-sectoral transformation;
- markets, goods, services, capital, and labor;
- processes of managing integration processes;
- digital infrastructure and ensuring the security of digital processors.

This concept model is formed taking into account the forecast for the spread of digital infrastructure in the world (from 2000 to 2060) – *Figure 1*.

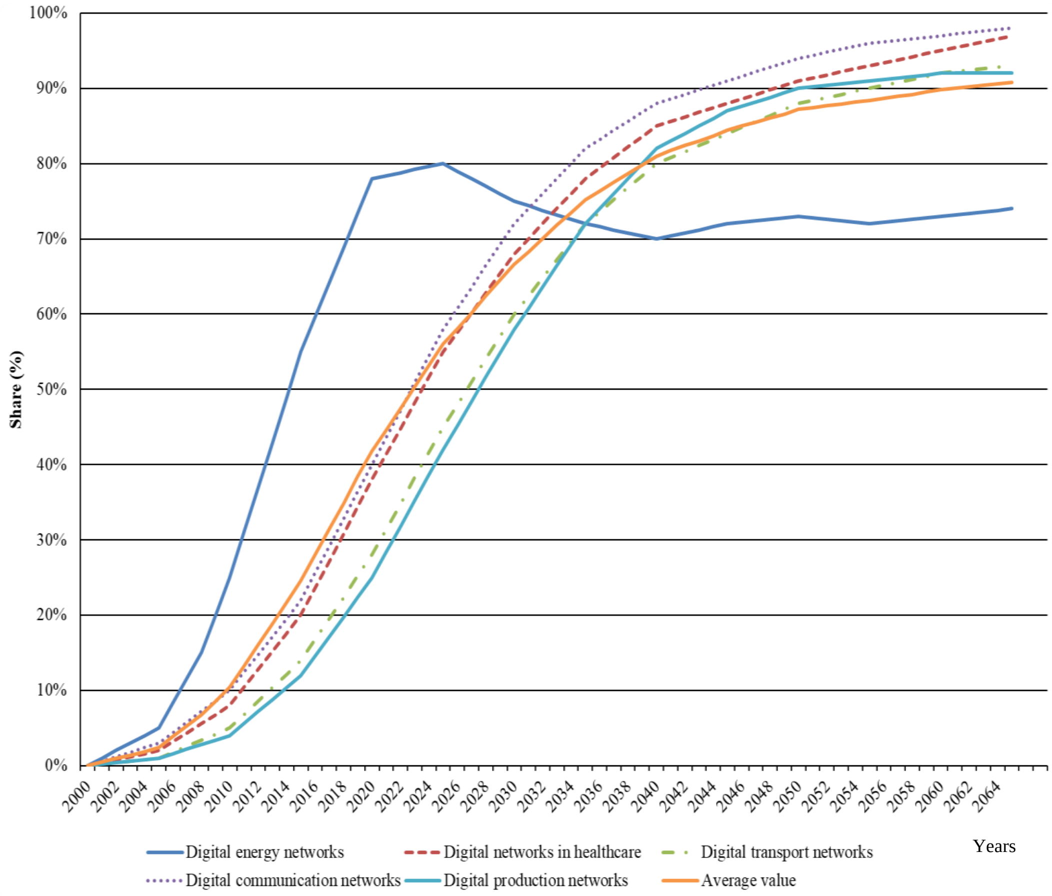

Figure 1. Distribution of digital infrastructure in the world over the years

Source: (Westerman et al., 2014).

It should be noted that the weaknesses of the Ukrainian program for the development of its own (rather independent) digital economy are the lack of a systematic analysis of the current state of the digital economy, and the lack of current provisions on the creation of structures responsible for their implementation. In addition, the amounts of financing and state support for specific areas of digital economy development are not indicated, and the competitive advantages of the domestic digital economy in the global system are not indicated.

Copying the experience of other countries in developing the digital economy and having limited financial and production resources, Ukraine risks becoming dependent in the field of digital technologies and information technologies, including for ensuring both economic and information security. In the scenario of integration into the global digital space of Ukraine, it will be quite difficult to gain significant competitive advantages and achieve high results in social and economic development.

3. Transformation of the business environment and analysis methodology in the minds of digitalization

The goal and strategic objectives of the development of the digital economy for Ukraine should be to create its own digital technologies, their use to increase the efficiency of management of national and regional economies, create conditions for the transition of the digital economy to a fundamentally new technological level in the areas of: innovation in the field of digital technologies and information technologies; in the formation of information infrastructure based on significant digital platforms; the introduction of digital technologies into social and economic processes; a radical increase in information, communication and digital education, as well as in the field of developing skills in the use of modern technologies among business and the population, within state structures and the formation of trust in the digital space. When assessing the prospects for the use of new methods and management tools in the era of the digital economy, it should be noted that the digital environment is currently having a revolutionary impact on the development of modern enterprises, companies, and corporations without restrictions on industry affiliation. For businesses that strive to meet current technological and technical trends, as well as for public sector organizations, the implementation and development of information and communication technologies has become an urgent need to increase the efficiency of their activities, which declares either the achievement of economic goals or the provision of socially useful services with the maximum level of satisfaction for consumers.

The development of digital technologies leads to the formation of a new segment of the economy (including the design of new markets with its active actors – digital companies), but already now, not only in the USA, Japan, Germany, Singapore, China and others, we can also talk about fully digital companies in other countries, including Ukraine (business models that are implemented in a digital environment), and about companies that implement digital technologies to improve their activities (with the introduction of digital solutions into basic business processes).

The digital economy is recognized as a current trend in the development of modern society, business, public administration, and citizens' lives, etc. The formation of the global digital space is becoming the next stage of development in the chain of "new industrialization – digitalization" and is caused by the need to ensure technological, information, and psychological leadership of business entities and states as a whole on the basis of information and communication and related technologies. These processes are accompanied by the modernization of traditional manufacturing industries and service industries and the reformatting of trade, procurement, and logistics activities.

When adapting the study of the digital economy as a modern external environment, attention should be paid to the fact that this phenomenon cannot be attributed only to a new factor, even such a global one. The digital economy adapts, changes, and creates something new in almost all elements of the external environment.

First of all, the economic conditions of activity are changing (from methods and means of payment to the organization of logistics flows), and the methods and means of the activities of business entities themselves are changing (from transferring activities in the digital space to the use of fundamentally new technologies, including artificial intelligence), economic factors are changing (in terms of creating new (digital) barriers and forming an oligopolistic conspiracy of digital market leaders), social factors are changing (most clearly manifested in the widespread distribution of social networks and messengers), national factors are changing (this is how developing countries get their chance to join the ranks of developed countries, no longer doomed to a technological gap), natural factors are changing (there is again a need to study environmental and other factors that reflect the processes of energy consumption of cryptocurrencies), methods of regulation at the level of state and inter-national structures are changing, new factors of economic and information security are emerging. In view of the above, it should be noted that it is necessary to develop new methods of analyzing the external environment (*Figure 2*).

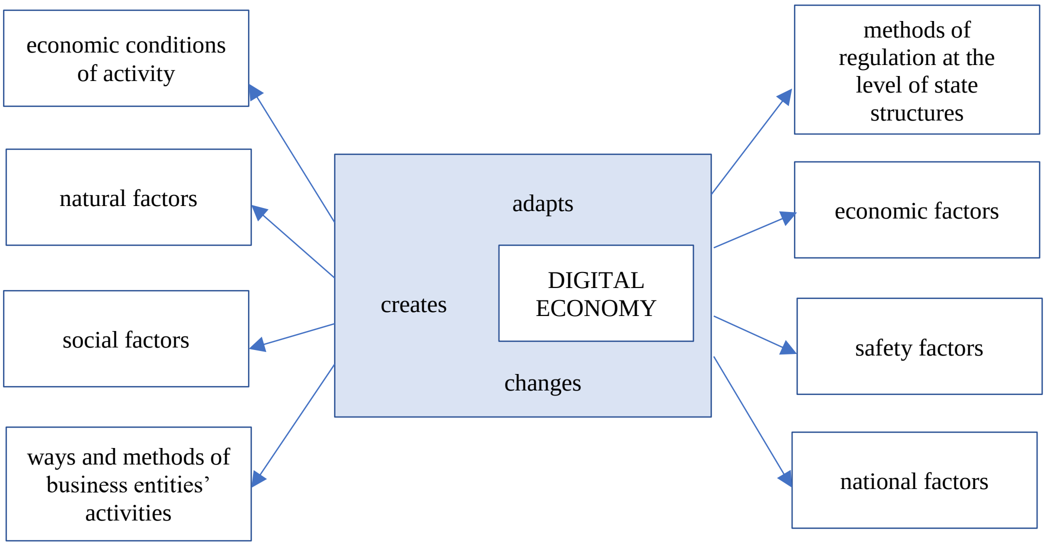

Figure 2. 8-factor model of environmental change

Source: (Smith et al., 2020).

Adapting the methodology for analyzing the external environment, first, it is necessary to identify and classify the manifestations of "digits" at different levels of management. First, it is necessary to determine the system-forming factors of the formation of the digital economy:

• the formation of a qualitatively new structure of economic assets that meet the economic priorities of the digital economy;

• the use of electronic technologies and services;

- the formation and support of favorable organizational, infrastructural, and regulatory characteristics for the development of digital technologies;
- the collection and processing of large data sets in digital form;
- the development of digital economy institutions;
- the preservation of the sovereignties of countries in the context of economic globalization;
- ensuring the economic information security of the state, business, society, and man;
- contributing to improving the quality of life of citizens;
- the protection of personal data and the inviolability of the private life of citizens in the digital space (Dovgal et al., 2021).

Thus, the system-forming factors of the formation of the digital economy encompass many interrelated elements (evolution of the structure of economic assets, integration of electronic technologies, optimization of information security, protection of users' personal data, etc.). The complex influence of the presented factors of action forms the institutional and infrastructural basis, without which a full transition to the digital economy is impossible.

Conclusions

According to the results of the research, the aim has been achieved, and the theoretical hypothesis put forward has been confirmed: a comprehensive analysis of the conceptual foundations of the digital economy and its role in the process of overcoming social and economic problems at the global and national levels allows for intensive growth in accordance with the goals of sustainable development.

In the context of globalization and complex transformation processes of the digital economy, the key factor in increasing the competitiveness of national economic systems is the implementation of effective management strategies that will allow achieving a long-term positive effect. The presence of various sources of information and their accumulation on a permanent basis allows national government bodies and international institutions to contribute to the adoption of effective management decisions. The main sources of information are web resources on the Internet, digital platforms, corporate data, etc. Both structured and unstructured data are valuable, since, thanks to machine learning algorithms, it is possible to identify hidden relationships.

Theoretical analysis of scientific literature and international experience shows the high efficiency of using modern information technologies, including machine learning algorithms, to process large amounts of information about the global environment and national economic systems. An analysis of international experience in the formation and implementation of national digital strategies (USA, China) has shown that effective transformation based on information technologies requires the introduction of relevant innovations and effective regulatory acts. Systematization of research confirms the potential of these technologies to optimize the transformation of the business environment, the formation of new markets, and strengthening competitiveness in accordance with existing requirements. The scientific novelty lies in the systematization of the conceptual foundations of the digital economy and the development of a conceptual model for the development of the digital economy of Ukraine by 2030, which integrates four basic areas of transformations, considering global trends and national characteristics. In the conditions of a full-scale invasion of our country, the proposed model can serve as a guideline for the formation of an effective national digital policy for the long term. The role of new management methods based on artificial intelligence and big data in overcoming the challenges of digital transformation, adapting best practices in the implementation of innovative information solutions in Ukraine in conditions of war and social and economic instability, is theoretically substantiated.

The importance of this research lies in the theoretical justification of the advantages of introducing high-performance digital tools into the management systems of domestic enterprises and the national economy of Ukraine to ensure technological sovereignty and competitiveness in international markets.

Further research will focus on empirical verification of the proposed conceptual model by collecting and analyzing multilingual and multi-contextual data using artificial intelligence algorithms and blockchain technologies. This will allow us to identify optimal directions for integrating digital technologies into economic systems and assess their multiplicative effect in the long term.

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DIGITAL DETERMINANTS OF EDUCATIONAL VALORISATION

The relevance of this study is driven by a shift in contemporary scholarly focus from the analysis of education digitalization technologies to the identification of their key driving forces–namely, digital determinants that define the direction, scale, and depth of the transformation of educational systems. These determinants create the preconditions for scaling the value of educational outcomes for individuals, society, and the economy in the digital era, while also highlighting the need to bridge the gap between the technological potential of digital change and its actual implementation and valorization in practice. In this context, there is a need to substantiate the theoretical and applied foundations of the valorization of the educational environment under conditions of digital transformation. The article confirms the hypothesis that the

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ЦИФРОВІ ДЕТЕРМІНАНТИ ВАЛОРИЗАЦІЇ ОСВІТИ

Актуальність дослідження зумовлена зміщенням сучасного наукового фокусу від аналізу технологій цифровізації освіти до виявлення її ключових рушійних сил – цифрових детермінант, які визначають вектор, масштаби та глибину трансформації освітніх систем. Саме такі детермінанти формують передумови до масштабування цінності освітніх результатів для особистості, суспільства та економіки в цифрову епоху, а також актуалізують потребу подолання розриву між технологічним потенціалом цифрових змін і реальною практикою їх використання та валоризації. У зв'язку з цим постає необхідність обґрунтування теоретичних і прикладних засад валоризації освітнього середовища в умовах цифрової трансформації. Висунуто гіпотезу, що цифрова трансформація *digital transformation of education contributes to the creation of additional social and economic value of educational outcomes, while the valorization of the educational environment serves as a key instrument for enhancing the competitiveness of education, fostering digital human capital, and integrating education into the digital economy. The methodological framework of the study is based on systemic, structural-logical, and comparative approaches, as well as methods of generalization, comparative analysis, structural modelling, conceptual design, and the algorithmization of processes for assessing the valorization of the educational environment. The empirical basis of the study comprises statistical data from the European Commission, OECD, UNESCO, and Eurostat, as well as the results of a bibliometric analysis of research on the digital determinants of education from scientometric databases. The article identifies international and national trends in the digital transformation of education, highlights strategic directions for the development of the population's digital competences, and outlines key challenges facing digital education in the context of the emerging knowledge economy. The level of digital education development in Ukraine is analyzed, along with the impact of digital technologies on the formation of digital competences and the development of human capital. A conceptual framework for the valorization of the educational environment under conditions of digital transformation is substantiated. Within this framework, the main effects of valorization are identified, a system of evaluation criteria is developed, and an algorithm for determining the levels of educational environment valorization is proposed. The framework makes it possible to assess the process of creating additional social, economic and innovative value of educational outcomes and can be used for the strategic planning of the transformation of educational systems and processes at institutional, regional, and national levels.*

Keywords: digitalization, valorization, digital transformation, digital technologies, digital determinants, education, educational environment, competences, innovations, values, management.

освіти сприяє формуванню доданої соціально-економічної цінності освітніх результатів, а валоризація освітнього середовища є ключовим інструментом підвищення конкуренто-спроможності освіти, розвитку цифрового людського капіталу та інтеграції освіти в цифрову економіку. Методологічну основу дослідження становлять системний, структурно-логічний і компаративний підходи, методи узагальнення, порівняльного аналізу, структурного моделювання, концептуального проєктування та алгоритмізації процесів оцінювання валоризації освітнього середовища. Емпіричну базу дослідження становлять статистичні дані Європейської Комісії, OECD, UNESCO, Eurostat, а також результати бібліометричного аналізу досліджень цифрових детермінант освіти, представлених у наукометричних базах даних. Розкрито міжнародні та національні тенденції цифрової трансформації освіти, висвітлено стратегічні напрями розвитку цифрових компетентностей населення та визначено ключові виклики розвитку цифрової освіти в умовах становлення економіки знань. Проаналізовано рівень розвитку цифрової освіти в Україні, а також вплив цифрових технологій на формування цифрових компетентностей і розвиток людського капіталу. Обґрунтовано концептуальний фрейм валоризації освітнього середовища в умовах цифрової трансформації, у межах якого визначено основні ефекти валоризації, сформовано систему критеріїв оцінювання та розроблено алгоритм визначення рівнів валоризації освітнього середовища. Запропонований фрейм дає змогу оцінювати процес створення доданої соціально-економічної та інноваційної цінності освітніх результатів і може бути використаний для стратегічного планування трансформації освітніх систем і процесів на інституційному, регіональному та державному рівнях.

Ключові слова: цифровізація, валоризація, цифрова трансформація, цифрові технології, цифрові детермінанти, освіта, освітнє середовище, компетентності, інновації, цінності, менеджмент.

JEL Classification: I 20, I 28, D 83, O 33, L 86.

Introduction

Digital technologies serve as a key driver of the transformation of modern society, reshaping approaches to education, professional activity, social and economic development, the formation of competitive human capital, and the achievement of sustainable economic growth. In the context of the emergence of a new vector of economic development based on the Society 5.0 paradigm (Mazaraki et al., 2020), the digital transformation of education acquires strategic importance as the foundation for the implement-tation of a knowledge-based economy and the enhancement of national competitiveness.

In this context, the European Union identifies the digital transformation of education as one of the priority areas of development within the Digital Decade 2030 initiative, according to which at least 80% of the population should possess basic digital skills by 2030 (European Commission, 2024, April 29). This initiative emphasizes the importance of developing digital competencies as a key factor in shaping digital human capital and ensuring sustainable, innovative economic growth.

According to Eurostat analytical findings, in 2024–2025, only 56–60% of the population of the European Union possess basic digital competencies, indicating the need to intensify the processes of digitalization in education and the development of digital skills among the population (Eurostat, 2025). At the same time, there is significant differentiation among EU countries. The highest indicators are demonstrated by the Netherlands, Finland, Denmark, and Ireland, where the level of digital skills exceeds 70–80%. The group of countries with a high level of digital competencies also includes Sweden, Luxembourg, Germany, and France, where the share of the population with basic digital skills exceeds 65–75%.

Countries of Southern and Central-Eastern Europe show average indicators, including Italy, Portugal, the Czech Republic, and Slovakia, where the level of digital skills ranges between 50–60%. The lowest indicators are characteristic of Romania, Bulgaria, Greece, and Poland, where the share of the population with basic digital competencies remains significantly below the European average (Eurostat, 2025), indicating the unevenness of the digital transformation of educational systems within the European Union (*Figure 1*).

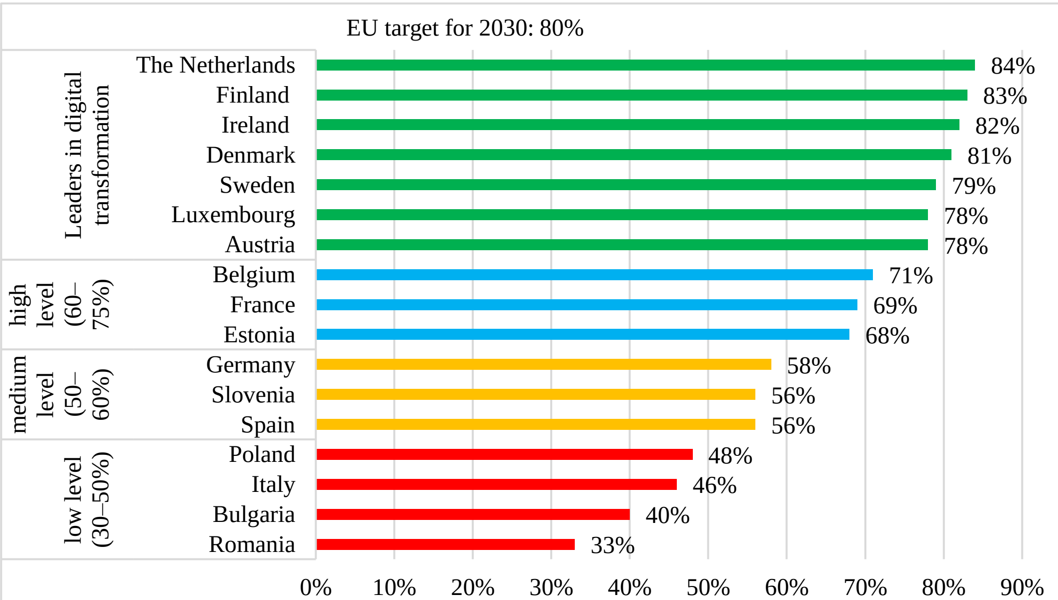

Figure 1. Level of basic digital competencies in EU countries, 2024–2025.

Source: compiled by the authors based on (European Commission, 2025, June 16; Eurostat, 2025).

According to the data presented in Figure 1, the level of digital competencies among the population of European Union countries is characterized by significant variation, indicating the uneven nature of the digital transformation of education across EU countries and highlighting the need to develop effective educational strategies to enhance digital competencies among the population (European Commission, June 16, 2025; Eurostat, 2025).

The key EU strategic document outlining the directions for the development of digital education is the Digital Education Action Plan 2021–2027, which identifies two main priorities: the development of a high-performing digital education ecosystem and the enhancement of digital competencies (European Commission, 2020). The Action Plan reflects the systemic nature of the digital transformation of education and emphasizes the development of digital competencies as an essential component of human capital.

Contemporary research confirms that the digitalization of education is accompanied by the active implementation of new technologies, including artificial intelligence, adaptive learning, digital platforms, and educational data analytics. Studies by the Organization for Economic Co-operation and Development (OECD) highlight that digital technologies contribute to the personalization of learning and improve the efficiency of the educational process; however, their implementation requires an adequate level of digital competencies among educators, as well as the development of digital infrastructure (OECD, January 19, 2026).

According to the position of the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the use of artificial intelligence in education creates new opportunities for individualized learning but also generates risks of digital inequality and underscores the need to establish ethical principles for the use of digital technologies (UNESCO, 2023).

International experience demonstrates the emergence of various models of digital transformation in education, depending on the level of countries' digital development and the strategic priorities of educational policy. Estonia integrates digital technologies and artificial intelligence into its education system, contributing to the development of a digital educational ecosystem and the enhancement of learners' digital competencies (European Commission, June 16, 2025).

Finland implements a comprehensive policy for the development of lifelong digital literacy, which involves integrating digital competencies at all levels of education (European Union, June 30, 2025). The Netherlands actively deploys digital educational platforms, adaptive learning technologies, and tools for personalizing the educational process, which enhances learning effectiveness and fosters the development of a digital educational environment (European Commission, August 7, 2024).

The generalization of international experience in the digitalization of education provides an analytical basis for assessing the level of digital education development in Ukraine, where the issue of digital transformation of the educational environment is becoming increasingly relevant in the context of economic digitalization, integration into the European educational space, and the development of digital competencies of human capital.

Conditions of distance and blended learning further intensify the need to implement digital platforms, online courses, and digital educational technologies. In particular, the development of the Diia.Osvita platform is aimed at fostering digital competencies among the population and supporting the concept of lifelong learning (Diia.Osvita. Research, n. d.).

At the same time, alongside the study of international experience in the digitalization of education, it is important to generalize scientific research in this field. A critical analysis of the scientific literature indicates a growing scholarly interest in the digital transformation of educational systems, the development of digital competencies, and the implementation of innovative educational technologies. Considerable attention in contemporary research is paid to the formation of digital competencies as a key factor in the development of digital education.

In particular, the issue of developing educators' digital competencies has been examined in the works of Redecker (2017), which substantiates the European framework for the digital competence of educators, DigCompEdu. Carretero et al. (2017) developed the DigComp 2.1 framework for citizens' digital competence. The further development of this concept is presented in the study by Vuorikari et al. (2022), which identifies new digital competencies related to the use of artificial intelligence and modern digital technologies.

A significant contribution to the study of the digital transformation of education was made by Selwyn (2016), who considers the digitalization of education as a complex socio-economic transformation, as well as by Bond et al. (2020), who identified key trends in the use of digital technologies in higher education. The conceptual foundations of blended learning and digital educational environments are substantiated in the works of Garrison and Vaughan (2008), where the authors examine blended learning as an effective tool for the digitalization of the educational process.

A separate strand of research focuses on the implementation of artificial intelligence in education. In particular, Holmes et al. (2019) identify artificial intelligence as a key factor in the personalization of learning, while Zawacki-Richter et al. (2019) conducted a systematic analysis of AI applications in higher education and identified (promising) directions for its use.

The issue of the digitalization of education is also actively explored by Ukrainian scholars. Its current trends, including the development of lifelong learning technologies, open online courses, adaptive learning, distance education, gamification, and the use of virtual and augmented reality technologies, are examined in the works of Mala (2022) and Safonov and Korotun (2024). The problem of digitalization of education as a vector for training 21st-century specialists was studied by Demianchuk and Bodnaruk (2022), who emphasize the need for digital transformation of the educational process.

Zabiaka (2024) analyzed the digitalization of higher education in the European context, emphasizing expanded access to educational resources, flexibility of the learning process, and the implementation of the concept of lifelong learning. A significant contribution to the digital transformation of education in Ukraine has also been made by Bykov and Burov (2020), Shyshkina and Nosenko (2023), and Lukianova and Hodlevska (2024), who investigate the development of the digital educational environment, the formation of digital culture among participants in the educational process, and the implementation of information and communication technologies in education.

Certain aspects of the digitalization of the educational process in higher education are also presented in the works of Zabiyaka (2024), Kremen and Spirina (2024), Morze et al. (2023), and Nosovets et al. (2024), where the authors substantiate the use of digital educational platforms, distance learning, and blended learning as key tools for the modernization of education.

Research on digital competencies in the context of the digital economy is also presented in the works of Karpenko et al. (2025) and Zakharchenko and Makletskyi (2024), which confirm the hypothesis that digital competencies constitute an important component of the professional training of modern specialists in the context of the digital transformation of society.

A bibliometric analysis of scientific research indicates a high level of scholarly interest in the digitalization of education at both the international and national levels (*Table 1*).

Table 1

Bibliometric profile of digital determinants of education valorization (2015–2025)

<table>
<tr><th>Thematic area</th><th>Information base</th><th>Number of publications</th><th>Growth rate</th><th>Leading countries</th></tr>
<tr><td>Education management</td><td rowspan="3">Scopus / WoS</td><td>41 500</td><td>32%</td><td rowspan="8">Spain, USA, China, United Kingdom, India, Germany</td></tr>
<tr><td>Digital technologies in education</td><td>1 709</td><td>35%</td></tr>
<tr><td>Artificial intelligence in education</td><td>3 623</td><td>67 times</td></tr>
<tr><td>Digital competencies</td><td>WoS / Lens</td><td>1 797</td><td>6.5%</td></tr>
<tr><td>Virtual reality in education</td><td rowspan="4">Scopus / WoS</td><td>1 157</td><td>5 times</td></tr>
<tr><td>Digital transformation of education</td><td>5 506</td><td>50 times</td></tr>
<tr><td>Valorization of education</td><td>12</td><td>–</td></tr>
<tr><td>Knowledge valorization</td><td>51</td><td>–</td></tr>
</table>

Source: compiled by the authors based on (Elsevier, n. d., Clarivate, n. d.; The Lens, October 24, 2022; The Lens, n. d.).

At the same time, in contemporary scientific discourse, the issues of creating added value within the educational environment under conditions of digital transformation remain insufficiently explored, which necessitates further research in the direction of educational environment valorization and the development of digital educational ecosystems.

The aim of this article is to substantiate the theoretical and applied foundations of education valorization in the context of digital transformation. To achieve this aim, the following objectives have been defined:

- to analyze the European experience of digital transformation of education and the development of digital competencies;
- to identify key trends in the development of Ukraine's digital ecosystem;
- to develop a conceptual framework of the determinants of educational environment valorization.

The study is based on the hypothesis that the digital transformation of education contributes to the creation of added social and economic value of educational outcomes, while the valorization of the educational environment serves as a key instrument for enhancing the competitiveness of education, fostering digital human capital, and acting as a prerequisite for the integration of education into the digital economy.

The research methodology is based on the use of systemic, structural-logical, and comparative analysis of international experience in the digitalization of education, statistical data from the European Commission, the Organization for Economic Co-operation and Development (OECD), the United Nations Educational, Scientific and Cultural Organization (UNESCO), Eurostat, as well as findings from contemporary scientific research in the field of digital transformation of education. The study employs methods of generalization, comparative analysis, structural modeling, conceptual design, and the algorithmization of processes for assessing the valorization of the educational environment.

Structurally, the article consists of three sections. The first section reveals European trends in the digital transformation of education, highlights the strategic directions for the development of digital competencies among the population, and identifies the key challenges in the development of digital education in the context of the emerging knowledge economy.

The second section is devoted to analyzing the level of development of digital education in Ukraine, examining the impact of digital technologies on the formation of digital competencies and the development of human capital.

The third section substantiates a conceptual framework for the valorization of the educational environment in the context of digital transformation. Within this framework, the effects of valorization are identified, a system of evaluation criteria is developed, and an algorithm for determining the levels of valorization of the educational environment is proposed. This makes it possible to assess the creation of added social, economic, and innovative value of educational outcomes.

1. European trends in the digital transformation of education

The digitalization of education is one of the key directions of educational policy in the European Union, aimed at developing digital competencies, modernizing the educational environment, and enhancing the competitiveness of human capital. In this context, the Digital Education Action Plan 2021–2027 plays an important role. The main objective of this initiative is to create a high-performing digital education ecosystem and to improve the level of digital competencies among the population in order to adapt the education systems of member states to the conditions of digital transformation.

A critical analysis of its content has led to the following conclusions:

- the document outlines a long-term vision for the development of high-quality, inclusive, and accessible digital education;
- it emphasizes the need for the development of individuals' digital competencies throughout their lives;
- it identifies two key strategic directions for the digital transformation of educational activities: the development of a high-performing digital education ecosystem and the improvement of digital skills and competencies.

The first direction involves the development of digital infrastructure, the implementation of modern educational platforms, the creation of digital educational resources, and the training of teaching staff in the use of digital technologies. The second direction focuses on the development of digital competencies among learners, educators, and the broader population, in line with the concept of lifelong learning.

The implementation of these strategic priorities of digital education is actively carried out in European Union countries through national strategies for the digitalization of education, the development of digital infrastructure, and the enhancement of digital competencies among the population. Almost all EU member states have developed their own strategies for the digital transformation of education in accordance with the Digital Education Action Plan (2021–2027), which indicates the systemic nature of the transformation of the educational environment in Europe (European Commission, 2020). *Table 2* presents the results of a comparative analysis of the development of digital education in European Union countries, aimed at assessing the level of development of digital educational infrastructure, the formation of digital competencies among the population, and the degree of integration of innovative technologies into the educational process.

Table 2

A comparative analysis of the development of digital education in selected EU countries as of 2024–2025

Country	Digital education indicator	Analytical characteristics	Strategic impact
Finland	Digital skills of the population	About 82% of the population has at least basic digital skills; the country is distinguished by a high culture of lifelong learning	Indicates the effectiveness of the digital competence development policy and the strong integration of digital education into the lifelong learning system
	Educational ecosystem	The state policy of digitalization of education until 2027 is focused on the development of digital infrastructure, platforms and digital readiness of educational institutions	Forms a sustainable digital educational ecosystem, where digital technologies are not an auxiliary, but a system-forming element of learning
Estonia	Basic digital skills	62.6% of the population has at least basic digital skills, which is above the EU average; the share of ICT specialists in employment is 6.7%	Confirms the combination of general digital literacy with a strong human resource potential to support the digitalization of education
	Integration of AI and digital technologies	In 2024, the use of AI by businesses increased from 5.19% to 13.89%, and 52.6% of enterprises use cloud technologies, which is significantly higher than the EU average	The high digital maturity of the economy creates a favorable environment for the implementation of AI solutions and digital platforms in education

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End of Table 2

Country	Digital education indicator	Analytical characteristics	Strategic impact
Nether-lands	National digital policy	The country remains one of the leaders in digital innovation, but faces a shortage of ICT personnel and a decrease in public investment in digital education. The roadmap includes 59 measures with a budget of 5.25 billion	The combination of strong scientific and technological potential with human resource constraints indicates the need to increase investments in digital competences and educational infrastructure
	Digital infrastructure	The Netherlands is among the leading EU countries in terms of digital connectivity and has a strategic goal to maintain its position as a European digital leader	Developed infrastructure creates the prerequisites for the large-scale use of digital educational platforms, adaptive learning and cloud services
Denmark	Position in the european digital transformation	Denmark is among the leading countries in the Digital Decade / DESI monitoring of digital maturity indicators	This indicates a systemic combination of digital infrastructure, skills and institutional capacity, which also has a positive impact on the education sector
Ireland	Digital environment and infrastructure	Ireland is among the countries with a high level of basic digital skills in the European dimension; the national digital development policy is coordinated by state bodies responsible for the digital economy and communications	A high level of digital integration of society supports the development of digital education and lifelong learning
Germany	Institutional conditions for digitalization	Germany is implementing large-scale digital transformation programs, and the European-wide Digital Decade monitoring records its participation in the systematic development of digital indicators	For the education sector, this means a gradual strengthening of digital infrastructure, platform solutions and digital training, although the pace of transformation is more institutionally complex than in Scandinavian countries
EU as a whole	Strategic framework	The Digital Education Action Plan 2021–2027 identifies two key areas: the development of a highly effective digital education ecosystem and the improvement of digital skills and competences	These areas are the basis for a comparative assessment of national models of digitalization of education and identification of strengths and weaknesses of countries

Source: compiled by the authors based on (European Commission, 2020; European Commission, August 7, 2024).

As shown in *Table 2*, Finland demonstrates one of the most successful examples of implementing the strategic direction of developing a high-performing digital education ecosystem. Within the framework of the national policy of education digitalization, the country develops digital infrastructure, educational platforms, and distance learning formats. A high level of digital preparedness among educators and learners has ensured the stability of the educational process in the context of digital transformation (Digital Skills and Jobs Platform, 2025).

Estonia is one of the leaders in the digitalization of education in Europe. The country actively implements digital educational platforms, electronic textbooks, and digital learning management services. Moreover, within the framework of the national initiative (AI Leap, n. d.), the integration of artificial intelligence into the educational process is envisioned, which contributes to the development of digital competencies among both learners and educators.

In Denmark, the digitalization of education is carried out through the development of digital platforms, open educational resources, and digital learning tools. According to the Digital Economy and Society Index (DESI) report, Denmark is among the leading countries in terms of the level of digital competencies of its population and the development of digital education (European Commission, August 7, 2024).

In the Netherlands, the digital transformation of education involves the active use of digital educational platforms, adaptive learning, and artificial intelligence. Research by the Organization for Economic Co-operation and Development (OECD) indicates that the digitalization of education is a key direction in the development of the country's education system, with digital technologies being integrated into the learning process (OECD, 2023).

Germany implements the digital transformation of education through the national program DigitalPakt Schule, which predicts the development of digital infrastructure in educational institutions, the implementation of digital platforms, and the enhancement of digital competencies among educators and learners (Federal Ministry of Education and Research, n. d.).

Ireland actively introduces digital educational technologies within the framework of the national Digital Strategy for Schools, which includes the use of digital resources, the development of digital competencies, and the integration of digital technologies into the learning process (Department of Education Ireland, 2021).

A comparative analysis of the development of digital education in EU countries indicates the systemic nature of the digital transformation of the educational environment and the active implementation of innovative technologies in the learning process. The highest level of digital education development is demonstrated by the countries of Northern Europe, particularly Finland, Denmark, and Estonia, which are characterized by a high level of digital competencies among the population, well-developed digital infrastructure, and the active use of artificial intelligence in education.

At the same time, Western European countries, including the Netherlands, Germany, and Ireland, demonstrate a systematic approach to the digitalization of education through government programs, institutional mechanisms, and the development of digital educational platforms.

The successful digital transformation of education requires significant investments in the development of digital infrastructure, educational technologies, and digital competencies of the population. In this context, financial instruments of the European Union play an important role in supporting the digitalization of education and the development of digital skills. In particular, the Digital Europe Programme *2021–2027* provides funding of EUR 7.5 billion, a substantial portion of which is allocated to the development of digital competencies, artificial intelligence, digital infrastructure, and educational technologies (European Commission, April 29, 2024).

Through the Recovery and Resilience Facility, EU countries attract significant investments in the digitalization of education. In particular, Germany invests more than EUR 6.5 billion in the *DigitalPakt Schule* program, France allocates more than EUR 3 billion for the digital transformation of education, Italy invests over EUR 2.1 billion, and Spain invests more than EUR 1.4 billion in the development of digital educational platforms and population digital competencies (EUR-Lex, September 28, 2021).

Thus, financial support for the digitalization of education in EU countries is an inherent condition of its digital transformation. It has a comprehensive character and encompasses the development of digital infrastructure, educational technologies, and digital competencies of the population.

To generalize the financial instruments supporting the digital transformation of education in EU countries, key funding areas and investment volumes have been systematized and are presented in *Table 3*.

Table 3

Funding for the digital transformation of education in EU countries

Country	Programme	Funding amount, EUR billion	Investment areas
EU	Digital Europe Programme 2021–2027	7.5	AI, digital competences, digital infrastructure, educational technologies
Germany	DigitalPakt Schule	6.5	Digitalization of schools, infrastructure, digital platforms
France	Recovery and Resilience Facility	3	Digitalization of education, digital competences
Italy		2.1	Digital educational platforms
Spain		1.4	Digital competences and digital education

Source: compiled by the authors based on (EUR-Lex, September 28, 2021; European Commission, April 29, 2024).

The analysis of funding volumes indicates substantial investments by EU countries in the development of digital education. The largest financial resources are directed toward the modernization of digital infrastructure, the development of digital competencies among the population, and the implementation of innovative educational technologies. This confirms the strategic role of digital education as a key factor in the development of human capital and the establishment of a digital economy.

An important analytical tool for assessing the level of digitalization of education is the Digital Economy and Society Index (DESI), which is used to monitor the development of digital competencies, the state of digital infrastructure, and the level of integration of digital technologies into society. This index makes it possible to conduct a comparative analysis of the digital maturity of European Union countries and to identify leaders in the digital transformation of the educational environment.

According to recent studies, the group of leading countries in digital education based on the DESI includes the Netherlands, Finland, Denmark, Sweden, and Ireland, which demonstrate a high level of digital competencies among the population and the active implementation of digital educational technologies (*Table 4*).

Table 4

Trends in the development of digital competencies in leading EU countries according to the DESI index

Country	Share of population with basic digital skills,%			Analytical characteristics
	2022	2023	2024	
Netherlands	80.5	82.1	82.7	One of the leaders in digital competencies in the EU
Finland	79.0	81.0	82.0	Stable high level of digital literacy
Denmark	67.0	68.8	69.6	Systematic state policy of digitalization
Ireland	70.0	72.1	73.0	Active development of the digital economy
Sweden	68.0	70.5	72.0	High level of digital education
EU (medium)	54.0	55.6	56.0	Moderate growth dynamics

Source: Compiled by the authors based on data from (European Commission, September 23, 2023; European Commission, April 29, 2024; Eurostat, 2025).

The obtained results indicate that the digitalization of education in the European Union is a priority strategic objective, characterized by a systemic nature and based on the integration of public policy, investment in digital infrastructure, continuous development of digital competencies, the use of artificial intelligence technologies, and the implementation of innovative educational technologies and digital educational platforms.

At the same time, the results of the comparative analysis demonstrate the uneven development of digital education across countries and the existence of different models of its implementation depending on the level of digital maturity of national education systems.

The level of a country’s economic development is determined by the combined effect of two key factors: the quality of the national education system and the depth of the digital transformation of the economy. Education ensures the formation of human capital necessary for innovation and increased labor productivity, while digitalization contributes to the optimization of production processes, the reduction of transaction costs, and the acceleration of knowledge exchange.

Thus, countries with more advanced educational institutions and broader implementation of digital technologies demonstrate sustainable GDP growth and competitiveness in global markets. In the context of studying the digital transformation of the educational environment in Ukraine, it is advisable to conduct an analysis of the development of digital education in Ukraine, taking into account existing challenges and opportunities.

2. Analysis of the development of digital education in Ukraine

The diagnosis of the problems in the development of digital education in Ukraine makes it possible to assess the level of digital transformation of the educational environment, the formation of digital competencies among the population, and the potential for adapting international experience to the national education system.

The development of digital education in Ukraine is taking place in the context of an active digital transformation of society, accompanied by expanded access to the Internet, the development of digital competencies among the population, the growth of the EdTech sector, and the implementation of digital educational technologies. The increasing number of digital educational initiatives contributes to the formation of a national digital education ecosystem, which includes educational platforms, digital educational resources, and innovative learning technologies (Sigma Software University, October 7, 2024).

The analysis of the development of digital education in Ukraine is carried out in stages, allowing for a comprehensive assessment of the key directions of the digital transformation of the educational environment. At the first stage, the development of Ukraine's EdTech ecosystem and digital educational platforms is examined. The second stage involves assessing the level of digital competencies among the population of Ukraine. The third stage focuses on analyzing the dynamics of digital skills over time. The fourth stage is devoted to examining the impact of the level of education on the formation of digital competencies. The fifth stage includes the study of digital competencies among youth as a key group in the formation of digital human capital. The sixth stage involves assessing the readiness of young people to use artificial intelligence technologies in the educational process.

Such a staged approach makes it possible to comprehensively study the development of digital education in Ukraine and to identify key trends in the formation of digital human capital in the context of digital transformation.

In accordance with the proposed research logic, the first stage involves analyzing the development of Ukraine's EdTech ecosystem. One of the key tools for such analysis is the EdTech Map, which is used to assess the development of digital educational platforms, innovative technologies, and educational startups. The results of the EdTech Map study indicate that online education in Ukraine is at a stage of active growth and structural transformation.

The online education ecosystem is represented by various segments of digital educational solutions, including distance schools, massive open online course (MOOC) platforms, tutoring services, professional skills development platforms, language-learning services, and learning management systems (LMS), as summarized in *Table 5*.

Table 5

Segment analysis of EdTech solutions for digital education in Ukraine

Digital Education Segment	Title of the institution/platform	Digital Solution Type	Functional purpose
Online and Distance Learning	All-Ukrainian lyceum YASNO	Distance education platform	External support and distance learning
	Education center "Optima"	Online school	Distance education
International education	EdEra	Educational digital platform	Online learning and educational services
Language learning	Optima School	Educational platform	Cambridge International Education programs
	TalkEn.Cloud	LMS platform	Online language learning
STEM education	Smarte / Class Builder	Digital content platform	Online textbooks
	GIOS	AI educational platform	Mathematics learning
Educational management	#brobots	STEM school	Technical education
	Voopty	ERP/CRM system	Educational business management
Professional training	TGI Academy	Educational management system	Educational process automation
Educational digital content	"Yedyna Shkola"	Educational ecosystem	Personalized learning
Tutoring	Sigma software university	Educational provider	Employee training
Digital education segment	AR Book	AR/VR Platform	Interactive learning
Online and distance learning	PROSTE ZNO	Educational platform	Preparation for national multi-subject test (NMT) / external independent evaluation (EIE)

Source: compiled by the authors based on (EdTech Ukraine Association, n. d.).

The results of the analysis of EdTech solutions presented in *Table 5* indicate the formation of a multi-component digital educational ecosystem in Ukraine, characterized by the active development of digital platforms, learning management systems, and innovative learning technologies. An important feature of the Ukrainian EdTech sector is the growing number of digital management solutions that automate educational processes, personalize learning, and improve the efficiency of educational activities.

A notable trend in the development of digital education is the spread of STEM platforms and artificial intelligence-based solutions, in particular GIOS and AR Book, which demonstrate the gradual integration of innovative technologies into Ukraine's digital education system (EdTech Ukraine Association, n. d.; GIOS, n. d.). At the same time, the development of platforms for professional training and exam preparation is shaping trends toward the implementation of lifelong learning and increasing demand for the development of digital competencies throughout life (IT Ukraine Association, n. d.; European Commission, 2020).

Thus, the dominant trends in the development of Ukraine’s EdTech ecosystem are:

- institutionalization and a European integration orientation of long-term strategies for the digital transformation of education;
- investment planning through the digital ecosystem;
- development of digital literacy among the population and digital accessibility;
- diversification of digital educational solutions;
- development of online and distance learning;
- integration of artificial intelligence technologies into educational ecosystems;
- development of learning management systems;
- formation of digital platforms for lifelong learning;
- harmonization of educational processes with the European digital space;
- formation of a sectoral focus of digital innovation development (DefenseTech, MedTech, EdTech, Agritech, AI, eco-technologies, etc.);
- ensuring digital resilience and cybersecurity of the EdTech ecosystem.

These processes are taking place under martial law conditions, are systemic, and aim to ensure economic resilience and the country’s post-war recovery.

The EdTech map demonstrates the territorial concentration of online education in Ukraine. The main centers of development of the EdTech ecosystem are Kyiv, Kharkiv, Lviv, Dnipro, and Odesa. The territorial distribution of EdTech organizations is presented in *Figure 2*.

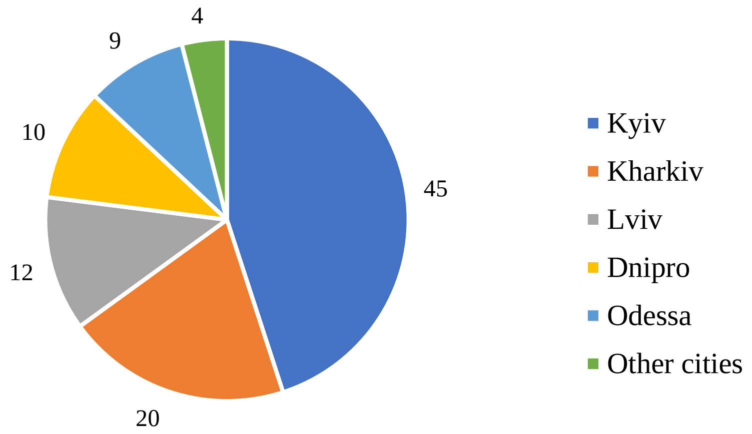

Figure 2. Geographical Distribution of EdTech Organizations in Ukraine, %

Source: Compiled by the authors based on (EdTech Ukraine Association, n. d.).

As shown in *Figure 2*, the largest number of EdTech organizations is concentrated in Kyiv, which can be explained by the high level of development of digital infrastructure, the concentration of IT companies, and educational institutions. At the same time, Kharkiv, Lviv, Dnipro, and Odesa form regional centers for the development of digital education. This distribution confirms the cluster model of EdTech sector development, according to which more than 70% of online educational organizations are concentrated in the largest cities of Ukraine (EdTech Ukraine, n. d.).

Alongside the development of the EdTech ecosystem, an important factor in the digital transformation of education is the level of digital readiness of the population, which determines the effectiveness of the implementation of digital educational technologies and innovative platforms. In this context, it is appropriate to analyze the level of digital literacy of the Ukrainian population and the development of digital competencies.

According to the results of the 2025 study on digital literacy and artificial intelligence, the share of the adult population of Ukraine with access to the Internet has increased by 8% compared to 2019 and amounts to about 97%. This indicates a high rate of development of digital infrastructure and active digitalization of society (Ministry of Digital Transformation of Ukraine, n. d.).

The assessment of the level of digital competencies of the Ukrainian population was carried out in accordance with the European Digital Competence Framework (DigComp), which identifies four key groups of competencies: information skills, communication skills, problem-solving skills, and digital content creation skills (Redecker, 2017; Ministry of Digital Transformation of Ukraine, n. d.).

Based on these groups of competencies, levels of digital competencies among the population were determined, which made it possible to assess the degree of digital readiness of society for the implementation of digital educational technologies. A summary of the levels of digital competencies of the Ukrainian population in accordance with the DigComp methodology is presented in *Table 6*.

Table 6

Levels of digital competencies* among the Ukrainian population (according to the DigComp methodology)

Level of digital competences	Level characteristics	Description of skills development
None	Lack of digital skills	No digital skills in all four competency groups, and/or the person has not used the Internet in the last three months
Low	Partial development of digital skills	Some digital skills are available, but there are no competencies in at least one of the key areas
Basic	Development of basic digital skills	The level of digital skills in all four competency groups is not lower than basic
Above basic	High level of digital competences	The level of digital skills in all four competency groups is above basic, with active use of digital technologies

* *The key groups of digital competencies according to the DigComp framework include: information literacy, communication and collaboration, digital content creation, safety, and problem-solving.*

Source: compiled by the authors based on (European Commission, 2017; Eurostat, 2025).

The analysis of the levels of digital competencies of the population presented in *Table 5* indicates a differentiated nature of digital skills development and demonstrates varying levels of digital readiness among the population to use modern educational technologies.

The application of the DigComp methodology:

- ensures a comprehensive assessment of digital competencies across key areas, including information literacy, communication skills, problem-solving, and digital content creation;
- makes it possible to determine the degree of digital integration of the population into the modern information environment and to assess readiness to use digital educational platforms.

Of particular importance is the transition of the population from a basic level to an above-basic level, which indicates the formation of digital human capital and an increase in the efficiency of the use of digital technologies in educational activities.

For a more in-depth analysis of the development of digital competencies, the dynamics of changes in the level of digital skills of the population of Ukraine have been studied. This approach made it possible to identify trends in the formation of digital literacy and to assess the level of readiness of the population to use digital educational technologies (*Figure 3*).

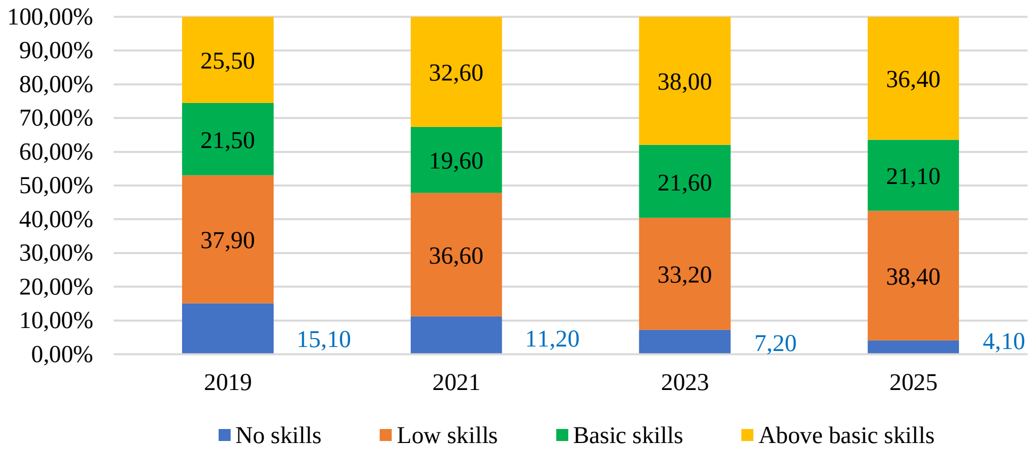

Figure 3. Trends in the level of digital skills among the Ukrainian population aged 18–70 in 2019–2025

Source: compiled by the authors based on (Ministry of Digital Transformation of Ukraine, n. d.).

According to the data presented in Figure 3, the share of the population without digital skills has significantly decreased over the studied period. At the same time, the proportion of the population with above-basic digital skills has increased, indicating a gradual improvement in the digital literacy of the Ukrainian population.

The share of the population with a low level of digital competencies remains relatively stable, which points to uneven digital development and the need for further improvement of the digital education system with the differentiation of technologies for various population segments.

An important aspect of the study of digital competencies is their assessment depending on the level of education of the population, which makes it possible to determine the impact of educational factors on the formation of digital skills (*Figure 4*).

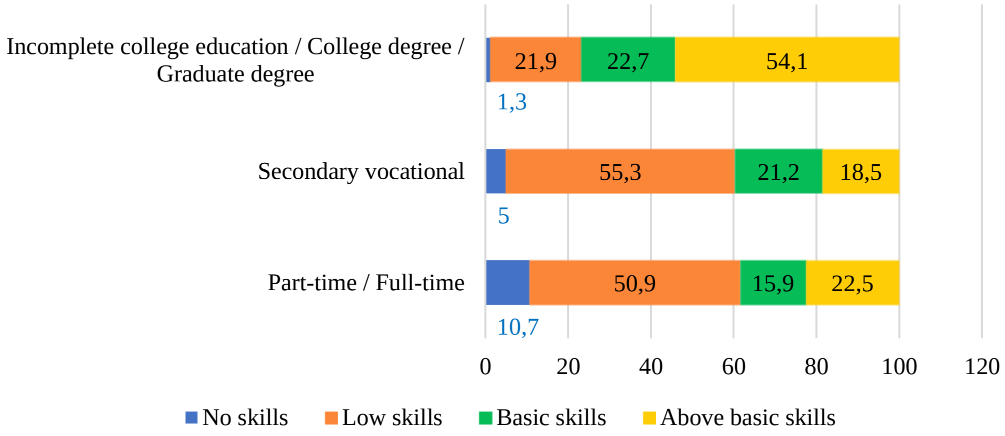

Figure 4. Digital competence levels of the Ukrainian population aged 18–70 by education level, 2025, %

Source: compiled by the authors based on (Ministry of Digital Transformation of Ukraine, n. d.).

The data presented in *Figure 4* indicate a pronounced differentiation in the digital competencies of Ukraine's population depending on the level of education. The most favorable profile of digital literacy is characteristic of individuals with higher education (academic degrees), confirming the importance of the educational environment as a factor in the accumulation and renewal of digital capital. In contrast, among groups with lower levels of formal education, there is a noticeable shift in the structure of digital skills toward basic and below-basic levels, which may limit the ability of these groups to fully participate in digitalized social and economic processes.

Particular attention should be paid to population groups with secondary and vocational secondary education, for whom an insufficient level of digital competencies necessary for the effective use of modern digital technologies in professional, educational, and everyday activities is typical. At the same time, the lower share of complete absence of digital skills among individuals with vocational secondary education may indicate a certain influence of professional training and practical experience on digital adaptation.

Thus, the level of education serves as one of the key determinants of digital literacy in the population. The identified differences highlight the need to develop targeted digital learning programs for groups at higher risk of digital vulnerability, particularly through instruments of non-formal education, short-term courses, micro-credentials, and practice-oriented digital training.

The obtained results confirm that the level of education is one of the key factors in shaping the digital competencies of the population and in the development of digital human capital.

Further analysis should be directed toward the study of digital competencies of youth as a key group in the formation of digital human capital and the development of the digital economy. In this context, particular interest lies in assessing the level of digital competencies of adolescents as the most active users of digital technologies (*Figure 5*).

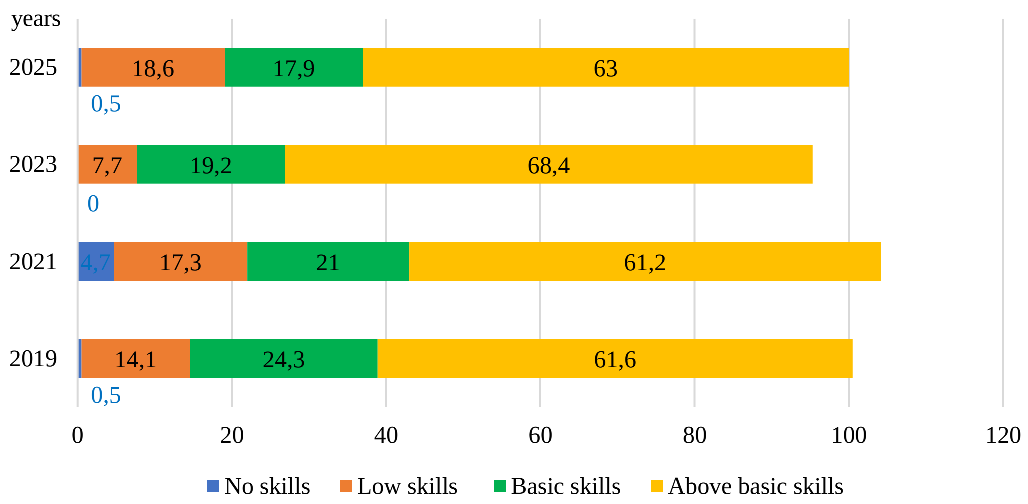

Figure 5. Digital skills of young people, 2019–2025, %

Source: compiled by the authors based on (Ministry of Digital Transformation of Ukraine, n. d.).

The analysis of the dynamics of adolescents' digital skills in 2019–2025 indicates the overall maintenance of a high level of digital competence within this age group. Throughout the study period, the share of adolescents with above-basic skills remained dominant, confirming their strong engagement in the digital environment and active use of digital technologies in learning, communication, and everyday activities. At the same time, the trends are not uniform. After reaching its highest value in 2023, the share of adolescents with above-basic skills declined, which may indicate a certain instability in maintaining a high level of digital competencies. A positive trend is the reduction in the share of adolescents with only basic digital skills, suggesting a gradual transition of part of the youth to more advanced forms of digital activity.

At the same time, the increase in the share of adolescents with low levels of digital skills in 2025 demonstrates the uneven nature of digital development within this age group. This may be associated not only with access to digital technologies, but also with differences in the quality of their use, educational support, motivation, and the nature of digital practices. The share of adolescents without digital skills remains negligible, confirming the nearly universal engagement of youth in the digital space.

Thus, adolescents remain one of the most digitally integrated groups in society. However, the observed fluctuations and the presence of a group with low skill levels highlight the need for targeted educational interventions aimed at developing critical, safe, and productive use of digital technologies, as well as the formation of digital human capital.

The high level of digital competencies among adolescents necessitates an analysis of their attitudes toward emerging digital technologies, particularly artificial intelligence, which is increasingly being integrated into the educational process. In this context, it is appropriate to examine adolescents' attitudes toward artificial intelligence technologies, the results of which are presented in *Figure 6*.

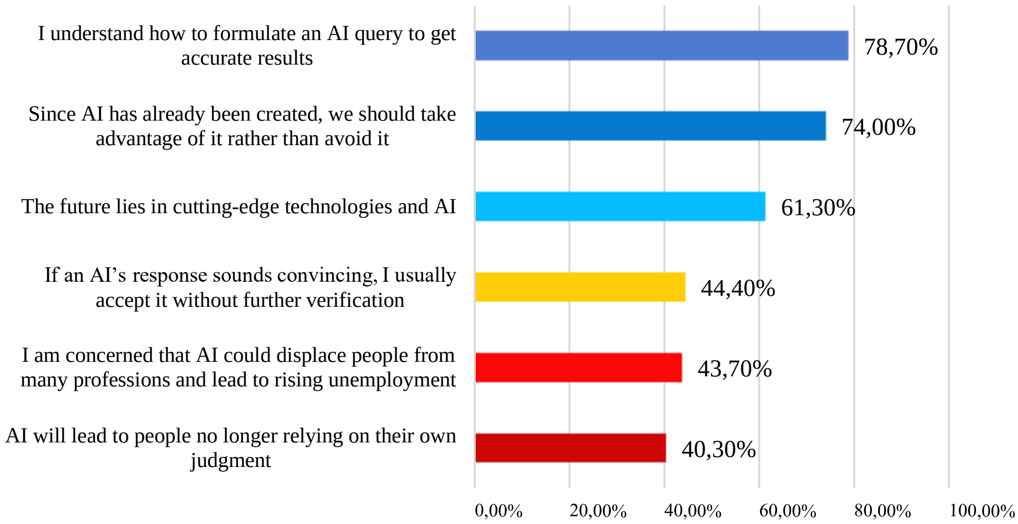

Figure 6. Adolescents' readiness to use artificial intelligence technologies

Source: compiled by the authors based on (Ministry of Digital Transformation of Ukraine, n. d.).

The obtained results indicate a high level of adolescents' digital adaptation to artificial intelligence technologies and highlight the need to develop skills for the critical use of digital resources within the educational process.

Overall, the results of the analysis of digital education development in Ukraine point to an active digital transformation of the educational environment, accompanied by the growth of the EdTech ecosystem, an increase in the population's digital competencies, and a rising level of digital integration among youth. The formation of digital human capital and the spread of AI technologies create the preconditions for rethinking the role of education in the modern digital economy, contribute to the transformation of the educational process, and enhance its economic and social value. This brings to the forefront the issue of valorization of education as a mechanism for improving its effectiveness, competitiveness, and alignment with the requirements of the digital economy.

Thus, the results of the conducted analysis confirm the active development of digital education in Ukraine, characterized by the formation of an EdTech ecosystem, the improvement of the population's digital competencies, and the increasing digital integration of youth. The digital transformation of education contributes to greater accessibility of educational resources, the emergence of new learning models, and the development of digital human capital, which, in turn, raises the importance of enhancing the social and economic value of education and the efficiency of utilizing educational outcomes.

3. Conceptual framework of determinants of the valorization of the educational environment

The digital transformation of education contributes to the growing importance of valorization of the educational environment as a mechanism for enhancing the social, economic, and innovative value of educational outcomes. In academic research, the valorization of education is understood as a process of creating added value from educational outcomes through their practical application and integration into social and economic development. The European Commission defines knowledge valorization as the process of generating social and economic value through the effective utilization of the results of education and research, emphasizing the role of education in fostering an innovation-driven economy (European Commission, April 23, 2026).

The theoretical foundation of this approach is the Triple Helix model, within which the valorization of education is considered through the interaction of universities, business, and government, ensuring the formation of an innovative educational environment and the development of a knowledge-based economy (Etzkowitz & Leydesdorff, 2000, pp. 111–115).

Benneworth and Arregui-Pabollet (2021) emphasize that the valorization of education involves the creation of social and economic value within the educational environment through the interaction of education, science, and the labor market, which contributes to improving the effectiveness of educational systems and the development of an innovation economy.

A critical reflection on contemporary scientific achievements allows for interpreting the valorization of the educational environment as a comprehensive process of creating the added value of education, shaped by digital transformation, the development of innovative technologies, and the strengthening of the interaction between education and the labor market. Based on the generalization of theoretical and methodological approaches, a framework of determinants of educational environment valorization has been substantiated, reflecting the structural elements, drivers, and mechanisms for generating added social, economic, and innovative value of education in the context of digital transformation (*Figure 7*).

Drivers of Digital Transformation in Education

- The digital transformation of society
- The development of the digital economy
- The globalization of education
- Advances in artificial intelligence
- The digitization of the labor market
- The need for digital skills

Digital technologies for enhancing education

- LMS platforms
- Online education
- Artificial intelligence
- Big Data in education
- EdTech solutions
- Digital educational

Mechanisms for Enhancing the Educational Environment

- Digitization of the educational process
- Personalized learning
- Integration of education, science, and business (Triple Helix)
- Development of digital competencies
- Lifelong learning
- International educational cooperation

Effects of enhancing the educational environment

- Building digital human capital
- Improving the quality of education
- Innovative business development (Triple Helix)
- Development of the digital economy
- Increasing the social and economic value of education

Figure 7. Conceptual framework of determinants of educational environment valorization

Source: compiled by the authors.

Within the conceptual framework proposed in *Figure 7*, the key effects of educational environment valorization are substantiated. For the purpose of their practical application, these effects have been operationalized through a system of characteristics and KPI-based evaluation indicators, as presented in *Table 7*.

Table 7

Effects of the valorization of the educational environment

Valorization effect	Characteristics	Manifestation in the digital educational environment	KPI evaluation
Improving the quality of education	Improving the educational process through digitalization	Development of digital competencies; modernization of educational programs	Level of digital competencies, level of academic success, and level of student satisfaction
Forming digital human capital	Developing digital skills and adaptability of education seekers	Development of digital skills; innovative thinking	Level of digital literacy; level of graduate employment

End of Table 7

Valorization effect	Characteristics	Manifestation in the digital educational environment	KPI evaluation
Increasing the competitiveness of education	Adapting educational programs to the needs of the labor market	Development of digital platforms; cooperation with employers	Share of employers; number of updated educational programs
Developing an innovative economy	Forming a knowledge economy	Development of EdTech; integration of education and business	Number of EdTech projects; level of innovative activity
Integration into the global educational space	International cooperation and digitalization of education	Online education; international platforms	Number of international projects; share of online courses

Source: compiled by the authors.

The presented effects of valorization of the educational environment and the corresponding KPIs enable a comprehensive assessment of the results of the digital transformation of education and help identify strategic directions for the development of the educational environment. The proposed approach provides an opportunity for both quantitative and qualitative evaluation of the level of educational valorization.

To determine the level of valorization of the educational environment, a system of evaluation criteria has been developed, based on educational, economic, innovative, and social indicators of the development of the educational environment (*Table 8*).

Table 8

Matrix of criteria for assessing the level of valorization of the educational environment

Evaluation criteria	Basic level	Digital level	Innovative level	Integration level	Strategic level
Educational	Fragmented digitalization of the educational process	Use of digital platforms and online courses	Personalized digital learning and adaptive technologies	Integration of digital technologies into all educational programs	Digital educational ecosystem and flexible educational models
Economic	Episodic interaction with employers	Initial integration with the labor market	Active cooperation with business and employers	System partnerships and joint educational programs	Strategic educational-business alliances and innovation ecosystems
Digital	Use of certain digital technologies	Implementation of digital educational tools	Use of EdTech and AI technologies	Formation of innovative educational ecosystems	Digital innovative ecosystem of education
Social	Limited availability of digital education	Expanding availability of digital learning	Formation of digital competencies of education seekers	Integration into the international educational space	Global integration of the educational environment

Source: compiled by the authors.

For a generalized quantitative assessment of the level of valorization of the educational environment, it is advisable to use an integral indicator (1), since the significance of individual groups of criteria is determined by the characteristics of a particular educational environment. This is determined by strategic priorities of the educational institution, its level of digital maturity, resource provision, the intensity of interaction with external stakeholders, and its orientation toward innovative development and social impact.

$$Vi = w_1O+w_2E+w_3D+w_4S \quad , \quad (1)$$

where: Vi – integral indicator of the valorization of the educational environment;
O – composite indicator of educational criteria;
E – composite indicator of economic criteria;
D – composite indicator of digital criteria;
S – composite indicator of social criteria.
w_1, w_2, w_3, w_4 – weighting coefficients of the respective groups of criteria, reflecting their relative significance within a particular educational environment.

Each composite indicator represents a generalized assessment of the corresponding block of criteria. Such a model ensures the adaptability of the evaluation and enhances its analytical sensitivity, as it takes into account the context in which the educational environment operates. Under certain conditions, digital criteria may be decisive, while in others, educational, economic, or social criteria may prevail. This approach is consistent with the practice of applying composite indices in the field of digital transformation and the assessment of complex systems development, including within the DESI framework, as well as with the use of SELFIE as a tool for self-assessment of the digital readiness of educational institutions.

The weighting coefficients may be determined based on expert evaluation, the pairwise comparison method, the analytic hierarchy process, or the empirical validation of the model within a specific educational institution. This ensures not only the formal aggregation of criteria but also the methodologically grounded construction of an integral indicator that is relevant to the actual conditions of the educational environment's functioning (Nardo et al., 2008).

The interpretation of the obtained value is advisable to carry out using a five-level scale of valorization: basic, digital, innovative, integrative, and strategic levels. The proposed indicator can be used not only to determine the current state of valorization but also for dynamic analysis of changes over time, comparison of educational institutions or educational programs, as well as for identifying strengths and problematic aspects of development across specific groups of criteria. In this context, the integral indicator of valorization should be considered as a tool for strategic management of the development of the educational environment in the conditions of digitalization and the emergence of the knowledge economy.

Conclusions

The digital transformation of education necessitates a rethinking of the role of the educational environment as a key factor in the formation of human capital and the development of the knowledge economy. Under these conditions, the valorization of the educational environment acquires strategic importance, as it ensures the creation of added social, economic, and innovative value of educational outcomes through the integration of education, science, business, and society. The conducted analysis of European experience in the digital transformation of education has shown that the development of digital competencies, the implementation of digital technologies, and the formation of digital educational ecosystems are key factors in enhancing the competitiveness of educational systems and the development of digital human capital.

The digital transformation of education in Ukraine is taking place in the context of integration into the European educational space and the active implementation of digital technologies in the educational process. Key challenges in the development of the digital educational environment – particularly the unevenness of digital infrastructure, the need to develop digital competencies among participants in the educational process, and the formation of digital educational ecosystems – necessitate the development of conceptual approaches to the valorization of the educational environment as a tool for increasing the effectiveness of the digital transformation of education.

The study confirmed the hypothesis that the digital transformation of education contributes to the creation of added social and economic value of educational outcomes, and that the valorization of the educational environment is a key instrument for enhancing the competitiveness of education, developing digital human capital, and integrating education into the digital economy.

The conceptual framework for the valorization of the educational environment integrates the key determinants of value creation in education – namely, the effects of valorization, the system of evaluation criteria, and the levels of educational environment valorization. The proposed framework ensures: first, a comprehensive assessment of the digitalization of education; second, the identification of strategic directions for the development of the educational environment in line with current trends in the development of digital competencies, the implementation of digital technologies, and the integration of education, science, and business; and third, the formation of digital educational ecosystems and the enhancement of the social and economic value of educational outcomes.

The use of the integral indicator of educational environment valorization provides the opportunity for quantitative assessment of the level of development of the educational environment, conducting comparative analysis, and monitoring the dynamics of changes. Such an approach makes it possible to identify the strengths and weaknesses of the development of the educational environment, justify managerial decisions, and determine strategic directions for increasing the social, economic, and innovative value of educational outcomes based on strengthening the role of education as a strategic factor in the formation of digital human capital and the development of the knowledge economy.

The results of the study create a theoretical and methodological foundation for further research on the implementation of the concept of educational environment valorization in the activities of educational institutions and form a scientific and practical basis for the transformation of educational models, which will contribute to the training of competitive professionals, the development of digital human capital, and the enhancement of the adaptability of educational systems in the context of digital transformation.

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DIGITAL RESILIENCE AND CYBERSECURITY OF EU COUNTRIES

The increasing frequency and complexity of cyber threats, combined with systemic digital disruptions, have made cybersecurity and digital resilience critical determinants of the stable functioning of socio-economic systems in the European Union. The research hypothesis assumes that a country's digital resilience is shaped by real cyber incidents in combination with institutional capacity, technological readiness, and the ability to restore digital systems. To test the hypothesis, a comparative analysis combined with statistical analysis methods was applied. Cybersecurity is assessed using the Global Cybersecurity Index and the Cyber-dependent Crimes Index. Adaptive resilience potential was measured using the European Digital Resilience Index (EDRIX), complemented by the European Open Technology Readiness Index (EOTRIX). The results show that, in a theoretical aspect, cybersecurity and digital resilience are complementary: cybersecurity is a necessary functional component that provides protection against cyberattacks and unauthorized interference, while digital resilience has broader functions, including crisis management, post-incident recovery, and adaptation to new threats. The analysis of the proposed indicators within the EU

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ЦИФРОВА СТІЙКІСТЬ ТА КІБЕРБЕЗПЕКА КРАЇН ЄС

Зростаюча частота та комплексність кіберзагроз у поєднанні з системними цифровими збоями зробили кібербезпеку та цифрову стійкість критичними детермінантами стабільного функціонування соціально-економічних систем у Європейському Союзі. Гіпотеза дослідження передбачає, що цифрова стійкість країни формується реальними кіберінцидентами в поєднанні з інституційним потенціалом, технологічною готовністю та здатністю відновлювати цифрові системи. Для перевірки гіпотези застосовано порівняльний аналіз у поєднанні з методами статистичного аналізу. Кібербезпека оцінюється за допомогою Глобального індексу кібербезпеки та Індексу кіберзалежних злочинів. Адаптивний потенціал стійкості вимірювався за допомогою Європейського індексу цифрової стійкості (EDRIX), доповненого Європейським індексом готовності до відкритих технологій (EOTRIX). Результати показують, що в теоретичному аспекті кібербезпека та цифрова стійкість доповнюють одна одну: кібербезпека є необхідним функціональним компонентом, який забезпечує захист від кібератак і несанкціонованого втручання, тоді як цифрова стійкість має ширші функції, зокрема управління кризами, відновлення після інцидентів та адаптацію до *revealed the absence of a direct linear relationship between cybersecurity levels and cybercrime, as well as between cybersecurity and digital resilience. Greece, Malta and Cyprus demonstrate a high level of cybersecurity but a relatively low level of digital resilience. In contrast, Germany, Finland, Estonia, and Slovenia, are characterized by both high digital resilience and cybersecurity, indicating that digital resilience is indeed formed under the pressure of increasing threats in conditions where institutions are prepared to respond to them adequately, promptly, and systematically, which confirms the article hypothesis.*

Keywords: digital resilience, cybersecurity, digitalization, crisis phenomena, European Union.

нових загроз. Аналіз запропонованих індикаторів у межах ЄС виявив відсутність прямого лінійного зв'язку між рівнями кібербезпеки та кіберзлочинністю, а також між кібербезпекою та цифровою стійкістю. Греція, Мальта та Кіпр демонструють високий рівень кібербезпеки, але порівняно низький рівень цифрової стійкості. Натомість Німеччина, Фінляндія, Естонія та Словенія характеризуються високими як цифровою стійкістю, так і кібербезпекою, що свідчить про те, що цифрова стійкість дійсно формується під тиском наростаючих загроз в умовах, коли інститути готові адекватно, оперативно й системно на них реагувати, що підтверджує гіпотезу статті.

Ключові слова: цифрова стійкість, кібербезпека, цифровізація, кризові явища, Європейський Союз.

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Introduction

Digitalization has now become a global trend and a key driver of economic development, which simultaneously increases the vulnerability of countries around the world to cyber threats. Cyber incidents, failures of information systems, attacks on critical infrastructure and the spread of cyber-related crimes are increasingly becoming systemic and are capable of causing large-scale economic, social and institutional consequences. In these conditions, ensuring digital resilience is gaining strategic importance, as it involves not only protecting digital systems, but also their ability to function continuously, adapt to threats and recover from crisis impacts. Therefore, studying the relationship between digital resilience and cybersecurity is important for developing effective approaches to managing digital risks and ensuring the long-term stability of modern socio-economic systems. This issue is particularly relevant for EU countries that are forming a common digital space and seeking to ensure a high level of reliability and security of digital environments within the framework of integration processes. Increasing cross-border interaction, growing interdependence of digital infrastructures and the complexity of cyber threats necessitate a systematic scientific analysis of the state of digital resilience and cybersecurity of EU Member States. Research on this topic is important for identifying existing imbalances, assessing the level of readiness to digital risks and justifying directions for improving the security and resilience of the EU's digital development.

Under current geopolitical conditions, digital transformation has ceased to be a purely technological process, evolving into a fundamental cornerstone of national security and economic stability. For the European Union, which strives to achieve "digital sovereignty", the protection of the information space has evolved from the concept of "cybersecurity" (viewed as a set of technical protective measures) to the broader notion of "digital resilience". The latter is understood not only a system's ability to withstand attacks but also as the capacity of critical infrastructure to maintain vital functions during incidents and recover swiftly thereafter.

The modern discourse on the European Union's security architecture is increasingly cantered on digital resilience. The transition from reactive cybersecurity to proactive resilience is most evident in the EU's recent legislative changes. The European Cyber Resilience Act (CRA) and the Digital Operational Resilience Act (DORA) represent a paradigm shift. The CRA introduces mandatory cybersecurity requirements for products with digital elements, thus institutionalizing a "duty of care" for manufacturers. T. Alcalá (2025), emphasizes that this legislation shifts the burden of security from the end-user to the developer as the CRA ensures that security is not an afterthought but is integrated into the entire lifecycle of digital products, from design to decommissioning.

Research into the Cyber Resilience Act (European Commission, 2025, December) highlights a paradigm shift toward "security-by-design". Kerttunen (2024) analyses how mandatory cybersecurity requirements for hardware and software products create a horizontal legal framework that reduces vulnerabilities across the EU supply chain.

The ENISA Threat Landscape (2025) highlights the "convergence of malicious activity," where threat groups increasingly use AI to automate and industrialize attacks. Recent literature suggests that the EU's resilience will depend on the rapid adoption of AI-driven defence mechanisms to counter harmful generative AI exploits (WEF, 2025)

In the financial sector, as analysed by Biliavskyi et al. (2024) digital transformation integrate digital technologies into all areas of business making it more effective. Industry reports, particularly the KPMG Cybersecurity Considerations 2025, highlight the dual nature of emerging technologies. AI Trust has become a central pillar of digital resilience. KPMG notes that CEOs see cybersecurity as the biggest threat to business in the past decade. With the rapid digitalization of all industries, particularly amid the massive adoption of AI, not only are companies' infrastructures at risk, but also their reputations, customer relationships, and even the markets they operate in (KPMG, 2025).

Academic studies by Carrapico & Farrand (2024) link these technical measures to the broader concept of "Digital Sovereignty." The research argues that resilience is no longer just a technical metric but a geopolitical tool used by the EU to ensure its autonomy in a fractured global digital world. In terms of policy, this means that it has transitioned into a system of stringent regulatory oversight and hierarchical governance, aimed not only at the internal consolidation of its cyberspace but also at projecting European security norms as global benchmarks through strategic foreign policy initiatives.

Further studies highlight digital resilience as a result of close public-private collaboration and enhanced effectiveness of public policy digital infrastructure. It is stressed that, in the context of rising hybrid threats, Europe's security depends on strong public–private partnerships and supportive conditions for digital companies to grow in Europe (Digital Europe, 2023, March 6). Rotar (2025) emphasizes the integration of cybersecurity and resilience in national digital policies, showing that institutional and regulatory measures enhance digital governance and regional comparability. Sorokina et al. (2024) identifies the key digital determinants of national economic resilience highlighting the role of digital infrastructure, policy frameworks, and strategic digital transformation measures in strengthening the resilience of national economies facing external shocks and structural challenges.

Bada and Agrafiotis (2021) emphasize the growing "cyber inequity" and skills gap. They argue that while large organizations show steady progress, smaller organizations struggle to maintain resilience, with the public sector facing a 49% deficit in necessary cybersecurity talent as of 2025.

Contemporary research often treats cybersecurity and digital resilience as synonymous terms within the EU's strategic discourse. However, a significant gap exists in understanding the potential trade-offs and synergies between these two concepts. This study addresses this oversight by evaluating the level of cybersecurity versus resilience performance, identifying whether standardized security measures are sufficient for crisis-era functionality or if a distinct set of resilience-oriented metrics is required to sustain the EU's digital ecosystem.

The authors of the article propose *the hypothesis* that a country's digital resilience is shaped by actual cyber incidents in combination with institutional capacity, technological readiness, and the ability to restore digital systems.

The aim of the study is to evaluate the levels of cybersecurity and digital resilience in EU member states, and determine the empirical interrelationship of cybersecurity and digital resilience within the context of digital systems' capacity to neutralize crisis events and maintain functionnality.

To achieve this goal, *methods* of comparative cross-national analysis with statistical analysis were used. Specifically, to evaluate the defensive potential of EU nations, the Cybersecurity Index (GCI) was used to measure legal, technical, and organizational maturity. This was correlated with the Cyber-dependent Crimes Index to assess the actual prevalence of threats and the effectiveness of existing countermeasures. Next, to measure the adaptive capacity of systems, the European Digital Resilience Index (EDRI) was applied, that describes the ability of national infrastructures to withstand systemic shocks. This was complemented by the European Open Technology Readiness Index, that evaluates the technological flexibility and openness of the digital ecosystem.

Finally, the comparison analysis was used to determine the strength of the link between a country's cybersecurity and its resilience performance. By comparing these indices, the authors identify the cases where a high cybersecurity does not necessarily lead to high resilience and vice versa.

The structure of the article is organized as follows. First, the theoretical foundations of digital resilience and cybersecurity are analysed. Next, the level of cybersecurity within the EU's digital environment is assessed using the Global Cybersecurity Index and the Cyber-dependent

Crimes Index. This is followed by an evaluation of the digital resilience levels of EU member states, utilizing the European Digital Resilience Index and the European Open Technology Readiness Index. Finally, the study concludes with a summary of findings.

1. Theoretical understanding of digital resilience and cybersecurity

The theoretical foundations of digital resilience and cybersecurity are being formed in the context of the rapid digitalization of economy, public administration and other social processes, that causes the growing dependence of the functioning of modern systems on information and communication technologies. Under such conditions, any disruptions in the operation of digital systems caused by cyberattacks, technical failures, the human factor or hybrid threats can have large-scale economic, social and security consequences. This highlights the need for a theoretical conceptualization of cybersecurity and digital resilience, their content, interrelationship, and role in ensuring the stability of modern socio-economic systems.

Cybersecurity is a set of measures aimed at protecting information in computer systems and networks from unauthorized access, use, disclosure, violation of integrity, modification or destruction. It encompasses technical, organizational, legal, and institutional mechanisms designed to ensure the confidentiality, integrity, and availability of information resources. Cybersecurity has become vital both for protecting users' private data and personal information and for ensuring the smooth operation of critical systems, including financial institutions, government information resources, energy networks, and medical facilities. Cybersecurity breaches in these areas can lead not only to economic losses but also to threats to national security and public life. Historically, the explosion of interest in cybersecurity occurred at the end of the 20th and beginning of the 21st centuries in connection with the emergence of the Internet and the widespread use of computer technology. The further growth in the number and complexity of cyberattacks, development of malicious software, as well as the active use of digital technologies in all spheres of society contributed to the transformation of cybersecurity into a separate field of scientific knowledge and professional activity. Within this field, risk-oriented, institutional and socio-technical approaches have been formed, which consider cybersecurity not only as a set of technical solutions, but as a comprehensive cyber risk management system. At the same time, the further evolution of the digital environment has revealed the limitations of the classical understanding of cybersecurity, focused mainly on preventing threats. In response, the concept of digital resilience was formed, which originates from the general theory of systems, the economics of sustainable development, the theory of risks and crisis management. Digital resilience is interpreted as the ability of digital systems, organizations and institutions to anticipate potential threats, withstand negative impacts, adapt to changes and quickly restore their functioning after incidents, regardless of their origin.

The distinctive features of the concepts of "digital resilience" and "cybersecurity" are given in *Table 1*.

Table 1

Distinctive features of the concepts of "Digital resilience" and "Cybersecurity"

Criterion	Digital resilience	Cybersecurity
Essence of the concept	The ability of digital systems to anticipate, withstand, adapt to, and recover from disruptions and attacks	A system of measures aimed at preventing, detecting, and neutralizing cyber threats
Purpose	Continuity of operations and recovery	Protection against unauthorized interference
Time horizon	Before, during, and after an incident	Mainly before and during an incident
Scope	A broader concept (includes cybersecurity)	A narrower concept (a component of digital resilience)
Objects of impact	IT systems, business processes, human capital, institutions	Data, networks, software
Outcome	System flexibility and adaptability	System security/protection

Source: developed by the authors.

Unlike cybersecurity, digital resilience has a broader meaning and focuses not only on protecting information and infrastructure, but also on ensuring the continuity of business and management processes, maintaining the functional capacity of systems in crisis conditions and their long-term adaptability. It assumes the availability of redundant resources, backup channels, flexible organizational structures, as well as the ability to learn from experienced crises. Thus, digital resilience reflects the transition from the logic of "absolute protection" to the logic of "system viability" in conditions of constant instability. In the European Commission’s approach, digital resilience and cybersecurity are considered as interrelated and complementary components of a single EU digital policy aimed at ensuring the stable, secure and continuous functioning of the digital economy and society. The European Commission considers that the modern digital environment is characterised by a high level of interdependence, cross-border threats and the constant evolution of cyber-attacks, which makes it impossible to reduce security solely to the technical protection of information systems (European Commission, 2020). In this context, cybersecurity is interpreted by the European Commission as a key element of protecting networks, information systems and data from unauthorised access, misuse and cyber-attacks, especially in critical infrastructure sectors. The Commission stresses that effective cybersecurity is a necessary prerequisite for trust in digital technologies, the functioning of the EU internal market and the protection of citizens’ fundamental rights (European Commission, n. d.). That is why, within the framework of the European digital strategy, a set of legislative initiatives was formed aimed at unifying requirements for cyber risk management, strengthening the role of national authorities and coordinating the actions of member states, in particular through the adoption of the NIS2 directive and the development of pan-European mechanisms for responding to cyber incidents (European Commission, 2022, December 14).

At the same time, the European Commission is consistently expanding the scope of the security discourse, integrating the concept of digital resilience into it. Digital resilience is understood as the ability of digital systems, organizations and economic sectors not only to withstand cyberattacks, but also to maintain operational capacity in crisis conditions, recover quickly from incidents and adapt to new types of threats (European Commission, 2025, December). This approach reflects the evolution from the classical understanding of security to a systemic concept of the viability of digital ecosystems, which is consistent with modern scientific approaches to risk management and the resilience of complex systems (Von Solms & Van Niekerk, 2013).

A practical example of this approach is the Digital Operational Resilience Act (DORA), which the European Commission considers as a tool to ensure the digital operational resilience of the financial sector. Within the framework of this regulation, digital resilience is defined as the ability of financial institutions to withstand serious ICT disruptions, including cyberattacks, and to continue providing key services without systemic disruption (DORA, 2025, January 17). A similar logic is embedded in the Cyber Resilience Act, which establishes mandatory cybersecurity requirements for digital products throughout their life cycle and places responsibility for a basic level of security on the manufacturers of digital solutions (European Commission, 2022, September 15). Thus, in the conceptual vision of the European Commission, cybersecurity is a necessary, but not exhaustive, component of digital resilience. While cybersecurity focuses on protectting against threats and minimizing vulnerabilities, digital resilience encompasses a broader range of tasks, including incident management, disaster recovery, institutional coordination, and long-term adaptation of digital systems (Christen et al., 2020). This integrated approach allows the European Union to view digital security not as a static state, but as a dynamic process, which is a key factor for the EU's competitiveness, strategic autonomy, and resilience in the face of growing hybrid threats (European Commission, n. d.).

2. Assessing cybersecurity in the EU digital environment

In the conceptual dimension, it is appropriate to distinguish between cybersecurity as a system of instruments and cyber incidents as a factor of dynamic change. Cybersecurity functions as an institutionally and technologically structured toolkit encompassing regulatory and legal mechanisms, organizational procedures, response algorithms, technical protection measures, and system recovery protocols.

At the same time, cyber incidents (cyberattacks, unauthorized intrusions, data breaches) act as a driving force that exposes vulnerabilities and stimulates the modernization of this toolkit. It is precisely real-world incidents that generate the empirical basis for revising security standards, refining risk management models, and strengthening the institutional capacity of both the state and the private sector.

Thus, cybersecurity is not a primary causal factor but rather an adaptive system of measures that evolves in response to the growing complexity and intensity of cyber incidents.

The modern digital environment is characterized by high dynamics of development and a simultaneous increase in the scale and complexity of cyber incidents. Cyber incidents cover a wide range of threats, from unauthorized access and malware to targeted attacks on critical infrastructure and data manipulation. Their nature is increasingly determined by the use of artificial intelligence, automation of attacks, the use of social engineering and the exploitation of vulnerabilities in global digital supply chains.

The analysis of cybersecurity in the EU digital environment demonstrates its key role in ensuring the stable functioning of economy, public administration and society in the context of rapid digitalization. The EU considers cybersecurity as a component of strategic autonomy and digital resilience, which is reflected in the formation of a comprehensive regulatory framework, in particular the NIS2 Directive, the Cyber Resilience Act and the General Data Protection Regulation (GDPR).

The main challenges for cybersecurity in the EU remain the increasing number and sophistication of cyberattacks, in particular against critical infrastructure, the financial sector, government information systems and supply chains, as well as hybrid threats in the context of geopolitical instability (Cyble, 2024, December 5). In response, the EU is strengthening coordination between Member States, increasing institutional capacity of the European Cybersecurity Agency (ENISA), investing in cyber education, innovation and joint incident response mechanisms. At the same time, the analysis shows that the level of cybersecurity in EU countries is uneven, which necessitates the need to harmonise standards, exchange best practices and support less resilient digital systems. Thus, cybersecurity in the EU's digital environment appears not only as a technical task, but as a multidimensional policy aimed at ensuring trust in digital technologies, protecting citizens' rights, and increasing the overall resilience of the EU.

It is advisable to analyse cybersecurity in the EU digital environment using the Cybersecurity Index and the Cyber-dependent Crimes Index (ENACT Programme (n.d.), that allow assessing the state of cybersecurity and the real level of cyber threats in countries (*Table 2*). The Cybersecurity Index (FM Global, n. d.) is developed by the international insurance and analytical company FM Global and is aimed at assessing the readiness of countries to counteract cyber risks at the systemic level. The index reflects the structural ability of the state to prevent cyberattacks and minimize their consequences through the development of the institutional framework, regulatory framework, digital infrastructure, and the level of cyber protection of business and the public sector. In the EU context, this index often correlates with the level of digital maturity, the quality of public administration, and investments in cyber resilience.

The Cyber-dependent crimes Index (ENACT Programme, n. d.), in turn, focuses not on readiness, but on the actual rate of cyber-dependent crime, i.e. crimes that cannot be committed without the use of digital technologies (hacking attacks, system hacking, malware, digital fraud, etc.). The Cyber-dependent crimes Index reflects the practical intensity of cyber threats and is an indicator of the real pressure of cybercrime on the economy, state institutions and society. For countries with a high level of digitalization, this index is often higher, which indicates an increase in the "attack surface" and the attractiveness of such states for cybercriminals.

Table 2

EU member states in Cybersecurity Index and Cyber-dependent crimes Index, 2025

Rank	Country	Cybersecurity Index (1–100 points)	Country	Cyber-dependent crimes Index (1–10 points)
1	Greece	99.6	Estonia	7
2	Cyprus	97.4	Netherlands	7
3	Luxembourg	95.5	Germany	7
4	Estonia	93.7	Belgium	6.5
5	Germany	93.4	France	6.5
6	Denmark	92.5	Denmark	6.5
7	Slovenia	92.1	Sweden	6.5
8	Finland	91.9	Spain	6.5
9	Netherlands	91.7	Romania	6
10	Italy	91.6	Italy	6
11	Malta	91.6	Ireland	6
12	Slovakia	91.2	Slovakia	6
13	Poland	91.0	Poland	6
14	Belgium	90.9	Bulgaria	6
15	Spain	89.8	Latvia	6
16	Lithuania	89.3	Lithuania	5.5
17	Romania	89.1	Hungary	5.5
18	France	88.9	Malta	5.5
19	Sweden	88.0	Finland	5.5
20	Ireland	87.2	Austria	5.5
21	Czech Republic	85.4	Czech Republic	5.5
22	Croatia	85.2	Portugal	5.5
23	Hungary	82.9	Croatia	5
24	Latvia	78.1	Slovenia	5
25	Austria	76.9	Greece	4.5
26	Bulgaria	72.1	Cyprus	4.5
27	Portugal	65.0	Luxembourg	4.5
EU average		88.2	EU average	5.8

Source: FM Global (n. d.); ENACT Programme (n. d.).

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The average Cybersecurity Index score across the EU (see *Table 2*), indicating an overall high level of institutional and technical preparedness of the Member States to counter cyber risks. The leaders in this indicator are Greece, Cyprus and Luxembourg, which demonstrate almost maximum index values, which is the result of targeted public investments in national cybersecurity strategies, regulatory support and coordination with European institutions. At the same time, 9 EU countries have lower than the average level of cybersecurity for the EU, which indicates certain imbalances within the integration group. Analysis of the Cyber-dependent crimes Index shows that the there is a noticeable differentiation between countries. The highest values were recorded in Estonia, the Netherlands and Germany, which, despite the high positions of these countries in the cybersecurity ranking, indicates increased vulnerability to cybercrime, due to the high level of digitalization of the economy, the development of electronic services and a significant concentration of digital assets (European Commission, 2026). In contrast, countries with lower cybercrime rates, in particular Greece, Cyprus and Luxembourg, have a high level of cybersecurity.

Comparing both indices allows us to conclude that there is no direct linear relationship between the level of cybersecurity and the scale of cyber-related crimes in EU countries. On the contrary, in highly developed digital economies, strengthening cybersecurity is often accompanied by an increase in the number or complexity of cyberattacks, which requires not only technical protection, but also the development of analytical, legal and international countermeasures. According to forecasts by the European Cybersecurity Agency (ENISA), by 2030, cyber threats in the EU will become systemic and will be determined by a combination of technical, organizational and social threats (*Figure*).

Cyberthreats to lookout for in the EU through 2030

Source: Cyble (2024, December 5).

The data presented shows that by 2030, cyber threats in the EU will be cross-sectoral in nature, going beyond purely technical problems. Attacks on supply chains and critical infrastructure are of particular danger, which can cause cascading disruptions in the economy and society. At the same time, the role of the human factor, staff shortages and the use of artificial intelligence as a tool of cybercrime is growing. Accordingly, this requires EU Member States to systematically invest in human capital, the regulatory framework, cyber security standards and coordination tools to ensure the resilience of digital infrastructure in the face of growing challenges.

3. The assessment of EU countries digital resilience

In EU countries, digital resilience is considered not only as a technical characteristic of IT infrastructure, but as a multidimensional phenomenon that combines cybersecurity, institutional capacity, regulatory framework, the level of digital skills of the population and the integration of digital technologies into the economy and public administration. EU leaders in the field of digital resilience, in particular the countries of Northern and Western Europe, are characterized by a high level of digitalization, developed mechanisms for managing cyber risks, effective interdepartmental coordination and active participation in joint EU initiatives. At the same time, significant asymmetry remains between Member States, due to different levels of investment in digital infrastructure, uneven training of personnel and unequal readiness to implement European regulatory acts, in particular NIS2 and the Cyber Resilience Act.

Against this background, the growth of cyber threats, the spread of cyber-related crimes, dependence on global IT suppliers and the vulnerability of critical infrastructure reinforce the need to ensure digital resilience as a component of the EU's strategic autonomy. In this context, DORA is a key element in shaping the digital resilience of the European Union, as it creates a single legal framework at the supranational level to ensure the operational digital resilience of the financial sector. An analysis of the role of DORA shows that the regulation of cyber resilience has shifted from fragmented national approaches to a systemic model of digital risk management, which covers IT risks, cyber incidents, business process resilience, supply chain security and interaction with external IT providers. DORA establishes common standards for ICT risk management, mandatory digital resilience testing mechanisms, a centralized incident reporting system, and enhanced oversight of critical digital service providers, which significantly reduces the level of regulatory fragmentation within the EU. In a strategic dimension, the regulation shifts the emphasis from reactive cybersecurity to proactive digital resilience, focused on the ability of financial systems not only to counter cyberattacks but also to maintain functionality in crisis conditions. Thus, DORA is not just a regulatory act of financial regulation, but an institutional framework for the formation of EU digital resilience, integrating cybersecurity, risk management, and the stability of digital infrastructure into a single systemic model of long-term digital security.

The results of the assessment of the level of digital resilience (The European Digital Resilience Index) and readiness for open technologies (The European Open Technology Readiness Index) of EU countries in 2025 are presented in the *Table 3*, divided into three analytical groups (tiers): Leadership Tier, Specialized Contender and Untapped Potential. In combination, these indices allow identifying structural imbalances between EU countries, showing different models of digital resilience formation, and assessing the role of open technologies as a strategic factor in strengthening the digital security and sovereignty of the EU.

Table 3

European Digital resilience Index
and European Open Technology Readiness Index in 2025

Rank	Country	EDRIX (1–10 points)	EOTRIX (1–10 points)	Tier
1	Germany	7.80	7.71	Leadership Tier
2	Czech Republic	6.89	4.75	
3	Sweden	6.80	7.48	
4	Finland	6.66	7.94	
5	Estonia	6.65	6.47	
6	France	6.64	6.29	
7	Slovenia	6.50	5.43	
8	Netherlands	6.24	7.93	Specialized Contender
9	Poland	5.98	4.28	
10	Austria	5.97	4.38	
11	Luxembourg	5.65	4.93	
12	Latvia	5.40	5.06	
13	Hungary	5.27	3.23	
14	Slovakia	5.25	3.55	
15	Portugal	5.15	4.91	
16	Denmark	5.08	5.85	
17	Spain	4.78	4.86	
18	Bulgaria	4.67	3.72	Untapped Potential
19	Italy	4.64	4.12	
20	Romania	4.02	2.50	
21	Belgium	3.87	4.11	
22	Greece	3.77	3.25	
23	Lithuania	3.49	3.98	
24	Croatia	3.48	3.56	
25	Ireland	3.10	4.49	
26	Cyprus	3.04	2.59	
27	Malta	2.76	4.83	

Source: EDRIX (2025).

The European Digital Resilience Index (EDRIX) and The European Open Technology Readiness Index (EOTRIX) are developed and calculated by the independent European analytical initiative EDRIX Consortium, which brings together experts in the field of digital policy, open technologies, economics and cyber resilience. The initiative is research and analytical in nature and is not an EU institution, but its methodology is focused on the EU's strategic goals, in particular digital sovereignty, strategic autonomy and digital resilience. The indices are calculated on the basis of open international and European statistical sources, expert assessments and comparative policy analysis, which ensures cross-country comparability of results.

EDRIX is a composite index designed to measure the overall level of digital resilience of EU countries. Its key feature lies in its focus not merely on the level of digitalization or cyber protection, but on a country's ability to independently design, implement, and sustain digital technologies over the long term, even under conditions of crisis, external pressure, or technological disruption. To this end, the index covers several interrelated dimensions, including digital public policy, the capacity of the public and private sectors, the development of the domestic technological and developer ecosystem, and the level of societal adoption to digital solutions. Thus, EDRIX makes it possible to assess not declarative intentions, but a country's actual structural readiness to ensure digital resilience.

EOTRIX, in turn, is a specialized derivative index that focuses on the readiness of countries to use open technologies as a basis for digital resilience. It is calculated with an emphasis on those components of the digital ecosystem that are directly related to open software, open standards and open innovation models. EOTRIX measures the readiness of public policy, environment and society as a whole to implement open-source solutions and reduce dependence on closed technological ecosystems. In a scientific context, this index is an indicator of the potential for digital autonomy, since open technologies are considered as a tool for increasing transparency, security and flexibility of digital systems.

The Leadership Tier group includes countries with high EDRIX values (above ~6.5), which indicates a well-established institutional, technological and regulatory framework for digital resilience. Germany, Sweden and Finland demonstrate balanced values of both indices, representing the use of a combination of developed digital infrastructure and active implementation of open technologies.

At the same time, the Czech Republic and Slovenia demonstrate an asymmetric development model, in which a sufficient level of digital resilience is not accompanied by a corresponding readiness for open technologies. Accordingly, this indicates the dominance of state-centric or more closed digital ecosystems, where the emphasis is on protection and control, rather than on openness and innovative interaction.

The Specialized Contender group is characterized by medium EDRIX values (mainly 5.0–6.2) and significant EOTRIX variability. An example of this is the Netherlands, where with a medium level of digital resilience the country has one of the highest indicators of readiness for open technologies.

This result indicates an innovation-oriented model, where openness and technological integration are ahead of digital resilience. In contrast, Poland, Austria, Hungary and Slovakia demonstrate moderate EOTRIX values with medium level of EDRIX, which indicates a fragmented digital transformation and limited use of open technology solutions. Such a development structure may reduce the adaptability of digital systems in the long term.

The countries in the Untapped Potential group are characterized by moderate values of both indices, which indicates an insufficiently developed digital infrastructure, weak institutional mechanisms and limited integration into open technology ecosystems. Romania, Greece, Cyprus and Bulgaria demonstrate the lowest EOTRIX values, which indicates structural barriers to the implementation of open standards and digital innovations.

At the same time, some countries in this group, in particular Ireland and Malta, have relatively higher EOTRIX values with moderate EDRIX, which indicates the presence of technological potential without an appropriate level of digital resilience. Such a disparity increases the vulnerability of digital systems to crisis phenomena.

In general, the analysis shows that high readiness for open technologies does not always correlate with high digital resilience. In a number of countries, a clear asymmetry between these indicators is observed. Thus, digital resilience without technological openness can lead to innovation inertia, while openness without resilience can lead to increased systemic risks.

Conclusions

In theoretical understanding, cybersecurity and digital resilience are in a relationship of complementarity. Cybersecurity is a necessary functional component of digital resilience, providing protection against cyberattacks and unauthorized interference, while digital resilience covers a wider range of tasks, including crisis management, incident recovery and strategic adaptation to new threats. Both concepts are related to ensuring the reliable functioning of information and communication systems, data and digital services.

At the same time, cyber incidents exert a decisive influence on the development of digital resilience, as they expose existing vulnerabilities and generate momentum for revising risk management approaches. In effect, the evolution of cybersecurity occurs under the pressure of real-world threats.

Each large-scale cyber incident becomes a catalyst for updating standards, tightening regulatory requirements, modernizing technical solutions, and improving institutional response mechanisms. Thus, within the digital environment, a distinct principle of adaptive evolution operates: threats stimulate the advancement of protective instruments, while a system's capacity to withstand cyber incidents ultimately determines the level of its digital resilience.

To analyse cybersecurity in the EU digital environment, the Cybersecurity Index and the Cyber-dependent Crimes Index were considered as complementary analytical tools. High values of the cybersecurity index are not always accompanied by low levels of cybercrime, especially in countries with a developed digital economy, which indicates the absence of a direct linear relationship between these indicators. Instead, such a comparison made it possible to identify structural features. Countries where a strong cybersecurity system is combined with a high level of cybercrime require attention to the implementation of preventive and analytical mechanisms, while countries with low indicators of both indices have a risk of hidden vulnerability due to insufficient digital integration and institutional framework.

The conducted analysis of The European Digital Resilience Index (EDRIX) and The European Open Technology Readiness Index (EOTRIX) indicates the presence of significant differences in the level of digital resilience and technological readiness of EU countries. In general, there is a clear differentiation of states by development levels, which allows for the identification of groups of leaders, specialized contenders, and countries with unrealized potential. Accordingly, 7 countries are included in the Leadership Tier group, 10 countries – Specialized Contender, 10 countries – Untapped Potential.

The examples of Greece, Malta and Cyprus demonstrate that a high level of cybersecurity does not always transform into a high level of digital resilience, which is due to the influence of institutional, technological and systemic factors. At the same time, the examples of Germany, Finland, Estonia, and Slovenia, which are characterized by high EDRIX and Cybersecurity Index results, indicate that digital resilience is formed under the influence of real cyber incidents in combination with institutional capacity, technological readiness, and the ability to restore digital systems, which allows us to confirm the hypothesis of the article.

Future research will involve the detailed modelling of sector-specific digital resilience parameters for critical infrastructure aimed at analysing industry-specific operational resilience indicators.

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DIGITALIZATION IN THE CONTEXT OF HOUSEHOLD ECONOMIC RESILIENCE

The transformation of the Ukrainian economy under the impact of full-scale invasion has created conditions for analyzing the relationship between digitalization and economic resilience of the household sector. Physical destruction of infrastructure and mass migration have transformed digital technologies from an optional tool into the primary means of preserving economic activity. However, despite the evident role of digitalization in ensuring Ukraine's economic resilience during shock impacts, a quantitative assessment of its contribution is almost absent. Therefore, this research is based on the hypothesis that digitalization can serve as a mechanism of economic resilience, partially compensating for losses from economic shocks through alternative channels of income generation and expenditure. To empirically test the proposed hypothesis, an Index of Economic Resilience of the Household Sector has been developed, which integrates economic indicators (consumption, income, lending, employment) and digital indicators (skills, infrastructure, institutions) into a single metric. The calculation results enabled the application of counterfactual analysis to compare actual resilience with a hypothetical scenario in the absence of the digital component. The calculations were based on data obtained from national statistics and international organizations for the period 2018–2024. It has been established that the sector's resilience decreased by 14% during 2021–2023; however, without the digital component, the decline would have been twice as deep. Thus, digitalization ensured 23–29% of the actual index value and prevented critical destabilization. At the same time, the research identifies problematic areas, such as rapid digital adaptation

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ЦИФРОВІЗАЦІЯ В СИСТЕМІ ЕКОНОМІЧНОЇ СТІЙКОСТІ ДОМОГОСПОДАРСТВ

Трансформація української економіки під впливом повномасштабного вторгнення створила умови для аналізу взаємозв'язку між цифровізацією та економічною стійкістю сектору домогосподарств. Фізичне руйнування інфраструктури та масова міграція населення перетворили цифрові технології з опціонального інструменту на основний спосіб збереження економічної активності. Проте через очевидну роль цифровізації у забезпеченні стійкості економіки України під час шокових впливів кількісна оцінка її внеску майже відсутня. Саме тому основу цього дослідження становить гіпотеза, що цифровізація здатна виступати механізмом економічної стійкості, частково компенсуючи втрати від економічних шоків через альтернативні канали генерування доходів та здійснення витрат. З метою емпіричної перевірки запропонованої гіпотези розроблено Індекс економічної стійкості сектору домогосподарств, який поєднує економічні показники (споживання, доходи, кредитування, зайнятість) та цифрові (навички, інфраструктура, інституції) в єдину метрику. Результати розрахунків дозволили застосувати контрфактичний аналіз та порівняти фактичну стійкість з гіпотетичним сценарієм за відсутності цифрової складової. Базою для розрахунків стали дані національної статистики та міжнародних організацій за 2018–2024 рр. Встановлено, що стійкість сектору знизилася на 14% протягом 2021–2023 рр., проте без цифрової компоненти падіння було б удвічі глибшим. Отже, цифровізація забезпечила 23–29% фактичного значення індексу та запобігла критичній дестабілізації. Водночас дослідження фіксує й проблемні зони: швидка цифрова адаптація населення відбувається за наявності суттєвих *of the population occurring in the presence of significant infrastructure constraints and institutional gaps, which restrain the full realization of digitalization's potential as a resilience factor.*

Keywords: economic resilience, household sector, digitalisation, digital resilience.

інфраструктурних обмежень та інституційних прогалин, що стримує повну реалізацію потенціалу цифровізації як фактора стійкості.

Ключові слова: економічна стійкість, сектор домогосподарств, цифровізація, цифрова стійкість.

JEL Classification: D10, O33, E21, C43.

Introduction

Research on the economic sustainability of the household sector and digitalization processes usually develops as separate scientific directions with limited interaction between them. While the first direction focuses mainly on economic components – income levels, consumption, and savings, the second approach considers the development of digital skills, access to digital infrastructure, and the use of digital public services. In recent years, the Ukrainian economy has been experiencing significant shocks and, at the same time, experiencing a rapid digital transformation. These two factors, paradoxical in their simultaneity, actualize the need to integrate several scientific approaches to understand synergistic effects. The key problem remains the lack of a single methodology that would combine economic and digital indicators, as well as allow assessing the contribution of digitalization to the overall sustainability of the household sector.

Undoubtedly, digitalization has long been considered one of the drivers of the transformation of economic systems. There is a concept of the "second machine age" (Dong and McIntyre, 2014), according to which digital technologies are a key factor in structural changes in the organization of economic activity, with the transformation covering not only technological changes, but also economic relations in general. In parallel, the concept of economic resilience is developing: the economy is considered as a system, and its response to shocks determines the immediate level of resilience. Several works (Martin & Sunley, 2014) have proposed a multidimensional typology of economic resilience, which includes the ability to resist shocks (resistance), adapt (adaptation), and transform (transformation). The proposed conceptual framework is also relevant for studying the resilience of the household sector, since it allows us to capture all levels of response to shocks – from short-term shock absorption to long-term changes in economic parameters.

One of the most studied shocks is COVID-19 and the response of economic systems to it. Since this factor was the impetus for the accelerated development of digitalization for many economies around the world, many works examine its impact on sustainability specifically during this time period. However, it is important to note that the results of such empirical studies often depend on the specifics of the economic system under study. Thus, the results for the US economy (Fairlie et al., 2021) indicate the presence of an adaptive function of digital technologies. According to the data obtained, the ability to switch to a remote type of work reduces the risk of job loss during the lockdown (but, of course, the results are not the same for all types of economic activity). A number of studies (Dingel & Neiman, 2020) have quantified the share of jobs (for the US, this figure is 37%). Digitalization and a developed digital infrastructure significantly increase the chances of survival of small businesses (20–25%, according to Bartik et al., 2020). There are indirect channels of influence of digitalization on the resilience of households through their economic connections with the business sector.

However, there are also negative effects of the impact of digitalization. On the one hand, digitalization acts as a tool for strengthening resilience, which can deepen inequality if the country has an uneven distribution of access to digital technologies. According to theoretical developments (Van Deursen & Van Dijk, 2018), digital inequality can be viewed as a multi-level model. It includes inequality in access to technologies (first-level divide), skills in their use (second-level divide), and results of their use (third-level divide).

Thus, even if a household has access to the internet, the lack of digital skills limits the full use of digital technologies to improve its economic situation. Some studies combine the assessment of digitalization and the level of economic resilience, but their number is quite limited. Most of the empirical studies concern the business sector, in particular the impact of digitalization on organizational resilience during COVID-19 (Soto-Acosta, 2020). The household sector was left out of the model, but the results for the business sector identify several channels of influence: digital infrastructure, digital competencies of personnel, digital business model, and digital ecosystems.

The scientific literature focuses on the role of digital technologies in supporting the resilience of households in rural areas (Phillipson et al., 2020). Access to broadband internet is a critical factor in maintaining economic activity, social ties, and access to public services. However, in this case, the quality of the digital infrastructure and access to it are important.

At the same time, research on the Ukrainian context in wartime conditions remains limited due to the difficulties of data collection. The developments mostly focus on separate aspects – either on the economic consequences of a full-scale invasion (Polyakova & Kogatko, 2025; Zayats, 2024; Nikolayets et al., 2023; Umantsiv & Shkuropadska, 2023) or on digitalization processes separately (Tomashevska, 2025; Novikova & Azmuk, 2023), without comparing these dimensions together.

The aim of the research is to quantify the contribution of digitalization to ensuring the economic resilience of the household sector of Ukraine under shocks for the period 2018–2024 based on an integrated index combining economic and digital dimensions of resilience.

The research is based on the hypothesis that digitalization is a significant factor in maintaining the economic sustainability of the household sector of Ukraine and is able to provide alternative channels of economic activity (remote work, digital payments, online services) in the event of a shock. The hypothesis is tested by constructing an integral resilience index that includes both economic and digital indicators. According to the results obtained, a counterfactual analysis of the contribution of digitalization was conducted: an alternative resilience index was calculated without taking into account digital indicators. A comparison of the actual index (with a digital component) and the counterfactual index (without a digital component) allows us to quantitatively assess the contribution of digitalization to the overall resilience of the sector.

The information base for the quantitative assessment is the data of the State Statistics Service of Ukraine for 2018–2024 (indicators of household income, consumer spending, lending, employment), the National Bank of Ukraine (structure of the loan portfolio), the International Telecommunication Union (digital development indicators), the Networked Readiness Index (network readiness index), the Ministry of Digital Transformation of Ukraine (data on the level of digital skills of the population and digital transformation of regions). The study has limitations, which are mostly related to the complexity of collecting data during a full-scale invasion. The values for some of the indicators are not published after 2022, and detailed statistical reporting of the digitalization process, on the contrary, begins in 2022. Therefore, in order to avoid discrepancies, certain indicators were not taken into account for those years during which data were missing. It is also worth noting that the chosen method has binary normalization (more details in the methodological overview) – unfortunately, this does not allow for a detailed assessment of the degree of deviation of actual values from thresholds. In addition, the counterfactual analysis does not take into account possible indirect effects between digital and economic indicators.

The main part of the research has three parts. The first section substantiates the theoretical channels of influence of digitalization on sustainability and reveals the features of the construction of the proposed Index. The second is devoted to the calculations of the Index and a more detailed analysis of the indicators. The third section presents the results of the counterfactual analysis and analyzes the asymmetry of digital influence.

1. Conceptual foundations and methodology of the household economic resilience Index

The household sector is the main consumer of goods and services and significantly affects demand and the labor market. In the context of digital transformation, households are an important element of economic resilience, since the level of their digitalization affects the adaptability of the economy to shocks and changes in the internal/external environment. Assessing the impact of digital technologies on the economic resilience of the household sector will allow for a comprehensive understanding of their ability to:

- adapt to digital transformations;
- maintain productivity and employment in the digital economy;
- minimize risks and vulnerabilities of the economic system;
- promote sustainable economic growth at the macroeconomic level.

This will allow identifying the strengths and weaknesses of the sector’s development in the context of economic sustainability and formulating effective public policies aimed at increasing the sustainability of the economy.

The economic sustainability of the household sector in the context of digitalization is the ability of households to maintain economic stability and adaptability through the use of digital tools. This includes the effective use of digital infrastructure, the development and maintenance of digital competencies, ensuring sustainable employment, and the ability to withstand shocks. Economic sustainability under the conditions of the use of digital technologies reflects the ability of households to maintain economic activity, integrate into the digital economy, and minimize vulnerabilities arising from the process of digitalization.

It is proposed to quantify the sector's economic resilience and determine the role of digitalization in ensuring it, using the Economic Resilience Index. The Economic Resilience Index of the Household Sector (hereinafter referred to as the Index) is based on the understanding of resilience as the sector's ability to maintain its own functionality and recover from shocks. In fact, the conceptual foundations of resilience make the proposed index a composite indicator. The index aggregates information on the main aspects of the functioning of households in the context of the transformation of the economic system: the components of the Index constitute 4 groups, the description and indicators of which are presented in *Table 1*. The index is built on the assumption that digital tools are able to increase economic resilience and mitigate the negative effects of shocks, and therefore, play an "auxiliary" function in the restoration of economic parameters.

Table 1

Indicators of the household sector economic resilience Index

Group of indicators	Description	Indicators
Financial sustainability and consumer potential	Covers basic economic parameters of household financial health. This group of indicators is included in the Index based on the fundamental role of consumption and financial stability in ensuring the sustainability of any economic system	1.1 Household final consumption expenditure to GDP (%). 1.2 Share of household loans in total gross loans (%). 1.3 Ratio of loans and loans for residential real estate to total gross loans (%). 1.4 Share of registered unemployed among the total population, %
Digital transformation and technological adaptation	Represents the sector's ability to adapt in the digital economy through the development of digital skills (1.5, 1.7), access to digital infrastructure (1.6), use and development of human capital (1.9), and motivation to be part of the digital labor market (1.8). Conceptually, the indicators reflect the modern paradigm of economic development (recall that according to it, digitalization acts as a mechanism for increasing sustainability through diversification of income sources, access to information, and the ability to adapt to changing market conditions). The high weight of the group (33.3%) corresponds to the growing role of digital factors in the modern economy	1.5 Digital skills gap index. 1.6 Universal connectivity index. 1.7 Network readiness index: component – People. 1.8 Average monthly salary of employees working in the ICT sector. 1.9 Human capital index

End of Table 1

Group of indicators	Description	Indicators
Institutional environment and information infrastructure	The indicators are added to determine the environment in which households carry out economic activities in the digital space. They cover the parameters of institutional support for the digitalization process (1.10 – legislative data protection, 1.11 – access to information) and the state of technological infrastructure (1.12 – stability of mobile Internet, 1.13 – speed of fixed Internet)	1.10 Legislation on the protection of personal data. 1.11 Access to information index. 1.12 Mobile Internet stability index. 1.13 Fixed Internet speed
Economic activity and income Structure	The group characterizes the position of the household sector in the structure of the national economy through its participation in the creation of added value (1.14) and the distribution of national income (1.15). The lower weight of the group is because these indicators are more aggregated and partially reflect the resulting effect of the factors presented in the previous groups	1.14 Share of households in gross value added (%)/ 1.15 Share of household disposable income in gross disposable income (%)

Source: compiled by the author.

The index is calculated in three stages:

Step 1. Indicator normalization. A threshold value is set for each indicator, reflecting the minimum acceptable level for each. Normalization is performed using a binary principle:

$$N_i = \begin{cases} 1, if\ X_i \ \geq T_i\ \ (for\ direct\ impact\ indicators) \\ 1, if\ X_i \ \leq T_i\ (for\ reverse\ impact\ indicators) \\ 0, in\ other\ cases \end{cases} ,$$

where N_i is the scaled value of the i-th indicator, X_i is the actual value of the i-th indicator, and T_i is the threshold value of the i-th indicator.

Step 2. Calculation of the composite index. The composite index is calculated using the following formula:

$$I_n = \frac{\Sigma N{=}1}{\Sigma N_x} \cdot 100\% ,$$

where I_n is the integral indicator of the nth sector of the economy; n = (1, 2, 3);

N_x = 1 is the number of indicators whose normalized value is equal to 1;

N_x is the total number of indicators.

Step 3. Results interpretation. The obtained value is interpreted according to the stability level scale (*Table 2*).

Table 2

Index interpretation scale

№	Index value, %	Number of indicators reaching threshold values	Stability level
1	86–100	13–15	High
2	66–85	10–12	Sufficient
3	45–65	7–9	Average
4	26–44	4–6	Moderate
5	0–25	0–3	Low

Source: compiled by the author.

The formation of the Index structure is based on the methodological principles of representativeness and availability of statistical data.

The representativeness principle assumes that each group of indicators covers key aspects of the sustainability of the household sector. The group of financial sustainability indicators (1.1–1.4) represents the basic ability of households to maintain consumption, accumulate financial resources, and maintain employment. The digital transformation indicators (1.5–1.9) reflect the adaptive potential of the sector and consider the accumulation of digital competencies and integration into the digital economy. The group of institutional environments (1.10–1.13) characterizes the conditions in which digital activity is implemented. Finally, the group of economic activity indicators (1.14–1.15) reflects the position of the sector in the structure of the national economy.

The principle of data availability has led to a restriction of the list of indicators to only those indicators for which there is regular statistical reporting or international indices with a transparent calculation methodology. This explains the absence of some potentially relevant variables in the structure of the Index. In particular, regional differentiation is not added due to the limited regional statistics in the period 2022–2024 (lack of data for occupied territories, inconsistent reporting). Digital literacy quality indicators (unlike the formal digital skills index) are not included due to the lack of regular measurements at the national level. Infrastructural constraints on the digital development of the sector are taken into account, but more detailed metrics (e.g., geographical coverage of broadband Internet, cost of access) are excluded due to data fragmentation.

The threshold values were set depending on the origin of the indicator. For example, for indicators based on international indices, the threshold values were set at the level of average indicators for Central and Eastern European countries or minimum values for EU countries. For example, the threshold level of the universal communication index of 70% (1.6) corresponds to the median value for the countries of the region according to ITU data. For macroeconomic indicators (1.1, 1.14, 1.15), a normative approach based on theoretical models of the economic structure was applied. Thus, the threshold of 55% for consumer spending to GDP corresponds to the lower limit of the range of 55–65%, typical for stable market economies according to the OECD methodology. For financial indicators (1.2–1.3), an average statistical approach based on the historical dynamics of developed credit markets with an adjustment for the specifics of Ukraine was used.

The weights of the indicators in the basic calculation are equal (each indicator has a weight of 1/n, where n is the number of indicators with available data). This decision is based on the principle of equal importance of all sustainability dimensions in the absence of unambiguous theoretical or empirical grounds for differentiating the weights.

The constructed Index uses binary normalization instead of the intensity scale (min-max normalization) for several reasons. First, it allows for clear interpretability: the indicator either reaches the minimum acceptable level or not. This corresponds to the concept of threshold effects in the theory of economic sustainability, according to which individual parameters of the system become functional only after reaching a critical level. Secondly, binary normalization is less sensitive to outliers and extreme values of individual indicators, which is especially relevant for the period 2022–2024. Thirdly, this approach allows for the aggregation of qualitatively heterogeneous indicators (percentage, index, absolute) without the distortions that arise with linear normalization of variables of different scales. However, it is worth recognizing the limitations of this choice – the use of a binary approach does not allow for the analysis of the degree of deviation from the threshold value.

The chosen method also has limitations related to the completeness of statistical data. Unfortunately, not all indicators have official data for the full selected study period. The lack of data for individual indicators in 2018–2021 (1.5–1.13) limits the comparability of the Index values between periods. The 2018 Index, calculated on the basis of 6 indicators, is conceptually different from the 2023 Index, based on 15 indicators. This is taken into account in the interpretation as a result of comparing trends within homogeneous periods, rather than absolute values between them. In addition, the conditions of a full-scale invasion led to territorial limitations in statistical data collection: the data do not cover occupied territories and territories without central government control. Also, mass migration (estimated at 6 million people in 2022) creates distortions in per capita indicators. Informal economic activity, which grows during the crisis, is not sufficiently reflected in official statistics, which may underestimate the real economic activity of households (indicator 1.14).

2. Dynamics of economic stability in Ukraine's household sector

Based on all the source data, the Index value for the period 2018–2024 is calculated (*Table 3*).

Table 3

Calculation result of the economic sustainability Index for the household sector

1	Indicator	Threshold value	2018	2019	2020	2021	2022	2023	2024
1.1	Household final consumption expenditure to GDP, %	≥ 55	68.5	73.38	72.33	68.21	62.68	59.11	61.55
1.2	Share of household loans in total gross loans, %	≥ 35	18.73	21.87	21.77	24.37	21.94	23.7	26.36
1.3	Ratio of loans and advances for residential real estate to total gross loans, %	≥ 25	22.11	15.35	14.01	11.23	9.65	11.22	12.7
1.4	Registered unemployed as a share of total population, %	≤ 4	0.81	0.81	1.1	0.72	0.45	–	–
1.5	Digital skills gap Index	≥ 6	–	–	–	–	4.8	4.8	4.8
1.6	Universal connectivity index	≥ 70	–	–	–	–	74.6	74.6	74.6
1.7	Network readiness Index: people component	≥ 44	–	–	–	–	67.09	74.99	77.28
1.8	Average monthly salary of employees working in the ICT sector	≥ 2.2	–	–	–	–	3.3	3.4	3.6
1.9	Human Capital Index	≥ 0.40	–	–	–	–	0.51	0.51	0.51
1.10	Personal data protection legislation	≥ 3	–	–	–	–	2	2	2
1.11	Access to information Index	≥ 6	–	–	–	–	8	8	7.1
1.12	Mobile internet stability index	≥ 0.13	–	–	–	–	0.1	0.08	0.12
1.13	Fixed internet speed	≥ 100	–	–	–	–	75.81	92.85	88.01
1.14	Share of households in gross value added, %	≥ 30	22.48	23.32	23.91	23.87	17.49	18.38	–
1.15	Share of household disposable income in gross disposable income, %	≥ 65	67.58	69.98	72.35	70.68	61.71	61.51	–
Result by sector, %			50	50	50	50	47	43	46

Source: calculated by the author based on (Financial Sector Statistics, n. d.; State Statistics Service of Ukraine, n. d.; Minfin; Measuring Digital Development ICT Development Index 2024, n. d.; Network Readiness Index, n. d.; Minfin, 2024; Digital Readiness Index 2021, n. d.; Digital Quality of Life Index – Surfshark, 2020; Speedtest Global Index – Internet Speed Around the World – Speedtest Global Index, n. d.).

The level of economic resilience of the sector during 2020–2021 reached 50%, which at first glance indicates an almost imperceptible impact of the COVID-19 shock on the economic system. However, a more detailed structural analysis reveals other trends.

Using the example of the unemployment rate indicator (1.4), one can observe sensitivity to the shock impact: the increase from 0.81% in 2019 to 1.1% in 2020 (an increase of 35.8%) reflects the deterioration of the labor market situation in the first months of the pandemic. However, since the value of the indicator remained significantly below the threshold level (4%), this did not affect its normalized value. Unfortunately, this also illustrates the limitations of the chosen methodology – binary normalization did not reflect the real deterioration, since it occurred within the "safe zone".

At the same time, the consumer spending to GDP indicator (1.1) demonstrated a counter-shock effect: the decrease from 73.38% in 2019 to 72.33% in 2020 (a decrease of 1.4%) is relatively moderate, which indicates the action of stabilization mechanisms, in particular state support and accumulated savings. In 2021, the indicator further decreased to 68.21%, which already reflects a longer-term effect of the shock on the structure of the economy.

The share of household income (1.15) demonstrates resilience to the pandemic shock: 72.35% in 2020 versus 69.98% in 2019, with a subsequent slight decrease to 70.68% in 2021. All these values exceed the threshold level, so the normalized indicator remained 1. The lack of a rapid deterioration can be explained by several factors: support for state social transfers, business adaptation to new conditions, and the relatively short-term nature of stricter restrictions. Thus, the relative stability of the integral index in 2020–2021 does not reflect the absence of a shock effect, but rather a balancing act between negative effects (deterioration of employment, gradual decline in consumption) and stabilization mechanisms of state policy (social support, adaptation). At the same time, for a number of indicators (1.5–1.13), data for 2020–2021 are missing, which limits the possibility of a full-fledged assessment of the impact of the pandemic on digital aspects of resilience.

The decrease in the index from 50% in 2021 to 47% in 2022 and 43% in 2023 clearly demonstrates the consequences of a full-scale invasion. The decline in the level of resilience can be explained, firstly, by the real deterioration of the economic situation, and secondly, by the expansion of the list of indicators monitored (statistical information has appeared for the group of digital indicators).

The share of disposable household income (1.15) fell sharply from 70.68% in 2021 to 61.71% in 2022 (a decrease of 8.97 pp, or 12.7%). This is the most dramatic change among all indicators, which may indicate a redistribution of national income in favor of the public sector (increasing military spending) and the corporate sector (in the case of enterprises providing military needs or critical infrastructure). The fall below the 65% threshold changed the normalized value from 1 to 0, directly lowering the integral Index. A further decrease to 61.51% in 2023 indicates the consolidation of this structural change.

The share of households in gross value added (1.14) decreased from 23.87% in 2021 to 17.49% in 2022 (a decrease of 6.38 pp or 26.7%). The sharp drop reflects the collapse of household entrepreneurial activity due to forced migration, loss of access to markets, destruction of physical capital (equipment, premises) in occupied territories, and in zones of active hostilities. Self-employed persons in the trade, consumer services, and tourism sectors were particularly affected. A slight recovery to 18.38% in 2023 indicates the beginning of adaptation, but its level remains critically low.

Consumer spending to GDP (1.1) decreased from 68.21% in 2021 to 62.68% in 2022 (a decrease of 5.53 pp, or 8.1%). Although the indicator remained above the threshold of 55%, the pace of decline indicates a significant shock to consumer behavior. The reduction in consumption reflects both a real decline in incomes and an increase in the propensity to save due to increased uncertainty.

Taking into account digital indicators also revealed vulnerabilities in digital resilience. In particular, the Digital Skills Development Index (1.5) is recorded at 4.8, which is only 80% of the threshold value (normalized value 0).

Fixed Internet speed (1.13) shows volatility: 75.81 Mbps in 2022, 92.85 Mbps in 2023 (22.5% increase), followed by 88.01 Mbps in 2024 (5.2% decrease). The sharp increase in 2023 can be explained by several factors: population concentration in regions with better infrastructure due to migration, exclusion from the sample of occupied territories with worse infrastructure, and investments by operators in restoring networks in controlled regions. At the same time, a decrease in the indicator was recorded in 2024, reflecting the impact of energy attacks on the functioning of network equipment. In addition, in none of the analyzed years was the threshold level of 100 Mbps reached, which limits the possibility of using the most technologically demanding digital services.

The stability of the mobile Internet (1.12) is characterized by even greater volatility: 0.1 in 2022, falling to 0.08 in 2023 (a 20% decrease), followed by a sharp increase to 0.12 in 2024 (a 50% increase). The drop in 2023 reflects the peak load on mobile networks due to population migration and the transition to mobile Internet as the main communication channel after the destruction of fixed infrastructure. The improvement in 2024 indicates the adaptation of mobile operators and investments in expanding network capacity, but the indicator still does not reach the threshold level.

Analysis of the dynamics of indicators allows us to identify three main mechanisms for the implementation of shock impacts on the stability of the household sector: a) income and employment; b) consumer behavior; c) digital adaptation.

The war shock directly affected income generation opportunities through job destruction (physical destruction of enterprises, loss of access to occupied territories), forced migration (loss of connection to sources of income), and structural reallocation of resources in favor of military needs.

The mechanism is manifested through a sharp decline in the share of households in gross value added (indicator 1.14) and the share of their income in national income (indicator 1.15).

Increased uncertainty about the future in wartime conditions has intensified caution as one of the main characteristics of consumer behavior, which has led to an increase in the propensity to save and a reduction in current consumption. At the same time, the real decline in income has limited consumer spending. Therefore, we can observe a shock impact mechanism through a decrease in the share of consumer spending in GDP (indicator 1.1), although this process was less rapid than the decline in income.

Unlike purely economic mechanisms, digitalization also partially performed a depreciation function. The possibility of remote work, access to online services, and digital payments allowed some households to maintain economic activity even in conditions of limited physical mobility. The paradoxical growth of individual digital indicators (1.7, 1.8) in the context of a general deterioration in resilience indicates the role of digitalization as a resilience factor. However, it is worth paying attention to the infrastructure limitations (indicators 1.12, 1.13), which somewhat limited the amortizing effect of digitalization; ultimately, this did not allow to fully compensate for the negative effects of shocks.

The increase in the index from 43% in 2023 to 46% in 2024 indicates the beginning of adaptation processes, but the level of stability is still lower than the baseline (50%). The improvement is mainly due to the performance of digital indicators: the increase in the network readiness index (1.7) to 77.28, the stabilization of the universal communication index (1.6) at 74.6%, and the improvement in the stability of the mobile Internet (1.12) to 0.12. At the same time, structural indicators of economic activity (1.14, 1.15) remain in the critical zone, which indicates the incompleteness of the recovery process.

3. Quantitative assessment of the role of digitalization in ensuring stability

Since the Index includes not only the economic, but also the digital component (1.5–1.9, 1.10–1.13), it is possible to assess the impact of digitalization on the overall sustainability of the sector. We assume that this impact will be observed at two levels – direct (as a change in the value of the Index itself) and indirect (through interaction with other indicators). To assess the direct impact of digital indicators, a counterfactual analysis was used: the index value for 2022–2024 was calculated excluding all digital indicators (1.5–1.9, 1.10–1.13), leaving only traditional economic indicators (1.1–1.4, 1.14-1.15).

Counterfactual index (without digital indicators):

- 2022: 2 out of 6 indicators = 33.3%;
- 2023: 2 out of 6 indicators = 33.3%;
- 2024: 2 out of 5 indicators = 40,0% (indicator 1.14 is missing).

Actual index (with digital indicators):

- 2022: 47%;
- 2023 p.: 43%;
- 2024 p.: 46%.

Changes due to the factor of digitalization of the economy:

- 2022: 47% – 33.3% = 13.7 p. p.;
- 2023: 43% – 33.3% = 9.7 p. p.;
- 2024: 46% – 40.0% = 6.0 p. p.

Thus, digital indicators do make a significant positive contribution to overall resilience. In 2022, digitalization added 13.7 percentage points to the resilience Index, which is 29.1% of the actual index value. Without digital factors, the resilience of the sector would be estimated at 33.3%, which corresponds to the category of "moderate level of resilience".

In 2023, the contribution of digitalization decreased slightly, to 9.7 p.p. (22.6% of the actual value), which may be due to the deterioration of individual digital indicators (decrease in mobile internet stability from 1.12 to 0.1 to 0.08, decrease in the information access index 1.11 from 8 to 7.1 in 2024). However, even in 2023, digitalization remained a critical factor that maintained resilience above the critically low level.

In 2024, the lowest contribution of digitalization is observed – 6 p.p. (13% of the actual value). This is due to two factors: first, the improvement of the counterfactual Index to 40% (by excluding indicator 1.14 due to lack of data), and second, the lack of further growth of most digital indicators (stagnation of 1.5, 1.6, 1.9, 1.10).

Probably the most noticeable is the positive contribution of digitalization during the period of full-scale invasion – the time of the greatest shock impact. According to the results of the Index, in 2022–2023, economic indicators (1.14, 1.15) demonstrated critical deterioration, while digital indicators (1.6–1.9, 1.11) ensured the prevention of the transition of the level of resilience to the "moderate level" category. This empirically confirms the thesis about the role of digitalization as a factor in the sustainability of economic systems.

If not for the positive contribution of digital indicators, the resilience of the household sector in 2022–2023 would be assessed at a lower level, reflecting serious structural problems in most aspects of resilience. The actual values of 47% (2022) and 43% (2023), although corresponding to the category of "below average", nevertheless indicate the preservation of the basic functionality of the sector with moderate, rather than serious problems.

A detailed decomposition of the contribution of individual digital indicators allows us to identify the specifics of their impact:

The indicators of digital adaptation of the population (1.6–1.9) provide a stable positive contribution:

- in 2022–2024, four indicators of this group (1.6, 1.7, 1.8, 1.9) stably have a normalized value of 1;
- their combined contribution is 4/15 = 26.7% of the maximum possible Index;
- without these indicators, the actual Index in 2023 (43%) would decrease to 28.6%, which would correspond to a low level of resilience.

This group of indicators is characterized by inertia and long-term effects of competence accumulation, which indicates resilience to short-term shocks. The growth of the network readiness index (1.7) from 67.09 to 77.28 during 2022–2024 demonstrates that even in conditions of military shock, the process of accumulation of digital competences does not stop, but, on the contrary, may accelerate due to the effect of forced adaptation.

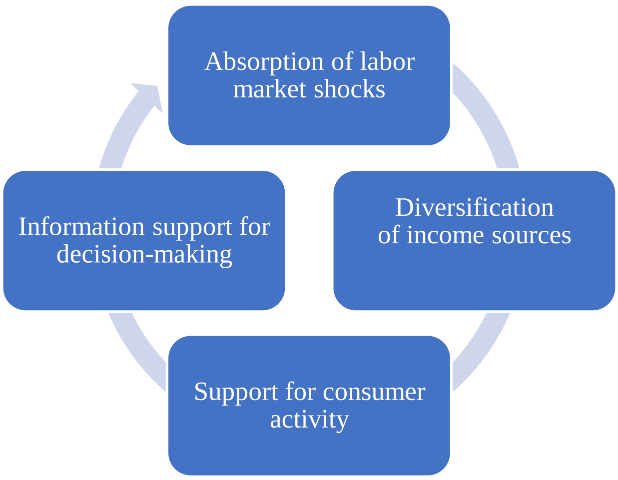
The infrastructure and institutional indicators (1.10–1.13) demonstrate a negative or zero contribution: none of these indicators reaches the threshold value during 2022–2024, and their combined contribution is 0/15 = 0% of the maximum possible index.

The lack of a positive contribution of this group indicates the existence of infrastructural and institutional constraints that do not allow the full realization of the potential of the population's digital adaptation. High indicators of network readiness (1.7) and universal connectivity (1.6) do not ensure adaptability due to insufficient internet speed (1.13), instability of mobile communications (1.12), and weakness of legislative data protection (1.10).

At the same time, the Digital Skills Indicator (1.5) occupies an intermediate position: it consistently does not reach the threshold value (4.8 at a threshold of 6), but the absolute value is relatively high (80% of the threshold).

This indicator reflects the gap between the practical adaptation of the population to digital technologies (high network readiness 1.7) and the formalized level of digital skills. This gives grounds to argue that digital competencies are mostly formed empirically, while the systematic development of in-depth knowledge and skills remains insufficient. In turn, this limits the possibilities of using complex digital services and technologies.

Digitalization affects sustainability not only directly (through its own indicators), but also indirectly, through its relationship with economic indicators (*Figure*).



Indirect mechanisms of digitalization's impact on resilience

Source: compiled by the author.

The development of digital skills and infrastructure allowed a part of the workforce to quickly switch to remote work after the outbreak of the war. This softened the shock of the employment decline, which could have had a much greater impact in the absence of digital opportunities. The growth of wages in the ICT sector (indicator 1.8) from a coefficient of 3.3 to 3.6 in the context of an overall decline in incomes indicates the emergence of the digital sector as a certain center of stability in the labor market. Digital platforms have allowed households to diversify sources of income through freelancing, the export of services, and e-commerce. Although this did not fully compensate for the decline in traditional sources (which was manifested in the decrease in indicator 1.15), digitalization partially softened the shock. This is evidenced by the fact that the rate of decline in consumer spending (indicator 1.1, a decrease of 8.1% in 2022) was lower than the rate of decline in the share of household income (indicator 1.15, a decrease of 12.7% in 2022), which may be due to compensation through digital tools.

The development of e-commerce and digital payments has allowed for consumer activity to be maintained even in conditions of limited physical mobility. This partly explains the relative resilience of the consumer spending indicator (1.1), which has remained well above the threshold level even in the most difficult periods. Without digital channels of trade, the decline in consumption could have been much deeper due to the physical inaccessibility of goods and services.

A high index of access to information (1.11) provides households with the opportunity to quickly obtain critical information about safety, market conditions, and available support services.

This reduces information asymmetry and allows for more informed economic decisions under conditions of high uncertainty.

However, the analysis also reveals limitations in digitalization as a factor of resilience. First, digitalization cannot fully compensate for fundamental economic shocks. The 26.7% decline in the household share of gross value added (indicator 1.14) in 2022 was not compensated by digital factors, as many types of economic activity (manufacturing of tangible goods, construction, physical services) cannot be fully digitalized.

Second, the impact of digitalization is limited by infrastructural and institutional factors. Insufficient internet speed (1.13), instability of mobile communications (1.12), and weakness of legal data protection (1.10) create additional negative effects that prevent digitalization from realizing its full potential.

Third, the effects of digitalization are unevenly distributed. Digital inequality, which manifests itself as a result of infrastructure constraints, lack of digital skills among parts of the population, or financial constraints, means that not all households receive the positive effects of digitalization.

Fourth, digitalization creates new vulnerabilities: dependence on the functioning of electricity networks (critical in the context of energy attacks), cyber threats, and risks of loss of personal data. In addition, the low level of legislative data protection (indicator 1.10) further strengthens these vulnerabilities. It is important to recognize that the identified mechanisms are based on the analysis of the dynamics of indicators and qualitative observations. The growth of digital indicators (1.7) in parallel with the relative conservation of consumption (1.1) does not prove unequivocally that the former caused the latter – other alternative explanations can be assumed (state support, use of savings, remittances from migrants). For mathematically clear causal identification, microdata at the household level are needed with the ability to control for multiple factors, which is beyond the scope of this study. The presented analysis establishes the plausibility of causal relationships based on theoretical mechanisms and empirical consistency with aggregated data, but does not claim to definitively prove causality.

Conclusions

Empirical results suggest that digitalization plays a significant role in maintaining the resilience of the household sector, especially in the face of shocks. In 2022–2023, digital indicators provided 23–29% of the actual value of the resilience index, which avoided the transition of resilience to the "low" category.

The analysis reveals four main mechanisms of the digitalization impact on the economic resilience of the household sector: maintaining employment through the transition to remote work (which in turn mitigated the labor market shock for highly skilled workers), diversifying income sources, maintaining consumer activity through e-commerce (which prevented an even deeper decline in consumption under limited physical mobility), and reducing information asymmetry (which accelerated access to state support and optimized economic decisions).

The results obtained confirm the hypothesis that digitalization is a significant factor in maintaining the economic sustainability of the household sector as a result of providing alternative channels of economic activity. At the same time, the research reveals the limitations of this impact: digitalization partially compensates for losses from economic shocks, but cannot fully replace economic stabilization tools.

At the same time, the impact of digitalization is asymmetric: high rates of digital adaptation of the population (indicators 1.6–1.9) partially compensate for structural economic problems (indicators 1.14–1.15), but cannot fully replace them. Infrastructural and institutional constraints (indicators 1.10–1.13) hinder the realization of the potential of digitalization.

To maximize the contribution of digitalization to resilience, a comprehensive policy approach is needed that combines human capital development (formal digital skills), infrastructure modernization (fast and stable internet), and institutional improvements (data protection legislation). Without synchronous progress across all these dimensions, digitalization will not be able to fully realize its potential as a resilience driver.

Future research opportunities include analyzing regional differences in the impact of digitalization on household resilience (if relevant statistical data are available) and examining the long-term effects of digital transformation on the structure of income and employment in the sector in the post-conflict period. Additional research is also needed on the issue of digital inequality and its impact on the differentiation of resilience between social and economic groups of households.

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EVOLUTION OF DIGITAL PLATFORM MANAGEMENT

Global technological transformations and the exponential growth of information volume have led to the emergence and rapid development of digital platforms, which have changed management mechanisms, created new business models and strategic partnerships, and become key market players and monetization leaders. The research is based on the hypothesis that the evolution of digital platform management is sequential and cumulative, reflecting a transition from narrow, specialized communicational and technological concepts to a strategic social and economic management vision of complex multi-industry business ecosystems with hybrid functions that influence social and economic relations, market structure, workforce, consumer demand, competition, innovation, and so forth. The hypothesis was substantiated using the following research methods: systemic-structural analysis (for systematizing scientific research on the processes of genesis and structural formation of digital platforms), dialectical method and method of interdisciplinary synthesis (for studying the evolutionary context of the development of digital platforms from Web 1.0 to Web 3.0), method of comparison and Internet monitoring (to determine the differences in the management of digital platforms at various stages), and logical

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ЕВОЛЮЦІЯ УПРАВЛІННЯ ЦИФРОВИМИ ПЛАТФОРМАМИ

Глобальні технологічні перетворення та експоненційне зростання обсягів інформації спричинили появу і стрімкий розвиток цифрових платформ, які змінили механізми управління, створили нові бізнес-моделі та стратегічні партнерства, стали ключовими гравцями на ринку і лідерами монетизації. В основу дослідження покладено гіпотезу, що еволюція управління цифровими платформами має послідовний і кумулятивний характер, відображаючи перехід від вузькоспеціалізованих комунікаційно-технологічних концепцій до стратегічного соціально-економічного управлінського бачення складних багатогалузевих бізнес-екосистем з гібридними функціями, що впливають на суспільно-економічні відносини, структуру ринку, ринок праці, споживчий попит, конкуренцію, інновації тощо. Гіпотезу обґрунтовано з використанням таких методів дослідження: системно-структурного аналізу (для систематизації наукових досліджень щодо процесів зародження та структурного формування цифрових платформ), діалектичний та метод міждисциплінарного синтезу (для дослідження еволюційного контексту розвитку цифрових платформ від Web 1.0 до Web 3.0), методи порівняння та Інтернет-моніторингу (для визначення відмінностей в управлінні цифровими *generalization (for formulating the conclusions of the conducted research). It is noted that the evolution of digital platforms is inextricably linked with the development of the infrastructure and functionality of the global Internet network, which experts conditionally divide into the Web 1.0, Web 2.0, and Web 3.0 stages. Each of these stages created technological and economic prerequisites for the formation, dissemination, and dominance of certain types of platforms. The Web 1.0 stage is explored as the period of genesis of digital platforms, where general management was reduced to content administration and unilateral control by the website owner. The Web 2.0 stage is viewed from the perspective of the formation of the platform economy and the further development of digital platforms, where management shifted from administration and linear control to the "orchestration" of interactions within complex ecosystems. The Web 3.0 period is characterized in the context of the transformation of digital platforms, with a shift in the management focus from interaction management to decentralized ownership and coordination. Understanding this transformation is crucial for modern management, as it has offered fundamentally new mechanisms for regulating economic activity, new values, and a new social and economic architecture of network consensus. The conclusions emphasize that despite the transparent and democratic idea, the management system of Web 3.0 digital platforms has critical vulnerabilities that require further active research.*

Keywords: digital transformation, management, business ecosystem, digital platforms, Web 1.0, Web 2.0, Web 3.0, the Internet (or Internet network), network consensus, and digital fragmentation.

платформами на різних етапах), логічного узагальнення (для формулювання висновків проведеного дослідження). Зазначено, що еволюція цифрових платформ нерозривно пов'язана з розвитком інфраструктури та функціоналу всесвітньої мережі Інтернет, яку фахівці умовно поділяють на етапи Web 1.0, Web 2.0 та Web 3.0. Кожен з цих етапів створював технологічні та економічні передумови для формування, розповсюдження та домінування певних типів платформ. Етап Web 1.0 досліджено як період зародження цифрових платформ, загальне управління якими зводилося до адміністрування контенту та одностороннього контролю з боку власника вебсайту. Етап Web 2.0 розглянуто з позиції формування платформної економіки та подальшого розвитку цифрових платформ, управління в цей період змістилося від адміністрування та лінійного контролю до "оркестрації" взаємодій у складних екосистемах. Період Web 3.0 охарактеризовано з огляду трансформації цифрових платформ зі зміщенням управлінського фокусу з керування взаємодією на децентралізоване володіння та координацію. Розуміння цієї трансформації є важливим для сучасного менеджменту, оскільки вона запропонувала принципово нові механізми регулювання економічної діяльності, нові цінності та нову соціально-економічну архітектуру мережевого консенсусу. У висновках зазначено, що, попри прозору і демократичну ідею, система управління цифровими платформами Web 3.0 має критичні вразливості, які надалі потребують активних досліджень.

Ключові слова: цифрова трансформація, управління, бізнес-екосистема, цифрові платформи, *Web* 1.0, *Web* 2.0, *Web* 3.0, мережа Інтернет, мережевий консенсус, цифрова фрагментація.

JEL Classification: M11, L86, B40, L14.

Introduction

Global technological transformations and exponential growth in information volumes have led to the emergence and rapid development of digital platforms, which have changed management mechanisms, created new business models and strategic partnerships, and have become key market players and leaders in monetization. Digital platforms (DPs) have attracted the attention of many Ukrainian and foreign scholars as a field of study for the most transformational phenomena of the modern economy (Novikova et al., 2023; Zaitseva et al., 2024). However, their dynamic and interdisciplinary nature of origin has created certain difficulties in forming a unified scientific and methodological approach to determining the essence, purpose, and management mechanisms of digital platforms.

Despite significant scientific achievements, a fragmented approach prevails in existing studies: platforms are considered either as technological tools or as separate business models without taking into account their dynamic transformation. The scientific problem of conceptual systematization of the evolutionary logic of management changes, which would explain the transformation of the role of management depending on the change of Internet generations, remains unresolved. Most sources do not reveal the mechanism of transition from hierarchical administration (characteristic of the early stages) to decentralized governance and network consensus. This article closes the indicated gap, proposing a holistic periodization of the development of digital platform management, which correlates the change of technological structures (from Web 1.0 to Web 3.0) with fundamental shifts in the management paradigm.

The aim of the article is to study the evolution of digital platform management in the context of the relevant stages of its formation and development.

The research is based on the hypothesis that the evolution of digital platform management is consistent and cumulative in nature, reflecting the transition from highly specialized communication and technological concepts to a strategic social and economic management vision of complex multi-sector business ecosystems with hybrid functions that affect socio-economic relations, the structure of the labor market, consumer demand, competition, innovation, etc.

The hypothesis is substantiated using the following general scientific research methods: system-structural analysis (to systematize scientific research on the processes of emergence and structural formation of digital platforms), dialectical method and interdisciplinary synthesis method (to study the evolutionary context of the development of digital platforms from Web 1.0 to Web 3.0), comparison method and Internet monitoring (to identify differences in the management of digital platforms in the context of the relevant stages of their formation and development), logical generalization (to formulate the conclusions of the research).

The information, theoretical, and methodological basis of the study was analytical reports of international and national organizations, research on the platform economy, monographic literature, and scientific publications of domestic and foreign authors studying the issues of analysis and systematization of scientific and methodological approaches to determining the essence and purpose of digital platforms.

The structure of the main part of the article has three consecutive sections. The first section examines the stage of the emergence of the concept of digital platforms, starting with the first publications on the mentioned issues, which appeared in the 1990s and early 2000s (Web 1.0) and were associated with the spread of information technologies, the growth of the popularity of the Internet, the emergence of relevant network structures, a description of the main characteristics of digitalization and an assessment of their impact on existing economic systems. These transformations created the prerequisites for the formation of the platform economy. The second section examines the maturity and dominance of digital platforms (Web 2.0) as established business models based on value-based interactions between two or more interdependent user groups, with the possibility of further diversification. The value of a platform increases the number of users; they evolve through targeted changes in their own design, operations, and ecosystem management rules, which create powerful positive feedback loops and contribute to their rapid scaling. The third section is devoted to the processes of decentralization and further hybrid development of digital platforms (Web 3.0) and the formation of a new network consensus architecture.

1. The emergence of the digital platform concept (Web 1.0)

The evolution of digital platforms is inextricably linked to the development of the infrastructure and functionality of the World Wide Web, which experts conditionally divide into the phases of Web 1.0, Web 2.0, and Web 3.0. Each of them created technological and economic prerequisites for the emergence, spread, and dominance of certain types of platforms.

The period of Web 1.0 (late 1980s – early 2000s) is characterized as the initial stage of digital mediation with a technological basis of static web pages (HTML), limited bandwidth, and the absence of dynamic databases. At this stage, there was a rapid spread of information technologies, the popularity of the Internet grew, and the corresponding network structures were built. The network was used mainly for publishing and consuming information by companies, government, academic institutions, and users on websites, and communication did not involve active interaction through a read-only model; communication was carried out via email, chats, forums, SMS on mobile phones, and was not yet built into digital platforms.

Platforms originated in the form of vertical portals and early aggregators, which were mostly one-way or two-way, focused on providing information or cataloging. Prototypes of early digital platforms include the first search engines and online stores, which acted as linear intermediaries (seller-buyer) or simple catalogs.

At this time, a corresponding "reconfiguration" of market structures was taking place (Konsynski & McFarlan, 1990), with the emergence of extended global enterprises and partnerships (Harasim, 1993), "virtual corporations" and "network organizations" (Bradley et al., 1993), "intermediary players in the electronic market" with new forms of receiving, processsing, transmitting information and forming shared databases (Rockart & Scott Morton, 1993).

The concept of a "digital platform" in the Web 1.0 period was not yet clearly formulated in its modern sense, but was considered by scholars mainly as a technological infrastructure that provided information exchange. Its economic value was formed through access to information, not user interaction. And although the general management of such structures was reduced to content administration and unilateral control by the site owner, these technologies created the prerequisites for fundamental changes in management practice and the formation of an "interorganizational" culture as a business philosophy (Sarkar et al., 1995).

The transition period from the technological base of Web 1.0 to Web 2.0 is characterized by the active development of search engines (AltaVista, Google), information portals (Yahoo!, AOL, Lycos), content management systems (CMS) for publications, online stores (Amazon, eBay) and other forms of e-commerce, which had much greater potential for shaping the system of platform values, as they provided the possibility of interaction between different groups of users, intermediaries and even competitors, who became part of the value chain in the digital economy as a new type of "cyber intermediaries" (Zimmermann, 2000).

Later, researchers Rochet and Tirole defined platforms as "two-sided markets" where two groups of users (sellers and buyers, advertisers and consumers of advertising) interact, whose interests are balanced, resulting in cross-network effects: the value of the platform for one group depends on the number of participants in the other (demand interdependence). Platforms can subsidize one side of the market (provide free access) to attract more users from the other side, i.e., mediate transactions between groups of agents (Rochet & Tirole, 2003, 2006; Armstrong, 2006). They also analyzed the dilemma of a firm choosing between two different business models: the first – acting as an intermediary (merchant), which buys goods or services from suppliers and resells them to customers, and the second – functioning as a two-sided platform, which allows suppliers and customers to interact directly (Hagiu, 2007). It has been determined that a two-way digital platform is not just an intermediary function, but a business model that stimulates cooperation between both parties through pricing, technology, and partner trust, acting as a catalyst for transactions, thereby reducing transaction costs (Evans et al., 2006). It has been emphasized that ignoring the multilateral nature of the platform economy can lead to misleading consequences in both business strategies and regulatory policies (Evans, 2008).

2. The development of the platform economy, maturity, and diversification of digital platforms (Web 2.0).

The Web 2.0 period can be divided into two stages: the formation of the platform economy (early 2000s – 2015) and the maturity and diversification of digital platforms (from 2016 to the present). This period, according to O'Reilly (2005), became the "golden age" for centralized digital platforms. If Web 1.0 was the so-called "reading network", then Web 2.0 became a "participation network", where value was created not by site owners, but by users themselves (User-Generated Content – UGC). Digital platforms did not own the main means in the traditional sense but created value using assets and resources belonging to their users. Management during this period shifted from administration and line control to "orchestrating" interactions in complex ecosystems. This is due to the integration emergence of cross-platform services (APIs and mash-up services), which are becoming more flexible, modular, and extensible, and the platforms themselves are acquiring economic, technological, and social meaning.

The main task of Web 2.0 platform management was to create an infrastructure that allowed external producers and consumers to find each other and exchange value (Van Alstyne et al., 2016), so digital platform managers (Facebook, Uber, Airbnb) focused on reducing transaction costs and removing barriers to entry to enable network effects through mass engagement, where the value of the platform increases with each new user. To trigger network effects, strategies were used to subsidize one side of the market (e.g., free access for Facebook users) at the expense of the other (advertisers) (Evans & Schmalensee, 2016). Successful interaction management required reaching a critical mass, after which the platform began to grow on its own through feedback loops (Parker et al., 2016). However, platforms could not be managed through direct orders (as in traditional corporations), because users were external agents. Therefore, management was transformed into Governance, which was implemented through two levers (Tiwana, 2014):

- Architecture: the program code defined what could and could not be done on the platform; management consisted of making decisions about how modular the system was and which interfaces (APIs) were open to third-party developers.
- Policies: establishing rules of conduct, content moderation, rating, and feedback systems. These are "soft control" mechanisms that provide trust and security to unfamiliar participants.

Key management competencies have become the collection and control of giant data sets (Big Data) about user behavior that are difficult for competitors to reproduce. The data was used to: improve matching algorithms (Matching: connecting the "right" driver with a passenger or a product with a buyer); personalize the experience to maintain attention (Lock-in effect); monetize through targeted advertising (O’Reilly, 2005). The mature period of Web 2.0 was characterized by aggressive competitive strategies, the actualization of leadership issues, the ability to effectively manage the digital ecosystem, maintain a balance between openness and control over the platform, as well as promote innovation not only in one’s own company, but also in the entire ecosystem, which allowed to "tilt the market" in one’s favor and create sustainable competitive advantages (Gawer & Cusumano, 2008). The dominance of digital platforms in one market provided opportunities to use their own user base to enter adjacent markets, absorbing the functionality of competitors (for example, adding Stories features to Instagram to compete with Snapchat). This required management to constantly monitor the ecosystem, react quickly, integrate new services (Parker et al., 2016) and solve a strategic trade-off: strive to attract a wider range of users, which may lead to a decrease in uniqueness, or focus on attracting exclusive "complementors" (partners/developers/co-creators/users), which may improve the quality of content, product, service, but limit the potential scalability of the platform (Cennamo & Santalo, 2013). Currently, the crucial formation of online identity and accumulation of social and economic capital of digital platforms is taking place, which has become a large-scale environment for the interaction of millions of users and the development of businesses, and a dominant force in many sectors of the economy and social life.

3. The development of digital platforms and the formation of a new network consensus architecture (Web 3.0)

Today, the world is on the threshold of a new era of the "Internet of Value", the direction of the "Creator Economy" is developing (Johnson & Woodcock, 2019), their role in monetizing content through direct interaction with the audience is growing, and new forms of ownership of digital objects are emerging (Wang et al., 2021). Web 3.0 technologies are improving so quickly that scientists often try to "catch up" with practice. Knowledge is generated in developer communities, so-called "white papers", projects, startups, and speeches at specialized conferences. The architecture of digital platforms is changing with a shift in the managerial focus from controlling interaction to decentralized ownership and coordination. Understanding this transformation is important for modern management, since Web 3.0 offers fundamentally new mechanisms for regulating economic activity (Tapscott D. & Tapscott A., 2016).

Understanding the essence of Web 3.0 digital platforms is appropriate to consider in comparison with their previous iterations, the evolutionary context of the development of which is presented in *Table 1*.

Table 1

The evolutionary context of digital platform development
from Web 1.0 to Web 3.0

***Web*-period**	**Characteristics of digital platforms**
Web 1.0 (Read-Only)	The period of protocols and static content, digital platforms as such in the modern sense were not formed; there were websites (HTML) with limited bandwidth, no dynamic databases that provided information unilaterally; management was completely centralized in the hands of the owner, administrator, and webmaster
Web 2.0 (Read-Write)	In the period of aggregator platforms (Facebook, Uber, Amazon), users are allowed to create content, but the platforms (intermediaries) own the data and monetize it; management is carried out by a corporate hierarchy, and the architecture of the digital platform is a "walled garden" (O'Reilly, 2005)
Web 3.0 (Read-Write-Own)	During the period of decentralization, digital platforms are built on blockchain; users not only generate content, but also own their own data and digital assets (through tokens); the role of the intermediary is minimized by the program code (Voshmgir, 2020)

Source: (O'Reilly, 2005; Voshmgir, 2020).

Web 3.0 digital platforms (also called dApps – decentralized applications) have a number of architectural and value differences that determine the specifics of their management:

• data decentralization: instead of storing data on central servers (e. g., AWS), Web 3.0 uses distributed registries, which reduces the risk of a single point of failure and censorship (Werbach, 2018);

• interoperability (compatibility): in Web 2.0, profile transfer between platforms was impossible; in Web 3.0, the user has a universal identifier (wallet) that works on different platforms, which forces platforms to compete not for "closing and retaining" the user, but for providing a better service (Chen, 2018);

• economics of ownership of digital objects: the use of NFTs (non-fungible tokens) allows the ownership of digital objects to be fixed with the user, not with the platform.

Governance of digital platforms in Web 3.0 is different from corporate management – it moves from hierarchy to algorithmic consensus and communities. Decentralized Autonomous Organizations (DAOs) have become the central tool of governance, and instead of a board of directors, decisions are made by the owners of Governance Tokens. Governance tokens are a tool that turns platform users into its co-owners and operators. This is the foundation of the Web 3.0 economy, which shifts power from a centralized office to a distributed community, although it faces growth diseases, in particular the dominance of big capital (Buterin, 2021, August 16). Code becomes law, and voting results are often automatically executed through smart contracts (Voshmgir, 2020). Governance occurs through Trustless Management, but this does not mean the absence of trust, but that participants do not need to trust or delegate authority to a specific manager or intermediary. Trust is transferred to the software code and cryptographic proofs, and platform governance consists of writing reliable, audited smart contracts that guarantee the execution of transactions without third-party intervention (Werbach, 2018). Thus, digital platforms are governed through tokenomics (the economics of cryptocurrency tokens), when early adopters receive platform tokens for their activity; if the platform becomes successful, the tokens increase in value, and this turns users into investors and "evangelists" of the platform, aligning the incentives of all participants (Catalini & Gans, 2020). Owners of governance tokens decide strategic and technological issues that are closed to users in conventional companies. They participate in: shaping the platform's financial policy (changing the size of transaction fees on the platform; distributing platform funds to marketing, developer grants, charity, token buybacks); technical approvals (updating the software code, changing algorithms, or adding new features); making personnel decisions (in some DAOs hiring/firing developers who maintain the protocol (Buterin, 2021, August 16). And although the analogy of tokens with shares in the process of making management decisions is appropriate, there are important differences that should be noted (*Table 2*).

Table 2

Key differences between shares and tokens

Characteristics	Shares (Web 2.0 / TradFi)	Governance Tokens (Web 3.0)
Decision execution	Legal / HR (execution of orders by managers)	Programmatic / Automatic (smart contract makes changes itself)
Availability	Regulated, mainly for accredited investors	Open purchase of tokens on the exchange
Transparency	Closed reporting, insiders	Full transparency in the blockchain (on-chain)
Main function	Receive dividends + (sometimes) vote	Protocol management (value is tied to the utility of the platform)

Source: (Hassan & De Filippi, 2021; Tapscott D. & Tapscott A., 2016; U.S. Securities and Exchange Commission, 2017; Peirce, 2020, February 6; Voshmgir, 2020).

It should be noted that despite the transparency and democratic nature of the idea, the Governance Tokens system has its own risks, significant structural and behavioral problems that are currently being actively researched. The authors have identified several critical vulnerabilities that threaten the stability of Web 3.0 digital platforms (*Table 3*).

Table 3

Critical vulnerabilities that threaten the stability of Web 3.0 digital platforms

Risks and governance issues	Description
Plutocracy and centralization ("Whale Power")	The biggest problem with the "1 token = 1 vote" (Coin Voting) model is the tendency towards plutocracy (the rule of wealth). In most DAOs, the distribution of tokens is uneven: venture funds, founders, and early investors ("whales") can control more than 50% of the votes. This neutralizes the influence of retail users and allows a narrow circle of individuals to make decisions in their own interests, ignoring the community (Buterin, 2021)
User apathy and low participation	Most token holders view tokens as a speculative asset rather than a governance tool. This leads to the phenomenon of "rational ignorance": users do not waste time studying complex proposals because they understand that their vote will not mathematically affect the outcome. As a result, voter turnout in many leading protocols (Compound, Uniswap) may not exceed 5–10%, making the system vulnerable to minority manipulation (OpenZeppelin, 2021)
Governance Attacks	The low liquidity of tokens and the ability to lend them create threats of specific attacks. Within a single transaction on the blockchain, an attacker can borrow a large amount of cryptocurrency without collateral for a few seconds, buy management tokens, vote for a proposal to withdraw funds to their wallet, and immediately return the loan (Qin et al., 2021)
Conflict of interest and short-termism	The conflict between long-term compliance with the protocol and the short-term desire of token holders to make a profit. Token holders can vote to increase fees or aggressive risk strategies to increase the token price "here and now," even if it may destroy the ecosystem in the future. This is a classic agency problem where the interests of "shareholders" (tokenholders) do not coincide with the interests of "clients" (protocol users) (Eahrhardt et al., 2022)
Regulatory uncertainty	The legal status of Governance Tokens remains a "gray area." The U.S. Securities and Exchange Commission (SEC) and other regulators often view such tokens as unregistered securities, which creates legal risks for digital platforms (Hassan & De Filippi, 2021)

End of Table 3

Risks and governance issues	Description
Impact of political fragmentation of the Internet	Fragmentation, when world states, seeking to establish their digital sovereignty, apply political control not to infrastructure, but to digital platforms through certain mechanisms of influence: the attempt to create a "sovereign internet" in russia; China's periodic blocking of Google and Facebook and the promotion of its own ecosystems of WeChat, Baidu and Weibo; forcing governments (and, accordingly, the policies of individual platforms) to remove content that is considered illegal under national law or unethical; requirements for global platforms to store their citizens' data on servers physically located within the country, which is done under the pretext of "privacy protection", but also gives government agencies access to the data and complicates the operations of digital platforms (Mueller, 2022)

Source: (Buterin, 2021; OpenZeppelin, 2021; Qin et al., 2021; Eahrhardt et al., 2022; Hassan & De Filippi, 2021; Mueller, 2022).

The vulnerabilities listed in Table 3 have significant consequences for digital platforms, which lose global universality, are forced to create different versions of their rules, functionality, and policies for different countries, which increases operating costs; are transformed from purely commercial companies into political players, balancing the requirements of local laws, pressure from human rights defenders, and their own business interests; become agents of state control, fulfilling requirements for moderation and implementation of national policies in the digital space, and are forced to adapt to the new reality of a "politicized" and "territorialized" Internet (Mueller, 2022).

Negative aspects also include specific practices of some platforms that are not always illegal but systematically undermine fairness in the market. Such practices include:

• self-preferencing: giving preference to their own products and services in rankings and search results on their platform (for example, Google promoting Google Shopping, or Amazon promoting its own products);

• using competitors' data obtained from business users on the platform to develop their own similar products;

• interoperability restrictions: creating "closed ecosystems" or "walled gardens" that make it difficult for products and services to interact with competing platforms;

• tying and bundling services to force users to use the entire product portfolio.

According to the Digital Markets Act (Regulation (EU) 2022/1925, 2022), preventing the further implementation of anti-competitive practices requires a fundamental change in the regulatory paradigm and the creation of a so-called "constitution for digital markets" to make the Web 3.0 economy fairer and more competitive.

Thus, in the Web 3.0 environment, a dualism begins to be clearly visible: on the one hand, unprecedented opportunities for value creation are opening, and on the other, existential challenges arise for the functioning and development of digital platforms. Therefore, the further evolution of digital platforms will depend not only on the improvement of blockchain technologies but also on the development of a new socio-economic architecture of network consensus.

Conclusions

The evolution of digital platforms is inextricably linked to the development of the infrastructure and functionality of the World Wide Web, which experts conditionally divide into the stages of Web 1.0, Web 2.0, and Web 3.0. Each of these stages had technological and economic prerequisites for the emergence, distribution, and dominance of certain types of digital platforms, which changed management mechanisms, created new business models and strategic partnerships, became key players on the market, and leaders in monetization.

The authors consider the Web 1.0 stage as the period of the emergence of digital platforms with static websites (HTML), limited bandwidth, lack of dynamic databases, and centralized management in the hands of the owner, administrator, or webmaster. The spread of information technologies influenced the growth of the popularity of the Internet and the emergence of corresponding network ecosystems, which became prototypes of digital platforms.

The Web 2.0 stage is associated with the formation of the platform economy and the further development of digital platforms. During this period, value was created not by site owners, but by users themselves. Digital platforms did not own fixed assets in the traditional sense, but created value by using assets and resources belonging to their users. The authors emphasize that management during this period shifted from administration and line control to the "orchestration" of interactions in the platform, the value of which increased with the increase in the number of users, which created powerful positive feedback loops and rapid scaling.

Subsequently, digital platforms underwent a transformation with a shift in management focus from interaction control to decentralized ownership and coordination in the Web 3.0 era. Understanding this transformation is important for modern management, as it has proposed fundamentally new mechanisms for regulating economic activity, new values, and a new social and economic architecture of network consensus. Thus, the aim of the article has been achieved, and the hypothesis has been substantiated and confirmed. A promising direction for further research will be an in-depth study of the consequences of digital fragmentation and the corresponding risks for the stable functioning of digital platforms.

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HYBRID CROSS-MARKETING STRATEGIES IN RETAIL

The article examines the theoretical and methodological foundations of the formation and development of cross-marketing strategies for retail enterprises under conditions of digital transformation, with a particular focus on the concept of hybrid marketing. The relevance of the study is driven by the deepening digitalization of the economy, the transformation of consumer behavior, the fragmentation of communication channels, and the increasing demand for personalized marketing solutions. Under these conditions, retail enterprises face the need to integrate online and offline marketing tools, coordinate interactions with partners, optimize marketing expenditures, and enhance the efficiency of resource utilization within cross-marketing initiatives. The research hypothesis is formulated as the assumption that the application of hybrid marketing as an integrated system – combining digital platforms, traditional promotion channels, big data analytics, personalized communications, and partnership programs – generates a synergistic effect. This effect contributes to increased efficiency of cross-marketing strategies, enhanced customer experience, strengthened consumer loyalty, and improved competitive positions of retail enterprises in both domestic and international markets. The methodological framework of the study is based on

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ГІБРИДНІ КРОС-МАРКЕТИНГОВІ СТРАТЕГІЇ В РИТЕЙЛІ

Досліджено теоретико-методологічні засади формування та розвитку крос-маркетингових стратегій підприємств торгівлі в умовах цифрової трансформації з використанням концепції гібридного маркетингу. Актуальність дослідження зумовлена поглибленням цифровізації економіки, трансформацією споживчої поведінки, фрагментацією каналів комунікації та зростанням вимог до персоналізації маркетингових рішень. За таких умов підприємства торгівлі стикаються з необхідністю інтеграції онлайн- та офлайн-інструментів, координації взаємодії з партнерами, оптимізації маркетингових витрат і підвищення результативності використання ресурсів у межах крос-маркетингових ініціатив. Гіпотезу дослідження сформульовано як наукове припущення, що застосування гібридного маркетингу як інтегрованої системи цифрових платформ, традиційних каналів просування, інструментів аналітики великих даних, персоналізованих комунікацій і партнерських програм формує синергетичний ефект. Такий ефект забезпечує зростання ефективності крос-маркетингових стратегій, підвищення цінності клієнтського досвіду, посилення лояльності споживачів і зміцнення конкурентних позицій підприємств торгівлі на внутрішніх і міжнародних ринках.

systemic, structural-functional, and process-oriented approaches, as well as methods of analysis and synthesis, comparative analysis, generalization, induction, and deduction. The empirical basis of the research is formed using statistical data, analytical reports from international research and consulting organizations, materials from professsional associations, and relevant academic publications. As a result of the study, hybrid marketing tools are systematized, and their functional role in shaping cross-marketing strategies is identified. The feasibility of an integrated combination of online and offline interaction channels is substantiated. The results obtained confirm the research hypothesis and demonstrate that the implementtation of hybrid marketing enhances the adaptability of retail enterprises to digital changes and contributes to the growth of their long-term market efficiency.

Keywords: hybrid marketing, cross-marketing, marketing strategies, retail enterprises, digital marketing tools, partnership interactions.

Методологічну основу дослідження становлять системний і процесний підходи, а також методи аналізу й синтезу, порівняльного аналізу, узагальнення. Емпіричну базу дослідження сформовано на основі статистичних даних, аналітичних звітів міжнародних дослідницьких і консалтингових організацій, матеріалів професійних асоціацій та релевантних наукових публікацій. У ході дослідження систематизовано інструменти гібридного маркетингу, визначено їх функціональну роль у формуванні крос-маркетингових стратегій та обґрунтовано доцільність комплексного поєднання онлайн- й офлайн-каналів взаємодії. Отримані висновки підтверджують гіпотезу та засвідчують, що впровадження гібридного маркетингу сприяє підвищенню адаптивності підприємств торгівлі до цифрових змін і зростанню довгострокової ринкової ефективності.

Ключові слова: гібридний маркетинг, крос-маркетинг, маркетингові стратегії, підприємства торгівлі, цифрові маркетингові інструменти, партнерські взаємодії.

JEL Classification: M31, L81, O33.

Introduction

The modern development of the international and national economy is characterized by high dynamics of changes in the field of market communications, digitalization of business processes, and the growing role of information technologies in shaping the consumer experience. In this context, traditional marketing concepts are losing their effectiveness, as modern consumers are increasingly focused on the integration of digital and offline channels of interaction, as well as on receiving personalized content and products. Hybrid marketing, which combines classical marketing approaches and digital tools, is becoming a strategic resource for retail enterprises (RE), capable of increasing the competitiveness and adaptability of companies in the context of global digital transformation (Balyk & Khylyuk, 2024; Grazhevska & Chyhyrynsky, 2021; United Nations Development Programme, 2021).

The relevance of the study is due to the fact that modern retail enterprises are faced with the need to combine traditional marketing tools with digital platforms, including social media, e-commerce services, and analytical tools for assessing consumer behavior. In this case, cross-marketing plays a significant role as a strategy for interaction between different brands, which allows expanding the market, attracting new consumer segments, and increasing the effectiveness of promotional campaigns. At the same time, despite the active introduction of digital technologies into marketing processes, the issue of integrating hybrid approaches into cross-marketing strategies of RE remains insufficiently studied, especially in the

Ukrainian and regional context (Balyk & Hylyuk, 2024; Nevmerzhitska & Tsalko, 2021).

The results of the analysis of recent studies demonstrate the active study of digital marketing, hybrid communication models, and cross-marketing strategies in the global scientific community. Thus, Kotler et al. (2019) in their work Marketing 4.0 explore the transition from traditional to digital marketing, focusing on personalization, multi-channel, and integration of online and offline communications. Ekman et al. (2020) demonstrate the relationship between digital marketing tools, consumer satisfaction, and financial results of large US companies, emphasizing the role of innovative strategies in increasing competitiveness.

In Ukraine and the region, studies by Balik and Khylyuk (2024), Ivanchenkova et al. (2025) pay attention to the impact of digitalization on consumer behavior in the field of e-commerce, but a comprehensive approach to integrating hybrid marketing into cross-marketing strategies of retail enterprises remains underdeveloped. Thus, in previous developments, individual components of the problem have been identified, but there is no systematic analysis and algorithm for implementing hybrid marketing strategies using cross-marketing practices.

The main problem that the study is aimed at solving is to determine the methodology for integrating hybrid marketing into cross-marketing strategies of PT, which ensures the maximization of the results of promotional activities, optimization of resource use, and increased consumer loyalty. The following issues remain unresolved: the systematicity of approaches to combining offline and online channels, the algorithm for selecting partners for cross-marketing campaigns, and assessing the economic efficiency of such strategies.

The aim of the article is to scientifically substantiate and develop directions for implementing hybrid marketing as the basis for cross-marketing strategies of retail enterprises, as well as to identify key factors of the effectiveness of these strategies in the context of digital transformation. To achieve the aim, the following tasks are envisaged:

• analyze modern approaches to hybrid marketing and cross-marketing strategies in world practice;

• identify key trends and digital tools used by retail enterprises;

• formulate directions for implementing hybrid marketing in cross-marketing strategies of retail enterprises.

The hypothesis was formed that the effective combination of digital and traditional marketing tools within the framework of cross-marketing strategies increases the effectiveness of communications, economic efficiency, and consumer loyalty of retail enterprises compared to the use of only classical or digital methods.

The methodological basis of the study was a comprehensive method of content analysis of scientific and practical sources, comparative analysis of successful PT cases, as well as quantitative and qualitative methods of assessing the effectiveness of marketing campaigns. The information base was publications of recent years, open company data, industry research reports (Digital Marketing: Benchmark Report, 2024; OECD, 2020), social media analytics, and official statistics. The hypothesis testing algorithm provided for: collecting data on marketing campaigns, identifying key digital and offline tools, analyzing the effectiveness of hybrid marketing integration, and formulating recommendations for optimizing strategies.

The structure of the main part of the article has three sections. The first is devoted to the theoretical justification of hybrid marketing and cross-marketing strategies, the analysis of modern digital tools, and consumer behavior models. The second section reveals the practical aspects of integrating hybrid marketing into cross-marketing campaigns of retail enterprises. The third section contains an algorithm for implementing hybrid marketing and recommendations for optimizing cross-marketing strategies in the context of digital transformation and global trends.

1. Theoretical and methodological foundations of hybrid and cross-marketing

The current scientific and practical discussion on marketing strategies of retail enterprises indicates the growing need to integrate traditional and digital tools for communicating with consumers. In this context, the concepts of hybrid marketing and cross-marketing are key mechanisms for increasing the competitiveness, adaptability, and effectiveness of retail enterprises in national and international markets (Kniazieva et al., 2023; Kotler et al., 2019).

Hybrid marketing is defined as a comprehensive strategy that combines traditional promotion channels and modern digital platforms, including social media, e-commerce, mobile applications, personalized CRM systems, and analytical tools for tracking consumer behavior. This approach allows for synergy between offline and online communications, which is especially important in the context of global digital transformation and high dynamics of the market environment (Balyk & Khylyuk, 2024; Shpak et al., 2022).

Cross-marketing, in turn, involves a strategic partnership between different brands, companies, or market segments to mutually increase audience reach, increasing consumer loyalty and the effectiveness of promotional campaigns. This approach is widely used internationally, for example, in the cooperation of Starbucks and Spotify, when the company ensures the mutual penetration of audiences through joint promotions, or McDonald’s and Coca-Cola, which use cross-promotions to strengthen brand awareness (Lozić & Fotova Čiković, 2024).

Scientific analysis of hybrid marketing allows us to identify its key components that form an effective marketing system of the enterprise:

traditional marketing: the use of classic promotion tools (advertising, PR, personal sales, direct mail);

digital marketing: social networks, e-mail marketing, content marketing, SEO/SEM, mobile applications;

analytical tools: Big Data, CRM systems, consumer behavior prediction platforms;

Personalization and segmentation: creating personalized offers based on customer behavior and preferences.

Channel integration: creating an omnichannel environment for seamless consumer interaction with the brand.

Table 1 provides a comparative description of traditional and digital marketing, which allows you to assess the synergistic effect of the hybrid approach.

Table 1

Key elements of hybrid marketing and their strategic role

Elements of hybrid marketing	Functionality description	Strategic role	Company example	Key performance indicators
Traditional channels	Advertising campaigns, stores, events	Brand support, fostering trust	Starbucks (offline cafes)	Repeat purchase frequency, foot traffic
Digital channels (online)	Social media, websites, mobile apps	Expanding reach, personalization	Amazon (recommendation algorithms)	Conversion rate, average order value, click-through rate
Analytics and CRM	Collection and processing of consumer data	Behavioral forecasting, segmentation	Nike (CRM + mobile app)	Retention rate, customer loyalty
Omnichannel	Online and offline integration	Improved convenience and loyalty	Sephora (stores + mobile app)	Sales growth, NPS
Cross-marketing campaigns	Joint promotions with partners	Brand synergy, audience expansion	LEGO + IKEA	Reach growth, joint campaign ROI
Personalization	Targeted offers, AI recommendations	Increased conversion, customer retention	Netflix (recommendation system)	Number of views/orders, CTR
Social and environmental aspects	ESG activities, social programs	Enhanced reputation, brand responsibility	IKEA (eco-programs)	Customer loyalty, CSR indices

Source: compiled by the author based on (Digital Marketing: Benchmark Report, 2024; Korhonen et al., 2018; OECD, 2021; Kniazieva et al., 2023).

Cross-marketing as a scientific and practical phenomenon is studied through the prism of strategic management, behavioral economics, and marketing communications. Recent studies indicate that the effectiveness of cross-marketing campaigns depends on factors such as compatibility of partner brands, level of consumer trust, integrity of communication strategy, and digital competence of companies (Grazhevska & Chygirinsky, 2021; Rosokhata, 2021).

An example of successful integration of hybrid and cross-marketing is the collaboration between Nike and Apple in the development of the Nike+

Run Club mobile application, which allowed for an increase in user activity and interaction between brands at the global level. Another example is the collaboration between IKEA and LEGO, where cross-promotions are accompanied by digital activities on social networks, which contribute to increasing audience reach and strengthening consumer loyalty (Digital Marketing: Benchmark Report, 2024).

Table 2 demonstrates different models of cross-marketing strategies used by international trading enterprises, indicating typical tools and effects.

Table 2

Key components of hybrid and cross-marketing integration

Integration aspect	Goal	Key tools	Results/Metrics
Brand and partner compatibility	Ensuring strategic synergy	Analysis of values, target audiences, and reputational risks (e.g., IKEA + LEGO)	12% increase in sales, improved brand awareness
Channel coordination	Aligning offline and online communications	Mobile apps, social media, email marketing, events (e.g., Nike)	25% increase in store traffic, 18% increase in online sales
Analytical support	Campaign optimization and personalization	CRM, Google Analytics, Big Data (e.g., Starbucks)	10–15% optimization of promotional expenses, increased loyalty
Economic and social impact	Increased ROI and social value	Sales monitoring, social engagement, ESG reporting (e.g., IKEA + LEGO)	Increased reach, improved reputation, and CSR indices
Innovative interaction	Creation of a new marketing environment	Content synchronization, cross-platform integration (e.g., Starbucks + Spotify)	Enhanced brand engagement, 15% increase in active users

Source: compiled by the author based on (Cross-platform marketing statistics, n. d.; Digital Marketing: Benchmark Report, 2024; Kniazieva et al., 2024; Kotler et al., 2019; MoEngage, 2025; Iankovets, 2024).

Hybrid marketing in the modern conditions of digital transformation is a key tool for strategic management of PT. Its role is not only to combine traditional and digital communication channels, but also to form sustainable competitive advantages, adaptability to changing market conditions, and increase the economic efficiency of the enterprise (Grazhevska & Chygirinsky, 2021; Kotler et al., 2019).

Firstly, hybrid marketing allows for omnichannel interaction with the consumer, which is today a critical condition for customer retention and loyalty formation. For example, Sephora actively integrates physical stores, mobile applications, and social networks, which allows customers to simultaneously receive personalized offers, make online purchases, and participate in offline loyalty programs. According to MoEngage (2025), omnichannel consumers demonstrate a 30% higher frequency of repeat purchases than users of individual channels.

Second, hybrid marketing increases the effectiveness of cross-marketing campaigns because it allows companies to coordinate joint actions with partners at all levels of communications. For example, the Starbucks and Spotify collaboration covers physical cafes, mobile applications, and social networks simultaneously, which allows both companies to increase audience reach and increase brand engagement.

Third, hybrid marketing provides dynamic management of consumer data through analytical platforms and CRM systems, which allows you to create personalized offers and predict consumer behavior in different market segments (Balyk & Khylyuk, 2024; Shpak et al., 2022). For example, Amazon and Alibaba use recommendation algorithms based on behavioral data, which allows you to increase sales conversion by 20–35% (Digital Marketing: Benchmark Report, 2024). Fourth, hybrid marketing acts as a tool for adapting businesses to global challenges: pandemics, economic crises, and growing competition. During COVID-19, companies that quickly integrated digital channels into traditional strategies were able to compensate for losses from offline sales: in particular, McDonald's, through its mobile application and online ordering systems, ensured an increase in orders by 15–18% in countries where lockdowns were the most severe (Rosohata, 2021).

Therefore, the strategic role of hybrid marketing is manifested in: increasing the competitiveness of PT; creating a personalized consumer experience; ensuring omnichannel interaction; integrating analytics and predicting consumer behavior; supporting business adaptability and resilience in the context of digital transformation. The integration of hybrid marketing and cross-marketing strategies provides synergy between the company's internal resources and external partner opportunities, which allows you to increase the effectiveness of communications, expand market reach, and create long-term value for consumers (Kniazieva et al., 2023; Digital Marketing: Benchmark Report, 2024).

The first aspect of integration is the analysis of brand and partner compatibility, which determines the success of cross-marketing campaigns. Companies should assess:

- the level of values and corporate culture of partners;
- compatibility of target audiences;
- reputational risks and history of interaction with the market;
- potential for synergy in communication channels.

For example, IKEA and LEGO combined their marketing teams to launch joint campaigns in social networks and offline stores, which increased brand awareness in the parent-child segment and ensured a 12% increase in sales in the first quarter after the launch of the campaign (Digital Marketing: Benchmark Report, 2024).

The second aspect of integration is the coordination of communication channels, which involves the synchronization of offline and online activities, the use of e-mail, mobile applications, social networks, and traditional media. For example, Nike, when launching cross-promotions between the Nike+ mobile app and retail stores, ensured the simultaneous integration of content, personalized messages, and local promotions, which allowed it to increase the frequency of store visits by 25% and increase online sales by 18% (Grazhevska & Chygirinsky, 2021).

The third aspect is analytical support and monitoring, which includes data collection through CRM systems, Google Analytics, social media, and other digital tools. This allows you to evaluate the effectiveness of campaigns in real time and adjust strategies for specific consumer segments. For example, Starbucks uses data on the behavior of mobile application users and loyalty programs to adapt cross-marketing campaigns in different countries, which allows it to optimize promotional costs by 10–15% (MoEngage, 2025). The fourth aspect of integration is the assessment of economic and social impact. Hybrid and cross-marketing provide not only economic benefits (increased sales, market coverage), but also create social value, strengthen brand reputation, and support the principles of sustainable development. For example, joint promotions by IKEA and LEGO were accompanied by environmental activities, including the use of eco-materials in products and charity programs, which increases consumer trust and loyalty on a global scale (Grazhevska & Chyhyrynsky, 2021).

Thus, the integration approach involves a systematic analysis of partner compatibility, coordination, and synchronization of communication channels, analytical support and adaptive campaign management, assessment of economic and social impact, and ensuring the integrity of brand strategies in the long term. The integration of hybrid and cross-marketing ensures the creation of an innovative marketing environment where the interaction between brands and channels occurs synchronously, enhancing the effectiveness of strategies and increasing value for the end consumer.

2. Hybrid marketing in the development of cross-marketing strategies for retail enterprises

In today's digital transformation of the global retail market, companies are forced to reconsider traditional approaches to building marketing strategies. The phenomenon of hybrid marketing, which combines classic marketing tools with digital communication channels, opens up new opportunities for the development of cross-marketing strategies, allowing to achieve a synergistic effect from the interaction of different platforms, formats, and partnerships. Such an approach is becoming not just a logical continuation of the evolution of marketing practice, but a necessary condition for increasing the competitiveness of business entities in the retail sector. Global trends that characterize today's retail trade confirm the need to apply integrated marketing strategies. According to forecasts, by 2027, the share of e-commerce in global retail sales will reach more than 20.5%, and the total volume of the e-commerce market will be approximately 6.42 trillion dollars. USA (Statista, 2024; Unified commerce platform statistics, n. d.) – this indicates a transformation of consumer behavior and the need for strategies that ensure a simultaneous presence in physical and digital channels of interaction with customers.

Hybrid marketing as a concept includes the use of digital analytics, CRM systems, personalized communications, automated content, and data management systems in combination with traditional marketing approaches, such as marketing through points of sale, direct marketing, or online communities. It is this comprehensive approach that forms the basis for the implementation of cross-marketing strategies that involve cooperation between brands, products, and platforms, which allows creating additional value for the end consumer. The basis of successful cross-marketing strategies is the understanding of consumer behavior, which increasingly operates in an omnichannel environment. Research shows that about 90% of consumers expect a continuous and high-quality experience when switching between different interaction channels, and 88% of buyers are more likely to return to companies with integrated omnichannel communications (Top 20 shopping platform marketing statistics, 2025). This means that coordinated communication across websites, social media, mobile apps, email newsletters, and physical points of sale is becoming the norm for modern retail marketing strategies.

Furthermore, channel usage analytics indicate that top digital platforms such as email (78.8%), social media (74.3%), and mobile websites (60.2%) remain the leading channels in the marketing communication strategies of retail and e-commerce companies (MoEngage, 2025). This suggests that cross-marketing campaigns should be built taking into account some channels that ensure maximum reach of target audiences. Hybrid marketing facilitates the implementation of cross-marketing initiatives based on deep consumer segmentation, personalization of offers, and adaptation of communication messages according to the behavioral patterns of different groups. For example, consumers who use mobile devices for shopping demonstrate significantly different behavioral patterns compared to those who prefer traditional channels, which requires the development of separate creative solutions and communication approaches within the same campaign (Email, Mobile Apps, Social Media).

Hybrid marketing provides a theoretical basis for building cross-marketing strategies, as it involves the integration of different channels, platforms, and partnerships within a single marketing system. In scientific discourse, such approaches are based on the concepts of omnichannel, which reflect the ability of an enterprise to ensure strategic coherence of all interactions with the consumer, regardless of the entry point or platform. Omnichannel strategies are considered one of the forms of cross-marketing, which consists of using synergies between channels to achieve marketing goals (message consistency, improving customer experience, increasing conversions). Theoretically, cross-marketing as a component of hybrid marketing follows from the concept of systemic marketing, which involves the interaction of elements of the marketing mix to achieve common goals. In the case of PT, this means including partnership interactions as a factor in increasing the value of the offer: joint campaigns between product manufacturers and logistics platforms, joint cross-promotions between clothing brands and digital delivery platforms, partner loyalty programs, etc.

As a result, the strategic integration of hybrid marketing and cross-marketing becomes not an option, but a structural element of a modern sales strategy, allowing enterprises to effectively adapt to changes in the environment, including increased competition from online players and changing consumer expectations. The process of forming a cross-marketing strategy in hybrid marketing involves several stages: from identifying partner segments to assessing their impact on key business performance indicators. The main steps include: strategic audit of target audiences, selection of relevant communication channels, integration of consumer data into CRM environments, building personalized scenarios, testing messages, and scaling successful solutions.

The experience of a number of international retail companies demonstrates that properly constructed cross-marketing campaigns can significantly increase key financial and marketing indicators. Thus, brands that implemented an integrated omnichannel strategy attracted 30% more consumer spending in their interactions than those that worked within separate communication channels. Similarly, it is observed that 89% of brands that use cross-channel approaches record an increase in customer retention, which directly affects long-term loyalty and profitability growth. Within the framework of hybrid marketing, retail enterprises can use a wide range of tools that support cross-marketing initiatives (*Table 3*).

Table 3

Instrumental support for hybrid marketing in the implementation of cross-marketing strategies for retail enterprises

Hybrid marketing tools	Functional role in cross-marketing	Combining data from a retail chain's loyalty program and a fintech partner	Strategic results
CRM Systems and Big Data analytics	Aggregation and integration of data from various channels and partner platforms	Coordinated messages in the mobile app, email, and offline store	Deep personalization, increased customer LTV
Omnichannel communication management platforms	Synchronization of consumer interactions across digital and physical touchpoints	Joint promotions between the retail chain and the delivery service	Improved customer experience
Cross-promotional partnership campaigns	Development of joint value propositions with other brands	Cross-platform campaigns on Instagram and TikTok with partner brands	Expanded reach and new segments
Social media and mobile marketing	Rapid communication and real-time interaction with the audience	Product recommendations based on partners' joint purchases	Increased engagement and virality
AI Personalization tools	Automation of recommendations and content	Combining data from a retail chain's loyalty program and a fintech partner	Increased conversion rates and average order value

Source: author's own analysis.

Therefore, it can be stated (see *Table 3*) that CRM systems and Big Data Analytics tools perform a basic analytical function, as they allow you to accumulate data about consumers from various sources: physical retail outlets, online platforms, mobile applications, as well as partner services. In the context of cross-marketing, this provides an opportunity to build a comprehensive customer profile, which is critical for developing joint offers between retail enterprises and their partners. It is the analytical integration of data that creates the basis for the transition from fragmented marketing activities to strategically coordinated campaigns. Omnichannel communication management platforms serve as an infrastructure element of hybrid marketing, ensuring the consistency of marketing messages across all consumer interaction channels. For cross-marketing strategies, this means the ability to maintain a single communication logic between different brands and touchpoints, minimizing information gaps and cognitive load on the consumer. As a result, a holistic customer experience is formed, which increases trust in partner initiatives.

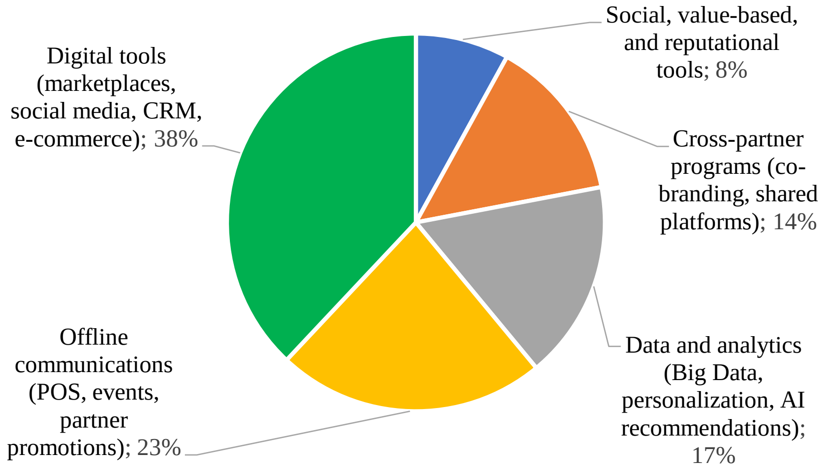
Cross-promotional partner campaigns are a direct manifestation of cross-marketing logic in a practical sense. Their effectiveness within hybrid marketing lies in the combination of offline and online tools to create joint value propositions. For retailers, this may include joint loyalty programs, bonus mechanisms, or integrated promotions with logistics, financial, or service companies, which allows not only to expand the audience, but also to reduce the cost of customer acquisition.

Social media and mobile marketing provide efficiency and interactivity for cross-marketing campaigns. They allow retailers to quickly adapt messages, test audience response, and engage consumers in joint initiatives of partner brands. In a hybrid marketing environment, these tools become a catalyst for viral content distribution, which significantly increases the effectiveness of cross-campaigns without a proportional increase in budget.

AI-personalization tools act as the final element of the hybrid cross-marketing system, as they allow you to automate the process of forming individual recommendations based on consumer behavioral data. In the retail sector, this creates conditions for a dynamic combination of products from different brands within a single customer scenario, which directly affects the growth of the average check and repeat purchases.

The data systematized in *Table 3* demonstrates the cause-and-effect relationship between the use of hybrid marketing tools and the effectiveness of cross-marketing strategies of retail enterprises. The presented areas of integration confirm that the combination of digital and traditional marketing tools in partnership models creates a synergistic effect, which is manifested not only in the growth of economic indicators but also in increasing the level of consumer involvement and strengthening brand sustainability.

In order to identify the structural priorities of using hybrid marketing tools within the cross-marketing strategies of retail enterprises, it is advisable to analyze their distribution by functional areas. Modern practice of international business shows that the effectiveness of cross-marketing interactions is increasingly determined not by separate communication channels, but by an integrated combination of digital, offline, and analytical solutions, supplemented by partner and value-oriented tools (Tomashevskiy & Proskura, 2024). Generalization of data from international analytical studies allows us to quantitatively assess the role of each of these groups of tools in the formation of hybrid marketing models. It is for this purpose that the *Figure* presents the structure of using hybrid marketing tools in cross-marketing strategies of retail enterprises, which makes it possible to substantiate the dominance of digital solutions and confirm the systemic nature of the integration of marketing channels in modern retail business.



Structure of hybrid marketing tool usage in cross-marketing strategies of retail enterprises

Source: compiled by the author based on (Deloitte Digital, 2025; OECD, 2021; Statista, 2024; Unified commerce platform statistics, n. d.).

The weight distribution of key components of hybrid marketing within cross-marketing strategies of PTs in the figure is consistent with international data from analytical sources: Statista, OECD, and Deloitte. The dominance of digital tools reflects global trends in the transition to omnichannel models of interaction with the consumer, which is confirmed by Statista Digital Market Outlook and Deloitte Digital Commerce Reports. A significant part of the resources remains for offline communications, which is consistent with OECD behavioral research on the role of physical presence of brands. Data analytics and AI technologies account for 15–18%, which is consistent with Deloitte Global Marketing Trends reports.

Cross-partner integration programs occupy a slightly smaller share according to Statista Partnership Reports, while social and value tools account for 5–8% of the total structure, which is consistent with the conclusions of OECD Responsible Business Conduct. These data confirm the research hypothesis that an effective cross-marketing strategy is built on the consistent use of hybrid marketing tools.

The study conducted a comparative case study of the use of hybrid marketing in cross-marketing strategies of leading Ukrainian retail companies. The sample included Rozetka, Epicentr, and Foxtrot, which represent omnichannel retail models and actively use integrated marketing tools.

The empirical basis of the study was formed on the basis of open corporate reports, marketing activities of enterprises, publications of industry analytical platforms, materials of professional associations, and expert interpretation of data on the digital presence of companies. The primary indicators were evaluated on an expert scale from 0 to 1, where: 0 – absence of a tool, 0.5 – partial implementation, 1 – full integration.

The methodological basis of the quantitative assessment was the approaches to composite index analysis, which are widely used in studies of omnichannel retail and marketing efficiency (Verhoef et al., 2015; OECD, 2008). The use of integral indicators allows you to aggregate diverse marketing characteristics into a standardized evaluation system.

To measure the level of integration of hybrid marketing, a model of three indicators was used:

• channel integration index (characterizes the degree of combination of online and offline interaction with consumers) – I_1;

• intensity of cross-marketing activity (reflects the intensity of affiliate programs) – I_2;

• marketing performance indicators (characterizes the effectiveness of integrated marketing campaigns) – I_3.

This approach corresponds to the concept of omnichannel measurement of interaction with the consumer, proposed in the works of Verhoef et al. (2015), which emphasizes the need to simultaneously take into account channels, affiliate ecosystems, and behavioral effects. The indices are normalized in the range from 0 to 1. The normalization of the indicators was carried out using the linear standardization method, which corresponds to the recommendations of the OECD (2008) for constructing composite indices. The general indicator is defined as the arithmetimean:

$$I_{hybrid} = \frac{I_1 + I_2 + I_3}{3}$$

Table 4

Assessment of the level of hybrid marketing adoption
by leading Ukrainian retail companies

Company	I_1	I_2	I_3	I_{hybrid}
Rozetka	0.90	0.82	0.88	0.87
Epicentr	0. 85	0.78	0.83	0.82
Foxtrot	0.76	0.71	0.79	0.75

Source: calculated based on (OECD, 2008; Statista, 2024; MoEngage, 2025; Verhoef et al., 2015) and data from companies' corporate materials.

The results obtained indicate a high level of integration of hybrid marketing in the activities of the studied enterprises. The company Rozetka demonstrates the highest generalized index (0.87), which is due to a developed digital ecosystem, active use of affiliate marketing programs, and a high level of personalization of communications. Epicentr is characterized by a powerful omnichannel infrastructure and large-scale cross-promotional campaigns with banks, logistics services, and partner brands. Foxtrot demonstrates stable integration of online and offline channels, but the intensity of affiliate programs is relatively lower.

Comparative analysis confirms that enterprises with a higher level of hybrid integration have more pronounced competitive advantages: wider audience coverage, higher customer engagement, and increased loyalty. The synergistic effect of cross-marketing partnerships is manifested in increasing the efficiency of promotion costs and expanding customer ecosystems.

Thus, the results of the case analysis empirically confirm the hypothesis put forward in the study: hybrid marketing acts as a systemic factor in increasing the effectiveness of cross-marketing strategies of retail enterprises. The integration of digital platforms, traditional channels, and affiliate programs forms long-term market stability and adaptability to the conditions of digital transformation.

3. Directions for the development of cross-marketing strategies for retail enterprises in the context of digital transformation

The digital transformation of the economy significantly changes the conditions for the functioning of retail, highlighting the need to rethink traditional marketing approaches and transition to more flexible, integrated, and partner-oriented strategies. In this context, cross-marketing, combined with the principles of hybrid marketing, acquires the features of a strategic tool for adapting business to the high turbulence of the market environment, digital competition, and fragmentation of consumer demand. The development of cross-marketing strategies of retail in the context of digital transformation occurs in several interconnected directions that form a new logic for creating consumer value. The first key direction is the deepening integration of digital platforms in cross-marketing interactions. Modern retail enterprises are increasingly implementing joint marketing initiatives not only at the level of communications, but also through the integration of e-commerce platforms, marketplaces, mobile applications, and CRM systems. This allows partners to create single points of contact with the consumer, synchronize data on customer behavior, and provide a continuous consumer experience. This approach transforms cross-marketing from one-time partnership actions into a long-term model of joint management of the customer base, which is especially relevant for network commerce, omnichannel retailers, and companies focused on the platform economy.

The second important direction of development is the use of data analytics and personalization tools in cross-marketing strategies. Digital technologies provide the ability to accumulate and process large amounts of data on consumer preferences, purchase frequency, reaction to promotional activities, and interaction with partner brands. Within the framework of cross-marketing alliances, this creates the prerequisites for deeper segmentation of consumers and the development of personalized offers that increase the relevance of communications and the level of customer loyalty. The transition from mass partnership campaigns to data-driven cross-marketing allows retail enterprises to optimize marketing costs and enhance the synergy effect between partnership participants. The third direction is the development of omnichannel and digital solutions in cross-marketing strategies. The conditions of digital transformation contribute to the blurring of the boundaries between online and offline trade, which necessitates the combination of digital communication channels with physical points of sale within joint marketing programs. Cross-marketing strategies increasingly include the use of QR codes, mobile coupons, loyalty programs with a single digital customer account, as well as the integration of offline partners into digital brand ecosystems. This approach allows retailers to expand their reach and improve the effectiveness of interactions with consumers at all stages of the purchase journey.

Another promising direction of development is the strengthening of the role of strategic partnerships and co-branding within cross-marketing models. In the digital environment, partnerships between retail enterprises, fintech companies, logistics services, and digital platforms are becoming systemic. Cross-marketing strategies are increasingly being formed around joint value propositions, and not just mutual promotion of goods or services. This allows PTs not only to increase sales volumes but also to form complex ecosystems within which the consumer receives additional convenience, time savings, and an increased level of service. An important direction for the development of cross-marketing strategies is also the integration of the principles of sustainable development and social responsibility. In modern conditions of digital transformation, consumers are increasingly paying attention to the ethical aspects of companies' activities, the environmental friendliness of products, and the transparency of business practices. Cross-marketing initiatives between retail enterprises and brands focused on sustainable values contribute to the formation of a positive image and increased trust in the partnership participants. In this context, hybrid marketing acts as a tool for combining commercial and social goals, which corresponds to global market development trends.

Special attention is required to develop the adaptability and flexibility of cross-marketing strategies in the context of an unstable external environment. Digital transformation is accompanied by increased risks associated with cybersecurity, regulatory changes, and geopolitical tensions. In such conditions, retail enterprises are forced to develop cross-marketing models that can quickly transform in accordance with changes in market conditions. The use of digital monitoring tools, scenario planning, and modeling of marketing solutions allows for minimizing the negative consequences of crisis phenomena and ensuring the sustainability of partnership strategies. Thus, the development of cross-marketing strategies of retail enterprises in the context of digital transformation is characterized by the transition from fragmented partnership actions to systemic, data-oriented, and value-integrated models of cooperation. The combination of hybrid marketing with cross-marketing approaches creates the prerequisites for increasing the competitiveness of retail enterprises, strengthening their market positions, and forming long-term relationships with consumers in the digital environment.

Conclusions

The conducted research allowed to comprehensively reveal of the role of hybrid marketing in the formation and development of cross-marketing strategies of retail in the conditions of digital transformation. Within the framework of theoretical and methodological analysis, it was established that hybrid marketing should be considered as an evolutionary stage in the development of marketing concepts, which involves a combination of digital and traditional tools, data analytics, personalization, and value-oriented communications. Unlike classical models, hybrid marketing forms a multidimensional system of interaction with the consumer and creates a methodological basis for the implementation of cross-marketing strategies in the retail business. This allowed us to clarify the essence of cross-marketing as a strategic tool not only for mutual promotion of brands, but also for joint management of consumer experience in the digital environment.

The results of the analysis of modern practices of retail enterprises confirmed the hypothesis that the use of hybrid marketing increases the effectiveness of cross-marketing strategies by integrating digital channels, offline communications, analytical tools, and partner programs. In particular, it was found that the dominance of digital tools in the structure of hybrid marketing is combined with the active use of offline elements and cross-partner initiatives, which provides a synergistic effect and increases the effectiveness of marketing solutions of retail enterprises.

The study proved that digital transformation significantly expands the possibilities of cross-marketing interaction, facilitating the transition from one-time partner campaigns to long-term strategic alliances. The use of CRM systems, marketplaces, loyalty programs, and personalization tools allows retail enterprises to form joint value propositions and increase the level of consumer engagement. The results obtained confirm that hybrid marketing acts as a catalyst for the transformation of cross-marketing in the digital economy.

An important conclusion is the establishment of the growing role of data-driven solutions in shaping cross-marketing strategies. Big data analytics and the use of artificial intelligence tools provide the opportunity for deeper market segmentation, increased targeting accuracy, and optimization of marketing costs. This allows PAs to achieve a higher level of effectiveness of partner strategies and reduce the risks associated with the instability of the market environment.

The study also showed that the development of cross-marketing strategies within hybrid marketing is impossible without taking into account social, ethical, and reputational factors. The integration of the principles of sustainable development, business transparency, and social responsibility into partner marketing initiatives contributes to strengthening consumer trust and forming long-term competitive advantages of PT. In this context, cross-marketing is increasingly acting not only as an economic, but also a socially oriented tool for brand interaction.

The practical significance of the results obtained lies in the possibility of using the proposed approaches to the formation of cross-marketing strategies in the activities of retail enterprises of various formats. The proposed directions for the development of cross-marketing can be used in the development of marketing strategies, loyalty programs, partner projects, and digital ecosystems aimed at increasing business sustainability in the context of digital transformation.

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MECHANISM FOR MANAGING PAYMENT RISKS IN INTERNATIONAL TRADE

In the modern practice of supporting trade and logistics operations of domestic companies, in conditions of increased volatility in the financial and commodity markets and increased risks of non-payment, lack of guarantees, etc., forms of settlement are often used, which ensure guaranteed receipt of revenue for shipped goods or performed works or provided services. The main form of payment, which to the greatest extent guarantees the seller the receipt of payment for goods, work, or services is a letter of credit. The integration of the economy into the world market and the processes of globalization create conditions under which the buyer and the seller can optimally and timely fulfill their obligations regarding payments for goods and services. Modern market relations contribute to the development of payment instruments that will allow entities to minimize the risks of trade operations. A letter of credit is one of such effective payment instruments. The research is based on the hypothesis that the use of the letter of credit form of payments in the modern globalized environment allows business entities to expand the boundaries of their activities and enter new markets by minimizing the risk of non-fulfillment of obligations under concluded contracts. The essence and necessity of using

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МЕХАНІЗМ УПРАВЛІННЯ ПЛАТІЖНИМИ РИЗИКАМИ У МІЖНАРОДНІЙ ТОРГІВЛІ

У сучасній практиці підтримки торговельних та логістичних операцій вітчизняних компаній, в умовах підвищеної волатильності на фінансовому і товарному ринках та посилених ризиків неплатежів, відсутності гарантій тощо часто використовуються форми розрахунку, що забезпечують гарантоване одержання виручки за відвантажений товар або виконані роботи чи надані послуги. Основною формою платежу, що найбільшою мірою гарантує продавцеві отримання оплати за товар, роботу чи послугу, є акредитив. Інтеграція економіки у світовий ринок та процеси глобалізації створюють умови, за яких покупець і продавець можуть оптимально та завчасно виконувати зобов'язання щодо розрахунків за товари і послуги. Сучасні ринкові відносини сприяють розвитку платіжних інструментів, які дозволяють суб'єктам мінімізувати ризики торговельних операцій. Акредитив є одним з таких ефективних інструментів платежу. В основу дослідження покладено гіпотезу, що використання акредитивної форми розрахунків у сучасному глобалізованому середовищі дає змогу суб'єктам господарювання розширювати межі своєї діяльності та виходити на нові ринки шляхом максимального зниження ризику невиконання зобов'язань за укладеними договорами. Досліджено сутність та *letters of credit have been examined, and the regulatory and legal framework governing the letter of credit form of payment have been studied. The types of letters of credit and the key participants in the calculation process have been systematized. The current state of the use of the letter of credit form of payment in Ukraine and the cost of servicing letters of credit by banks have been analyzed.*

Keywords: letter of credit, contract, settlements, issuing bank, beneficiary, notification, risks, exporter, importer, Unified rules and customs for documentary letters of credit.

необхідність використання акредитивів, вивчено нормативно-правову базу, якою регулюється акредитивна форма оплати. Систематизовано види акредитивів та ключових учасників процесу розрахунків. Проаналізовано сучасний стан використання акредитивної форми оплати в Україні та вартість обслуговування акредитивів банками.

Ключові слова: акредитив, договір, розрахунки, банк-емітент, бенефіціар, авізування, ризики, експортер, імпортер, Уніфіковані правила і звичаї для документарних акредитивів.

JEL Classification: F40, G21, L14.

Introduction

Letters of credit are used both in domestic and international business and financial practice to minimize the risks of non-fulfillment of obligations by partners under a contract. In the absence of complete trust between the parties, they prefer to involve a financial intermediary (bank), which guarantees the supplier timely receipt of payment for delivered goods (works, services), and the buyer – that the supplier will not receive the money before delivering the specified goods (works, services) under the contract and issuing all the agreed-upon shipping documents (Shpylovyi, 2015, p. 50).

The need to use a letter of credit form of settlement is due to the potential riskiness of a future transaction for one of the parties to the agreement (either the seller or the buyer). So, if the seller of the goods is not sure that payment will be made according to the contract, a payment guarantee can be used as an obligation of the bank to pay if the seller or the buyer (depending on the type of guarantee) fails to fulfill their obligations regarding payment or delivery of goods. However, a guarantee is not a form of settlement under the contract, but serves the function of "insurance" against the risks in case of non-performance of the contract terms.

The legal nature and peculiarities of making payments through a letter of credit in Ukraine are the subject of research by many scholars. The main approaches to defining the essence of a documentary letter of credit and its advantages, as well as the legislation in this field, have been examined in the works of Leshanych (2017), Burkovska and Pavlenko (2020), Tovkun and Menkova (2021), and others. In particular, the authors emphasize the importance of using the letter of credit form of payments, taking into account the modern regulatory and legal requirements. Similar definitions of the letter of credit are used in scientific articles. Some authors, including Fimiar (2012), point out that it is "a firm commitment of the bank, issued on the basis of the buyer-client’s instruction, to pay the seller of goods or services a specified amount of money upon timely submission of documents specified in the letter of credit, confirming the shipment of goods or the performance of services".

In turn, Shpylovyi (2015) interprets a letter of credit as "a form of settlement in which the buyer's bank makes a payment to the supplier upon submission of the specified documents," which emphasizes the use of a letter of credit in conducting international transactions.

A significant number of foreign and domestic scientific works are devoted to the study of the legal status of the parties to an agreement using a letter of credit, their functions, as well as the classification of letters of credit. In particular, among foreign authors, Biswas (2011) should be noted, who examines the essence, principles, and mechanism of concluding a letter of credit agreement, as well as the legal basis of the obligations of the issuing bank. Soni (2014) investigates the role of documentary letters of credit in international sales agreements and also substantiates why a letter of credit is a separate contract from the one on which it is based. In the work of Mahendra Soni (2024), it is emphasized that a letter of credit agreement usually involves the participation of five main parties. The first two parties are the seller (applicant) and the buyer (beneficiary), who carry out trade transactions, while the other three parties are the issuing bank (which issues the letter of credit), the confirming bank, and the negotiating bank, respectively.

The implementation of foreign economic activity by enterprises is a necessary tool for existence within the system of economic and market relations. The use of letters of credit in the practice of foreign economic activity was studied by Shpylovyi (2015), Diachek et al. (2018), Tovkun and Menkova (2021). The authors justify that a letter of credit is a positive alternative to advance payments and provides the parties to the contract with additional guarantees. A letter of credit, as a form of cashless payments, flexibly allows the interests of all parties to the contract to be taken into account, which is evidenced by both the possibility of its transfer and the possibility for the payer to obtain credit upon opening the letter of credit.

The foreign practice of using letters of credit, including as a means of reducing risks during crisis periods, is thoroughly revealed in the work of Crozet et al. (2022). It is noted that the ability of trade partners to mitigate risks associated with international trade operations is particularly important during periods of increased uncertainty. The authors point out that the dependence of products on letters of credit has a direct impact on the stability of trade flows. In particular, during periods of increased uncertainty, the export of products insured through letters of credit is more resilient.

In turn, the current issues of using letters of credit in Ukraine regarding the structure of international banking operations for import and export agreements, the volume of agreements concluded with letters of credit, and the cost of services provided by domestic banks under documentary letters of credit were studied by domestic researchers, including Mangushev (2020) and Burkovska and Pavlenko (2020). It has been established that the use of letters of credit in Ukraine is a rather complex process due to the lack of proper interaction between Ukrainian banks and foreign partners. Foreign banks, especially European and American ones, demonstrate distrust towards the domestic banking system. Documentary letters of credit are mainly used

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by Ukrainian enterprises for settlements when cooperating with European and American countries to ensure compliance with all their requirements. Ukraine also tries to use documentary letters of credit when concluding agreements with countries whose economic situation is risky, which allows avoiding non-fulfillment of requirements under letters of credit and guarantees Ukrainian sellers payments of funds under contracts (Burkovska & Pavlenko, 2020, p. 42).

Despite its effectiveness, the use of the letter of credit form of payments in Ukraine is accompanied by a number of problems. First of all, there is an insufficient level of trust in the Ukrainian banking system from foreign financial institutions, which causes difficulties in confirming letters of credit and increases their cost. A significant number of international banks limit cooperation with Ukrainian banks due to country risks and regulatory instability, which considerably complicates payments in foreign trade operations.

A significant problem is the high cost of documentary operations, in particular commissions for opening, confirming, notifying, and checking documents, which makes letters of credit less accessible to small and medium-sized businesses. Additional expenses related to the need for making amendments, sending documents, or extra verifications increase the overall cost of the financial instrument, reducing its attractiveness.

The state of martial law in Ukraine also has a significant impact on the use of letters of credit, which has led to a reduction in foreign trade activity, changes in logistics routes, and a decrease in the number of international settlements using letters of credit. High military risks necessitate additional guarantees from foreign banks, which further complicates the use of the letter of credit payment method.

The research is based on the hypothesis that the use of the letter of credit form of settlements in the modern globalized environment allows business entities to expand the scope of their activities and enter new markets by minimizing the risk of non-fulfillment of obligations under concluded contracts.

The purpose of the article is to determine the legal nature and economic essence of a letter of credit as a means of reducing payment risks, as well as the role of banks in providing services for the maintenance of documentary letters of credit. To achieve this goal, the following research methods were used: induction and deduction, analysis and synthesis for studying the theoretical aspects of the application of the letter of credit form of payment in domestic practice; systematization and generalization – to reflect the volume of operations under documentary letters of credit and the cost of bank services in their servicing.

The theoretical and methodological basis for writing the article were the works of foreign and domestic scientists on the issues of regulation and development of the letter of credit payment form, the legislative acts of Ukraine in the field of using letters of credit, as well as official statistical data of the National Bank of Ukraine as a regulator of the financial market and of certain domestic banks.

The main part of the article consists of three interrelated sections. The first section examines the economic essence and current issues of normative and legal regulation of letters of credit in Ukraine. The second one considers the role of banks in the use of the letter of credit form of settlements. The third is the practice of using letters of credit in Ukraine.

1. Economic essence and current issues of normative and legal regulation of letters of credit in Ukraine

A letter of credit (from Latin – *accre-ditivus* – fiduciary) is a form of settlement based on a contract that contains the obligations of the issuing bank, under which this bank, on behalf of the client (the applicant of the letter of credit) or on its own behalf, undertakes to make a payment in favor of the supplier of goods or services and instructs another (executing) bank to make this payment against documents that comply with the terms of the letter of credit.

The conclusion of letter of credit agreements in any case requires compliance with the current legislation of the countries in which the subjects of trade relations are located and the implementation of international standards, which will ensure the responsibility of the parties, the fulfillment of letter of credit obligations, and minimize risks: the seller receives funds regardless of the buyer, as the bank acts as a guarantor of the letter of credit payment; the buyer reduces his risk regarding the supplier's failure to fulfill obligations to ship and deliver the goods.

This mechanism allows minimizing costs from fraudulent schemes and ensures the reliability of international trade relations, especially when entering a new unfamiliar market. At the same time, the economic security of both parties to the contract is ensured. The exchange rates at which settlements are made are clearly specified in the contracts and are determined according to the rates of national banks (Burkovska, Pavlenko, 2020, p. 40).

In Ukraine, work with the letter of credit payment method is regulated by the following normative and legal acts:

- by the unified rules and practices for documentary credits (*Uniform Customs and Practice for Documentary Credits*), developed by the International Chamber of Commerce. Currently, there are two valid editions of these rules: UCP 500 (edition of 1993) and UCP 600 (edition of 2007);
- by the Resolution of the Board of the National Bank of Ukraine № 514 "On Approval of the Regulation on the procedure for banks to conduct transactions under letters of credit" (2003, December 3);
- by the Civil Code of Ukraine (2003);
- Law of Ukraine "On Banks and Banking" (2001).

Moreover, a letter of credit is a contract, separate from the contract of sale or any other document that has the validity of a contract on which it is based. This position is indicated in a number of regulatory legal acts (*Table 1*).

Table 1

Interpretation of a letter of credit in the regulatory and legal framework

Regulatory legal act	Definition
Uniform customs and practice for documentary letters of credit (p. 2)	Refer to any agreement, whatever it may be called or designated, according to which a bank (issuing bank), acting at the request and on the instructions of the client (applicant) or on its own behalf: (I) must make a payment to a third party (the beneficiary) or by his order, or accept and pay the bills of exchange (drafts) issued by the beneficiary, or (II) authorizes another bank to make such a payment or to accept and pay the bills of exchange (drafts), or (III) authorizes another bank to negotiate against the stipulated documents in compliance with the terms and conditions of the letter of credit
CCU (Art. 1093)	In the case of settlements under a letter of credit, the bank (issuing bank), on behalf of the client (payer) – the applicant of the letter of credit and in accordance with his instructions or on its own behalf, undertakes to make a payment under the terms specified in the letter of credit, or instructs another (executing) bank to make this payment in favor of the recipient of the funds or a person designated by him – the beneficiary
Regulations on the procedure for banks to carry out transactions under letters of credit (p. 4, p. 6)	"A monetary obligation of the issuing bank to fulfill the obligations against proper representation." "A letter of credit is an agreement that is separate from the contract on which it is based"

Source: IAS Consultant (n. d.); Civil Code of Ukraine (2003, January 16); Resolution of the Board of the National Bank of Ukraine № 514 (2003, December 3).

In general, in practice there is a fairly large number of types of letters of credit (*Figure 1*). The main ones are cash and documentary.

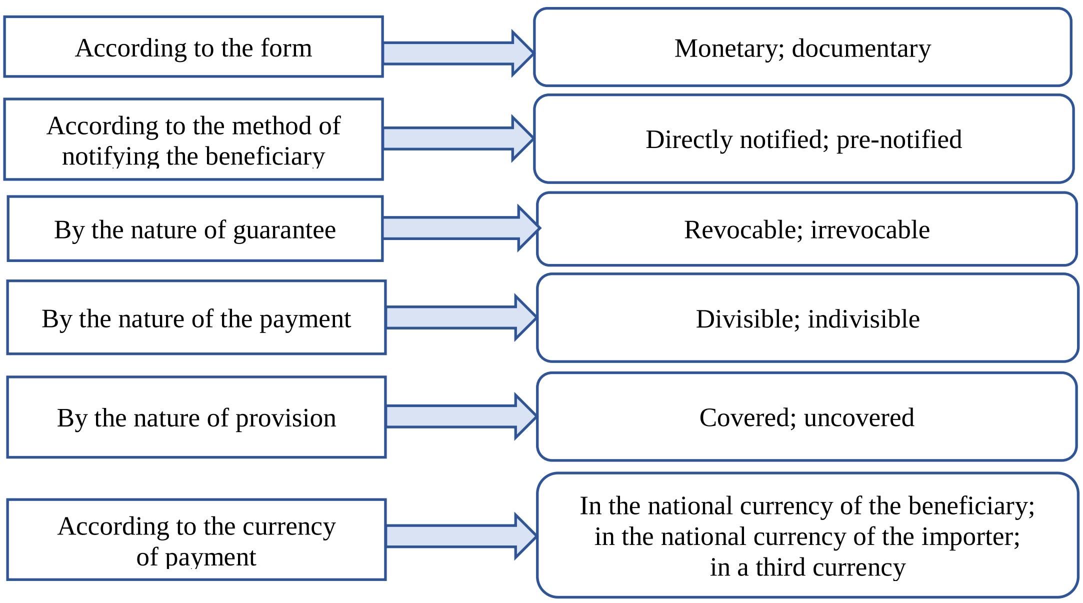

Figure 1. Classification of the main types of letters of credit

Source: (Burkovska & Pavlenko, 2020, p. 41; Diachek et al., 2018, p. 74; WikiLegalAid, n. d.; Mahendra Soni, 2024, p. 3768).

A cash letter of credit is issued by a bank to its client granting the right to receive the full amount specified in it or in separate parts in other banks within a specified period of time. Worldwide, more than 90% of all settlements by letters of credit are carried out in documentary form.

A documentary letter of credit is a contract filled out on a standardized form, in which the bank that opens the letter of credit (the issuing bank) undertakes the obligation to make a payment of the amount specified in it to a third party (the beneficiary) on the order and at the expense of the buyer – in the case of cash settlements, or to accept a draft (in the case of credit settlements) against the presentation by the seller of the package of documents specified in the contract, which confirm the delivery of goods in accordance with the terms of the contract (Leshanych, 2017, p. 129).

In general terms, the use of the letter of credit form of settlement involves the following main stages:

- the buyer and the seller conclude an agreement for the supply of goods or the provision of services;
- the buyer contacts their bank with a request to open a letter of credit in favor of the seller;
- the buyer's bank issues a letter of credit specifying the terms;
- the seller receives a letter of credit and delivers goods or services in accordance with the terms of the agreement;
- after fulfilling the terms of the agreement, the seller presents to the bank their documents confirming the fulfillment of the terms;
- the buyer's bank makes payment to the seller according to the terms of the letter of credit.

Let's consider the main participants of the letter of credit form of settlements (*Table 2*).

Table 2

Participants of the letter of credit form of settlements

Participant	Role in conducting settlements
Notifying bank	At the request of the issuing bank, it notifies the beneficiary or instructs another notifying bank to notify the beneficiary or another notifying bank
Beneficiary	A letter of credit is opened in his favor
Beneficiary's bank	Serves the beneficiary under the letter of credit
Issuing bank	On behalf of the applicant of the letter of credit or on its own behalf opens a letter of credit in favor of the beneficiary
Executing bank	It provides for the execution of a letter of credit
The applicant of the letter of credit	By his order, a letter of credit is opened at the issuing bank
Negotiating bank	Has the authority from the issuing bank to carry out negotiation – the purchase and/or considering of bills of exchange (drafts) and/or documents that constitute proper representation, as provided by the terms of the letter of credit, by providing an advance or agreeing to provide an advance to the beneficiary no later than the banking day on which the negotiating bank receives reimbursement

End of Table 2

Participant	Role in conducting settlements
Confirming bank	Adds its confirmation to the letter of credit on behalf of or at the request of the issuing bank
Reimbursing bank	Has the authority from the issuing bank to ensure reimbursement under the letter of credit to the confirming (executing) bank or another bank in accordance with the given payment instructions
Transferring bank	Carries out the transfer of a letter of credit, or, if the letter of credit is executed in any bank, is directly authorized by the issuing bank to carry out the transfer and which carries out the transfer of the letter of credit (may be the issuing bank)

Source: (IAS Consultant, n. d.; WikiLegalAid, n. d.; Koliesnikova at al., 2012, p. 138; Mahendra Soni, 2024, p. 3765).

Thus, when using a letter of credit, the maximum participation of banks in making settlement is ensured. The most complete payment security for the beneficiary is achieved, since a letter of credit, by its nature, is a monetary guarantee of payment for the shipped goods provided by the bank that opened the letter of credit.

2. The role of banks in the use of the letter of credit form of settlements

The key banks when using the letter of credit form of settlement are:

- the notifying bank, called upon to confirm the legality and inform the bank's client (the beneficiary/exporter, that is, the supplier) about the terms of the letter of credit, which are the client's payment obligations;
- the issuing bank, obligated to set the terms and determine the obligations in letters of credit.

The notifying bank has significantly less responsibility to the client in performing the letter of credit part of the contract. Therefore, under modern conditions, there has arisen a need to exclude such an institution as the notifying bank from the process of financing logistics and trade operations, which has been facilitated by the digital revolution and the digitalization of logistics as a whole (see *Figure 2*). In most cases today, there is no need to verify the letter of credit manually, as transactions are processed efficiently, and it is sufficient to send an electronic or paper version of the document.

Letters of credit with such notification increase the security of the client's operations. The simplest explanation is that fewer parties are involved in the letter of credit, which means there is a lower likelihood of misunderstandings between the institutions and the beneficiary. As noted, the notifying bank is responsible for processing and delivering the letter of credit to the exporter, but does not have all the information about the document that the issuing bank has. It also reduces the costs and time required to verify the validity of letters of credit and notify additional conditions, since all this can be done at the issuing bank.

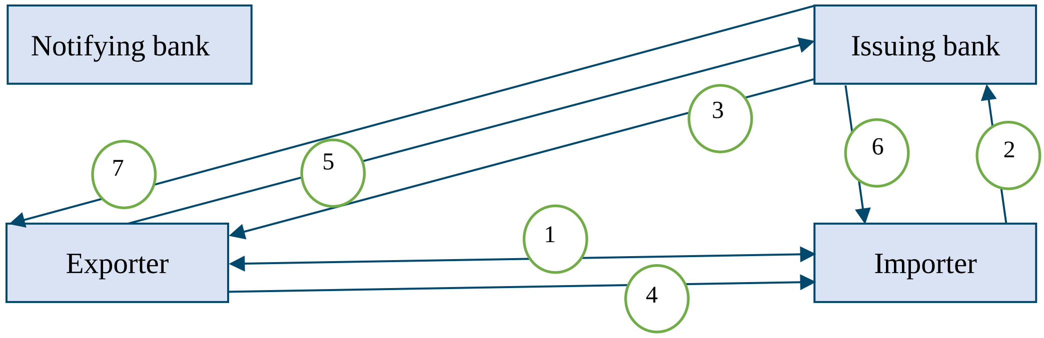

Figure 2. Letter of credit scheme with direct notifying

1 – purchase/sale of goods;
2 – letter of credit application;
3 – issuance of a letter of credit;
4 – cargo delivery;
5 – presenting the volume of documentation;
6 – documents on the issuance;
7 – the process of payment and acceptance of payments.

Source: (Shkuro, 2024, February 20).

However, direct notification also has its own risks, in particular:

improper provision of services by the issuing bank (this problem can be solved with the involvement of external supervisory bodies and audit inspections, which confirm that the issuing bank assumes and fulfills all obligations to the beneficiary. The most important thing is to quickly notify about any changes in letters of credit, etc.);

false beneficiary identification data (not only the issuing bank can act as a party that fails to fulfill its own obligations. To prevent dishonesty and fraud on the part of the beneficiary, it is sufficient to go through the KYC (Know Your Customer) process, check all the documentation registered for the client company's financial report, etc.).

In the process of executing a letter of credit, the proper set of documents is submitted to the executing bank, where they are verified and a decision is made regarding payment under the letter of credit. The letter of credit must specify *documents* sufficient for the seller and buyer to fulfill the terms regarding delivery and payment. The most common among them are: commercial invoice; certificates (of origin, quality, etc.); transport documents (which may vary depending on the type of transport); insurance.

Transport documents are used to confirm the fact of shipment of goods. In the case of transport documents and certificates, it is advisable that they are issued by impartial organizations (chambers of commerce and industry, carriers, inspections) to avoid forgery (ProCredit Bank, n. d.).

In the letter of credit part of the contract, the parties must specify the broadest possible terms of the letter of credit, so that after its issuance there are no discrepancies that could lead to amendments to the letter of credit, increased costs, or refusal to make payments and termination of the agreement. In case of questions, it is advisable to request a preliminary review of the contract. The contract terms are always checked by the issuing bank of the letter of credit. Other banks can conduct a preliminary review only if there are doubts about the correctness of the contract's completion.

Banks provide services for the maintenance of documentary letters of credit in accordance with the International Rules for working with letters of credit, the current legislation of Ukraine, and the regulatory documents of the NBU. As a rule, banks provide services for the maintenance of documentary letters of credit only to their clients with active accounts.

When opening a letter of credit, banks require customers to provide coverage in the form of:

- 100% cash security (covered letters of credit);
- other types of security (uncovered letters of credit) – in this case, an additional credit agreement is concluded with the bank and the decision is made by the bank's credit committee.

The main commissions and expenses of banks when servicing a letter of credit are as follows:

Under an import (provided) letter of credit:

- commission for opening a letter of credit;
- commission for verification of documents under the letter of credit;
- commission for making a payment under a letter of credit;
- comission for sending a swift-message.

Under an export (received) letter of credit:

- commission for notification of letter of credit;
- commission for verification of documents under the letter of credit;
- postal expenses for sending documents to the correspondent' bank;
- comission for sending a swift-message.

In addition to the specified services, banks may additionally provide other services for a fee stipulated by the tariffs of the respective bank. In particular, most often such additional services include: preliminary verify-cation of documents related to a letter of credit upon the written request of the client, processing of documents with discrepancies regarding the letter of credit terms, additional document verification, conducting inquiries/ investigations on letters of credit at the client's request, and cancellation of a letter of credit. It should be noted that a number of banks offer letter of credit services to their clients, widely outlining their advantages, but detailed tariffs are not published on their websites.

Let's consider in more detail the tariffs for providing services related to letters of credit using the example of leading systemically important domestic banks (*Table 3*).

Table 3

The cost of providing services for documentary letters of credit of leading domestic banks, 2025

Services for letters of credit opened by banks	Cost and terms (x – amount of the letter of credit)				
	JSC CB "PrivatBank"	JSC "Sens Bank"	JSC "Ukrsibbank"	JSC "Kredobank"	JSC "Pumb"
Opening or increasing the amount of a covered letter of credit (in hryvnias / in foreign currency)	0.2% $100 \leq x \leq 2000$ (USD)	0.2% $1\,000 \leq x \leq 5\,000$ (UAH) $100 \leq x \leq 2\,000$ (USD)	0.2% $800 \leq x \leq 8000$ (UAH) $200 \leq x \leq 4000$ (USD)	0.3 % $50 \leq x \leq 1500$ (USD)	0.3% $2\,000 \leq x \leq 10\,000$ (UAH) $100 \leq x \leq 1\,000$ (USD)
Payment under the letter of credit (in hryvnias / in foreign currency)	0.15% $100 \leq x \leq 1000$ (USD)	50 UAH./ 0.15% of the payment amount $30 \leq x \leq 150$ (USD)	0.15% of the payment amount $30 \leq x \leq 150$ (USD)	0.15% of the payment amount $10 \leq x \leq 75$ (USD)	1 000 UAH / 50 USD
Commission for obligations under an uncovered letter of credit (in hryvnias / in foreign currency)	2% per year – secured by property rights on a deposit, government bonds or under counter-guarantees of other banks; 3% per year – secured by property; (not less than 20 USD per month)	from 3% to 7% per year; but not less than 500 UAH for each month or part of it/ from 3% to 7% per year, but not less than 50 USD for each month or part of it	2 – 5% per year	from 3 % to 8 % per year of the letter of credit amount	from 2% to 4.5% (not less than 2 000 UAH for each year or part of the letter of credit validity) / from 2% to 4.5% (not less than 100 USD)
Forwarding of payment documents between banks (in hryvnias / in foreign currency)	According to the courier service rates	In the total incurred expenses, additionally increased by 20% VAT			
Increase of the letter of credit amount (in hryvnias / in foreign currency)		0.2% of the increase amount; $100 \leq x \leq 2\,000$ (USD)	0.3% (not less than 1200 UAH) 0.3% (not less than 300 euros)	0.25% of the increase amount $25 \leq x \leq 1000$ (USD)	0,1% $1\,000 \leq x \leq 10\,000$ (UAH) $50 \leq x \leq 500$ (USD)
Making changes (in hryvnias / in foreign currency)	50 USD	300 UAH / 50 USD	375 UAH 50 EUR	50 USD	1 000 UAH 50 USD
Verification of documents provided under the letter of credit (in hryvnia / in foreign currency)		0.2% of the amount of documents; But not less than 500 and not more than 10 000 UAH / 0.2% of the amount of the documents; but not less 100 USD, and not more 1 000 USD		0.2% of the amount of submitted documents ($25 \leq x \leq 1000$ USD)	0.2% (but not less than 1 000 UAH, and not more than 3 000 UAH) 0.2% (not less than 75 USD, not more than 1500 USD)

Source: compiled by the authors based on materials JSC CB "PrivatBank" (n. d.), JSC "Sens Bank" (n. d.), JSC "Ukrsibbank" (n. d.), JSC "Kredobank" (n. d.), JSC "Pumb" (n. d.).

Thus, the use of letters of credit by Ukrainian enterprises requires a fairly significant allocation of funds, as concluding a letter of credit in banks requires the availability of substantial capital. Analysis of the tariffs for opening and servicing letters of credit in the leading banks of Ukraine shows that each bank sets a different pricing policy for issuing letters of credit in national and foreign currencies, which, in turn, does not vary significantly. It is also worth noting the minimum and maximum limits of certain services related to letters of credit, which business entities should pay attention to when opening a letter of credit.

3. The practice of using letters of credit in Ukraine

After the beginning of the full-scale invasion, the risks for Ukrainian exporters increased many times due to instability, the need to enter new markets, and growing distrust from foreign partners. In such conditions, letters of credit remained one of the most reliable forms of international settlements, since payment is guaranteed by the buyer's bank only after all documents have been submitted. Confirmation of the letter of credit by a third bank is especially important when the importer's bank has a dubious reputation or a low rating. However, currently, due to high military risks, confirmation from European banks is often required, which is one of the restraining factors for the use of letters of credit in Ukraine.

According to the official data of the NBU, the total number of letters of credit in 2024 was 16.6% higher than in 2023, but 61.2% lower than in 2021, indicating a significant decrease in the use of the letter of credit payment method in Ukraine since the beginning of the full-scale war (*Table 4*).

Overall, statistics indicate that domestic banks mostly provide letters of credit rather than receive them, and their share in foreign currency significantly exceeds that in hryvnias. If we consider the distribution of letters of credit by volume across groups of banks, the highest activity is observed in state-owned banks, especially in part of provided letters of credit.

Let's consider letter of credit operations by the most popular types of economic activity according to NACE in 2024 in *Figure 3*.

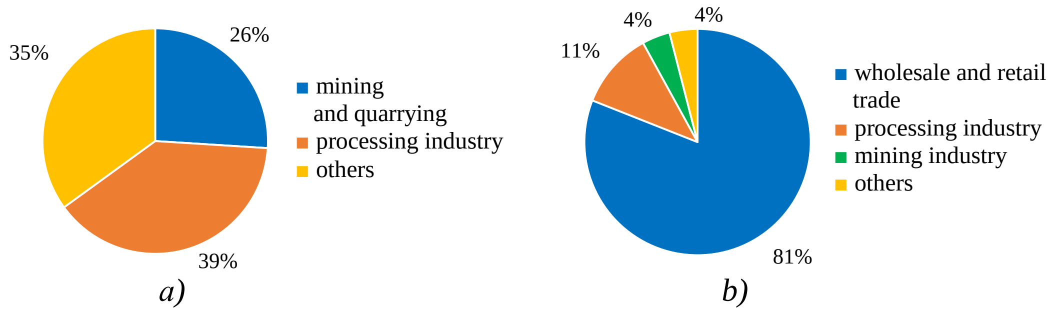

Figure 3. Structure of letters of credit provided by banks of Ukraine by types of economic activity as of January 1, 2025:
a) in hryvnias; b) in foreign currency.

Source: (National Bank of Ukraine, n. d.).

Table 4

Operations with documentary letters of credit of Ukrainian banks in 2021–2024, UAH billion

Banks	Provided letters of credit												Received letters of credit											
	National currency, billion UAH				Foreign currency (equiv.), billion UAH				Quantity, un.				National currency, UAH billion				Foreign currency (equiv.), UAH billion				Quantity, un.			
Years	2021	2022	2023	2024	2021	2022	2023	2024	2021	2022	2023	2024	2021	2022	2023	2024	2021	2022	2023	2024	2021	2022	2023	2024
with a state share	3.37	1.88	1.07	0.54	23.36	13.62	20.05	19.08	254	126	213	193	0.26	0.38	0.3	0.25	11.55	4.38	3.95	4.71	563	138	167	131
foreign banking groups	1.17	0.17	0.03	0.33	6.91	8.67	17.15	14.98	608	232	173	237	1.8	0.56	0.33	0.16	2.75	0.77	0.81	0.40	371	105	67	68
with private capital	1.17	0.46	0.05	0.48	1.72	0.34	1.37	3.58	549	96	243	394	1.84	1.62	0.49	0.18	4.53	0.97	1.13	1.71	476	115	75	71
Total	5.71	2.51	1.15	1.35	31.99	22.63	38.57	37.64	1411	454	629	824	3.9	2.56	1.12	1.59	18.83	6.12	5.89	6.82	1410	358	309	270

Source: (National Bank of Ukraine, n. d.)

Thus, the letter of credit form of settlements is most widely used in wholesale and retail trade, and the vast majority of provided letters of credit are in foreign currency (81% of the total number of letters of credit – 597 units). For comparison, in 2023, the same trend was observed, although the share was somewhat lower – 75%.

The second place in terms of volume is occupied by the processing industry (67 letters of credit). The mining industry prevails in terms of the number and volume of letters of credit issued in foreign currency. In the national currency, the amounts are insignificant, which indicates the use of letters of credit as an effective method of settlement primarily in the foreign economic activities of enterprises.

Conclusions

Therefore, letters of credit are a means of reducing settlement risks and a guarantee of complete security in relationships with counterparties. After all, during the supply of goods and the provision of services, risks may arise at various stages: from the procurement of raw materials, manufacturing, and storage of goods to the timely delivery/provision of services and payment. The use of letter of credit settlements allows protecting the interests of both the seller and the buyer in such situations.

In modern conditions, it is profitable to use letters of credit:

in business operations (for ensuring safe and effective international transactions, where the parties may be unfamiliar and geographically distant; for financing large projects that require significant capital expenditures, where it is necessary to ensure financial stability; for protection against the buyer’s insolvency or uncertainties regarding the fulfillment of the terms of the agreement);

for financial support (obtaining a financial loan through a bank for further use for personal needs; for the distribution of finances into parts for better management and optimization of financial resources; for increasing the amount of financial funds that can be used in one’s own interests).

The authors have studied the significant role of banks in providing services for the maintenance of documentary letters of credit – from establishing the legality of the terms of indicated settlement instrument to the process of payment and acceptance of funds. At the same time, there are several significant problems with the use of letters of credit in Ukraine, one of which directly concerns banking institutions. First of all, it is a low level of trust in Ukrainian banks on the part of foreign partners, due to which the latter establish such terms for servicing letters of credit, which are often unacceptable for domestic banks. For the proper development of Ukrainian banks on the world stage, it is necessary to improve the system of international settlements at the state level, bring it in line with modern trends, and enhance the image of both Ukrainian companies and banks.

A significant problem is the war on the territory of our state, which has greatly limited the foreign economic activity of business entities and the use of the letter of credit form of payment accordingly. The conducted research indicates a significant reduction in the use of the letter of credit form of payment in Ukraine – more than half of the number of opened letters of credit since the beginning of the full-scale invasion. Due to high military risks, letter of credit settlement often requires confirmation from European banks as guarantors, which is one of the restraining factors today.

An important factor is the cost of a financial instrument, which depends on the amount, term, level of risk, security, bank tariffs, and involvement in international programs. For letters of credit, commissions are usually provided for notification, confirmation, as well as an annual charge of 1–3%. The authors conducted an analysis of the tariffs for opening and servicing letters of credit at leading banks in Ukraine, which revealed different pricing policies for issuing letters of credit in national and foreign currencies. At the same time, it was established that concluding a letter of credit in banks requires the availability of significant capital for domestic enterprises.

The authors confirmed the hypothesis that under modern conditions of increased volatility in financial markets, a letter of credit acts as an effective means of reducing settlement risk, ensuring the economic security of both parties to the concluded contract and expanding the scope of their foreign economic activity by minimizing the risk of non-fulfillment of obligations under concluded contracts.

Future scientific studies on this issue have broad prospects in terms of securing payments when choosing a form of settlement by business entities.

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INVESTMENT DETERMINANTS OF SUSTAINABLE DEVELOPMENT AND COMPETITIVENESS IN TRADE

In defining the strategic role of the trade sector, especially under the conditions of the full-scale invasion by the russian federation, it is important to emphasize the significance of investment activity as a key instrument for preserving and strengthening competitiveness and ensuring sustainable economic development both overall and at the level of individual business units. The study is based on the hypothesis that investment activity is a key driver of sustainable economic development and of strengthening the competitiveness of Ukrainian trade enterprises, an integral component of strategic business models, and a modulator of their contemporary development trajectory. Under a favorable investment strategy, these interrelations become not only a foundation of

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ІНВЕСТИЦІЙНІ ДЕТЕРМІНАНТИ СТАЛОГО РОЗВИТКУ ТА КОНКУРЕНТОСПРОМОЖНОСТІ В ТОРГІВЛІ

Визначаючи стратегічну роль сфери торгівлі особливо в умовах повномасштабного вторгнення рф, підкреслено значення її інвестиційної діяльності як ключового інструменту збереження і зміцнення конкурентоспроможності, забезпечення її сталого економічного розвитку в цілому і в розрізі окремих бізнес-одиниць. Висунуто гіпотезу, що інвестиційна активність виступає ключовим інструментом сталого економічного розвитку та зміцнення конкурентоспроможності підприємств торгівлі України, є невід'ємною складовою стратегічних моделей сучасного бізнесу, модулятором траєкторії його сучасного руху. За умови сприятливої інвестиційної стратегії зазначені взаємозв'язки стають не лише основою стабільності, а й джерелом синергії, що здатна *stability but also a source of synergy that enhances the trade sector's resilience, ensures its integration into global value chains, and increases its social and economic efficiency. The study reveals the impact of investment on enterprise adaptability, innovation capacity, the achievement of sustainable economic development, and the strengthening of competitiveness during crisis periods affecting the country's economic system as a whole. To test the hypothesis, general scientific research methods were applied, including formalization, historical analysis, abstraction, general logical methods (analysis, synthesis, induction, and deduction), generalization, and ascent from the abstract to the concrete, along with specific social and economic methods based on the dialectical approach to understanding the essence of development processes in accordance with the object and subject of the study. The study draws on scientific works by domestic and foreign scholars on investment, sustainable economic development, and the formation and assessment of enterprise competitiveness, as well as materials from the State Statistics Service of Ukraine and the National Institute for Strategic Studies. The research analyzes indicators of the sustainable economic development of Ukraine's trade sector and characterizes a theoretical investment model for ensuring the competitiveness and sustainable economic development of trade enterprises under conditions of crisis distortions and the restoration of economic equilibrium in business activity.*

Keywords: investment, trade sector, sustainnable economic development, competitiveness, capital investment, innovation, performance, business unit, business processes, investment resources, investment risks.

посилювати стійкість торговельного сектору, забезпечуючи його інтеграцію у глобальні ланцюги створення нової вартості та підвищення рівня його соціально-економічної ефективності. Розкрито вплив інвестицій на адаптивність підприємств, їхню здатність до інновацій та забезпечення сталого економічного розвитку, зміцнення конкурентоспроможності у кризові періоди функціонування всієї господарської системи країни. Для перевірки гіпотези застосовано загальнонаукові методи дослідження: формалізація, історичний, абстрагування, загальнологічні (аналіз, синтез, індукції, дедукції), узагальнення і сходження від абстрактного до конкретного, специфічні соціально-економічні методи на базі діалектичного підходу пізнання сутності процесу розвитку відповідно до об'єкта і предмета. Інформаційною базою дослідження слугували наукові праці вітчизняних та закордонних науковців з проблематики інвестування, сталого економічного розвитку, формування та оцінки конкурентоспроможності підприємств, матеріали Державної служби статистики України, Національного інституту стратегічних досліджень. Проаналізовано індикатори сталого економічного розвитку торговельної галузі України, охарактеризовано теоретичну інвестиційну модель забезпечення конкурентоспроможності та сталого економічного розвитку підприємств торгівлі України в умовах кризових деформацій та відновлення економічної рівноваги у діяльності бізнесу.

Ключові слова: інвестиції, торговельна галузь, сталий економічний розвиток, конкурентоспроможність, капітальні вкладення, інновації, результативність, бізнес-одиниця, бізнес-процеси, інвестиційні ресурси, інвестиційні ризики.

JEL Classification: E22, L81, O11, R11.

Introduction

Trade is an organic component of a country's economy that performs the final stage of capital turnover within the system of social production by ensuring a functional connection between producer and consumer through the recognition of products' marketability and their movement across all segments of demand in the commodity market. It is precisely this functional completion of all stages of capital movement within the economic system that allows trade to be regarded not only as a specific mechanism for satisfying the basic consumer needs of the population, but also as a powerful economic element in gross domestic product formation, the budget process, and the solution of employment problems, thereby ensuring socio-economic stability.

Under martial law, the importance of trade has increased significantly due to the reassessment of its role as the main supplier of essential goods to the population, especially in frontline areas and combat zones, as well as a humanitarian actor in the implementation of social relations and state policy aimed at protecting the population in wartime.

The full-scale invasion of the russian federation into Ukraine caused significant deformation of the trade system, which at the beginning of the hostilities was characterized by a high level of quality in commodity supply to the population, as well as by the formation of the industry by economic entities with a practically optimal profile and specialization of activity. Product saturation, technological advancement in customer service, sound marketing justification of the main commodity strategies, material and logistical support, and the formation of commercial relations based on rationality, competitive advantages, and entry into new promotional formats and activities according to modern criteria of their own KPIs, as well as the modernization of models for assessing competitive positions in the external environment and trajectories of their development, formed a platform of resistance to destructive aggression and ensured the survival potential of the industry.

Even before the introduction of the legal regime of martial law, the survival potential of trade had been formed based on anti-crisis management models already in use, acquired adaptation mechanisms for force majeure scenarios, and state support, which introduced legislative and regulatory measures to strengthen motivation not only to preserve or restore lost positions, but also to return to strategic development ambitions. The state’s efforts are tangible and aimed at forming a strategic roadmap for restoring the competitiveness of the Ukrainian economy in connection with its industrial structure, within which economic development as a process structurally covers the stages of preserving capacities, sustainable economic growth, and achieving competitive rates of economic development.

Accordingly, trade, as an important economic component, must follow this path and experience the effects of the investment multiplier and accelerator as objective mechanisms of investment support for economic development, reflected in the effectiveness of capital investment and the formation of potential for further investment. Investments as a key factor and instrument of sustainable development in modern economic systems are examined in studies by Ukrainian scholars, particularly in relation to global challenges, turbulence in the operating environment under martial law, competitive dynamics, and changes in assessment metrics and regulatory conditions. The attention of both foreign and domestic scholars is focused on individual factors that contribute to sustainable development and enterprise competitiveness.

The article by Cui and Brychko (2023) is devoted to a comprehensive analysis of the implementation of an entrepreneurial management style in the context of the sustainable development of enterprises and to the development of a new method for assessing the effectiveness of the investment process according to the innovation vector, taking into account the dynamic nature of external influences. The authors examine in detail the relationship between operational and strategic innovation management, emphasizing the importance of integrating these components to ensure the effective functioning of the enterprise in the long term. The authors also note the systemic nature of the impact of innovations on enterprise activities, which necessitates the use of new methods for assessing their effectiveness and integrating the innovation block into the overall strategy of sustainable economic development. In general, the study shows that the coordination of operational innovations in the strategic dimension is a key condition for successfully ensuring the sustainable economic development of enterprises, and that a comprehensive approach to innovation management contributes to their effective implementation in line with current requirements and long-term market competitiveness.

Se and Lin (2022) investigated the impact of business organization efficiency on enterprise competitiveness and on the state of ensuring sustain-nable development. In particular, they analyzed the impact of sustainnable development goals and investment strategies on the organizational efficiency of automobile companies in China and noted the mediating role of this factor in building the relationship between sustainable development goals, investment strategies, and overall organizational efficiency.

In the work of Gutierrez-Broncano et al. (2024), the concept and mechanism of the influence of a hybrid strategy on the performance of small and medium-sized businesses through the prism of innovation are revealed. The authors emphasize that the combination of different strategic approaches on an organic basis allows enterprises to respond promptly to external changes, in particular by strengthening innovation potential and increasing the efficiency of its functional implementation and, as a result, competitiveness. Particular attention is paid to the role of the ability to adapt quickly as a key factor in ensuring the sustainability of business models in a dynamic market environment. The conclusions presented in the article are recommenddatory for Ukrainian trade enterprises, for which the implementation of innovative solutions and the development of adaptive competencies act as basic investment tools for ensuring sustainable development and strengthening competitive positions.

Kannan and Gambetta (2025) analyzed the impact of technology on the effectiveness of the sustainable development process in small and medium-sized enterprises. The authors identify key factors that determine the sustainable development of an enterprise: organizational context, technological capabilities, innovation, knowledge management, and practices for implementing a sustainable development strategy. The researchers emphasize that technology plays a leading role in the transformation of SMEs, ensuring the integration of the sustainable development process into the enterprise business model while increasing resource efficiency and strengthening competitive advantages.

In the same segment of scientific research, Gumenyuk and Tkachev (2024) focused on the features of financing the sustainable development of the country's economy as a whole and of its individual components, in particular in the context of the possibilities of using financial engineering products alongside the widespread introduction of digital technologies, which should support intensive investment processes under traditional financial support schemes or in project financing models. The authors prove that emphasis on the investment approach to substantiating the basic principles of ensuring sustainable development of the system simultaneously ensures its economic, social, and environmental well-being.

Berdar et al. (2024) emphasize that the key factor in the recovery of the Ukrainian economy in the post-war period is investment with a strong innovative component. It is the innovative nature of future investments that should accelerate the economic development of individual business entities, contribute to a significant increase in labor productivity and job creation, form powerful competitive trajectories, and systematically bring the Ukrainian economy to strong competitive positions. Based on the analysis of the innovative activity of modern enterprises under conditions of military upheaval, the authors emphasize the role of state support and identify areas for its necessary strengthening in the proactive period and in the future.

It is in this context that the conclusions of Ustymenko (2024) are formed, who considers the active pragmatic position of the state in supporting small and medium-sized businesses at all levels of management, which implement investment support strategies along innovation trajectories, to be the main means of increasing the competitiveness and economic stability of Ukrainian enterprises under conditions of military upheaval. The author identifies the main barriers as limited access of enterprises to financial resources and the insufficient readiness of businesses to cooperate with innovation producers, both at the stage of ordering innovations and at the stage of implementing already developed projects. The low level of business communication throughout the functional environment acts as an inhibiting factor in the process of integration with international economic systems and markets, as well as in effective interaction with state institutions.

The same problem is considered by Atamas (2023), who analyzes the current state of investment activity in Ukraine, highlighting domestic and international aspects, the prospects for increasing the level of investment attractiveness of the economy, and the starting positions in this process today. The inclusion in a comprehensive analytical model of the problems of forming the investment potential of the economy based on the assessment of factors and main risks lends the author’s conclusions scientific credibility and argumentative value in other areas of investment analysis.

Investments as the main way out of the crisis state of the Ukrainian economy are defined by Legkostup and Sainchuk (2022), who formulate the main tasks of this process in the direction of improving the investment climate, in particular through motivating and stimulating state influence.

The issues of the objective needs of the Ukrainian economy and the importance of foreign investment are convincingly and illustratively raised in the publication by Krekhivskyi and Salikhova (2022). They argue for the possibilities of foreign investment, emphasizing its ability to accelerate modernization processes and technological innovation as the basis for the resource needs of Ukrainian business. The authors stress the need to include foreign investment in national development plans, which will contribute to the concentration of capital, including that of foreign investors, in ensuring post-war recovery and its direction toward industry, which generates a significant multiplier effect in the economy.

The issue of investment support for the processes of economic systems emerging from crisis, the formation of a stable basis for sustainable economic growth, and the development of the Ukrainian economy is actively covered in scientific journalism and in materials from scientific and scientific-practical conferences of various levels and scales, both in macroeconomic aspects and in a sectoral context, especially about individual economic units. While maintaining the general principle of the uniqueness of the investment dimension in the process of implementing development strategies, scholars focus on the features of such processes in different sectors of the economy: differences in the sources of generating net cash flows as returns on investments; the specifics of mobilizing investment resources; the nature of target functions and economic constraints in models for estimating the cost of attracting them and optimizing structure; as well as models for maximizing the effect of investments through optimally formed investment programs and in developing investment risk management policies, etc.

The results of modern scholarly understanding of sustainable economic development processes, as well as their active scaling and deepening, make it possible to assert that a new paradigm for managing these processes is being formed, within which there is an obvious need for scientific assessments and applied models of functional blocks for solving this main problem.

The article puts forward the hypothesis that investment activity is a key tool for sustainable development and for increasing the competitiveness of Ukrainian trade enterprises, an integral component of strategic models of modern business, and a modulator of the contemporary development trajectory. Under a favorable investment trajectory, these relationships become not only the basis of stability but also a source of synergy that can enhance the resilience of the trade sector, ensuring its integration into global value creation chains and increasing its social and economic efficiency. To test the hypothesis, general scientific methods were used: formalization, historical analysis, abstraction, general logical methods (analysis, synthesis, induction, deduction), generalization, and ascent from the abstract to the concrete, as well as specific socio-economic methods based on the dialectical approach to understanding the essence of the development process in accordance with the object and subject of the study. The information base of the study included scientific works by domestic and foreign scholars on investment, sustainable development, and the formation and assessment of enterprise competitiveness, as well as materials from the State Statistics Service of Ukraine and the National Institute for Strategic Studies.

The main part of the article consists of two sections: the first analyzes indicators of the sustainable development of Ukraine’s trade sector, and the second describes a modern investment model for ensuring the competitiveness and sustainable economic development of Ukrainian trade enterprises.

1. The investment paradigm for sustainable economic development of Ukraine's trade sector under martial law

Trade, as a branch of the national economy that is directly exposed to the external environment and depends on how the quality of its activities is assessed, must not only establish competitive product benchmarks but also ensure a high technological standard of trade service provision, adequate equipment with modern technical means in attractive configurations, and convenience for consumers in obtaining these services. The ability of an enterprise to quickly introduce innovative tools into trade processes, find new technological solutions, and use know-how is one of the main sources of strengthening competitiveness, and, according to the study, this capacity not only persists under martial law but also continues to develop.

In addition to destruction caused by shelling, loss of goods, and the outflow of human resources to safer regions or abroad, Ukrainian trade enterprises face problems related to insurance and cost reimbursement, pressure on the use of their own reserves, the need to maintain working capital, and the preservation of the current operational capacity of personnel. When a trading business operates under such conditions, financial and economic mechanisms become unbalanced; paradoxically, however, enterprises strengthen their potential for survival and future development through an innovative approach. E-commerce and omni-channel trade are developing rapidly, logistics routes are being rationalized in terms of delivery volume and cost intensity, and enterprise management systems are increasingly incorporating modern technologies based on the digitalization of accounting, cost, and organizational indicators of commercial transactions, and models for analyzing and planning financial and economic performance under current financial and management accounting standards adopted by the enterprise.

The depth of the destruction of the Ukrainian economy and the estimated losses during the full-scale invasion of the russian federation have been assessed in numerous publications by statistical and analytical institutions in Ukraine and abroad. In a study prepared by the World Bank Group, the Government of Ukraine, the European Commission, and the UN, the amount of losses and, accordingly, the cost of post-war reconstruction in Ukraine as of the end of 2024 was estimated at almost USD 524 billion, which exceeds previous estimates by USD 38 billion. The housing sector, transport, energy and mining facilities, trade, and industry were most affected. In the regional dimension, the most affected were Donetsk, Luhansk, Kharkiv, Kyiv, Chernihiv, and Zaporizhzhia regions. According to the study (World Bank, 2024), the direct damage to Ukraine at the time of the assessment amounted to almost USD 176 billion.

Due to the destruction, the pace of Ukraine's economic dynamics achieved in the pre-war period was lost. In addition to the destruction of infrastructure, a crisis in the logistics sector and, most importantly, a decrease in solvent demand in the domestic market were added. Experts consider the prerequisites that have developed in the realities of martial law to be the starting point for reviving the Ukrainian economy and bringing it to a competitive position in terms of such tasks as restoring the infrastructure complex, developing the logistics system in general and with reference to the specifics of industries, strengthening energy security, stimulating domestic demand in commodity markets, etc. This involves the targeted concentration of financial resources, both public and private, as well as opportunities to attract external donor assistance, in particular within the framework of existing mechanisms and European instruments (Plan for the Ukraine Facility 2024–2027, n. d.), for the reproduction of locomotive sectors of the economy to launch the entire contour of social production into sustainable processes of economic development.

Capital investments in such conditions acquire a system-forming significance, contributing to ensuring macroeconomic stability and financial self-sufficiency of the state. Investment resources are especially in demand in such strategically important sectors of the economy as transport and digital infrastructure, energy, agro-industrial complex, dual-use industry, trade and services, which should systematically form a competitive national production complex on new technological platforms, function effectively in conditions of acquiring a sufficient margin of economic security, and ensure sustainable development of territories.

The prerequisite for the upward movement of the Ukrainian economy in the future is the increase in gross fixed capital accumulation in all chains and at all sites of social production. This focuses on the real processes of investment in fixed assets and resources and ensures the dynamics of economic growth. Investments in fixed capital with innovative content are a means of increasing labor productivity on a modernized production base, as well as the creation of high-tech jobs, achieving product quality in the metrics of progressive standards, benchmarks according to the criteria of competitiveness in the national and global markets.

Analyzing the dynamics of the level of gross fixed capital accumulation in Ukraine in 2020–2024 (in % of GDP) (*Figure 1*), it should be noted that the presence of a cyclical nature of fluctuations in parameters with an increase in the base of deviations as a manifestation of the sensitivity of the investment environment to foreign policy and economic shocks.

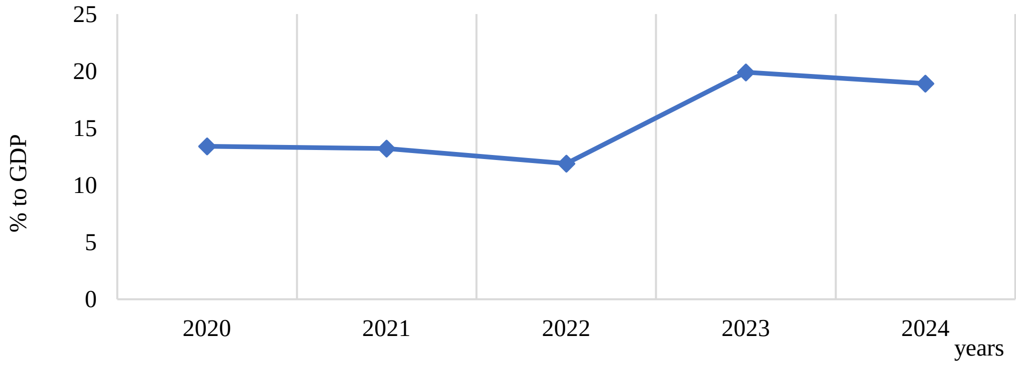

Figure 1. Level of Gross Fixed Capital Formation in Ukraine, 2020–2024

Source: Compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

During the COVID-19 pandemic in 2020–2022, there was a gradual decrease in this indicator, and with the invasion of the russian federation in 2022, private investment declined almost critically due to difficulties in accessing financial resources and the curtailment of project self-financing programs because of the direct threat of losing investments. However, in 2023, a sharp increase in this indicator was recorded, which coincided with the launch of international support programs, the mobilization of grant and blended financing within the framework of the Ukraine Facility initiative, as well as the implementation of national investment incentive programs, in particular, state guarantees for investment projects. The fluctuations in the share of capital investment in 2024, while remaining significantly higher than in the previous war years, were mainly caused by organizational factors and did not destroy the general model of investment support for stabilization processes and the formation of development potential in the country.

The change in investment dynamics in 2024 can also be cautiously interpreted as a transformation of processes from emergency recovery of critical industries to a gradual transition to strategic development of the economy in a systemic structure. The key reason for the growth of gross fixed capital formation in Ukraine at this time was the urgent need to mobilize resources into the defense-industrial complex to ensure national security and focus the production sector on military needs. At the same time, such an investment structure forms a unique basis for the development of technologies in the defense sector, which can become a driver of post-war economic development and strengthen the country's export potential.

The main factors in the restoration of investment activity in the economy were the priority financing of capital investments in the defense-industrial complex and in the restoration of destroyed infrastructure. These initiatives were implemented primarily through state funding. An important supporting factor was the assistance of international partners, in particular in the restoration of social infrastructure (schools, kindergartens, hospitals, bomb shelters), as well as transport infrastructure (roads, bridges, etc.). Investment activity in the corporate sector of the economy also gradually increased (Bazylyuk et al., 2025).

Analysis of the dynamics of capital investments by type of economic activity in Ukraine in 2020–2024 allows us to identify key trends in the change in investment activity in conditions of prolonged high economic turbulence caused by both internal structural challenges and shocks caused by a full-scale invasion. Overall, the volume of capital investments increased from UAH 419.8 billion in 2020 to UAH 534.4 billion in 2024 (*Figure 2*), which can be considered signs of a gradual recovery of the economy after the crisis shocks associated with the COVID-19 pandemic and the destruction during wartime. A feature of the process is that investment activity in Ukraine was mainly manifested in strategically important sectors of the economy. However, the intensity of growth by type of economic activity is uneven, as indicated by obvious imbalances in the structure of aggregate capital investments.

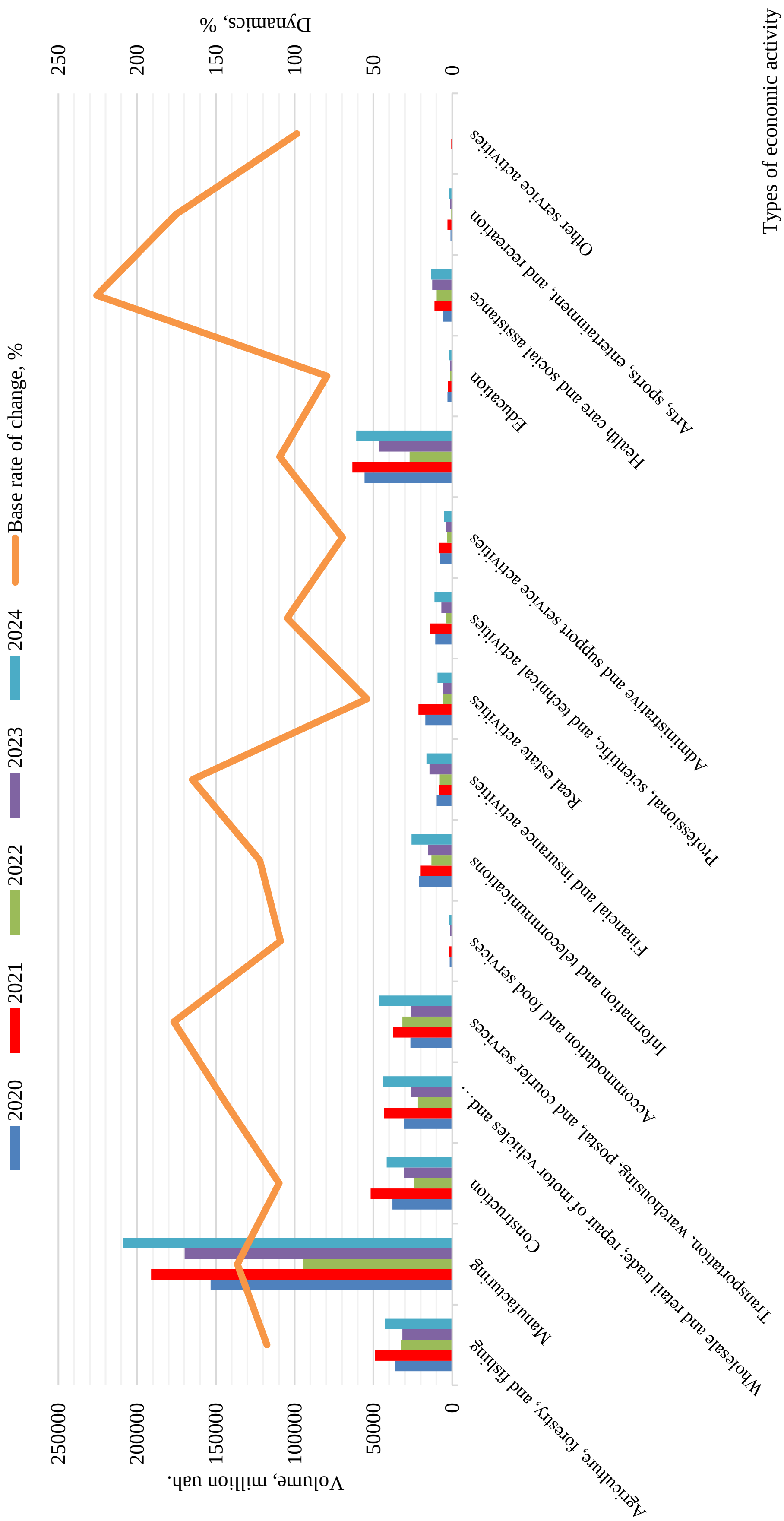

Figure 2. Capital investments of Ukrainian business entities by economic activity for 2020–2024

Source: Compiled by the authors based on data from the State Statistics Service of Ukraine (n.d.).

According to the increasing intensity of investment activity, the following sectors of the country's economy can be identified: agriculture (118%), industry (136%), and construction (110%), where state policy aimed at supporting production potential and ensuring the country's food security is implemented. The state's efforts to ensure the harmony and systematic nature of economic development programs are manifested in the growth of investments in information and telecommunications (122%) and financial activities (165%) under digitalization and financial infrastructure modernization projects, including for the post-war period. Thus, the generalized structural characteristics of capital investments over the past five years indicate an update of the system of priorities: strengthening the investment impact on the development of the medical, financial, trade, and industrial sectors, which are experiencing an increased burden in the processes of adapting the economy to martial law conditions and forming the potential for recovery in the post-war period.

2. Competitiveness and sustainable development of Ukrainian trade enterprises: an investment model for ensuring

The preservation of acquired competitiveness and the restoration of economic development potential under current conditions of adaptation of the national economy to the effects of external military aggression and global economic challenges depend almost directly on the real intensity of trade enterprise activity. Trade, as an important component of the country's economic complex, plays a system-forming role in shaping the consumer market according to the structure of population demand, supporting economic activity in the regions, and ensuring fiscal stability.

Under conditions of unpredictable shocks and turbulence in the operating environment, trade enterprises require the implementation of modern mechanisms for preserving and developing competitive advantages in the long term. The multitude of destabilizing factors complicates traditionnally constructed schemes of strategic planning and operational management for business entities, and these models must be supplemented with parameters formalized in functional dependencies and, in essence, with new matrices of determinants.

In current trade practice, modern automated systems for managing trade turnover and marketing models for processing and applying big data to forecast demand are being used increasingly widely. This reflects both investments already made, domestic and foreign, and the objective need for substantial further investment in these areas. The effectiveness of investment in strengthening the ability of Ukrainian trade enterprises to survive and maintain their development potential under martial law is confirmed by rising labor productivity, business expansion, and the creation of new jobs. In other words, it is reflected in the development of human capital according to modern quality criteria, stronger integration ties with foreign partners, greater export-import potential, and the accumulation of a reserve of economic security and competitiveness.

Therefore, investments in the trade sector allow us to preserve and simultaneously develop an important element of the country's economy, which ensures the systematic functioning of its economic mechanism, the stability of the market both internally and externally.

The statistical profile of the assessment of the activities of Ukrainian trade enterprises from 2020 to 2024 does not reveal the stability of the trends in the change of indicators, since the analytical array is constantly supplemented with data on current factors that either stimulate or inhibit their development, which expands the field of analysis and requires additional tools to ensure comparability (*Table 1*).

Table 1

The dynamics of key performance indicators of Ukrainian trade enterprises for 2020–2024

Indicator	2020	2021	2022	2023	2024
Wholesale turnover of wholesale enterprises, UAH billion	2462.60	3377.40	2768.30	3382.00	3477.22
Rate of change in wholesale turnover of wholesale enterprises, %	–	137.15	81.97	122.17	102.82
Retail turnover, UAH billion	1201.60	1443.80	1396.30	1855.40	2171.98
Rate of change in retail turnover, %	–	120.16	96.71	132.88	117.06
Retail turnover of retail enterprises, UAH billion	868.3	1044.5	971.1	1248	1511
Rate of change in retail turnover of retail trade enterprises, %	–	120.29	92.97	128.51	121.07
Number of operating trade enterprises, units	98369.00	97038.00	67395.00	79577.00	н/д
Rate of change in the number of operating trade enterprises, %	–	98.65	69.45	118.08	–
Residual value of fixed assets and intangible assets of trade enterprises (as of the end of the year), UAH billion	228.60	240.70	260.60	277.50	н/д
Rate of change in the residual value of fixed assets and intangible assets of trade enterprises, %	–	5.29	8.27	6.49	–

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

The analysis of the dynamics of key indicators of trade enterprise activity in 2020–2024 covers periods of large-scale crisis phenomena in Ukraine, including the COVID-19 pandemic, economic turbulence, logistical distortions in commodity supply, and direct destruction and losses during martial law. Nevertheless, the industry survived and retained its motivation for development. Overall, retail turnover increased from UAH 1 201.6 billion in 2020 to UAH 2 171 billion in 2024. This can be regarded as evidence of the preservation and growth of domestic consumption and demand, as well as of the flexibility of retail businesses in adapting trade service technologies through online sales, the development of delivery methods, and the implementation of marketplace systems. At the same time, these indicators were also influenced by inflation. In addition, the number of operating trade enterprises declined during the same period, especially in 2022, when the rate of decline reached 15.3%. Some enterprises found themselves in zones of active hostilities or occupation, while others relocated to safer regions and have not yet achieved economic certainty. The moderate pace of this decline confirms the sector's strong capacity for survival. Another positive signal for assessing the prospects of sustainable economic development is the increase in the residual value of fixed and intangible assets, which rose from UAH 228.6 billion to UAH 277.5 billion in 2023.

According to the general assessment of investment activity in trade, its selected directions should be specified: infrastructure renewal and strengthening enterprise potential through an innovative approach, modernization of management systems, etc. Thus, despite the real threat of destruction and losses, the trade sector demonstrates signs of a gradual transition to a transformational economic model based on the structural adaptation of commodity policy, equipping enterprises with new-generation technical means, and the modernization of models for assessing competitiveness and implementing them according to the criteria of innovative content and substantiation of the target level of economic security.

In this context, modern concepts of sustainable development of economic systems, built on the criteria of balance of economic interests, environmental and social responsibility, and the efficiency of their functionning, acquire special importance.

In this methodological construction, the implementation of the principles of ensuring sustainable economic growth and development of economic systems is declared as a tool for increasing their competitiveness, the effect of which is manifested in changing the parameters of activity by highlighting such abilities as adaptability, innovation, and efficiency in responding to the challenges of a dynamic market environment.

According to Pylypenko (2020), sustainable development is one of the most important factors in ensuring the competitiveness of an enterprise in modern business conditions in the strategic management paradigm, which the author structurally defines as a formed sequence of qualitative changes in characteristics in the current and long-term periods according to the target function of systemic interconnection in a balanced mechanism for managing the development of the economic, social and environmental subsystems of an enterprise in response to the challenges of the external environment.

The above definition is quite widely supported in modern scientific discourses and allows us to generalize approaches and build the following essential characteristic of the process: sustainable economic development of an enterprise is a process of long-term balanced upward movement of the economic system with the transition to higher phases of the life cycle based on achieving target rates of economic growth with the simultaneous formation of a sufficient level of economic security and social responsibility, coordination of the interests of all subjects of interaction in the external environment based on a substantiated model of operational adaptability.

Therefore, the ability of an enterprise to quickly adapt to changes in the external environment and restore the economic balance of the system ensures the preservation of competitive positions and the strengthening of long-term competitiveness.

In the context of the concept of sustainable economic development of an enterprise, the functional capacity of the system is ensured by the following integral elements: production, personnel, marketing, financial, and investment dominant spheres, which are organic components of the mechanism for forming long-term and stable efficiency and competitiveness of a business entity according to reasonable standards of presence in the market.

Among the listed components, the investment dominant sphere is of particular importance, the key purpose of which is to update the technological base of activity, increase production potential, introduce new business models, increase energy efficiency and environmental safety, develop human capital according to modern quality criteria, etc. Investments create unique competitive advantages that may be unavailable to other market players in the short term.

Thus, investment activity with innovative content is not only a condition for sustainable economic growth and development, but also a determining factor in strengthening the competitive position of an enterprise that has already formed a high technological level, flexibility in view of the instability of the operating environment. The need for investment in the trade industry is constantly growing, despite the stresses of martial law. Direct restoration of the material and technical base, its modernization, innovative transformations of the management system, digitalization of business processes, development and implementation of modern logistics projects and infrastructure, technological modernization, and equipping of end-user service processes are generalized characteristics of the directions of capital investment in trade.

From the point of view of today's planning for the restoration of the industry according to modern standards, the above benchmarks constitute a map of investment support directions in the strategic field of development, which takes into account the potential progress of scientific and technological progress and the possibility of significantly expanding and deepening the innovativeness of the content, changing the metrics for assessing competitive advantages.

Figure 3 presents the dynamics of investment volumes in non-current assets of trade enterprises in 2020–2024, with a division into tangible and intangible components. A general analysis of their volumes in 2020–2024 proves the validity of a number of important conclusions regarding the transformation of the industry's investment behavior in conditions of deep economic and security challenges. Thus, during the period under study, significant fluctuations in the volumes of capital investments were observed, which reflect the business response to crisis processes – the COVID-19 pandemic, the full-scale invasion of the russian federation, the destruction of infrastructure, and the decline in the purchasing power of the population as the main factor in the development of trade.

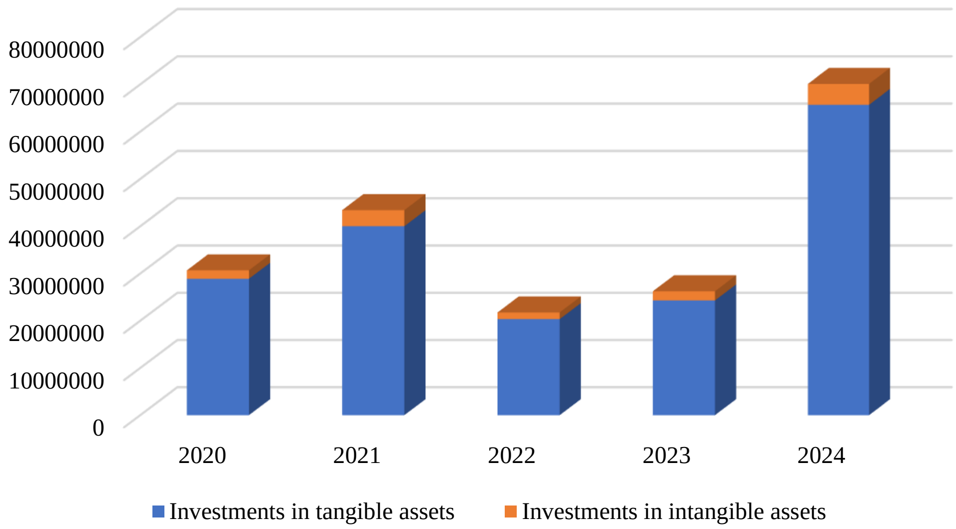

Figure 3. Structural characteristics of investments in the "trade" sector by volume of investments in tangible and intangible non-current assets in Ukraine in 2020–2024, in %

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

The recovery of investment activity became evident in 2024: the volume of investments in the industry exceeded UAH 80 million, almost twice the level of previous years. Clear signs of gradual business recovery emerged, supported during this period by the state, international partners, and the institutional framework of the country's economic governance. Logically, the main volume of investments was directed toward the development of tangible assets, given enterprises' urgent need to restore their material and technical base, infrastructure capacity, and logistical support for trade operations. Characteristic of this period is not merely the replacement of lost fixed assets, but also the implementation of development projects based on both extensive and intensive approaches and on modern criteria of efficiency and innovation. At the same time, the relatively balanced structure of investments in the intangible assets of retail enterprises in 2020–2024 (see *Figure 2*), where their share remains significant and fluctuates within 5–7%, indicates that the industry has maintained its strategic course toward supporting intangible factors that strengthen competitiveness, including digital technologies, modern software, branding and marketing modernization, and innovations in business management.

Maintaining the relative stability of such investments, even during periods of economic turmoil, indicates an already formed strategic orientation of enterprises toward a long-term competitive trajectory: expanding their segment of presence in the commodity market while maintaining a stable position of competitive advantages, introducing innovative means of forming a stable consumer audience, and developing effective models of commercial interaction with counterparties under agreements, etc. That is, the choice of innovative investment instruments is an indicator of the transition of the trade business to a model of sustainable economic development based on the functioning of intangible assets as a component of the balanced movement of the economy as a whole.

Thus, the development of trade enterprises in recent years demonstrates examples of combining short-term needs for material renewal with long-term investments in the intangible factor of strengthening competitiveness, which corresponds to the concept of sustainable development of management systems and strengthens the position of the trade sector in a turbulent economy.

As statistics show, trade solves these tasks in the absolute majority of analysis periods on the basis of self-financing of investment activities, which significantly restrains the pace of investment growth (*Table 2*).

Table 2

The sources of financing for capital investments by economic activity type "Wholesale and retail trade; repair of motor vehicles and motorcycles" in Ukraine for 2020–2024

Source	2020		2021		2022		2023		2024	
	Amount, UAH million	Share, %	Amount, UAH million	Share, %	Amount, UAH million	Share, %	Amount, UAH million	Share, %	Amount, UAH million	Share, %
Local budget funds	2.13	0.01	44.60	0.10	–					
Own funds of enterprises and organizations	28865.49	94.08	42722.25	98.42	21216.57	97.45	25942.85	98.83	43161.77	97.74
Bank loans and other loans, UAH million	1713.21	5.58	634.34	1.46	533.75	2.45	277.69	1.06	904.77	2.05

End of Table 2

Source	2020		2021		2022		2023		2024	
	Amount, UAH million	Share, %	Amount, UAH million	Share, %	Amount, UAH million	Share, %	Amount, UAH million	Share, %	Amount, UAH million	Share, %
Investment companies, funds, etc., UAH million	–		4.73	0.01	–					
Total	30683.20		43405.91		21772.37		26249.67		44158.74	

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

Although the analysis of the dynamics of the volume and structure of capital investments in Ukraine's trade sector during 2019–2023 shows growth in 2024 by 1.44 times compared with 2020, when investment support for the sector was provided mainly by the own funds of enterprises and organizations, the share of which consistently exceeds 94% of the total volume of capital investments, there remains a high inherited dependence of the intensity of investment development processes on the internal financial capabilities of the business entities themselves.

The share of bank loans and other loans during the studied period fluctuated within the range of 2 to 6%, and this is an insufficient level of use of debt instruments in financing innovation processes to support the pace of economic development.

Thus, the modern model of investment support for the activities of business entities in trade is mainly self-financed, which at the same time limits the possibilities of accelerating structural transformations of the sector and necessitates the improvement of state incentive mechanisms and attracting institutional investors.

From the perspective of sustainable development, the expansion of the share of real investments in intangible assets reflects the current adaptation of the trade sector and its modification in accordance with modern innovation models and existing realities of activity, and also actualizes the need to reassess its own market position and the trajectory of its expansion with a sufficient margin of competitiveness, despite the deep uncertainty of the prospects for activity and the aggressiveness of external factors.

The positive dynamics of capital investments, maintaining a focus on the innovation component, as well as the growth of the total volume of investments in 2024, according to the general assessment, are a sign of real processes of restoring economic activity, increasing the investment capacity of Ukrainian trade enterprises and creating prerequisites for them to acquire a margin of competitiveness in the long term based on sustainable economic development.

The statistical view of the strength of investments in the trade business and the level of their innovation (*Table 3*) supports the previous conclusions and demonstrates a clearly expressed positive trend in increasing investment and innovation activity in the industry. Over the five years, the volume of investments in enterprises increased by 23.3%. This is undoubtedly evidence of growing investor confidence in the Ukrainian trade sector, its rising investment attracttiveness, and its orientation toward development and modernization.

Table 3

Indicators of investment attraction and innovation utilization by Ukrainian trade enterprises for 2019–2023

Indicator	2019	2020	2021	2022	2023
Volume of investments in trade enterprises, UAH billion	59.6	63.0	66.4	69.8	73.5
Share of trade enterprises that implemented innovations, %	13.2	14.5	15.7	16.3	17.1
Number of innovation projects in the trade sector, units	263	278	295	310	328
Volume of expenses for innovations in the trade sector, UAH billion	5.2	5.7	6.1	6.5	7.0

Source: Compiled by the authors based on data from Statista (n. d.).

In addition, positive changes should be noted directly in the innovation activity. The share of enterprises implementing innovations has increased significantly, which indicates business adaptation to modern technological challenges, the introduction of digitalization across operational processes, and the formation of clear contours of competitiveness in domestic and foreign markets. Indirect evidence of the achievement of a new quality of enterprise functioning through innovative activity is provided by the statistics on the implementation of innovative projects in the trade sector, the number of which steadily increased during the period under study (see *Table 3*).

The parameters of this process are detailed by data on the steady increase in spending on innovations in trade, which can be considered evidence of a strategic reorientation of Ukrainian trade enterprises toward modernization of the technological support process, optimization of operational schemes, and the introduction of new business models. According to the general assessment, these trends are regarded as a sign of the gradual strengthening of the investment potential of the Ukrainian trade sector, according to the innovation principle and the content of activity reform.

The obtained study results of the processes of Ukrainian trade enterprises' competitiveness formation and the prerequisites for their sustainable economic growth in the realities of martial law can be considered a verification of theoretical management models already accepted by science and practical business in this segment of financial and economic activity.

General and special methods for assessing enterprise competitiveness, as adopted in theoretical and applied interpretation, are based primarily on the assessment of the investment support for this direction of managerial influence. Thus, according to the positions shown in *Figure 4*, it is possible to formalize the content of the enterprise's areas of activity in projection onto the content of the objects for assessing its competitiveness, the place of investments in ensuring their required level, the implementation tools, as well as metrics for measuring the impact on the parameters of matrices describing the quantitative characteristics of the competitive position and for forecasting its development in the future.

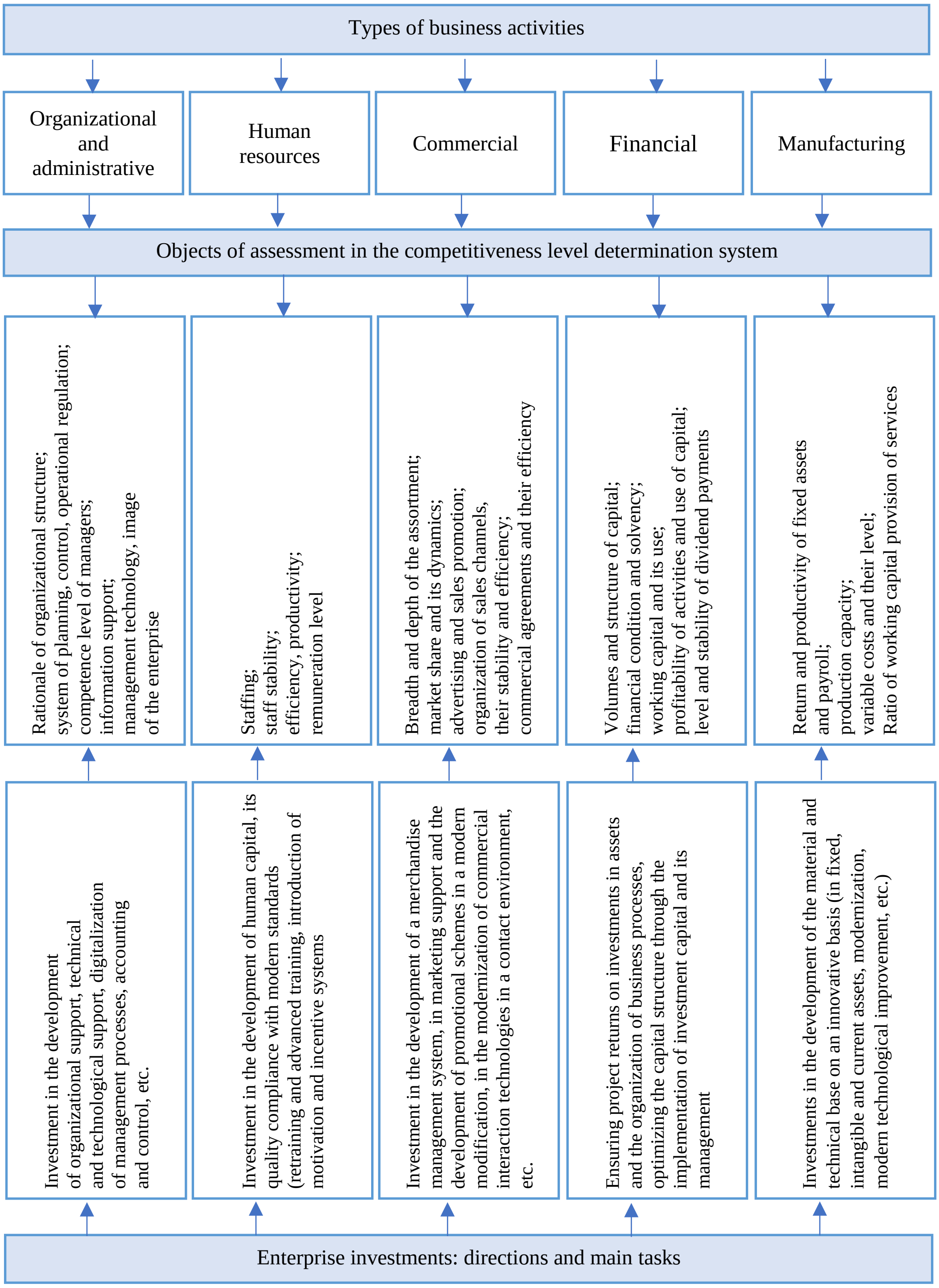

Figure 4. Investment support for the competitiveness of a retail enterprise by business area and assessment criteria

Source: compiled by the authors.

The issue of the investment dimension of enterprise economic growth processes in the context of ensuring target growth rates is most convincingly formalized in the economic and mathematical interpretation of Damodaran (2025). In generalized form, the model has a linear equation expressing the dependence of the target rates of enterprise economic development in period n on the level of capitalization of retained earnings received in period n-1, considered a potential source of reinvestment, and on the level of return on the enterprise's equity in the same period n-1:

$$g_n = b \cdot ROE,$$

where: g_n is constant rate of profit growth;
b is a level of capitalization of retained earnings;
ROE means return on equity.

If the acquired return on equity (ROE) in the period n-1 was 8%, and according to the current policy of the enterprise, 40% of the net profit received is capitalized, then in the subsequent period, this can ensure the rate of economic growth $g_n = 8 \cdot 0.4 = 3.2\%$.

Both the theoretical position of modern scientists regarding factor dependencies, their formalization in economic and mathematical models, and the obtained results of the systemic analysis of the state and prospects for the development of Ukrainian trade enterprises in the realities of martial law coincide in a methodological approach, which allows us to predict with a certain degree of confidence the development trajectories of this economic system, examining the nature and content of the factors generated by the operating environment in conditions of force majeure, overcoming the crisis, restoring the ability to sustainable economic growth and development, increasing competitiveness with access to stable competitive positions in the market.

Conclusions

The full-scale invasion by the russian federation became the direct cause of the destruction of the asset base of the trade sector of the Ukrainian economy. This led to substantial direct business losses and deformation of the economic system, shifting the enterprise operating paradigm from developmental to adaptive and anti-crisis; disrupting commercial activity through breaks in logistics chains and supply channels; weakening commodity supply; and reducing trade turnover because of infrastructure damage and declining household solvency.

The results of the study show that, despite a severely adverse exogenous operating environment, enterprises in the sector demonstrated high adaptability and resilience, quickly reorienting themselves toward innovative technological platforms and new business models in order to preserve their competitiveness and maintain a strong position in the market.

Strategic efforts to modernize the material and technical base and to introduce digital technologies and innovative approaches to the management of trade enterprises under these difficult conditions have created, in resource and instrumental terms, the potential for the sustainable development of the industry.

In the context of the above, Ukrainian trade enterprises are gradually transforming their organizational and economic mechanisms in accordance with modern standards and development criteria, laying the foundation for intensive growth rates and implementing maximization programs with a transition to a dynamic model of long-term economic development.

The generalization of theoretical approaches to assessing the prerequisites, means, and models for ensuring sustainable economic development of economic systems, their features during a crisis period, and the results of research into the real processes of the trade industry functioning under force majeure conditions as a segment of the Ukrainian economy allow us to formulate its definition in theoretical terms as a process of long-term balanced movement of the system based on achieving target rates of economic growth with the simultaneous formation of a sufficient level of economic security and social responsibility, as well as coordination of the interests of all subjects of interaction based on a substantiated model of operational adaptability.

In addition to the methodological tools for managing this process, the main principles of its implementation have been formulated: adaptability, innovation, and responsiveness to the challenges of the market environment. Maintaining enterprise competitiveness is organically ensured by providing the system with an economic drive based on models of sustainable economic growth and development, supporting the stability of the acquired competitive position under conditions of post-war recovery and management based on modern paradigms for governing these processes in peacetime.

Investment activity is a key tool for sustainable development and increasing the competitiveness of Ukrainian trade enterprises, an integral part of strategic models of modern business, and a modulator of the trajectory of modern movement.

The proposed hypothesis concerning the leading role of enterprise investment activity in ensuring sustainable economic development and competitiveness, its indispensability within modern strategic business models, and its function as a modulator of the contemporary development trajectory–through strengthening the stability of the trade sector, supporting integration into global value creation chains, and increasing socio-economic efficiency – is confirmed. It was found that the creation of a flexible mechanism for taking internal and external factors into account determines the enterprise’s specific investment needs, which at this stage correspond to a policy of adaptation to dynamic changes in the economic environment and are subsequently filled with the parameters of resource provision for sustainable economic development. The investment trajectory aimed at achieving target rates of economic development thus becomes a source of greater sustainability and competitiveness, as illustrated by the organic relationship between the areas of investment influence and the objects used to assess the system's competitive potential.

Despite the dynamics of factors influencing the effectiveness of the economic system, both in terms of content and in terms of the strength of the impact on the features of the tools for solving problems of functioning in the face of new challenges by means of investment response, these issues require further research in the field of financial engineering and economic management of the system according to the criteria for achieving target rates of sustainable economic development and the level of competitiveness.

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EVALUATION OF THE EFFECTIVENESS OF THE BUSINESS MODEL IN TRADE

Global transformations in economic relations necessitate advanced approaches to evaluating enterprise performance. Analyzing a company through the lens of its business model enables a systemic characterization within the context of complex interactions with both external and internal environments. This article critically examines three key methodological approaches to such evaluation: performance measurement and KPI systems, composite indicators, and qualitative analysis methods. The authors put forward the hypothesis that the application of KPI systems in combination with qualitative analysis provides a comprehensive assessment of the efficiency of trade enterprise (TE) business models. In contrast, composite indicators are unable to meet managerial needs in terms of the completeness of results. Using methods of comparative analysis, synthesis, induction, and deduction, the study generalizes theoretical approaches to assessing the efficiency of TE business models. Through ratio analysis, the authors examine the structure of financial and economic indicators of TEs in Ukraine in the context of B2B and B2C business models and evaluate their efficiency. The study identifies significant differences between the

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ОЦІНЮВАННЯ ЕФЕКТИВНОСТІ КЛІЄНТООРІЄНТОВАНИХ БІЗНЕС-МОДЕЛЕЙ В ТОРГІВЛІ

Глобальні трансформації економічних відносин вимагають удосконалених підходів до оцінювання діяльності підприємств. Дослідження підприємства через його бізнес-модель дозволяє отримати системну характеристику в контексті складних взаємовідносин із зовнішнім і внутрішнім середовищем. Розглянуто три ключові методологічні підходи до оцінювання ефективності: performance measurement *та система KPI, інтегральні показники і методики якісного аналізу. Висунуто гіпотезу, що застосування системи KPI у поєднанні з якісним аналізом забезпечує всебічне оцінювання ефективності бізнес-моделі ПТ на відміну від інтегральних показників, які не здатні забезпечити управлінські потреби повнотою результатів. На основі методів порівняльного аналізу, синтезу, індукції й дедукції узагальнено теоретичні підходи до оцінювання ефективності бізнес-моделей ПТ. Шляхом коефіцієнтного аналізу досліджено структуру фінансово-економічних показників ПТ України в розрізі бізнес-моделей B2B і B2C та оцінено їх ефективність. Виявлено суттєві відмінності в результативності моделей B2B та B2C, зокрема в ефективності* *performance of B2B and B2C models, particularly in terms of resource utilization efficiency, solvency, and operating financing policies. The authors also substantiate the key KPIs for assessing business models. The findings demonstrate a higher level of efficiency in the functioning of the B2B model in Ukraine. The calculated industry benchmarks are proposed as a basis for conducting GAP analysis at the enterprise level. The identified patterns and trends in the development of trade business models allow for the formulation of assessment principles that constitute an integral part of the methodology. The results obtained confirm the hypothesis regarding the effectiveness of applying KPI systems in combination with GAP analysis of deviations in evaluating the efficiency of TE business models. The proposed methodological approach takes into account the specific features of the structural components of TE business models and ensures a strong managerial focus on the use of assessment results.*

Keywords: business model, effectiveness, KPI system, composite indicator, performance measurement system, trade enterprise.

використання ресурсів, платоспроможності, а також в політиці фінансування операційної діяльності Обґрунтовано основні KPI для оцінювання бізнес-моделей. Встановлено вищу ефективність функціонування моделі B2B в Україні. Розраховані галузеві значення пропонуються як основа для проведення GAP-аналізу на рівні підприємства. Виявлені закономірності і тенденції розвитку бізнес-моделей торгівлі дозволили сформувати принципи їх оцінювання, що становлять невід'ємну частину методології. Отримані результати доводять гіпотезу про доцільність застосування системи KPI у поєднанні з GAP-аналізом відхилень в оцінюванні ефективності бізнес-моделей ПТ. Запропонований методичний підхід дозволяє враховувати специфіку структурних блоків бізнес-моделі ПТ та забезпечує управлінське спрямування використання результатів оцінювання.

Ключові слова: бізнес-модель, ефективність, система KPI, інтегральний показник, система вимірювання результативності, підприємств торгівлі.

JEL Classification: M21, L81, L25.

Introduction

In the context of transformational changes driven by internal challenges and global trends, the trade sector in Ukraine is undergoing significant structural and functional transformations. In particular, the growth of digitalization, increased competition, the evolution of consumer preferences, changes in the purchasing power of the population, and the impact of military operations within the country are shaping new conditions for the functioning of this sector of the economy.

Under such conditions, a comprehensive approach to assessing enterprise activities, performance, and efficiency becomes increasingly important. Such an assessment can be conducted at the level of business models, as analyzing an enterprise through its business model enables a broad and structured consideration of key aspects of both its external and internal activities, while also systematizing approaches to doing business.

The concept of a "business model has become widespread in both academic research and practice, largely owing to the work of Osterwalder and Pigneur (2017). Contemporary scholars continue to actively develop this concept. For example, Ruda and Todoshchuk (2024) summarize e-commerce business models in Ukraine, while Zybarev et al. (2025) systematize interpretations of the essence of business models. Nagara (2023) substantiates the mechanisms of business model transformation under the influence of digital technologies and increasing instability, whereas Kononov (2025) identifies the features of business model formation based on digital marketing technologies. Studies by international researchers are also devoted to innovative business models. In particular, Snihur and Markman (2023) systematize the evolution of business models through innovation under the influence of competitive dynamics and sustainable development concepts.

However, the issue of assessing the effectiveness of business models across specific groups of enterprises or sectors of the economy remains insufficiently explored. Among Ukrainian scholars, the work of Shostak et al. (2025) is noteworthy, as it generalizes approaches to business model evaluation, including both quantitative and qualitative methods, as well as approaches to identifying and describing business models. The study by Shulga and Omelenchuk (2022), which focuses on business models in the banking sector, is also important; the authors cluster banks according to their business models and evaluate each cluster. Leppänen et al. (2021), based on an analysis of 169 companies, examine the relationship between business model novelty and enterprise performance, concluding that novelty influences performance only in combination with other factors. Zhang (2024), based on a review of 445 scholarly publications, identifies key components of successful business models: novelty, efficiency, sustainability, scalability, and value co-creation.

Therefore, the issue of evaluating the effectiveness of business models of retail enterprises (REs) is highly relevant under current conditions. It is important to generalize and systematize scientific developments related to theoretical, methodological, and practical approaches to assessing business effectiveness and efficiency. Since a business model represents a set of structural elements and the system of relationships among them, its evaluation should be based on a comprehensive approach to ensure meaningful and reliable results.

Methodological approaches to business evaluation can be broadly classified into three groups: quantitative, qualitative, and mixed. Due to advances in digital technologies and artificial intelligence (AI), many qualitative approaches have evolved into mixed ones, as certain qualitative indicators are increasingly being quantified. At the same time, quantitative approaches can be divided into two main categories: evaluation based on key performance indicators (KPIs) and evaluation based on composite (integral) indicators. Both approaches have established their respective roles over decades of theoretical development and practical application. However, since the evaluation of enterprises through the prism of business models remains methodologically underdeveloped, it is advisable to critically examine each approach.

The aim of the research is to develop a methodological approach to evaluating the effectiveness of business models of trade enterprises based on a comprehensive analysis and generalization of quantitative and qualitative methods for assessing enterprise performance.

It is hypothesized that the use of KPI systems in combination with qualitative analysis provides a comprehensive and management-oriented assessment of the effectiveness of trade enterprise (TE) business models, compared to the use of composite indicators, which are unable to provide sufficiently complete results for managerial decision-making.

The methodological basis of the study includes general scientific methods such as analysis and synthesis, induction, and deduction, used to generalize theoretical approaches to assessing the effectiveness of TE business models. Methods of systematization, comparative analysis, and scientific generalization are employed to analyze the literature. Statistical and comparative methods are applied to examine the dynamics and structure of financial and economic indicators of TEs in Ukraine in the context of B2B and B2C business models.

The assessment of business model effectiveness is carried out using ratio analysis of key performance indicators in combination with qualitative evaluation of performance outcomes. The main body of the article consists of four sections. The first section examines quantitative approaches to assessing business effectiveness and efficiency, while the second focuses on qualitative approaches, with particular attention to those widely applied in practice. The third section presents a dynamic analysis of the effectiveness and efficiency of B2B and B2C business models in Ukraine based on statistical data. The fourth section proposes theoretical and methodological approaches to evaluating business model effectiveness in the trade sector.

1. Quantitative approaches to evaluating business models: comprehensive indicator vs. KPI system

In foreign academic and educational literature, the approach to the comprehensive assessment of enterprise performance based on groups of indicators began gaining popularity in the mid-20th century. The most influential approaches, developed in the 1990s, have achieved widespread practical application and remain relevant today.

Performance Measurement System (PM). A significant contribution to the development of enterprise evaluation systems based on indicators was made by the British scholar Neely, whose work synthesized the results of many years of research conducted by a group of British scientists (Neely, 2002). Performance Measurement is defined as a comprehensive system for evaluating enterprise effectiveness, ensuring alignment among financial, operational, and strategic dimensions. This approach goes beyond purely accounting functions and involves the use of indicators as tools for management, control, and strategic feedback. A key feature of Performance Measurement systems is their multidimensionality, which allows for the consideration of different time horizons and sources of value creation. This enhances the adaptability of evaluation systems to the specifics of an enterprise’s business model and increases their practical relevance in performance management.

KPI System (Key Performance Indicators). The emergence of the concept of a KPI system does not have a clearly defined origin in the literature; however, its modern interpretation is primarily associated with Parmenter (2007), who developed the idea of linking enterprise goals with key results. Since then, KPIs have become widely used in both theory and practice. The KPI system is based on the principle of multidimensional performance measurement, according to which enterprise success cannot be adequately captured by a single aggregate indicator. Within this framework, each indicator serves a specific analytical function and reflects a particular aspect of the implementation of a strategy, business model, or business process. A fundamental advantage of KPI systems is their managerial orientation: indicators not only record performance outcomes but also function as tools for monitoring, control, and decision-making adjustment. It is useful to distinguish between key performance indicators (KPIs) and key result indicators (KRIs). KPIs typically reflect the efficiency of operational or functional processes and are predominantly short-term and tactical in nature. In contrast, KRIs focus on evaluating the achievement of strategic outcomes and reflect the aggregated results of business model or strategy implementation.

The Balanced Scorecard (BSC) system was developed in 1992 by D. Norton and R. Kaplan. It evaluates enterprise performance across four perspectives: financial, customer, internal processes, and learning and growth. Kaplan (2009) traces the 17-year evolution of the Balanced Scorecard from a performance measurement tool to a comprehensive strategic management system integrating financial and non-financial indicators. He emphasizes the growing importance of intangible assets, the need for long-term strategic objectives, and the value of a multidimensional performance assessment system. A central element in the evolution of the BSC is the introduction of strategy maps, which formalize cause-and-effect relationships among investments, internal processes, customer value propositions, and financial outcomes. Thus, the BSC has evolved from a set of independent metrics into an integrated KPI system aligned with enterprise strategy.

The practical effectiveness of the BSC is confirmed in the study by Madsen and Stenheim (2015), which synthesizes over 20 years of research on the Balanced Scorecard. The authors highlight that the BSC has significantly expanded both conceptually and in terms of application. Today, it increasingly functions not as a "pure" measurement tool but as a hybrid system for performance management and strategy implementation. The effectiveness of BSC implementation depends largely on the appropriate selection of indicators and the establishment of meaningful relationships among them and with strategic objectives.

The described systems of enterprise performance evaluation should not be viewed as mutually exclusive but rather as complementary. Performance Measurement represents a general conceptual framework encompassing the principles, approaches, and methods of evaluating performance. It defines what should be measured and for what purpose, but does not prescribe specific indicators or tools.

The KPI/KRI system is an applied instrument of Performance Measurement that enables multidimensional assessment through the selection and use of specific indicators without requiring a rigid strategic architecture.

The Balanced Scorecard, in turn, is a formalized management system that integrates Performance Measurement and KPI/KRI systems into a unified, strategy-oriented framework. Its distinctive features include clearly defined perspectives, explicit cause-and-effect relationships among indicators, and a strong focus on strategy implementation rather than merely performance measurement.

Contemporary academic and practical research on indicator systems primarily focuses on their application in specific fields and areas of activity (Ghahremani-Nahr & Nozari, 2021; Gorobets, 2025; Dipura & Soediantono, 2022; Shaleva, 2024), as well as on improving KPI systems in the digital economy (Setiawan & Purba, 2020; Mulissa & Abdul-Kader, 2025). Ukrainian scholars Tsalko and Nevmerzhytska (2019) identify the most common KPI groups as financial performance, business processes, customer activity, and personnel management. Semenenko (2023) emphasizes the role of KPIs in performance evaluation and outlines the stages of their implementation. Shumilo et al. (2024) also describe implementation stages and provide a list of widely used business indicators.

In contrast to indicator-based systems, composite (integral) indicators are widely used in enterprise evaluation. The most well-known include bankruptcy prediction models (e.g., the Tereshchenko model, 2025), competitiveness indices (e.g., global indices), and indicators of financial and economic condition (Andrenko et al., 2023; Mykhaylik, 2023). In Ukraine, integral indicators are also used to assess creditworthiness and investment attractiveness (Cabinet of Ministers of Ukraine, 2016; Ministry of Finance of Ukraine, 2016). Andrenko et al. (2023) classify methods of integral assessment into expert evaluation methods, multidimensional statistical analysis (which underpins many popular models), and data mining techniques. The development of artificial intelligence (AI) significantly contributes to the expansion of economic and statistical integral models for business evaluation and data-driven decision-making. However, such models are not always necessary for practical management purposes.

Both foreign and domestic studies widely use integral indicators for ranking, benchmarking, and forecasting. However, their applicability in operational management is limited due to the loss of analytical detail. Making management decisions regarding business model changes based solely on an integral indicator requires decomposing it to identify the strengths and weaknesses of individual components, which calls into question the practicality of its use.

In our view, when evaluating the effectiveness of business models of retail enterprises, it is advisable to apply Performance Measurement and KPI/KRI systems without necessarily implementing the full Balanced Scorecard architecture. Avoiding the aggregation of indicators into a single composite index prevents the loss of information about internal cause-and-effect relationships, enables evaluation at the level of individual business processes and responsibility centers, and allows the assessment system to be adapted to the specific characteristics of retail business models.

2. Qualitative approaches to evaluating the effectiveness of business models

Among the methodological approaches primarily aimed at qualitative assessment and used to analyze an enterprise's business model, the SWOT analysis should be highlighted first. It is traditionally regarded as a strategic planning tool in business. SWOT analysis enables the evaluation of both the internal and external environments of a company, which is critical for developing an effective business strategy. It helps organizations formulate strategies by identifying key internal and external factors that influence the achievement of business objectives. This provides a foundation for analyzing competitiveness and preparing for potential challenges in the business environment. The assessment of these factors supports informed decision-making and facilitates the adaptation of strategies to changing market conditions. However, SWOT analysis is largely a preliminary diagnostic tool on the basis of which a company develops or adjusts the design of its business model.

PESTLE analysis, as an extended and more structured form of environmental analysis, focuses on the external environment, particularly market conditions, but does not include an assessment of the company's internal processes.

Another tool applicable to the qualitative assessment of an enterprise's business model is the Accountability Scorecard (ASC), first introduced in 2000. It is designed to achieve a balance of interests between the enterprise and its stakeholders by analyzing the interrelationships among them (Rich, 2013).

The Gap Analysis Model is an important component of effective business management, as it provides a systematic basis for identifying and addressing discrepancies between the current state of an organization and its desired future state. This comprehensive approach considers various factors, including market trends, customer needs, internal capabilities, and the competitive environment. By comparing the current position with desired outcomes, the model identifies gaps across different dimensions of activity, such as product and service offerings, operational efficiency, customer satisfaction, and employee competencies. Its structured nature enables organizations to objectively evaluate their performance and identify specific areas requiring improvement. As a result, managerial efforts can be more effectively directed toward closing these gaps and achieving strategic objectives (Gupta, 2020, p. 2954).

Summarizing the analysis of qualitative methodological approaches, it can be concluded that most of them perform an auxiliary or preparatory role in assessing an enterprise's business model. SWOT and PESTLE analyses should be viewed as diagnostic tools for evaluating the external and internal environment, providing an information base for designing or adjusting business models rather than directly assessing their effectiveness. The Accountability Scorecard (ASC), in turn, emphasizes the balance of stakeholder interests, which is important from a corporate governance perspective but does not directly evaluate business model performance. Accordingly, the most appropriate qualitative tool to combine with key performance indicator systems is the Gap Analysis Model, as it provides a logical transition from measuring current results to identifying strategic and operational gaps between the actual and desired states of a business model. Therefore, integrating KPI systems with Gap Analysis makes it possible not only to assess the effectiveness of a trade enterprise's business model but also to identify directions for its further improvement.

The proposed approaches to evaluating the effectiveness of trade enterprise (TE) business models require further empirical validation using available statistical data. At the macro level, official statistics allow analysis of trade enterprise performance only in aggregated terms, distinguishing between wholesale (B2B) and retail (B2C) models. Given the significant differences in business operations, revenue structures, and value creation mechanisms between these models, further analysis focuses on the dynamics of selected statistical indicators (KPIs) for wholesale and retail trade in Ukraine. The results obtained form an empirical basis for developing a system for assessing the effectiveness of trade enterprise business models.

3. Analysis of key indicators of Ukrainian retail business models

To assess the effectiveness of trade enterprise (TE) business models, it is essential to examine the current state of the trade sector as a whole, taking into account the dynamics of macroeconomic indicators, changes in the regulatory environment, and the division of trade into two main categories based on business models–wholesale (B2B) and retail (B2C). A comprehensive analysis of the current state of the trade sector in Ukraine is necessary both for a scientific understanding of the relationships and processes that drive the prevalence of specific business models and for the development of improved trade business models that are aligned with contemporary conditions.

Trade accounts for more than one-third of total economic turnover in Ukraine, and its share has remained relatively stable over the past six years. Specifically, the share of wholesale and retail trade in the total volume of goods and services sold in Ukraine fluctuated between 36% and 38% during the period 2019–2024. The structural dynamics of TE sales are presented in *Figure 1*.

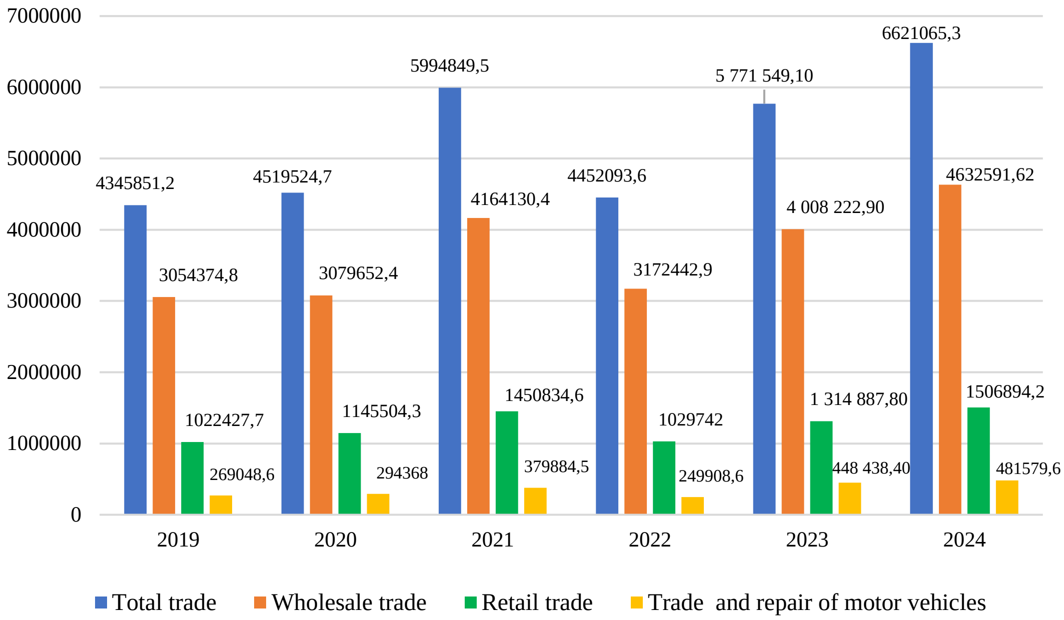
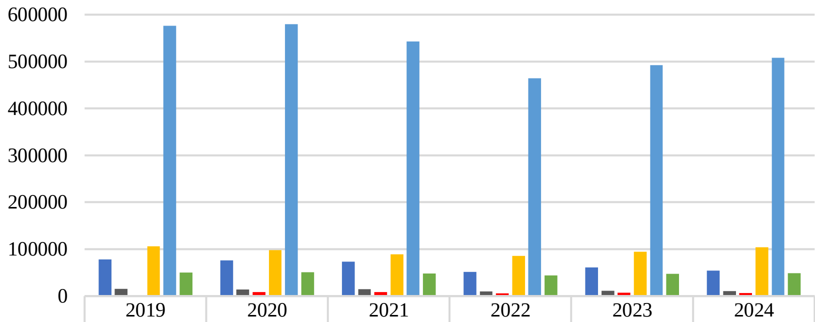


Figure 1. Structural trends in the volume of products sold by retail enterprises, 2019–2024, in millions of hryvnias

Source: Compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

As shown in *Figure 1*, the volume of sales in the wholesale and retail trade sector in 2023 increased by 32.81% compared to the base year 2019, and by a further 12.6% in 2024. In 2022, this indicator declined significantly, falling back to approximately the 2019 level. Prior to the outbreak of full-scale hostilities, trade in Ukraine demonstrated a relatively rapid recovery following the COVID-19 crisis, as evidenced by the 2021 data. Although the full-scale war slowed the growth dynamics of the trade sector, by 2024 the volume of goods and services sold reached its highest level over the entire period under analysis. Thus, in 2022, the volume of sales in the wholesale and retail sector declined to nearly the 2020 level. Nevertheless, a positive aspect is that businesses were able to adapt to crisis conditions: by 2024, sales volumes had increased by 48.7% compared to 2022 and by 14.7% compared to 2019. It should also be noted that the growth rate in 2023 exceeded that of 2024. The slowdown in 2024 may be attributed to negative expectations among businesses and the population regarding the duration and outcome of the war, the migration of Ukrainians abroad, and other war-related factors. An analysis of the dynamics of wholesale and retail trade separately does not reveal significant structural imbalances. Their growth patterns are largely similar and correspond to broader market trends, including declines in 2020 and 2022, rapid growth in 2023, followed by a slowdown.

The structure of the trade sector is dominated by wholesale trade, whose share fluctuated between 68% and 71% over the period under study, while retail trade accounted for approximately 22–26%. The remaining share (5–7%) consists of wholesale and retail trade in motor vehicles. In particular, enterprises operating in the B2B segment account for significantly higher sales volumes than those operating under the B2C model. This pattern persists both during crisis periods and in phases of economic recovery (*Figure 2*).



	2019	2020	2021	2022	2023	2024
Number of B2B enterprises	78003	76253	73715	51289	61132	53960
Number of B2C enterprises	15188	13717	14824	9931	11259	10623
Number of motor vehicle enterprises	0	8399	8499	6175	7186	6847
Number of B2B Sole Proprietorships	106040	97653	89320	85427	94857	103849
Number of B2C sole proprietorships	576641	579547	542622	464523	492467	508156
Number of Motor Vehicle Sole Proprietorships	50051	50560	48439	43813	47643	49097

Figure 2. Structural dynamics of the number of business entities in trade for 2019–2024

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

The data presented in Figure 2 indicate that over the analyzed period (2019–2024), the number of enterprises steadily declined, except in 2023, when a post-shock recovery was observed. Overall, over the six years, the number of enterprises decreased by 29.6%, or nearly 30 thousand. This decline was primarily driven by a reduction in the number of wholesale trade enterprises, which decreased by approximately 24 thousand units during the period under study. The share of trade enterprises (TEs) in the total number of enterprises remained relatively stable throughout 2019–2024, fluctuating within the range of 25–26%.

The reduction in the number of business entities can be attributed to several factors. These include increased competition, leading to the market exit of less competitive and less efficient firms, as well as the displacement of small and medium-sized enterprises by larger retail chains and facilities. While the COVID-19 pandemic had a limited negative impact, the decisive factors behind the decline were armed aggression, territorial occupation, and heightened security risks. However, in 2023, a revival of business activity was observed, with the number of trade enterprises increasing by 18.01%.

At the same time, the positive dynamics in the number of sole proprietors in the trade sector, which began in 2023, have been characterized by relatively slow growth. This is due to the high number of business closures compared to the registration of new sole proprietors. The share of sole proprietors in the trade sector remains higher than that of private enterprises, reaching 39.7% in 2024, although this represents a decrease of 7.9 percentage points compared to 2019.

Unlike corporate enterprises, the majority of sole proprietors operate in retail trade. Their share remained relatively stable over the analyzed period, accounting for 77–80% of the total number of sole proprietors in the trade sector. This indicates a clear preference for the B2C business model among individual entrepreneurs. The number of sole proprietors engaged in the trade and repair of motor vehicles is somewhat lower than the number of enterprises operating in these activities; however, their overall share within this segment is similar for both enterprises and sole proprietors.

In terms of business model effectiveness, the trade sector as a whole remains profitable, as evidenced by the data presented in *Figure 3*.

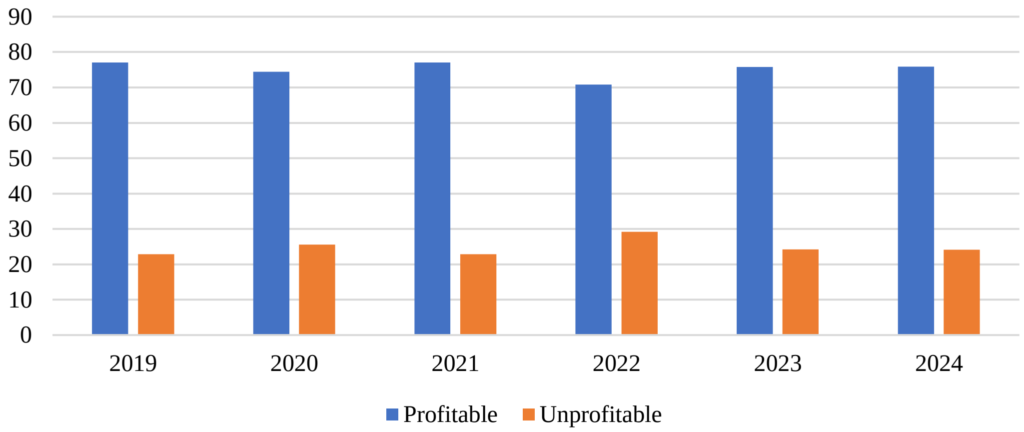


Figure 3. Share of profitable and unprofitable wholesale and retail trade enterprises in Ukraine for 2019–2024, %

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

The trade sector has demonstrated considerable resilience over the past six years, with the share of profitable enterprises consistently exceeding 70%. Even in 2022, this indicator remained higher than the national average for Ukraine (66.1%). Despite the downturns observed during the crises of 2020 and 2022, the sector has shown a strong capacity for rapid recovery. In particular, profitability increased significantly in 2021 compared to 2020, and in 2023 it rose by a further 5 percentage points. This trend reflects the existence of internal reserves for business growth, which have been supported, among other factors, by state preferential lending programs. A detailed statistical analysis of the efficiency parameters of the relevant business models is presented in *Tables 1–3*.

Table 1

Dynamics of operating and overall profitability of enterprises, %

Type of activity	Profitability of enterprises	2019	2020	2021	2022	2023	2024
Total Ukraine	Operating	10.2	6.2	12.6	3.3	8	5.7
	General	7.6	0.9	10.1	–3.2	4.5	5.8
Total trade	Operating	25.3	16.2	17.9	17.2	29.1	26.3
	General	16.4	3.6	14.8	3.1	15.2	13.7
Wholesale	Operating	27.9	17.5	17.3	18	35	31.5
	General	18.2	4.3	16.3	3.3	17.2	15.5
Retail	Operating	16.8	12.9	14.6	11	13.2	12.1
	General	11	0.8	8	–1.6	6	4.9
Trade and repair of motor vehicles	Operating	39.8	19.2	44.9	47.8	68.8	64
	General	20.9	9.1	31.8	29.9	46	47.1

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

As shown in *Table 1*, the profitability of trade enterprises throughout the analyzed period, across all trade business models, is higher than that of enterprises in Ukraine overall. At the same time, in the fields of wholesale trade and the trade and repair of motor vehicles, this difference is quite significant. Over the six-year period, a decline in profitability was observed in 2020 and 2022, coinciding with the COVID-19 pandemic and the onset of the full-scale invasion. Thus, in the crisis year of 2020, very low financial performance became characteristic of trade enterprises (TEs), which led to reduced overall profitability. However, starting from 2021, the situation improved, with increases in both overall and operating profitability. Notably, the decline in profitability in 2022 in certain sectors was less pronounced than in 2020. The overall operating profitability of trade in 2022 was 17.2%, compared to 16.2% in 2020. It should also be noted that, unlike the profitability of all activities, operating profitability did not exhibit a sharp decline in either 2020 or 2022. In 2020, this indicator decreased by 9.06 percentage points (p.p.), or approximately 36%. By comparison, the profitability of all activities declined by 12.87 p.p., or about 78.5%. The rapid recovery of the trade sector after the COVID-19 pandemic indicates its high adaptability and efficiency.

The operating profitability of motor vehicle trade and repair in 2022 nearly doubled compared to 2020. The war, which significantly increased both the volume of purchases and the demand for vehicle repairs, had a positive effect on the efficiency of business models in this sector.

During the analyzed period, 2019 was the most profitable year for trade enterprises; however, by 2024, B2B enterprises in motor vehicle trade and wholesale trade exceeded 2019 levels in terms of operating profitability. The profitability of the B2C model, although higher than the national average, lagged significantly behind other trade business models and trade overall. This trend is rather atypical and requires further research.

Based on the aggregated statistical data, it is possible to calculate the key performance indicators (KPIs) of wholesale and retail enterprises in Ukraine separately.

Table 2

Dynamics of KPIs for B2B trade enterprises for 2019–2024

Metrics	2019	2020	2021	2022	2023	2024
Turnover, UAH million	3 054 375	3 079 652	4 164 130	3 172 443	4 008 223	4 632 592
Net profit, UAH million	81 840	20 349	87 047	19 229	99 953	103 068
Non-current assets (NCA), UAH million	227 351	225 256	253 667	260 495	266 514	312 384
Current asset turnover ratio	1 713 158	1 863 903	2 039 005	2 134 271	2 442 442	2 841 526
Current assets (CA), UAH million	1 661 202	1 774 311	1 905 054	1 984 434	2 186 958	2 424 549
Current liabilities (CL), UAH million	138 701	183 127	258 634	259 905	357 938	422 153
Equity (E), UAH million	1.03	1.05	1.07	1.08	1.12	1.17
Current ratio	1.57	1.47	1.82	1.32	1.48	1.47
Current Asset Turnover Ratio	1.78	1.65	2.04	1.49	1.64	1.63
Net Working Capital (NWC), UAH million	–88 650	–42 133	4 967	–590	91 424	109 769
Working Capital (WC - Payables), UAH million	51 956	89 592	133 951	149 836	255 485	416 977
Return on Working Capital, %	59.0	11.1	33.7	7.4	27.9	24.4
Return on Assets, %	4.22	0.97	3.80	0.80	3.69	3.27
Return on Sales, %	2.68	0.66	2.09	0.61	2.49	2.22
Financial Leverage (Assets/NWC)	14.00	11.41	8.87	9.22	7.57	7.47

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

The operating profitability of the motor vehicle trade and repair almost doubled in 2022 compared to 2020. The war, which significantly increased both the volume of purchases and the demand for car repairs, had a positive impact on improving the efficiency of business models in this sector. During the analyzed period, 2019 was the most profitable year for PT. However, in 2024, B2B enterprises in the motor vehicle trade exceeded the 2019 level in terms of operating profitability. Although the profitability of the B2C model surpassed the overall average profitability in Ukraine, it significantly lagged behind other trade business models and the trade sector overall. This trend is quite atypical and requires further research.

Based on the aggregated statistical data, it is possible to calculate the key integrated KPIs for wholesale and retail enterprises in Ukraine separately.

Table 3

Trends in KPIs for B2C retail companies for 2019–2024

Metrics	2019	2020	2021	2022	2023	2024
Total Revenue, UAH million	1 022 428	1 145 504	1 450 835	1 029 742	1 314 888	1 506 894
Net Profit, UAH million	19 378	1 569	17 786	-3 977	17 573	17 457
Non-current Assets (NCA), UAH million	102 898	125 602	120 489	150 411	164 602	180 310
Current Assets, UAH million	346 123	334 132	380 118	393 940	485 287	519 728
Current Liabilities, UAH million	331 730	325 759	377 084	387 546	473 026	517 242
Equity (E), UAH million	24 985	21 103	13 458	31 673	54 307	59 816
Current Ratio	1.04	1.03	1.01	1.02	1.03	1.00
Asset Turnover Ratio	2.28	2.49	2.90	1.89	2.02	2.15
Current asset turnover ratio	2.95	3.43	3.82	2.61	2.71	2.90
Net working capital (NWC – NA)	–77 914	–104 499	–107 031	–118 737	–110 295	–120 493
Working capital (WC – CL)	14 393	8 373	3 034	6 394	12 261	2 485
Return on equity (ROE), %	77.6	7.4	132.2	–12.6	32.4	29.2
Return on assets (ROA), %	4.31	0.34	3.55	–0.73	2.70	2.49
Return on sales (ROS), %	1.90	0.14	1.23	–0.39	1.34	1.16
Financial leverage (A/NWC)	17.98	21.79	37.20	17.19	11.97	11.70

Source: calculated by the authors based on data from the State Statistics Service of Ukraine (n. d.).

An analysis of the dynamics of key financial indicators of B2C trade enterprises for 2019–2024 indicates a high dependence of retail trade on changes in consumer demand and overall macroeconomic instability. These dynamics reflect the sensitivity of the B2C model to crisis phenomena and fluctuations in household income. At the same time, in 2023–2024, a recovery in profitability can be observed; however, the level of profitability remains below pre-crisis values. The asset structure of B2C trade enterprises is characterized by a relatively higher share of non-current assets compared to B2B enterprises, which is explained by the need to maintain retail space, equipment, and infrastructure. Current assets have grown at an accelerated pace since 2022, reflecting the recovery of inventories and working capital amid a revival in consumer demand.

The current liquidity ratio throughout the period remains close to the minimum acceptable threshold (1.00–1.04), indicating a limited solvency margin. A consistently negative value of own working capital, combined with a positive but low level of net working capital, suggests a moderate yet controlled dependence of B2C enterprises on liabilities. Indicators of asset turnover and current asset turnover in the B2C segment exceed those of B2B trade, confirming a higher intensity of resource utilization in retail.

Financial leverage in B2C trade remained extremely high in 2019–2021, indicating a significant level of financial risk. Its subsequent decline in 2023–2024 is associated with growth in equity; however, the overall level of debt burden remains substantial.

An essential element of the business model of trade enterprises is the structure of resource provision, which determines both the potential for scaling operations and the level of financial risk. A generalized analysis of financing sources among Ukrainian trade enterprises indicates the persistent dominance of current liabilities in the capital structure. This is a characteristic feature of the national business financing model and explains the low liquidity ratios and negative values of own working capital observed in both B2B and B2C segments. At the same time, in 2023–2024, a positive trend toward a gradual increase in the share of equity and a reduction in dependence on current liabilities–primarily accounts payable–is observed, particularly in B2B trade.

Overall, the results confirm that the effectiveness of the B2B trade business model is determined not so much by absolute financial results–which exhibit more stable dynamics compared to B2C–but by the ability to maintain liquidity, turnover, and a manageable capital structure under conditions of high external instability. The B2C business model is characterized by a higher asset turnover ratio compared to the B2B segment, but is less efficient in terms of profitability. High volatility of financial results and a strong dependence on short-term liabilities contribute to increased financial vulnerability of the B2C model. In contrast, B2B trade, despite a high reliance on borrowed resources, demonstrates a gradual increase in equity, indicating potentially greater financial stability of this business model in the medium term.

The conducted assessment of the effectiveness of PT business models, based on a system of key performance indicators combined with qualitative analysis, provides a multidimensional view of business model performance and makes it possible to identify the specific features of its individual components, which are clearly revealed in the comparison of B2B and B2C models.

This approach makes it possible to determine the sources of the achieved level of effectiveness in terms of turnover, profitability, and financial stability, which is fundamentally important for effective business model management.

Reducing the assessment of business model effectiveness to a single integral indicator is methodologically limited, as aggregation obscures differences between individual components.

4. Methodological approaches to developing a KPI system for evaluating the effectiveness of business models in the retail sector

The results of the analysis of statistical indicators of the development of wholesale (B2B) and retail (B2C) trade in Ukraine reveal the heterogeneity of dynamics across key performance parameters, which confirms the limitations of using a single integral indicator to assess business model effectiveness. Based on these findings, as well as the theoretical approaches substantiated in the previous sections, there is a need to develop a methodology that accounts for the specifics of different business models and enables interpretation of results oriented toward improving management quality.

To develop methodological approaches to assessing the effectiveness of PT business models–based on a combination of key performance indicators and the qualitative identification of strategic and operational gaps–it is necessary to complement the evaluation methodology with additional theoretical components. In particular, alongside the methods outlined above, a set of evaluation principles is proposed as the foundation for a system for assessing the effectiveness of trade enterprise business models.

These principles include:

- The principle of business model alignment, according to which the selection of key performance indicators is carried out concerning the logic of value creation in wholesale (B2B) and retail (B2C) trade. This prevents the use of universal indicators that fail to capture the real differences between models.
- The principle of relevance, which implies the use of indicators that can be directly interpreted in the decision-making process. Within this framework, the evaluation system is focused not only on measuring performance but also on identifying problem areas and opportunities to improve business model efficiency.
- The principle of completeness, implemented through the integration of a KPI system with the GAP analysis model. This combination enables comparison of actual results with target benchmarks and facilitates the identification of strategic and operational gaps in business model performance.
- The principle of dynamism, which involves assessing business model effectiveness over time rather than at a single point. This allows for consideration of changes in the external environment, stages of the business model life cycle, and the outcomes of management decisions implemented in previous periods.

The implementation of these principles establishes a methodological foundation for developing a comprehensive system for assessing the effectiveness of trade enterprise business models, capable of providing a holistic view of their functioning.

Conclusions

Managing a company through its business model corresponds to modern requirements and allows for the formation of a systemic view of operational and other processes, as well as the company's internal and external relationships. Effective management should be based on measuring the business performance of the company's business model implementation, which necessitates the development of an appropriate methodological approach. The extensive methodological toolkit for assessing company performance, developed by economic theory and practice, should also be applied to business models, taking into account their conceptual and structural characteristics. The study has demonstrated that integral indicators–whose essence lies in the mathematical aggregation of multiple indicators into a single value–do not meet the requirements of a comprehensive and multidimensional assessment and, therefore, should not be applied at the business model level.

It is advisable to assess the effectiveness of a trading enterprise's business model using the Performance Measurement approach, which serves as a methodological framework and conceptual foundation for comprehensive evaluation. This approach should be implemented through a system of key performance indicators without reduction to a single integral index, thereby allowing for the consideration of the specific features of wholesale (B2B) and retail (B2C) models. The obtained results confirm the hypothesis that the proposed evaluation system should rely on a limited set of indicators that directly reflect business model performance and are relevant for managerial decision-making. Industry-level indicators derived from statistical data may serve as KPI benchmarks at the level of an individual enterprise.

To complement the quantitative assessment and enhance the practical value of the results, it is advisable to apply GAP analysis models, which enable the identification of areas for improving the business model by comparing actual KPI values with target benchmarks.

The proposed approach involves combining a system of key performance indicators with a qualitative interpretation of results. This makes it possible to assess the effectiveness of a trading enterprise's business model while taking into account the specifics of its individual components and providing practical guidance for managerial decision-making.

The authors see prospects for further research in deepening the methodology for assessing business model effectiveness, particularly through the application of modern information tools and artificial intelligence technologies.

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RENTAL VALUE DRIVERS IN RETAIL REAL ESTATE DEVELOPMENT

Ongoing transformations in the retail real estate market, structural shifts in consumer behavior, and economic and security challenges necessitate a rethinking of approaches to retail real estate development. In the context of intensifying competition, the digitalization of trade, and constrained investment resources, improving the economic efficiency of development decisions and the decisions of retail market participants has become especially important. The research is based on the hypothesis that there is a statistically significant relationship between rental rates for retail properties and a set of macroeconomic and market factors. The aim of the research is to identify and quantify the impact of key external factors on the formation of rental rates in the retail real estate segment. The methodology includes theoretical generalization, systems analysis, comparison, and abstraction, as well as statistical data-processing methods and economic-mathematical modeling. The empirical basis of the study comprises analytical materials from consulting companies, statistical data, and publicly available market reviews. The article analyzes the current state of Ukraine's retail real estate

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ЦІНОУТВОРЕННЯ У ДЕВЕЛОПМЕНТІ ТОРГОВЕЛЬНОЇ НЕРУХОМОСТІ

Сучасні трансформації ринку торговельної нерухомості, структурні зрушення у споживчій поведінці, економічні та безпекові виклики зумовлюють необхідність переосмислення підходів до девелопменту в ритейлі. В умовах посилення конкуренції, цифровізації торгівлі та обмеженості інвестиційних ресурсів особливої актуальності набуває проблематика підвищення економічної ефективності девелоперських рішень та рішень суб'єктів ринку роздрібної торгівлі. Дослідження ґрунтується на гіпотезі про наявність статистично значущого зв'язку між рівнем орендної плати за об'єкти торговельної нерухомості та певною сукупністю макроекономічних і ринкових чинників. Метою статті є виявлення та кількісна оцінка впливу ключових факторів зовнішнього середовища на формування орендних ставок у сегменті торговельної нерухомості. Використано методи теоретичного узагальнення, системного аналізу, порівняння та абстрагування, а також статистичні методи обробки даних і економіко-математичне моделювання. Інформаційною базою дослідження слугували аналітичні матеріали консалтингових компаній, статистичні дані та відкриті ринкові *market, taking into account regional disparities, the influence of security factors, investment constraints, and the transformation of consumer demand. The research demonstrates that retail real estate development is a system-forming factor in rent formation, as it integrates spatial, investment, and management decisions with market conditions. The modeling was carried out using the Kyiv retail real estate market as a case study, as it is the most information-rich and representative segment of the national market. The regression analysis reveals a significant effect of inflation, unemployment, the NBU policy rate, and retail space vacancy on rental dynamics. The findings may be used by developers, investors, and public authorities to forecast changes in rental values and improve the soundness of decisions in the field of retail real estate development.*

Keywords: development, retail real estate, rental value, retail, security risks, econometric modeling.

огляди. Проаналізовано сучасний стан ринку торговельної нерухомості України з урахуванням регіональних диспропорцій, впливу безпекових чинників, інвестиційних обмежень та трансформації споживчого попиту. Визначено, що девелопмент торговельної нерухомості є системоутворюючим чинником формування орендних ставок, оскільки інтегрує просторові, інвестиційні та управлінські рішення з кон'юнктурою ринку. Моделювання виконано на прикладі ринку торговельної нерухомості Києва як найбільш інформаційно забезпеченого та репрезентативного сегмента національного ринку. За результатами регресійного аналізу встановлено значущий вплив інфляції, рівня безробіття, облікової ставки НБУ та вакантності торговельних площ на динаміку орендних ставок. Отримані результати можуть бути використані девелоперами, інвесторами та органами управління для прогнозування змін орендної вартості та підвищення обґрунтованості рішень у сфері розвитку торговельної нерухомості.

Ключові слова: девелопмент, торговельна нерухомість, вартість оренди, ритейл, безпекові ризики, економетричне моделювання.

JEL Classification: R33, C10, L81.

Introduction

The retail sector occupies a prominent place in the structure of Ukraine's national economy, demonstrating the resilience of consumer demand under various exogenous conditions. The material and spatial basis for retail activity is real estate, which enables the functioning of different formats of retail and wholesale trade. Retail real estate reflects the current state of development of the retail sector and actively shapes the conditions for its operation. In particular, the type, location, architectural and planning solutions, and level of infrastructure support of retail properties directly affect consumer behavior, purchasing priorities, visit frequency, and length of stay. The parameters of retail real estate shape retailers' demand for retail space, determine the choice of retail formats, and influence assortment policy and service organization.

The main objective of retail development is to maximize project profitability through rental income and an increase in market value. The economic efficiency of retail market participants depends significantly on the characteristics of commercial real estate, the development of which determines the spatial, functional, and qualitative parameters of retail activity. At the same time, the business performance of retail operators depends on development decisions, the investment attractiveness of properties, and the potential for growth in their market value.

For developers, rental income is the main source of return on investment; therefore, an error in forecasting rent can turn a profitable project into a loss-making one. Accordingly, a comprehensive analysis of the factors affecting commercial real estate rents provides the basis for sound management and investment decisions that contribute to maximizing asset capitalization and ensuring strategic resilience amid macroeconomic fluctuations.

The high level of scholarly interest in commercial real estate development is reflected in a substantial body of fundamental and applied research by both domestic and foreign scholars devoted to market conditions and pricing factors. A review of recent studies shows that existing scientific and analytical work is largely generalized and focused on the real estate market as a whole or on commercial real estate broadly, without differentiation by specific property categories.

A systematic analysis of real estate development strategies, emphasizing the role of comprehensive planning, transport accessibility, and functional diversification in improving project efficiency, was presented by Alwee and Gamal (2024). The authors note that the economic efficiency of development projects is largely determined by the degree of integration of spatial, transport, and functional solutions.

Dobrovolska and Fenenko (2024) examine the real estate market in Ukraine and forecast its development using the Brown-Mayer method with Statgraphics software. In particular, they identify critical external factors influencing changes in demand and real estate prices and note that during the war, there was a reorientation of demand toward the rental of commercial premises, primarily warehouses, due to population migration and business relocation to safer regions of the country.

Valuation expert Simonova (2024, April 26) analyzed the impact of the full-scale invasion of Ukraine by the russian federation and identified its long-term consequences for the economy and the real estate market. The author emphasizes the need to assess losses associated with destroyed and damaged real estate in accordance with the International Valuation Standards and the RICS Valuation – Global Standards (Red Book Global Standards). This area of research is also relevant for development companies that have suffered not only direct material losses but also lost profits and increased financing needs for the restoration of property damaged as a result of armed aggression.

Kobzan and Pomortseva’s study (2021) provides a solid basis for understanding the transformation of the Ukrainian real estate market, combining a strong theoretical framework with a practical analysis of market conditions. The authors examine the state of the real estate market before major global and local shocks, including the COVID-19 pandemic and the pre-war period, demonstrating the relationship between the construction industry and the real estate market. They also consider structural problems that have accumulated in Ukrainian development over the years, as well as the logic of price formation in the primary market. In a later study, Kobzan and Pomortseva (2023) provide a systematic overview of the domestic real estate market as of 2023 and examine the impact of geopolitical factors and the full-scale war on market structure. Special attention is paid to valuation methodology during periods of crisis; price indicators and changes in demand and supply are analyzed, along with the implementation of modern technologies such as GIS and PropTech for market monitoring and analysis, which are critical for industry transparency.

Retail real estate analytics are also provided by market experts. In particular, Neposedov (2024, May 20) notes that the Ukrainian commercial real estate market changed dramatically across all segments in 2019–2021 and has continued to transform during the war. The active development of retail trade in previous years led to market saturation with retail space; therefore, against the backdrop of declining consumer sentiment, attendance became more dispersed, vacancy increased, and rental rates declined. According to the author’s analysis, a tenant-driven market for retail real estate has emerged in Ukraine, while operators are slowing expansion, refusing investments, reducing renovation costs, and transferring risks to developers.

International experience in forming developers’ competitive advantages through the lens of sustainable development is also reflected in the work of Chinese researchers, who view the real estate sector as a strategic foundation of the national economy of the People’s Republic of China and focus on the determinants of the competitiveness of large firms in the industry. Using structural equation modeling (SEM), the authors identify key internal influencing factors and demonstrate that the long-term sustainability and market advantages of modern development companies directly depend on the integration of sustainable development principles into their business models (Li et al., 2021).

A review of the available information base, ranging from academic research to industry analytics produced by leading consulting companies, reveals a high degree of abstraction. This underscores the need to move from general conceptual provisions to specific factor analysis focused on the applied aspects of the issue under study.

The research hypothesis is that, under martial law, the traditional mechanism of commercial real estate rent formation is transformed: the dominant influence of macroeconomic and market factors is supplemented by a critical security-risk factor, which, through migration processes and changes in consumer behavior, differentiates rental rates according to regional location and the extent to which a property’s development concept can ensure business continuity.

The aim of the article is to identify and quantify the impact of key environmental factors on the formation of rental rates in the commercial real estate segment.

The study addresses the following tasks: to examine the features of commercial real estate development in Ukraine under martial law; to establish the presence and nature of the relationship between commercial real estate rents and macroeconomic, market, and security factors; and to use the results for forecasting commercial real estate rents and for supporting management and investment decision-making by market participants.

The research methodology is based on theoretical generalization and systems analysis; statistical methods of data collection, processing, and grouping to study trends in the retail real estate market; comparison, analysis, and synthesis to provide a comparative characterization of key indicators of Ukraine’s retail real estate market by region; regression analysis to assess the impact of factors on retail real estate rents; and induction, deduction, and interpretation to formulate the study’s conclusions.

The empirical basis of the research is the official statistical and macroeconomic data of the State Statistics Service, the National Bank of Ukraine, the Ministry of Finance of Ukraine, as well as analytical reports of the Ukrainian Council of Shopping Centers (UCSC) and consulting companies (Colliers, CBRE, PwC, JLL).

The main body of the article consists of two sections. The first describes the directions of transformation in retail real estate development in Ukraine under martial law and reveals the asymmetry of market development and substantial regional differentiation in its key indicators. The second section examines the influence of macroeconomic factors (inflation, the NBU policy rate, GDP, and unemployment), market factors (vacancy rate), and security risks on the rental value of retail properties.

Confirmation of the hypothesis is important for increasing the efficiency of domestic development, especially during the war period, which requires the creation of objects with high adaptability to offset the negative pressure of macroeconomic and security factors on rent. The results obtained can be used to forecast rental rates for commercial real estate and form management decisions by market participants.

1. The transformation of retail real estate development in Ukraine amid military threats and security risks

The specific features of retail real estate development in Ukraine are primarily associated with security risks. The relative safety of the western and central regions of Ukraine, as well as population growth there due to migration, has increased retailers’ interest in regional expansion. Kyiv retains its position as the most stable and liquid market, especially in the premium retail real estate segment, where the vacancy rate is minimal and rental rates are rising.

Before the war, the sector demonstrated steady growth focused on large shopping and entertainment centers in major cities. With the onset of the full-scale invasion by the russian federation, however, demand declined, and activity shifted toward the safer western regions. Despite the wartime challenges, in 2022, new small-format shopping centers with a total leasable area of 51 thousand m2 were opened in the western part of the country. Rental prices in Ukraine fell by an average of 30–40% in the first months of the war compared with pre-war levels, which was reflected in the retail well-being index (RWBI), an indicator that integrates shopping center footfall, vacancy rates, and rental rates. RWBI declined sharply in February–March 2022 to 16.7, but by September of the same year, it had risen to 28.3 (Interfax-Ukraine, 2022, November 7).

According to analysts at CBRE Ukraine and their representative EXPANDIA (Expandia, 2025, March 31), the total volume of competitive shopping center supply in the capital has remained at approximately 1.59 million m^2 in recent years. In total, nine new shopping centers and one additional phase of a previously built center opened in Ukraine in 2025. The total retail area commissioned in 2025 amounted to 161 thousand m^2. Several small retail facilities that do not qualify as shopping centers under the international classification were also commissioned (UCSC, 2025, December 23; UCSC, 2026).

An analysis of the retail real estate market in Ukraine's capital showed that consumer demand and shopping center attendance were positively affected by macroeconomic changes in 2023, including slowing inflation and growth in real GDP. Demand increased, the growth of the consumer price index slowed by 21.1 percentage points, and RWBI reached 29.5 points. The average market vacancy rate showed a downward trend, reaching 15% (–2 percentage points) in 2023. Rental rates in Kyiv for the best spaces (100–200 m^2) in prime locations reached USD 40–65/m^2 per month, an average increase of 8% since the beginning of the year. Rental rates for other facilities increased by an average of 10% and ranged from USD 15 to USD 33/m^2 per month. Retail property owners began returning to fixed rental rates, while turnover-linked rent became less common (CBRE, 2024b). During 2023, the overall trend of active retail expansion in the western regions of Ukraine, primarily by large chain food retailers, continued. A key reason for the steady recovery in consumer demand was large-scale internal migration.

In 2024, the Ukrainian retail real estate market showed signs of recovery amid increased consumer activity, stronger retailer confidence, and the gradual return of international brands. According to UCSC, RWBI reached 29.8 points (+0.3 percentage points), the highest level since the beginning of the war. The frequency of offline shopping recovered (+8% compared with 2023), supporting retailer demand and encouraging businesses to move away from cautious expansion strategies (Deloitte, 2024, March 13).

In Kyiv, by the end of 2024, rental rates for typical shopping gallery units with an area of 100–200 m^2 in prime facilities ranged from USD 40 to USD 70/m^2 per month (+8% since the beginning of the year), while in other facilities, particularly district-format shopping centers, they ranged from

USD 18 to USD 38/m^2 per month (+15% YTD). Owing to growing interest in prime locations, vacancy in prime shopping centers decreased significantly to 14% (–3 percentage points YTD), while district-format shopping centers maintained a consistently low technical vacancy rate of 2–3%. Occupancy improved across most shopping centers in Kyiv against the backdrop of strengthening market fundamentals. Average vacancy rates declined to 12% YTD because of active demand and the lack of new supply (CBRE, 2025).

Rental rates for retail real estate continued to recover and approach pre-war levels in 2025. In prime retail locations in Kyiv, rates reached USD 40–70/m² per month for typical gallery units with an area of 100–200 m², while in other facilities they ranged from USD 18 to USD 38/m^2 per month. The average rental rate increased to USD 17/m^2, which was 30% higher than in the previous year. Vacancy in shopping centers remained elevated, reaching up to 12.9% in January–June 2025 compared with 13.1% at the end of 2024 (Interfax-Ukraine, 2025, November 4).

Table 1 presents a comparison of key indicators of the commercial real estate market across the regions of Ukraine in 2025. The indicators are presented as ranges and estimates based on analytical market reviews.

Table 1

A Comparative analysis of key indicators of Ukraine's retail real estate market by regions in 2025

Indicator	Ukraine (national level)	Kyiv city	Western regions	Eastern regions
Vacancy rate, %	12–13 (district shopping centers – 6–6.5)	10.5–12 (premium shopping centers – 2–3)	Low with a tendency to decrease	High due to security risks
Rent rate, USD/m² per month	22–24 (areas 50–200 m²)	40–70 (premium), 18–40 (other formats)	15–22 (high street retail), up to 60 (central locations)	3–6
Change in average rental rates, % compared to 2024	10–18	20–30	8–12; in retail hubs up to 25	–15 … –35
New supply of retail space, m²	161 000	11 500	Over 50,000 (partially introduced, partially postponed)	Minimal
Footage, people / 1000 m² GLA	380–400	On average national level	High, especially in regional centers	Reduced

Source: compiled by the authors based on (CBRE, 2024a CBRE, 2024b CBRE, 2025; Colliers, 2025; Nastych, 2025, August 14; PwC & Urban Land Institute, 2025; UCSC, 2025, December 23; UCSC, 2026).

It is projected that the intensification of competition and the moderate pace of post-war recovery in consumer demand will lead to deep differentiation between innovative retail real estate assets and outdated formats. This trend will heighten the need for strategic reconceptualization of existing shopping centers, while retail businesses will be forced to focus on developing comprehensive omnichannel models of consumer interaction (Trubei et al., 2023; JLL, 2025).

Thus, the Ukrainian retail real estate market is characterized by significant regional differentiation driven by a combination of economic and security factors. At the national level, a relatively stable, though elevated, vacancy rate is observed alongside a moderate increase in rental rates. Kyiv retains its status as a key center of retail development, with minimal vacancy in prime properties and the highest rental rates. The western regions remain drivers of regional development due to migration processes, the concentration of business activity, and growing consumer demand. Low rates and high vacancy in the eastern regions constrain development activity and create pent-up demand. These trends point to the asymmetric development of Ukraine's retail real estate market and to the growing role of development and location factors in shaping the economic efficiency of retail market participants.

Conducting a quantitative assessment of the impact of macroeconomic and market parameters on the cost of rent allows us to specify the identified trends and determine the extent of the influence of key environmental factors on the economic results of the operation of retail facilities.

2. Assessment of the impact of key factors on the rental value of retail properties

2.1. Regression analysis of the impact of the policy rate and retail vacancy on rental rates

Analyzing the factors that affect rent is fundamental to retail development. In this area, a forecasting error of 10–15% in the rental rate can turn a profitable project into a loss-making one already at the design stage. In addition, development determines the conceptual content of retail facilities, including the balance between anchor and small tenants, as well as the presence of entertainment, service, and public functions, all of which create a synergistic effect and increase footfall. These factors contribute to tenants' turnover growth, enabling developers and property owners to set higher rental rates or apply combined rental models, in particular, a fixed rate plus a percentage of turnover.

Macroeconomic factors such as inflation, the policy rate, GDP, and unemployment, as well as vacancy rates and security risks, to a certain extent, determine both tenants' (retailers') financial capacity and landlords' strategies. To build the economic-mathematical model, a time series of indicators was constructed based on officially published data: inflation and unemployment rates (State Statistics Service of Ukraine, n. d.), the policy rate and currency indicators (National Bank of Ukraine, n. d.), and gross domestic product indicators (Ministry of Finance of Ukraine, n. d.).

It is advisable to model the influence of factors on rental rates using the Kyiv retail real estate market as an example because of both informational and structural limitations at the national level. The analysis of data on premium retail properties in the capital's shopping centers is supported by the completeness, transparency, regularity, and analytical coverage of consulting company reports.

In addition, under martial law, regional retail real estate markets in Ukraine are developing extremely unevenly under the influence of security risks, migration processes, and significant differences in business activity. This complicates the formation of a representative national sample and may lead to statistical distortions in the modeling results. By contrast, Kyiv, as the country's largest consumer and business center, concentrates a substantial share of high-quality retail real estate, demonstrates the relative stability of market processes, and at the same time reflects the influence of key factors, which makes it a representative case for studying the mechanisms of rental-rate formation.

At the first stage of modeling, a multivariate logarithmic regression model was used in which the dependent variable, the logarithm of the rent level for retail real estate, and the independent variables, the NBU policy rate and the vacancy rate of retail space, were expressed in natural logarithms. This specification makes it possible to interpret the estimated parameters as elasticity coefficients reflecting the percentage change in rent in response to a percentage change in the relevant factors.

Model parameters were estimated using the Python programming language and specialized libraries for economic and mathematical modeling. In particular, the NumPy library was used for mathematical operations and logarithmic transformations of variables, Pandas for structuring and preprocessing empirical data, and Statsmodels for estimating the parameters of the regression model using the least-squares method.

A 14-year dataset covering the period from 2012 to 2025 was used for modeling, with statistics collected at six-month intervals. During the search for statistically significant relationships, an initial dataset of 14 observations, with one observation per year, was used. However, this limited number of observations did not allow statistically significant results to be obtained. Therefore, the dataset was expanded to 28 observations. As a result, a logarithmic regression model of the following form was obtained:

$$ln(rent) = 2.7409 - 0.3730 \cdot ln(nbur) - 0.2886 \cdot ln(vacancy) , \quad (1)$$

where: *rent* – retail property rental rate per 1 sq. m, USD;
nbur – NBU discount rate, %;
vacancy – retail vacancy rate, %.

The exponential form of the economic-mathematical model is as follows:

$$rent = e^{2.7409} \cdot nbur^{-0.3730} \cdot vacancy^{-0.2886} . \quad (2)$$

In logarithmic form, the coefficients for the independent variables reflect the elasticity of rents with respect to the relevant factors.

In exponential form, the model demonstrates the multiplicative nature of the influence of macroeconomic and market factors, where the discount rate and the vacancy rate of rental space have a restraining effect on the level of rents.

Negative values of the coefficients show that both an increase in the discount rate and an increase in the vacancy rate of rental space in Kyiv have a downward effect on rental rates.

The coefficient of determination, $R^2 = 0.567$, indicates that 56.7% of the variation in the logarithm of rents is explained by variation in the policy rate and the vacancy rate of retail space in Kyiv. The model coefficients and their significance are presented in *Table 2*.

Table 2

Coefficients of the logarithmic model and their significance

Variable	Coefficient	*P-value*	Interpretation
NBU discount rate, ln(nbur)	−0.3730	0.002	A 1% increase in the NBU refinancing rate reduces rent by approximately 0.37%
Vacancy rate of retail real estate in Kyiv, ln(vacancy)	−0.2886	0.011	A 1% increase in the vacancy level reduces rent by approximately 0.29%

Source: calculated by the authors based on the obtained model.

The statistical significance of the estimated coefficients for the variables nbur and vacancy is confirmed by comparing their p-values with the generally accepted significance level of 0.05. For the variable nbur, the p-value is 0.002, and for vacancy, it is 0.011, which is less than the critical value of 0.05. This allows us to confirm the influence of the selected factors on the level of rent within the sample.

The obtained coefficients of the model have an elastic interpretation. In particular, an increase in the discount rate by 1% leads to an average decrease in rent by approximately 0.37%, which reflects the sensitivity of the retail real estate market to changes in monetary policy and the cost of financial resources. At the same time, an increase in the vacancy rate of rental space by 1% leads to a decrease in rent by approximately 0.29%, which indicates the influence of market conditions and an imbalance between demand and supply. A comparative analysis of the coefficient values shows that the macroeconomic factor – the discount rate – has a greater impact on the formation of rental rates than the vacancy factor.

The modeling results indicate a statistically significant and economically justified negative impact of the NBU refinancing rate and the vacancy rate in shopping centers in Kyiv on rent costs. Higher levels of monetary tightening and an increase in the volume of vacant retail space are putting pressure on rental rates, with the impact of macroeconomic factors being greater than the impact of market conditions.

2.2. Modeling the dependence of rent on macroeconomic indicators of inflation and unemployment

At the second stage of modeling, a multivariate logarithmic regression model was applied in which the dependent variable is the logarithm of the rent level for commercial real estate, while some independent variables, in particular the inflation rate and the unemployment rate, are expressed in natural logarithms. This specification makes it possible to interpret the estimated coefficients as elasticities reflecting the percentage change in rent in response to percentage changes in macroeconomic factors. Logarithmic transformation also helps stabilize variance and provides a better approximation of nonlinear economic relationships. Model parameters were estimated using the Python programming language and specialized libraries for econometric analysis. A 14-year dataset covering the period from 2012 to 2025 was used, with statistics collected at six-month intervals, yielding a total of 28 observations. As a result of the calculations, a logarithmic regression model of the following form was obtained:

$$ln(rent) = 5.4402 - 2.1770 \cdot ln(inflation) + 0.4206 \cdot ln(unemp), \qquad (3)$$

where: *rent* – Rent for retail real estate per 1 sq. m., USD;
inflation – Inflation rate in the Ukrainian economy, %;
unemp – Unemployment rate, %.

The exponential form of the economic-mathematical model is as follows:

$$rent = e^{5.4402} \cdot inflation^{-2.1770} \cdot unemp^{0.4206}. \qquad (4)$$

In logarithmic form, the coefficients of the independent variables reflect the elasticity of rents with respect to the relevant factors. In exponential form, the model reflects the multiplicative impact of macroeconomic factors, where inflation and unemployment affect the level of rents differently.

The coefficient of determination $R^2 = 0.409$ indicates that approximately 40.9% of the variation in the logarithm of rents is explained by the variation in the level of inflation and unemployment.

The statistical significance of the model as a whole is confirmed by the value of the F-statistic (8.639) and the corresponding p-value of 0.00141, which is significantly less than the significance level of 0.05. This allows us to confirm the joint impact of the independent variables on rents and to conclude that the model is adequate for analyzing macroeconomic factors of rental rates. The model coefficients and their significance are shown in *Table 3*.

Table 3

Coefficients of the logarithmic model and their significance

Variable	Coefficient	*P-value*	Interpretation
Inflation rate, ln(inflation)	− 2.1770	0.009	A 1% increase in inflation reduces rents by an average of 2.18%
Unemployment rate, ln(unemp)	0.4206	0.002	A 1% increase in unemployment increases rents by an average of 0.42%

Source: calculated by the authors based on the model obtained.

The statistical significance of the estimated coefficients for the variables inflation and unemp is confirmed by comparing their p-values with the generally accepted significance level of 0.05. For inflation, the p-value is 0.009, and for unemp, it is 0.002, both of which are below the critical value of 0.05. This allows us to reject the null hypothesis that the selected factors do not affect rent and to conclude that they have a statistically significant effect within the sample.

The modeling results indicate a statistically significant impact of macroeconomic factors on rental rates. Inflation has a negative effect on rents, which is associated with a decline in tenants' real purchasing power and increased economic uncertainty. It should be noted that under martial law, the relationship between inflation and rent becomes distorted, and rental rates may decline even in periods of high inflation because of falling effective demand. This makes it advisable to assess the impact of the war factor separately.

The positive relationship between the unemployment rate and rental rates in Kyiv during 2012–2025 reflects the specific structural resilience of the capital's market. In the pre-war period, this relationship can be explained by the rapid growth of the city's service economy, where short-term fluctuations in unemployment did not restrain investment demand. During the war period (2022–2025), this effect intensified because of the concentration of solvent demand and relocated capital in Kyiv. The capital remained a priority market for retailers, which made it possible to maintain rental costs at a higher level than in other regions.

2.3. Econometric modeling of the impact of macroeconomic dynamics and security risks on rent

The third model is a semi-logarithmic regression model in which the dependent variable, the logarithm of the rent level, is modeled as a function of the logarithm of GDP and a binary variable reflecting the presence of martial law. This specification allows the coefficient on GDP to be interpreted as an elasticity and the coefficient on the martial-law variable as a percentage structural shift in the level of rent.

For modeling, a 14-year dataset covering the period from 2012 to 2025 was used, with statistics collected at six-month intervals, yielding a total of 28 observations. As a result of the calculations, a logarithmic regression model of the following form was obtained:

$$ln(rent) = 2.0159 + 0.5472 \cdot ln(gdp) - 0.5838 \cdot warcond, \qquad (5)$$

where: *rent* – retail real estate rental rate per 1 sq. m., USD;
gdp – Ukraine's gross domestic product, million USD;
warcond – Presence of martial law, binary variable, 0 or 1.

The exponential form of the economic-mathematical model is as follows:

$$rent = e^{2.0159} \cdot gdp^{\,0.5472} \cdot e^{-0.58380 \cdot warcond.} \qquad (6)$$

The coefficient on the logarithm of GDP has an elasticity interpretation: a 1% increase in GDP is associated with an approximately 0.55% increase in rent, all else being equal. The variable warcond captures a discrete effect: under martial law, rent decreases on average by 44.2% ($e^{-0.5838} - 1$), indicating a substantial negative structural impact of the war on the commercial real estate rental market.

The coefficient of determination $R^2 = 0.523$ indicates that about 52.3% of the variation in the logarithm of rent is explained by changes in GDP and the impact of war conditions. The statistical significance of the model as a whole is confirmed by the value of the F-statistic (13.73) and the corresponding p-value of $9.48 \cdot 10^{-5}$, which is significantly less than the significance level of 0.05. This allows us to confirm the joint influence of the independent variables on the logarithm of rent and indicates the adequacy of the model specification.

The statistical significance of the estimated coefficients for GDP and warcond is confirmed by comparing their p-values with the generally accepted significance level of 0.05. For GDP, the p-value is 0.004, and for warcond, it is 0.001, both below the critical value of 0.05. This allows us to reject the null hypothesis that the relevant factors do not affect rent and to conclude that their effects are statistically significant within the sample.

The positive coefficient on GDP indicates that economic growth is accompanied by higher rental rates, reflecting the beneficial effect of macroeconomic expansion on the rental market. At the same time, the negative coefficient on warcond indicates that martial law exerts a significant downward effect on rents, creating a negative structural effect on market functioning.

The constructed regression model confirms the hypothesis that the commercial real estate market depends significantly on both the general economic environment and the security situation. The commercial real estate rental market responds moderately to changes in GDP, while the statistically significant negative coefficient on warcond demonstrates the severe impact of the war, which caused structural changes in rent formation.

Conclusions

The research results confirm the hypothesis concerning the impact of military risks on rent, the formation mechanism of which has shifted from a purely economic model to a security-oriented one. The security factor has become critical because of changes in consumer demand, business relocation, and population migration. Under such conditions, properties with an adaptive development concept gain a competitive advantage and higher value because they help ensure business resilience to external threats.

Commercial real estate development is a fundamental pricing mechanism that synthesizes investment strategies, architectural and spatial parameters, and management models with the current balance of supply and demand. Commercial development determines the vector of rental-rate formation, acting as the point at which investment decisions, the physical characteristics of a property, and management methods converge within the market environment. Research into the factors influencing rent, therefore, provides the foundation for commercial development, as the accuracy of rent forecasting directly determines project profitability at the design stage.

The results of the economic-mathematical modeling make it possible to formulate conclusions regarding the factors influencing the commercial real estate market. The macroeconomic environment was found to have a stronger effect on rental-rate dynamics than market conditions. Inflation emerged as the most significant negative factor: a 1% increase in the consumer price index leads to a 2.18% decrease in rent because of declining purchasing power. The market also demonstrates an inverse relationship between rent, the NBU policy rate, and the vacancy rate. In particular, a 1% increase in the policy rate and a 1% increase in the share of vacant space lead to decreases in rent of 0.37% and 0.29%, respectively. A moderate positive elasticity of rental rates with respect to GDP was also identified: 1% economic growth generates a 0.55% increase in rates. A specific feature of the Kyiv market is the atypical positive relationship between the unemployment rate and rent. This can be explained by the capital's role as a key hub for capital flows and demand concentration, which modifies traditional crisis patterns. The introduction of martial law caused fundamental structural transformations that significantly changed the parameters governing the functioning of commercial real estate in Kyiv.

Research into the factors that determine rent formation is fundamental to retail development, as it helps minimize investment risks and ensure project profitability through quantitative forecasting of the market's response to macroeconomic fluctuations and security challenges. For retailers, the study provides a basis for optimizing operating costs and benefiting from the synergies of well-designed development even under unstable macro-economic conditions. Promising directions for further research include scaling the econometric analysis to the regional markets of Ukraine as security disparities diminish, as well as conducting a more detailed study of the influence of the conceptual synergy of retail facilities on the sustainability of rental income in the post-war period.

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