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C O N T E N T

GLOBAL ECONOMIC TRENDS

DIGITAL SPACE

ENTREPRENEURSHIP

З М І С Т

СВІТОВІ ЕКОНОМІЧНІ ТРЕНДИ

ЦИФРОВИЙ ПРОСТІР

ПІДПРИЄМНИЦТВО

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THE EUROPEAN UNION AND UKRAINE: IN SEARCH FOR A NEW ECONOMIC REALITY

A comprehensive analysis of the impact of contemporary geopolitical turbulence on the economy of the European Union and Ukraine has been conducted. In the context of increasing global instability, the escalation of russia's war against Ukraine, the transformation of energy markets, and the growing role of the USA as a geo-economic player, the depth and multidimensionality of challenges to macroeconomic stability, energy security, and the structural integrity of the European economic space are highlighted. The study is based on the hypothesis that the geopolitical turbulence of recent years has caused a significant but differentiated impact on the economy of the EU and Ukraine. The methodological basis of the research is formed by a systemic approach, comparative analysis, statistical methods for assessing macroeconomic and energy indicators, as well as structural-functional and cause-and-effect analysis. The dynamics of key macroeconomic indicators of the EU and Ukraine under the influence of foreign policy shocks are characterized. It has been established that geopolitical tension, disruptions in supply chains, sanctions policy,

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ЄВРОПЕЙСЬКИЙ СОЮЗ – УКРАЇНА: ПОШУКИ НОВОЇ РЕАЛЬНОСТІ

Проведено комплексний аналіз впливу сучасної геополітичної турбулентності на економіку Європейського Союзу та України. У контексті посилення глобальної нестабільності, ескалації війни росії проти України, трансформації енергетичних ринків і зростання ролі США як геоекономічного гравця висвітлено глибину та багатовимірність викликів для макроекономічної стабільності, енергетичної безпеки та структурної цілісності європейського економічного простору. Дослідження базується на гіпотезі, що геополітична турбулентність останніх років зумовила значний, але диференційований вплив на економіку ЄС та України. Методологічну базу дослідження формують системний підхід, порівняльний аналіз, статистичні методи оцінювання макроекономічних та енергетичних показників, а також структурно-функціональний і причинно-наслідковий аналіз. Охарактеризовано динаміку ключових макроекономічних показників ЄС і України під впливом зовнішньополітичних шоків. Встановлено, що геополітична напруга, порушення ланцюгів постачання, санкційна політика та

and armed aggression by the russian federation have become factors slowing economic growth in the EU and limiting the recovery of the Ukrainian economy. The main channels of the impact of geopolitical factors on the EU economy were studied: increased defence costs, higher inflationary pressure due to energy shocks, trade reorientation, reduced investment activity, and logistics destabilization. Attention is focused on the transformation of European energy markets. A separate emphasis is placed on the impact of the energy war on the Ukrainian economy, in particular on the damage to generating capacities, the growing dependence on electricity imports, and the decline in agricultural and industrial production. The role of external financial and humanitarian assistance in stabilizing the macro-financial situation is assessed. Practical steps for Ukraine's economic policy under ongoing risks are proposed – ranging from strengthening energy resilience to developing export-oriented clusters and adapting to new requirements for integration with the EU. It is also emphasized in the conclusion that the experience of 2022–2025 should become the basis for revising the economic strategy of Ukraine and the EU towards enhancing strategic autonomy, energy diversification, investments in infrastructure resilience, and rethinking interdependence models in the context of increasing geopolitical fragmentation.

Keywords: geopolitical turbulence, EU economy, Ukrainian economy, energy security, macroeconomic indicators, post-war recovery, sanctions, foreign policy, EU integration, economic resilience.

JEL Classification: F51, F52, F15, Q43, E66.

збройна агресія рф стали чинниками гальмування економічного зростання в ЄС та обмеженого відновлення української економіки. Досліджено основні канали впливу геополітичних факторів на економіку ЄС: зростання оборонних витрат, підвищення інфляційного тиску через енергетичні шоки, переорієнтацію торгівлі, зниження інвестиційної активності та дестабілізацію логістики. Зосереджено увагу на трансформації енергетичних ринків Європи. Окремий акцент зроблено на впливі енергетичної війни на економіку України, зокрема на пошкодженні генеруючих потужностей, зростанні залежності від імпорту електроенергії, зниженні аграрного та промислового виробництва. Оцінено роль зовнішньої фінансової та гуманітарної допомоги у стабілізації макрофінансової ситуації. Запропоновано практичні кроки економічної політики України в умовах триваючих ризиків – від зміцнення енергетичної стійкості до розвитку експортноорієнтованих кластерів та адаптації до нових вимог інтеграції з ЄС. Також у підсумку наголошено, що досвід 2022–2025 рр. має стати основою для перегляду економічної стратегії України та ЄС у напрямі посилення стратегічної автономії, енергетичної диверсифікації, інвестицій в інфраструктурну стійкість та переосмислення моделей взаємозалежності в умовах зростаючої геополітичної фрагментації.

Ключові слова: геополітична турбулентність, економіка ЄС, економіка України, енергетична безпека, макроекономічні показники, післявоєнне відновлення, санкції, зовнішня політика, інтеграція з ЄС, стійкість економіки.

Introduction

Modern global realities are characterized by a high level of geopolitical turbulence, which directly affects economic processes in the European Union (EU) and Ukraine. Russia's full-scale war against Ukraine, ongoing since 2022, has significantly impacted the region's economy, undermining Europe's post-pandemic recovery and creating new uncertainties regarding future development. An important negative factor has been Europe's proximity to the conflict zone. Thus, according to European Commission estimates, in 2022–2023, every 1.000 km reduction in distance to Ukraine/russia cost the EU countries about 2 percentage points of annual economic growth, while for countries bordering Ukraine, losses reached 1.4–1.8 percentage points of growth per year (European Economic Forecast – Autumn 2025, 2025). At the same time, the war caused a large-

scale inflationary shock in the EU, with inflation in 2022–2023 being 5.9 percentage points higher than expected, while in countries close to the conflict, annual inflation was 2.2–3.7 percentage points higher than the EU average. These facts confirm the relevance of studying the impact of geopolitical turbulence on macroeconomic stability in the European region.

In addition to the war in Ukraine, other geopolitical shifts also affect the EU economy and, indirectly, Ukraine. The world has entered a period of realignment of powers, which is manifested in the formation of new trade alliances, intensified competition for resources, and global trade being fragmented into blocs around the US and China. In particular, in recent years, the US has pursued an active trade policy by establishing new tariffs, industrial support through the Inflation Reduction Act (2022)[1], etc. This encourages Europe to respond with its own industrial initiatives aimed at maintaining competitiveness. At the same time, potential changes in US foreign policy add uncertainty. Thus, this year's discourse at the economic forum in Davos demonstrated a transformation of the security provision regime in the US–EU–Ukraine triangle: against the backdrop of increasing transactional nature and conditionality of American engagement, the European Union is institutionalizing a broader role as a co-guarantor of deterrence and resilience in Eastern Europe, which shifts EU–Ukraine relations from a predominantly integration-normative plane to a security-institutional one (Davos 2026, 2026, January 21). Such statements indicate risks of weakening transatlantic support, which could have serious consequences for both the security and the economy of Europe and Ukraine. Thus, this research is timely and necessary for understanding the extent of the impact of geopolitical factors on the economies of the EU and Ukraine and for developing appropriate response strategies.

Thus, the geopolitical turbulence that engulfed the Euro-Atlantic space as a result of russia's aggression against Ukraine and the intensification of global competition has created unprecedented challenges for the economies of the EU and Ukraine. Enhanced external shocks, such as war, sanctions, the energy crisis, and changes in the foreign policy of key players (the USA, China) disrupted established economic ties, caused a surge in inflation and a slowdown in economic growth, and forced a reassessment of priorities, particularly in favour of defence and energy security spending. The EU economy faced the threat of stagflation in 2022–2023: the sharp surge in energy and raw material prices was accompanied by a significant decline in production activity. At the same time, Ukraine has suffered colossal losses in production capacity and infrastructure, losing a significant share of GDP in 2022. In this regard, the question arises: to what extent and through which channels does geopolitical instability affect key macroeconomic indicators of the EU and Ukraine, and how can these countries adapt to the new realities?

[1] Inflation Reduction Act. – US Inflation Reduction Act

For the EU, this problem is concretized in finding a balance between the need to support Ukraine and applying sanctions pressure on the aggressor while at the same time maintaining its own economic stability. The war has brought the issue of Europe's energy security to the forefront, as the urgent abandonment of russian energy resources has led to the restructuring of gas supplies, accelerated transition to renewable energy sources, and the need to invest in energy infrastructure. EU policy has had to resolve the dilemma between short-term costs (high energy prices, support for households and businesses) and long-term benefits from increased energy independence. At the same time, Europe's security dependence on the position of the USA has increased, which, in the context of internal polarization in the USA and possible political changes, creates additional uncertainty for economic expectations in the EU.

Under these conditions, Ukraine faces a dual challenge: it is necessary both to wage a war by mobilizing internal resources and external assistance, and to maintain the functioning of the economy and the energy system. Ukraine's dependence on external financing of the deficit and support from partners for the restoration of energy infrastructure damaged by strikes remains critical. Therefore, the urgent question arises of minimizing the economic losses from the war and ensuring the foundation for post-war recovery already now, even under conditions of ongoing hostilities.

Thus, the central problem of the research is to identify the scale and mechanisms of the impact of geopolitical turbulence (primarily the war and related global shifts) on the economies of the EU and Ukraine, as well as to develop recommendations for Ukraine's response to new risks. Solving this problem has both scientific-theoretical and practical significance, as it will allow understanding the economic consequences of contemporary geopolitical processes and outline ways to strengthen economic resilience.

To date, the issue of the impact of geopolitical turbulence on the economy is actively researched by both foreign and Ukrainian scientists. In its autumn 2025 forecast, the European Commission noted that the EU economy has proven to be fairly resilient. Despite slow growth at the beginning of the 2020s, in 2025 all member states expect positive indicators, and the EU GDP growth in 2025–2026 is forecast at approximately 1.4%. At the same time, the Commission emphasizes that the "proximity" to russia's protracted war against Ukraine suppresses EU economic indicators, especially in countries geographically close to the conflict, and requires a consolidated strengthening of defence capability and financial support for Ukraine. Similar conclusions are confirmed by a special European Commission study on the impact of the war: the countries bordering Ukraine lost more than 1 percentage point of growth annually in 2022–2023, and their inflation exceeded the European average by several percentage points (European Economic Forecast – Autumn 2025, 2025). This indicates that EU scholars and analysts are aware of the high cost of geopolitical instability for the economy.

The study by European Parliament experts (Cinzia Alcidi, 2025) is dedicated to the development trajectories of EU–US economic relations, taking into account trade, investment, productivity, policy formation indicators, and risks for the EU. In another European Parliament work (Bottazzi et al., 2025), an assessment was carried out on how US trade restrictions (tariffs) can affect the Eurozone economy through trade, financial channels, and risk premiums. In this regard, the authors emphasize the importance of trade diversification, promotion of innovation, and prudent monetary policy to mitigate economic vulnerability and support long-term growth.

Experts at the Bruegel think tank, assessing the tariff shock in 2025, comprehensively analyse geopolitical shifts and economic consequences for Europe, including the sharp change in the US trade regime, and formulate three contrasting geopolitical scenarios for Europe for 2030–2035, which differ in two variables: the degree of intensity of geopolitical competition between the US and China and the ability of other major powers and smaller countries to organize international cooperation and institutions based on three rules: the collapse of international cooperation; return to a world of blocs; reimagined multilateral approach.

Among foreign researchers, it is also worth noting the IMF analysts. According to their assessments, the economic shock from the war, although significant, but in terms of direct macro effects for developed countries, it is less severe than the shocks of the pandemic era. Instead, emphasis is placed on long-term consequences, including structural changes in trade, energy, and security expenditures. The Vienna Institute for International Economic Studies (WIIW) (2025, October 22), in its forecast, emphasizes that the economies of Central and Eastern Europe generally maintain relative growth, but Ukraine remains in a state of a "war-stuck economy" with a growth forecast of only about 2% in 2025. WIIW experts note that the ever-increasing destruction of infrastructure from russian shelling and the shortage of labour due to mobilization and emigration significantly limit Ukraine’s economic prospects. They also warn about hybrid threats in the form of russia’s destabilization of neighbouring countries through the use of drones, cyberattacks, and sabotage, which undermines the investor confidence and can hinder the development of Eastern European economies.

Ukrainian scientists and analytical centres are also actively researching this topic. Since March 2022, the Centre for Economic Strategy (CES) has been regularly providing monthly reviews of the wartime economy. In the January 2026 publication, CES notes that in 2025 Ukraine’s real GDP grew by only 1.8% due to security risks, the loss of infrastructure and production capacities, electricity shortages, and labour force constraints. However, growth was supported by resilient demand (CES, 2026, January 16). At the same time, it was emphasized that the situation in the energy sector worsened in the fall of 2025 due to the resumption of russian attacks on infrastructure facilities, creating additional risks for further growth. Ukrainian experts are also discussing new funding opportunities: in particular, the idea of confiscating frozen russian assets. According to CES, the total amount of frozen russian

assets is about EUR 289.5 billion, of which 180 billion is in Belgium, and the EU is considering a mechanism to use these funds to help Ukraine (for example, a loan of EUR 140 billion euros secured by these assets). Although such an initiative could cover 2–3 years of Ukraine's military expenditures, discussions continue regarding the optimality of this way of defence financing.

Some recent works by Ukrainian authors (Ksenzuk et al., 2025; Pankovets & Shevchuk, 2024; Benedysiuk, 2025) are devoted to the study of sanctions as a means of foreign policy influence. Scholars note that international economic sanctions, imposed by many countries of the democratic world in order to force the russian federation to peace, although correct and coordinated and cause some economic losses to the country's economy, they are insufficient as a tool to achieve the set goal. The authors see the reason for this in the adaptation of the russian federation's economy to the sanctions regime, mainly due to the reorientation of foreign economic relations towards cooperation with Global South countries, "grey" imports, and insufficient pressure on the country's energy sector, which provides a significant share of its revenue. Moreover, the modern international security system has turned out to be not quite ready for new challenges, as it relies on instruments that demonstrate insufficient effectiveness under current conditions.

It is worth separately noting the contribution of Ukrainian economists to the strategic vision of post-war recovery. In the work of Gorodnichenko and Obstfeld (2026, 26 January), based on the experience of Eastern Europe, possible ways for Ukraine's rapid development after the war through integration into Europe's economic and security structures are substantiated. The authors point out that the combination of large-scale investments and the inflow of capital through private investments and EU funds, along with institutional reforms, can provide Ukraine with sustainable growth and convergence with the EU. Thus, recent scientific publications unanimously, on the one hand, note the negative effects of the impact of geopolitical shocks (war, hybrid threats, trade wars) on the economy, and on the other hand, open a discussion about new opportunities and necessary reforms for adaptation to new conditions.

The purpose of the study is to develop scientifically based recommendations for minimizing negative consequences and adapting Ukraine's economic policy to new challenges based on a comprehensive analysis of the impact of modern geopolitical turbulence on the economy of the European Union and Ukraine.

The hypothesis has been formulated that the geopolitical turbulence of recent years has caused a significant, but differentiated, impact on the economies of the EU and Ukraine. In particular, the EU economy, despite short-term slowdown and shocks, demonstrates adaptability and gradual recovery due to internal resilience and consolidated measures, whereas the Ukrainian economy has experienced a deeper decline and remains more vulnerable, but through business adaptation to wartime conditions and substantial external assistance also demonstrates relative resilience.

The methodological basis of the article consists of a systemic approach, methods of comparative, structural, and functional analysis, as well as statistical and analytical methods for evaluating macroeconomic and energy indicators. The study uses a comprehensive approach to examining the current state of the EU economy under conditions of geopolitical instability, transformations in European energy markets, as well as the impact of external shocks on the Ukraine's economy and its energy sector. To determine the most vulnerable areas and the degree of Ukraine's dependence on external support, methods of cause-and-effect, comparative, and situational analysis were applied. The justification of practical proposals regarding Ukraine's economic policy under conditions of military, energy, and financial risks has been carried out based on a forecasting approach, the generalization of analytical assessments, and the development of recommendations for short-term stabilization and long-term post-war recovery.

Structurally, the article consists of four sections. The first section analyses the current state of the EU economy in conditions of geopolitical instability. The second section is devoted to the characteristics of changes in the European energy markets. The third section examines the impact of external shocks on the economy of Ukraine and its energy sector, identifying the most vulnerable areas and the degree of dependence on external support. The fourth section is devoted to practical proposals for Ukraine's economic policy under ongoing risks (military, energy, financial), including short-term stabilization measures and long-term post-war recovery strategies.

1. The EU economy under the influence of US geopolitics

The geopolitical factor of the United States has a significant impact on the economic dynamics of the EU, both directly and indirectly. Trump's statements at this year's World Economic Forum in Davos clearly highlight a new trend in geopolitics – the combination of "transactional alliances" and coercive policy. This means that the American president is actively pushing Europe to the view that the economy and security are no longer separated: tariffs, energy policy, supply chains, and defence spending become elements of a single bargain, rather than a "neutral" economy. As a result, the trend in the EU towards strategic autonomy and the involvement of anti-coercion tools – from defence integration to trade levers – is strengthening.

The change in the EU's macroeconomic indicators over the past two years has been the result, on the one hand, of European shocks themselves, in particular the war in Ukraine and the energy crisis, and on the other hand, a reaction to the monetary, trade, and sanctions policies of the USA.

Financial conditions in Europe are influenced by the monetary policy of the United States. The aggressive increase in the Federal Reserve's interest rate during 2022–2023 (up to 4.5–5%) led to a global tightening of the cost of money. This caused the strengthening of the dollar against the euro and

the outflow of capital from emerging markets to safe assets in the USA. For the eurozone, this meant importing inflation due to the rising cost of raw material imports in US dollars and restraining its own economic growth through tighter financial conditions. The European Central Bank was also forced to raise rates, although with a lag, to curb record inflation (10% in the eurozone). However, by the middle of 2025, inflation in the EU was decreasing and approached the 2% target. According to the European Commission's forecast for 2025, it is noted that inflationary pressure is weakening and prices are gradually stabilizing. Thus, the impact of US monetary policy had a wave-like character, in particular, initially contributing to an increase in inflation and a slowdown in growth in the EU, but later, after the synchronized reaction of central banks, the situation evened out (*Figure 1*).

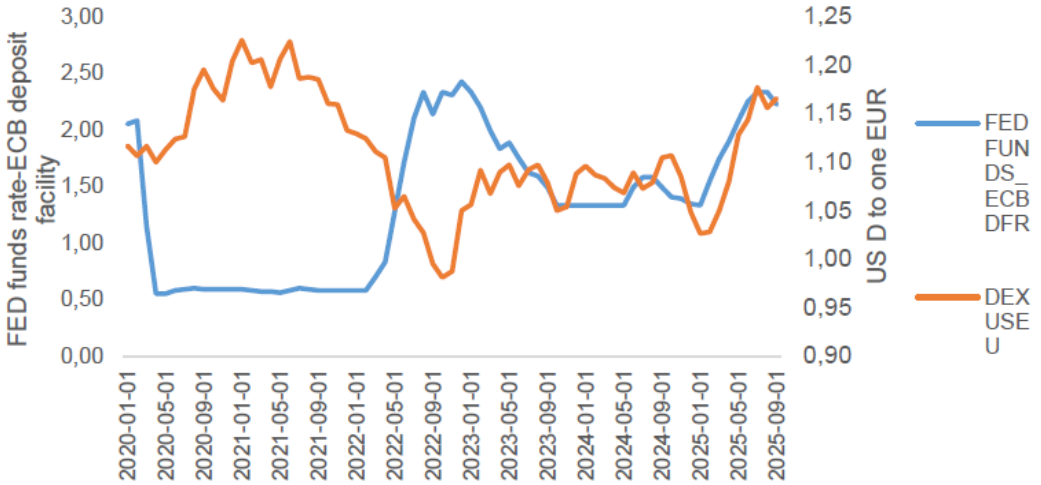

Figure 1. Differences in ECB and FED interest rates and the USD to EUR exchange rate, 2020–2025 (September)

Source: Federal Funds Effective Rate (n. d.).

According to the U.S. Bureau of Economic Analysis (BEA), U.S. exports of goods to Europe (the EU plus the Great Britain and Switzerland) are more than three times higher than U.S. exports to China (U.S. International Trade in Goods and Services December and Annual 2025, 2026). Forty-eight of the 50 U.S. states exported more goods to Europe than to China. Together, they account for nearly 30% of global trade in goods and services and 43% of global GDP. In 2024, transatlantic trade in goods and services exceeded EUR 1.68 trillion.

As shown in *Figure 2*, the USA and the EU are the two largest partners in trade in services in the world, the most important trading partners and service markets for each other. It should be noted that the USA consistently has a surplus in trade in services with the EU.

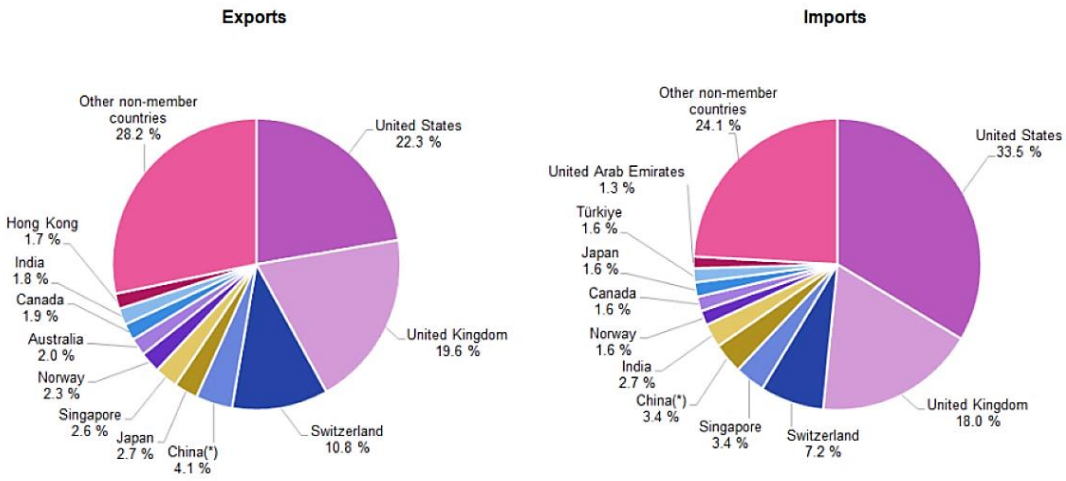

Figure. 2. Geographical structure
of EU service exports and imports, 2024

Source: compiled by the authors based on Eurostat data (International trade in services (since 2010), 2026, January 13).

The volume of trade in services between the EU and the US in 2024 amounted to approximately EUR 817 billion, of which EU imports of services were EUR 482 billion and exports EUR 334.5 billion, resulting in a US surplus of $148 billion. In contrast, the EU had a surplus of EUR 98 billion in trade in goods with the US, while in trade in services the deficit amounted to almost USD 148 billion (EU–US trade: facts and figures, 2026, January 22). In this regard, the economies of the EU and the US complement each other very well.

Since the beginning of the financial crisis, research and policy debates have increasingly shifted from transatlantic synchronization of cycles to growth differentials. Since approximately 2010, the USA has been systematically outpaced the EU in terms of nominal and real GDP growth (*Figure 3.1*). This marked a change from previous trends and reinforced the perception that the EU is losing ground compared to the US. However, this picture looks different when comparing GDP based on purchasing power parity (PPP) (*Figure 3.2*). The divergence between EU and US GDP, measured in current US dollars, and their close convergence by PPP, indicates differences in price levels, exchange rates, and domestic purchasing power, rather than actual output. Nominal GDP reflects relative market valuations and external competitiveness (for example, the growth of the US dollar exchange rate), whereas GDP adjusted for PPP reflects comparable real economic capabilities and living standards. When price differences are taken into account, the economies of the EU and the US have grown at roughly the same real rates over time.

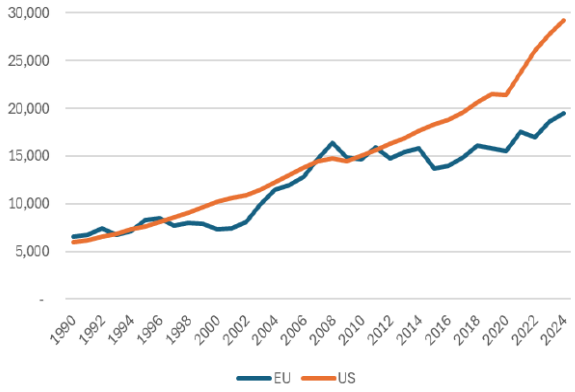

Figure 3.1. GDP of the EU and the USA at the current US dollar exchange rate, billion US dollars

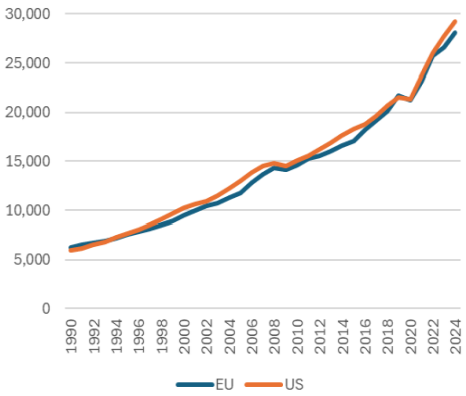

Figure 3.2. EU and USA GDP by PPP, billion US dollars

Source: World Bank (GDP (current US$) – United States, European Union, n. d.).

However, the gap in labour productivity persists, which is recognized as a key driving force behind the better performance of the USA (The future of European competitiveness: Report by Mario Draghi, n. d.). There are several explanations for this productivity gap between the EU and the USA, but two of them are most often identified as the main ones. First, EU markets (from capital markets to sectoral markets) remain fragmented compared to the USA, and regulatory differences are an obstacle to scaling up and spreading best practices, production and implementation of advanced technologies, as well as the effective allocation of capital and labour. Secondly, the United States quickly gained global leadership in the development and implementation of advanced digital technologies and productivity enhancement based on artificial intelligence, which has contributed to widening the gap with EU companies, especially in the high-tech and service sectors.

Regarding the US trade and industrial policy, it had a dual effect. On the one hand, the conclusion of a new trade agreement between the EU and the USA in the summer of 2025 reduced uncertainty in the trade sphere. This positively influenced the sentiment of European businesses, resulting in improved export targets, with some companies even increasing supplies to the US, especially against the backdrop of expectations of possible tariff disputes. In the first half of 2025, an upturn in EU exports was observed, partly due to frontloading – the early shipment of goods to the US ahead of potential new tariffs. As noted in the materials of the European Commission, this emphasizes the adaptability of the EU economy – businesses were able to quickly reorient themselves, which supported GDP in difficult times. On the other hand, the U.S. Inflation Reduction Act (2022), which provides large subsidies for the "green" industry in the U.S., has caused concern in the EU about the outflow of investments. In 2023–2024, some European companies (for example, in the automotive and chemical sectors) announced plans to expand production in North America, where conditions have become more

favourable. The EU responded by preparing its own initiatives – the Net-Zero Industry Act (Regulation (EU) 2024/1735, 2024, June13), the Critical Raw Materials Act (Regulation (EU) 2024/1252, 2024, April 11), and so on – to create similar incentives within the EU. Although this aspect relates more to structural policy, in the short term it affected investment sentiment, as governments of individual EU countries have expanded industrial support programs to retain investors, which, in turn, impacted fiscal balances.

The security component of U.S. policy towards Europe indirectly affects the EU economy through changes in defence spending and the investment climate. After the start of the war in Ukraine, the European allies sharply increased defence budgets (Germany, Poland, and other countries announced multibillion-dollar rearmament plans). In 2024–2025, NATO countries' defence spending in Europe reached record levels for the past decades. This stimulated the relevant sectors of the economy, especially the military-industrial complex and high-tech industries, which, by estimates, provided an additional approximately +0.2–0.3% to GDP growth in Eastern European countries (WIIW, 2025). At the same time, the uncertainty about the future position of the U.S. (due to Trump's political statements about NATO) made the EU countries consider accelerating the development of "strategic autonomy". Economically, this means a potential increase in investments in the domestic defence-industrial complex, cybersecurity, and energy infrastructure, which could reshape the structure of government budget expenditures. Moreover, despite political risks, the statements themselves from the U.S. could also encourage Europe to greater cohesion. For example, at the 2024 NATO summit, EU countries confirmed their course to fulfil the commitment of 2% of GDP for defence, partly as a response to doubts about the sustainability of overseas support.

Thus, the macroeconomic indicators of Europe in recent years indicate a complex interaction of factors. The EU's GDP, after zero growth in 2023, began to increase moderately. In the first quarter of 2025, the eurozone GDP increased by +0.4% compared to the same period, and over the year showed 1.5% growth (GDP up by 0.3% in both the euro area and the EU, 2026, January 30). Inflation decreased from double-digit values in 2022 to 3–4% in 2024 and reached the target level (2%) as of December 2025. The labour market remains strong – the unemployment rate in the EU is holding at a historically low level – 6% (even lower in some countries). However, due to ongoing uncertainty, business and consumer confidence is recovering more slowly – the PMI business sentiment indices at the beginning of 2026 were balanced around 50 points (between decline and growth) (HCOB Eurozone Composite PMI, 2026, January).

Thus, in 2022–2023, the EU was subjected to the impact of two external shocks: a monetary one, which was associated with a sharp increase in interest rates in the USA and other developed countries (primarily the US Federal Reserve) and led to capital outflows from Europe, increased currency exchange rate volatility, higher borrowing costs, and a general tightening of

financial conditions, risks to the banking system, and a slowdown in lending, as well as an energy-related one, caused by the cessation of gas and oil supplies from russia, resulting in a sharp increase in gas and electricity prices in the EU and household utility payments, losses or shutdowns of enterprises, and a rise in inflation, especially in the energy and food sectors. But already in 2024, the EU was able to adapt to them, implementing a new energy policy (REPowerEU, joint purchases and the Market Correction Mechanism (MCM) (European Commission, 2023, November 28); anti-crisis monetary coordination with the ECB; subsidies for businesses and households; structural changes in energy supply (transition to LNG, RES).

As Interfax-Ukraine expert Maksym Urakin summarizes, as of 2025, the global economy shows signs of a "multi-speed economy": the US is somewhat cooling down, Europe is moving onto a trajectory consistent with inflation targets, China's growth is 5%, India is leading (around 8%), and Turkey is experiencing high inflation (30%) (Urakin, 2026, January 31). For Ukraine, the expert notes, this means a new configuration of opportunities: cheap global money will not appear soon, but the "window" for investments in production relocation, energy, and the military-industrial complex is already open. This context confirms that Europe has adapted to the turbulence and remains capable of supporting Ukraine, although it is aware that global risks (including the US stance) will continue to affect the economic planning horizon for a long time.

2. Changes in the EU energy markets

The war in Ukraine has caused the largest shift in European energy markets since the beginning of the century. In the energy supply sector, by 2022 the EU was closely integrated with the russian federation – more than 40% of imported gas and significant shares of oil and coal came from russia. Exploiting this dependence, after its invasion, the russian federation began gas blackmail, sharply reducing pipeline supplies in the summer of 2022. As a result, Europe experienced an energy shock in the form of a rapid rise in natural gas prices (at the *TTF* hub they reached over 300 euros per MWh in August 2022, compared to the pre-crisis period of 20–30 euros). European governments have been forced to take extraordinary measures – from subsidizing consumer bills to seeking emergency alternative supplies of liquefied natural gas (*LNG*).

During 2022–2023, the European Union managed to achieve an almost revolutionary restructuring of gas supply. *Firstly*, gas consumption has been significantly reduced due to energy-saving measures and switching to other types of fuel. The total gas demand in the EU in 2022–2023 decreased by about 20% compared to the level in 2021. This became possible both due to warmer weather and lower consumption for heating, as well as temporary reductions in industrial production in energy-intensive sectors

(chemicals, metallurgy), partially offset by government programs. *Secondly*, import flows were reoriented through a sharp increase in *LNG* imports from the global market. Its main supplier became the United States – they accounted for up to 40% of LNG imports to Europe in 2022–2023, making the US effectively the new main gas supplier to the EU. Supplies from Qatar, Nigeria, Algeria, and other countries also increased. Regasification capacities were utilized: Germany built its first LNG terminals in record time, while other countries (France, the Netherlands, Poland) expanded theirs. Thirdly, the remainder of russian gas supplied via pipelines (through Ukraine and the "Turkish Stream") as well as in the form of LNG significantly decreased. According to Brookings, in 2023 Europe still received about 14.8% of its gas from russia (8.7% by pipelines, 6.1% LNG) – that is, less than one-fifth of total supply, compared to almost half before the war (Gross & Stelzenmüller, 2024). The European Commission reported that the share of russian gas in imports fell from 45% to 19%. Although in 2024 there was some deviation (the russian federation increased LNG exports to Europe, which some traders took advantage of), a clear strategic course was determined toward a complete refusal of russian energy resources by 2027. In May 2025, the EU approved the "Road Map", in particular committing to suspend new contracts for russian gas and completely eliminate its import by the end of 2027 (European Commission, 2025, May 12). Thus, the disconnection is not yet complete, as of November 2025, russian gas accounted for about 12% of total EU imports (7% – pipeline, the rest – LNG).

At the same time as diversifying supplies, Europe experienced an acceleration of the green transition. The energy crisis became a catalyst for massive investments in renewable energy sources and infrastructure. According to the World Economic Forum (WEF), as a result of the "energy shock" following the war, the share of renewable electricity in the EU increased from 38% to 47% of generation in just four years (World Economic Forum, 2026, January 12). This is an impressive increase, largely explained by the introduction of new wind and solar power capacities, as well as energy efficiency measures that have reduced fossil fuel consumption. Some regulatory barriers for the installation of renewable energy sources (RES) were removed, and permit issuance procedures were accelerated. For example, Spain, which suffered from droughts and high gas prices, added a record amount of solar power plants to the grid in 2023, while Germany simplified regulations for the construction of wind farms. Demand for solar panels and heat pumps in EU households has sharply increased due to high gas prices in 2022. This surge in investment in RES has not only contributed to achieving climate goals but is also considered as a matter of national security.

In addition to successes, there are also bottlenecks. The main problem has become the energy infrastructure, primarily the electricity grids. The rapid development of renewable sources has revealed the inadequacy of network capacity to integrate new volumes of electricity. In 2025, in Europe, incidents became more frequent where wind power generated in northern

Germany had to be curtailed due to grid overloads, while deficits arose in southern EU countries. Such "bottlenecks" increase costs and slow the further growth of the share of renewables (*Figure 4*). Investments in networks are currently lagging: although the EU is increasing expenditures (EUR 70 billion in network investments are expected in 2025, which is twice as much as ten years ago), it is still not enough to achieve the goals. Therefore, another priority is cross-border interconnectors and energy storage.

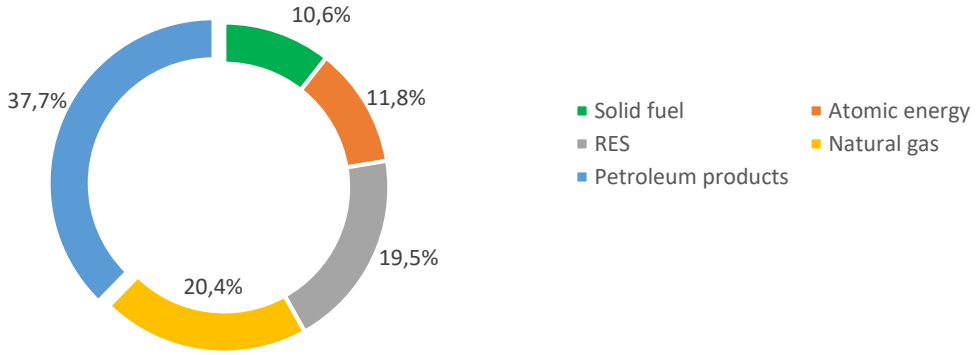

Figure 4. Energy consumption structure in the EU by sources, 2023

Source: compiled based on Eurostat data (Energy statistics – an overview, 2025, May).

From the perspective of energy security, 2024–2025 were relatively successful for the EU. Europe managed to get through the winter of 2022/2023 without gas outages, filling gas storage facilities to over 90% before the start of the heating season. The winter of 2023/2024 also passed more calmly, as prices fluctuated within the range of EUR 50–70 per MWh, which is several times lower than the peak values in 2022 (IEA, 2024). Another achievement is the mechanism for joint gas purchases and the EU Energy Platform, which allows EU countries to coordinate gas imports, preventing "price races" among themselves. Additionally, to avoid speculative jumps, cap prices for gas at European hubs have been introduced.

Thus, by the end of 2025, the EU energy market has significantly recovered and become more resilient to shocks. The strategic goal – a complete abandonment of russian energy resources – is already close to being achieved without excessive economic losses. On the contrary, the crisis has been turned into an opportunity: Europe has accelerated energy innovation, increased the share of clean energy, and strengthened transatlantic energy ties (through LNG imports from the USA). Challenges ahead include modernizing infrastructure and ensuring energy affordability, since although wholesale prices have decreased, consumer bills in 2023 were still higher than pre-war levels, negatively affecting industrial competitiveness. However, overall the EU has demonstrated that even under conditions when energy is used as a weapon (energy weaponization), coordinated and timely actions can protect the economy from destructive consequences.

3. The impact of external shocks on Ukraine's economy and energy sector

Signs of geopolitical turbulence, confirmed at the 2026 Davos Economic Forum, indicate that the "new reality" in EU–Ukraine relations goes beyond a purely integration track and increasingly acquires a security-institutional dimension. In particular, the European Union is gradually moving from the role of a primarily financial donor and sanctions actor to the function of a co-guarantor of regional security, carrying this out through the mobilization of resources, the development of the military-industrial complex, and political coordination amid the growing conditionality and transactional nature of American security involvement.

The Ukrainian economy suffered an unprecedented blow in scale as a result of military aggression. According to official data, Ukraine's real GDP in 2022 has decreased by more than 29%, almost by a third, which is the largest decline in the history of independent Ukraine and one of the sharpest economic downturns in the world in recent decades. The reasons are obvious: occupation and hostilities in part of the territory, destruction of productive capacities (factories, infrastructure), blockade of seaports (which before the war provided about 70% of foreign trade), and mass displacement of the population (both abroad and internally). The loss of control over part of the economically active regions (Donetsk, Luhansk, Kherson, Zaporizhzhia regions), which traditionally made a significant contribution to GDP (metal-lurgy, chemistry, engineering, agriculture sector), immediately affected the overall indicators.

Despite these extreme circumstances, the Ukrainian economy already showed signs of adaptation and growth in 2023. According to the State Statistics Service, in 2023, GDP increased by +5.5% compared to the catastrophic 2022 (State Statistics Service of Ukraine, 2025, March 31). Such recovery growth is explained by the low base effect (after a deep decline, even partial recovery results in a large percentage increase) and some revitalization of domestic economic activity: businesses and the population have adapted to life under wartime conditions. For example, in the central and western regions in 2023, new enterprises were actively developing, particularly due to the relocation of businesses from dangerous regions. Agriculture, after the failure of 2022, restored production volumes, although it faced difficulties in exports due to the blockade (alternative logistics routes were established – "solidarity routes" through the western border, Danube ports). Government spending, financed by international aid, supported consumer demand (payment of salaries, social expenditures, and pensions was carried out without significant delays). Inflation in Ukraine, which sharply rose to 26.6% in 2022, slowed down in 2023 (annual inflation was 12%, and by the end of 2023 – about 9.8%, according to official data). This became possible thanks to the strict monetary policy of the NBU (fixing the

hryvnia exchange rate in 2022–2023 and raising the discount rate to 25% per year), the stabilization of fuel prices, and international financial support, which helped finance critical imports.

In 2024, growth rates slowed down – over the year, Ukraine's GDP increased by only 2.9%. In fact, after a short-term upturn in 2023, the economy entered a phase of slow recovery. The reasons for this situation were: exhaustion of the easy recovery resource (many sectors have already recovered as much as possible under wartime conditions), as well as new shocks – in 2023, the grain export situation deteriorated after russia withdrew from the "grain agreement" in July, which reduced foreign currency inflows. In addition, while 2022–2023 were characterized by some macro-financial stabilization (thanks to international inflows), in 2024 the risks associated with delays in deficit financing increased (in the fall of 2024, the US temporarily suspended aid funding, which caused tension).

Thus, the sharp decline in GDP in 2022 due to the full-scale war was followed by a partial recovery in 2023–2025 (*Figure 5*).

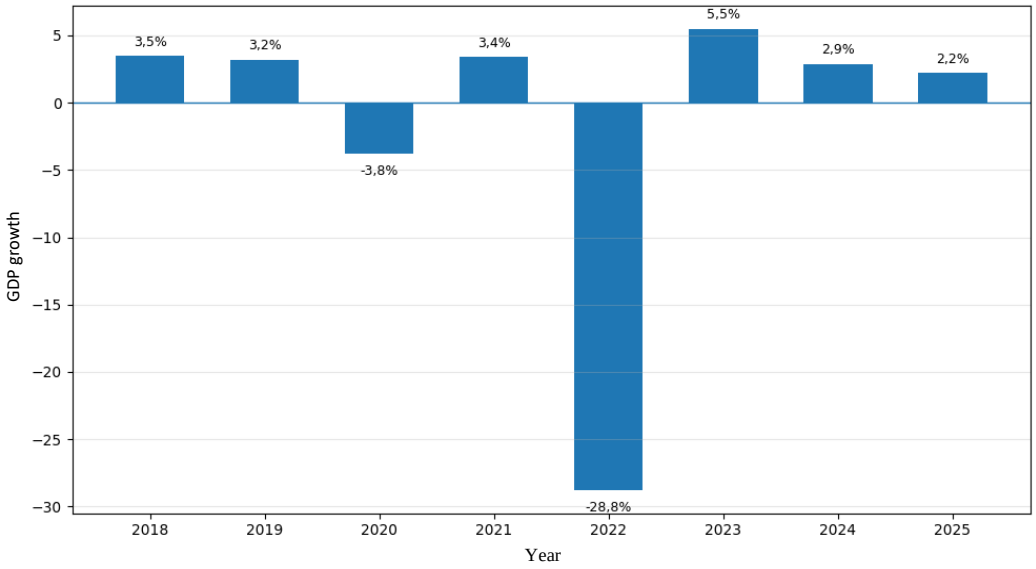

Figure 5. Real GDP growth of Ukraine (2018–2025), %

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (2025, March 31) and the Ministry of Economy of Ukraine (2026, January 16).

During the war, the structure of the Ukrainian economy also changed. The shares of agriculture and IT in GDP increased, while industry, especially metallurgy, declined. The energy crisis at the end of 2022 – beginning of 2023 (massive attacks on power grids) led to a temporary decline in industrial production – in December 2022, industrial production was 40% below the pre-war level. After the stabilization of energy supply in spring of 2023, the industry partially recovered, but it is still far from pre-war volumes. In contrast, the IT sector, which became one of the largest service exporters (the share of IT in service exports exceeded 40%), continued to operate and even

grew due to many IT companies relocating employees abroad or using remote work.

Ukraine's energy sector has turned into one of the fronts of the war. The russian army carried out hundreds of missile and drone strikes on Ukraine's energy infrastructure from October 2022 to March 2023. These attacks were aimed at leaving the country without electricity and heat during the winter period, in order to undermine the morale of the population and the viability of the economy. President Zelensky even declared an energy emergency on January 14, 2026, after another series of power plant attacks. At peak times (December 2022, November 2023), up to 50% of Ukraine's energy system was damaged or disconnected, with millions of people left without light for several hours a day every day. For the economy, this meant production shutdowns, disruptions in transport, communications, and critical infrastructure.

In the winter of 2026, russia again began carrying out massive attacks on the energy system. The events were accompanied by a sharp cold snap in January 2026, which led to peak loads on the energy system and complicated the balance between electricity production and consumption. The consequences of the crisis included disruptions in the operation of industrial enterprises, disturbances in the functioning of critical infrastructure, a decline in economic activity, and a deterioration of living conditions for the population in certain regions. Emergency crews in Ukraine continue around-the-clock efforts to restore electricity and heat supply while night-time temperatures drop to –20°C.

Large-scale damage to the energy system has become a key factor in revising forecasts. The NBU worsened its estimate for real GDP growth in 2026 to 1.8% (previously expected to be 2%). The estimate of the electricity deficit in Ukraine has doubled – from 3% to 6%. This forces enterprises to spend more resources on autonomous generation, which affects the cost of final products. As of Q1 2026, the NBU estimates an unprecedented electricity deficit of 12% (*Figure 6*).

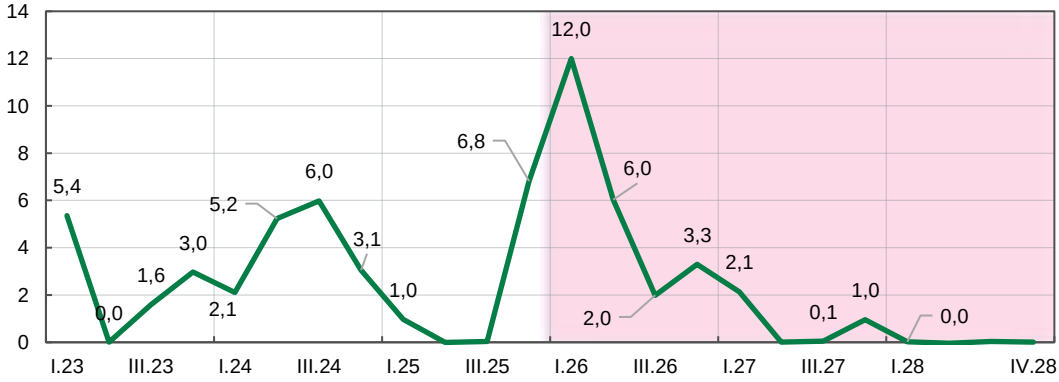

Figure 6. Electricity deficit (2023–2028), %

Source: compiled by the authors based on data from the NBU (National Bank of Ukraine, 2026, January).

The economic and energy war is costing Ukraine very dearly. According to estimates by the Ministry of Economy, in 2022–2023, direct damages to the energy sector exceeded 10 billion USD (dozens of high-voltage transformers were destroyed or damaged, hundreds of kilometres of power lines, over 50% of key thermal power plants and combined heat and power plants were damaged). Indirect losses – underproduction, forced downtime – are even greater. The government is forced to spend reserve funds on purchasing fuel for generators, emergency repairs, and importing electricity at high prices (*ACAPS*, 2024, *September* 13). In the winter of 2022/2023, the National Bank of Ukraine even estimated that blackouts could cost the economy up to –0.5% of GDP per month in the worst-case scenario, and also forecasts the departure of another 400.000 people due to constant power outages and shelling of energy infrastructure (Dobrovolska, 2024, September 2).

Another dimension is the foreign economic and financial impact. Due to the blockade of ports and the danger to shipping, Ukraine's exports in 2022 fell almost by half. In 2023, the situation improved somewhat thanks to the "grain corridor" (which operated from July 2022 to July 2023, allowing the export of up to 33 million tons of agricultural products) and alternative routes, but nevertheless, goods exports in 2024 amounted to only USD 39 billion compared to USD 64 billion in 2021. Imports decreased less (due to increased demand for fuel, machinery, and military equipment), so the trade deficit rose sharply and in January–September of 2025 amounted to USD 13.6 billion (NBU, n. d.). This gap is covered through external financial inflows – grants, donor loans, and remittances from Ukrainians abroad. Thanks to external assistance, the NBU's international reserves have grown to a record USD 57.3 billion as of January 1, 2026 (National Bank of Ukraine, 2026, January) – a paradoxically high level in the midst of the war, indicating unprecedented volumes of external support. This allowed for maintaining relative exchange rate stability (the official exchange rate of UAH 36.6/USD was fixed back in 2022, while the market cash rate fluctuated within UAH 41–43/USD during 2024–2025). In the future, sharp jumps in the national currency exchange rate are unlikely due to a more than sufficient level of gold and foreign exchange reserves, which allow for these interventions to be maintained.

Financially, Ukraine survives thanks to international aid. In 2023, the volume of official financing (grants and loans) exceeded USD 30 billion, in 2024 – about USD 28 billion; the EU, IMF, and World Bank are key donors. In 2025, Ukraine attracted USD 52.4 billion in external financing, of which over 70% was covered thanks to the income from frozen russian assets. International support allowed the full funding of social and humanitarian budget expenditures, while domestic resources were directed to defence. The key donors were the EU (Ukraine Facility) and the USA (Ministry of Finance of Ukraine, 2025, December 30). This made it possible to finance the budget

deficit, most of which goes to military needs (as of 2025, state spending on defence and security amounted to about 50% of all budget expenditures). Ukraine's public debt rose to almost 130% of GDP, but during the war creditors agreed to a moratorium on payments, so default was avoided. In addition, as noted by the NBU, a significant part of the public debt is considered conditional debt obligations, as it is formed through loans based on frozen russian assets (National Bank of Ukraine, 2026, January). Data on the sources of additional financing of Ukraine's state budget during the war are summarized in the *Table*.

Table

Additional financing of the state budget of Ukraine during the war period as of December 31, 2025, USD billion

Source	Type of funding				
	grants	loans	from income from russian assets	Internal	
				Ukrainian Domestic Government Bonds	issuance of the hryvnia (2022)
The EU	4.5	52.4	–	–	–
UDGB	–	–	–	51.4	–
ERA funding	–	–	37.9	–	–
USA	30.3	–	–	–	–
IMF	–	13.3	–	–	–
NBU	–	–	–	–	12.5
Japan	1	7.6	–	–	–
World Bank	–	6	–	–	–
Canada	–	5.4	–	–	–
Great Britain	0.1	2.9	–	–	–
Others	0.7	1.3	–	–	–
Germany	1.4	0.3	–	–	–
France	–	0.4	–	–	–
Italy	0.1	0.2	–	–	–

Source: compiled by the authors based on data from the Ministry of Finance of Ukraine (2026, February 18).

The results of the analysis indicate that the impact of geopolitical turbulence on Ukraine is destructive but not fatal. The economy has lost a third of its volume, but it has managed to stabilize at a lower level and even resume growth. Ukraine's energy sector is resisting attempts at destruction and is gradually being renewed with more decentralized, resilient technologies. Ukraine's experience, which is already valuable for partners – in the form of rapid network repair, the creation of distributed microgrids, mobile boiler houses, and so on – can be useful to other countries in emergencies. Ukrainian businesses, having survived the shock, are beginning to look for new niches and adapt to European markets (especially considering the prospects of EU membership). Thus, despite prolonged risks, the Ukrainian economy shows signs of resilience and potential for recovery, provided external support continues and reforms are maintained.

4. Ukraine's response to emerging risks

In the context of ongoing geopolitical turbulence, Ukraine needs to implement a set of response measures aimed at reducing the economy's vulnerability, strengthening its resilience, and laying the foundation for post-war development. In this regard, the main strategic directions have been identified, related to ensuring macro-financial stability and supporting the population and businesses, developing energy resilience, stimulating critically important sectors, conducting institutional reforms, diversifying sales markets, cooperating with the EU on the use of frozen russian assets, and forming a strategic vision for the further development of the national economy.

Regarding macro-financial stability and the continuation of cooperation with partners, it should be understood that in the coming years Ukraine will remain dependent on external financing for the budget and the balance of payments. Therefore, it is critically important to negotiate multi-year support packages in advance from the EU, the USA, the IMF, and other donors. It is necessary to develop mechanisms for insuring military risks for private investors (for example, through agencies like MIGA[2] or by providing state guarantees) in order to immediately launch projects in less dangerous regions. The priority direction for the NBU should be stimulating economic activity through abandoning strict control of the currency market and returning to a flexible exchange rate and inflation targeting.

Alongside this, in order to maintain social stability, the government must continue targeted assistance programs for the most vulnerable segments of the population, particularly displaced persons, the unemployed, and poor households. The expansion and accessibility of grant programs for small businesses (start-ups for veterans, entrepreneurship for displaced persons) will promote self-employment and the rapid restoration of economic activity locally. It is also necessary to start planning measures for the return of labour migrants after the war, as Ukraine is losing its labour potential, and recovery will be difficult without a workforce. These could include incentives for businesses to employ people in Ukraine, housing programs for those who return, and the development of educational initiatives to ensure that young people stay or come back.

Regarding the development of energy resilience, given that attacks on the energy sector continue, Ukraine should invest in decentralized energy. A priority direction is increasing the share of renewable sources with distributed networks (solar panels on roofs, small wind turbines, biogas plants for communities), which will reduce the load on the central grid and make each settlement less vulnerable. It is also necessary to continue installing industrial energy storage systems (batteries) at key network nodes,

[2] The Multilateral Investment Guarantee Agency (MIGA), which is part of the World Bank Group, specializes in insuring against political risks (war, expropriation, currency inconvertibility) to encourage foreign investments in developing countries.

which will allow faster restoration of energy supply after accidents. Ukraine is already cooperating with the EU within the framework of ENTSO-E – it is worth continuing to expand the capacity of cross-border power lines in order to import more electricity from the EU in case of a shortage. However, due to grid damage caused by russian strikes, imported energy cannot always reach the regions where the shortage is greatest, but it reduces the overall level of deficit (DiXi Group, 2026, January 21). At the same time, import capabilities have physical and market limitations. Ukraine sometimes purchases 2100–2120 MW, which is the maximum volume of commercial imports. Moreover, if prices in neighbouring EU countries exceed Ukrainian prices, imports become economically unprofitable, and purchase volumes also decrease.

Undoubtedly, in the future, when Ukrainian renewable energy generation grows, by using integration with ENTSO-E, Ukraine will be able to export "green" electricity to Europe.

An important project is the reconstruction and modernization of the power grid based on the principle of "build back better", namely, restoring destroyed substations using modern technologies (digital substations, more resilient equipment). European investment institutions (EIB, EBRD) are ready to finance such projects, and Ukraine should attract these funds as much as possible. In addition, it is necessary to create a strategic reserve of equipment (transformers and generators), which currently does not exist, in case of new attacks, possibly together with partners who could store and quickly supply such reserves.

It is necessary to implement a series of measures *to stimulate critically important industries and import substitution*. In the context of supply disruption risks (as it happened with fuel in 2022 or with electricity), Ukraine should develop its own production of key goods, as much as possible. It is worth supporting the development of enterprises of military-industrial complex and related sectors – not only for the needs of the front, but also with an export strategy. For example, Eastern European countries are increasing defence spending, so Ukrainian companies can integrate into European defence supply chains. Cooperation with the EU in the field of critical materials is also promising: Europe is looking for alternative sources for supplies of rare earth elements, lithium, titanium, and Ukraine, rich in some of these resources, can become a partner in their extraction and processing (attracting European investments with guarantees of supply security). The government estimates the total investment potential of the sector at approximately USD 12–15 billion by 2033 (Reuters, 2025, May 1). At the same time, this will strengthen the economic base and enhance ties with the EU.

In order to prepare for post-war reconstruction, even during the war, Ukraine should continue *institutional reforms* – in public administration, the judicial system, and anti-corruption measures. This is a condition for receiving aid and a guarantee that after the war, the funds for recovery will be used effectively. It is necessary to reform the tax and customs services to

simplify trade with the EU (a duty-free regime with the EU is already applied to most goods, but technical compatibility is also needed, for example, mutual recognition of certificates, "industrial visa-free"). Corporate governance reform in state-owned companies and privatization (where possible during the wartime) will help attract investments. Integration into the EU systems also opens the way for Ukraine to receive significant resources – private investments and assets from structural funds. Therefore, it is necessary to lay the foundation for this right now: to adapt the legislation to the EU standards (to meet candidacy requirements) and create institutions for managing recovery funds (including with international oversight for trust). The goal is to implement a Marshall Plan for Ukraine when the active phase of hostilities ends. However, for this plan to work, Ukraine needs to have the capacity to effectively absorb aid – qualified personnel, transparent procedures, project readiness, etc.

Regarding trade activation, it is necessary *to diversify sales markets* and logistics routes. Since trade routes through the Black Sea remain under threat, Ukraine must develop alternative logistics. With the support of the EU, it is necessary to increase the carrying capacity of railways and roads at the western border, to build grain storage facilities and terminals in neighbouring countries (Poland and Romania). Although work is currently underway in this direction, the pace should be accelerated to reduce transportation costs – currently, transhipment via the Danube and by rail is more expensive, which makes Ukrainian products less competitive. It is also advisable to develop transportation through the Baltic ports (by trains to Lithuanian or Latvian ports), thereby reducing dependence on the Black Sea. At the same time, it is necessary to search for new markets beyond the traditional ones. For example, to expand the presence of Ukrainian food products in Asia and Africa through food security programs.

Further *interaction with the EU regarding frozen russian assets* and reparations will allow covering a significant portion of reconstruction needs without additional debt burden. As it is known, the EU has accumulated about 200 billion euros of frozen assets of the Central Bank of the russian federation and oligarchs (European Commission, n. d.). Ukraine must actively work with European partners on a legal mechanism for using these funds. The offer of the Ukraine Reparation Facility (borrowing against these assets and transferring the loan to Ukraine) is an interesting instrument. Ukraine needs to argue on the international stage the moral and legal right to allocate these funds for the reconstruction of what was destroyed by the aggressor.

It is also necessary to formulate a strategic vision for the development of Ukraine: a transition from survival to development. As Ukrainian experts emphasize, it is not enough to simply aim to restore the pre-war economic structure – the opportunity should be used for a structural leap in productivity (Gorodnichenko et al., 2022). In other words, reconstruction should be innovative: instead of the Soviet industrial giants – modern processing

facilities converting raw materials on-site, instead of a transit raw materials model – the development of logistics with added value, IT, and engineering services that can be scaled for export. This, in turn, will require an educational reorientation (training personnel for new industries), as well as the involvement of the diaspora and international experts in reconstruction. Ukraine has already chosen the path of integration with the EU, and future membership in the European Union is a realistic prospect a few years after the war. Therefore, all reforms and projects should be considered from the perspective of European integration. Ukraine's economic security is a component of Europe's economic security, so it is advisable to initiate closer platforms for coordinating economic policy with the EU already now.

The proposed measures aim not only to mitigate current risks, but also to prepare the foundation for rapid development after the restoration of peace. As the experience of post-war reconstruction in European countries shows, or, for example, the successes of Eastern European EU members, the right strategy and resource mobilization can ensure an economic miracle even after severe shocks. It is important that Ukraine already forms a consensus on such a strategy and acts to anticipate risks, so that the consequences of geopolitical turbulence will be significantly minimized.

Conclusions

The geopolitical turbulence of the twenties of the 21st century – primarily, russia's war against Ukraine and the accompanying global shifts – has created serious challenges for the economies of both the European Union and Ukraine.

The impact of geopolitical shocks on the EU economy was noticeable, but, as analysis shows, controlled. Although the war highlighted Europe's vulnerabilities, in particular its energy dependence and insufficient defence spending, the EU is successfully implementing adaptation policies, and its economy has demonstrated significant flexibility and resilience to external shocks, while geopolitical challenges have even provided an impetus for accelerating transformations.

The United States of America, as a key geopolitical player, influenced the EU economy both through markets and political signals. The Fed's tight monetary policy led to a tightening of global financial conditions, which also affected the EU. At the same time, close transatlantic cooperation in response to the war (sanctions against the russian federation, aid to Ukraine, the new 2025 trade agreement) generally had a positive effect, reducing uncertainty and laying the foundation for long-term partnership. A restraint factor in Europe is the risk of political uncertainty, which prompts the EU to develop its own autonomy in defence and energy.

Ukraine has suffered a colossal economic blow from the war, but has demonstrated the ability to survive and adapt. However, the foreign trade imbalance and budget deficit remain critical, so currently these indicators are being covered at the expense of partners. The most destructive aspect is the

deliberate destruction of energy infrastructure, due to which Ukraine is going through the cold winter of 2026 with a long-term blackout.

The main channels of influence of geopolitical turbulence on the EU economy were:

• proximity to war – countries neighbouring Ukraine lost up to 1.5–2 percentage points of growth in 2022–2023 and experienced several additional points of inflation;

• energy shock – a peak price increase added about 5–7 percentage points to inflation in 2022;

• financial effects – the global increase in rates and capital outflows reduced investments in the EU in 2022–2023, but the stability of the eurozone was not shaken;

• migration effect – the reception of millions of Ukrainian refugees in Europe initially required fiscal expenditures, but in the medium and long term it may provide an influx of labour.

The following channels have been set for Ukraine:

direct military destructions – a significant portion of fixed assets has been lost, which suppresses growth potential for years ahead;

intervention in foreign trade – port blockades, disruption of logistics limited exports and imports, increasing dependence on international aid;

electric power industry as a target – attacks on infrastructure reduce GDP and require resources for repairs instead of directing them towards development;

mass migration – about 5–6 million Ukrainians have gone abroad, which led to the loss of part of the labour potential and further prospects regarding the loss of the workforce are bleak.

Ukraine and the EU have mutually strengthened economic ties in the face of a common threat. The EU has provided Ukraine with multi-billion financial support (macro-financial assistance, budget funding, humanitarian programs) and opened its market (abolishing tariffs and quotas on Ukrainian goods), which helped the Ukrainian economy to hold up. Ukraine, in turn, has become a factor in the consolidation of the EU – countries united in sanctions policy and in reducing dependence on the authoritarian regime of the russian federation, and also invested in defence. Such integration has strategic significance: in the future, Europe's economic security will be impossible without the recovery and development of Ukraine, and vice versa – a prosperous Ukrainian economy will strengthen the common European market and security. Thus, the hypothesis put forward at the beginning of the article was generally confirmed, but with some clarifications. For the European Union, the war caused short-term turbulence; however, in the medium term, the EU returned to positive growth and even accelerated transformational processes in the energy and defence sectors. The Ukrainian economy, as predicted, suffered significant losses but survived and, largely thanks to external support and the internal flexibility of businesses, transitioned to slow growth.

There are still many challenges ahead – from uncertainty on the battlefield to political changes in the world – but the acquired experience allows for better preparation for them. The most serious risks for Ukraine are energy attacks, financial dependence, and export restrictions, so proposals for their minimization should be taken into account when developing state policy. An adequate response to current geopolitical risks will become the foundation for successful post-war recovery in Ukraine.

Further research should focus on an in-depth analysis and assessment of the medium- and long-term impact of external shocks on Ukraine's economy, its energy sector, financial stability, and capacity for structural adaptation. On this basis, it would be advisable to justify models of post-war recovery of Ukraine aimed at increasing productivity, energy resilience, technological modernization, and reducing critical dependence on external support.

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21st CENTURY NOBEL LAUREATES: ECONOMIC REFLECTIONS ON CONTEMPORARY CHALLENGES

Based on the application of historical, institutional, and comparative analysis methods, this research outlines the key contemporary challenges that have driven the emergence and development of specific economic research trends recognized by the Nobel Prize in Economics. The hypothesis of the research, tested by the specified methods, assumes that leading economists respond to modern challenges by studying the key problems facing humanity. The research highlights how the world's leading economists respond to urgent global problems, detailing their proposed solutions and the role of Nobel laureates in institutions dedicated to addressing economic issues at national or regional levels.

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НОБЕЛІВСЬКІ ЛАУРЕАТИ XXI ст.: ЕКОНОМІЧНІ РЕФЛЕКСІЇ НА ВИКЛИКИ СУЧАСНОСТІ

На основі використання історичного, інституційного, компаративного методів аналізу у статті окреслені основні виклики сучасності, які обумовили появу і розвиток економічних досліджень певного спрямування, автори яких отримали Нобелівську премію з економіки. Гіпотезою наукового пошуку, яка перевіряється зазначеними методами, є припущення, що провідні вчені-економісти змушені реагувати на сучасні виклики, досліджуючи проблеми, які постали перед людством. Показана специфіка реагування провідних економістів світу на низку нагальних проблем із висвітленням запропонованих ними методів розв'язання, а також роль лауреатів премії Нобеля з економіки у діяльності інституцій,

The article identifies Nobel Prize winners' contributions to the adoption of new scientific research methods and to the development of innovative approaches to analyzing economic phenomena and processes. It establishes a correlation between the choice of research topics and the specific regional or national economic pressures most acute at the time. The research proves that the direction of scientific inquiry among leading economists is closely linked to their understanding of modern challenges and threats, the neglect of which could lead to long-term negative consequences. Furthermore, it is shown that their research focus is deeply rooted in their commitment to particular scientific schools and academic traditions. Finally, the research outlines the potential for applying the findings of Nobel laureates to the Ukrainian context, identifying promising directions for economic reform and ensuring sustainable economic growth across individual regions.

Keywords: The Nobel Prize in Economic Sciences, Nobel Prize laureates, Economic crises, Contemporary economic theories, Inclusive institutions, Extractive institutions.

покликаних вирішувати економічні проблеми у масштабі країни чи регіону. Визначений внесок лауреатів Нобелівської премії з економіки у використання нових методів наукового пошуку та формування нових підходів до аналізу економічних явищ і процесів. Визначено залежність вибору тематики для економічного аналізу від того, проблеми якого регіону чи країни виявилися найбільш болючими для економістів. Доведено, що спрямування наукового пошуку провідних економістів тісно пов'язане з розумінням ними сучасних викликів та загроз, ігнорування яких може мати довготривалі негативні наслідки. Висвітлено, що спрямування наукового пошуку провідних економістів тісно пов'язане з їх прихильністю до певних наукових шкіл та напрямів дослідницької роботи. Окреслені можливості використання напрацювань лауреатів премії Нобеля з економіки для України з визначенням перспективних напрямів реформування економіки та забезпечення зростання економічного розвитку окремих регіонів.

Ключові слова: Нобелівська премія з економічних наук, нобелеали, економічні кризи, сучасні економічні теорії, інклюзивні інституції, екстрактивні інституції.

JEL Classification: A11, B30, B31.

Introduction

The 21st century has presented humanity with several important problems, the solution of which requires the joint efforts of many leading states, coordinated based on common interests and formulated thanks to the results of scientific research with a high level of scientific abstraction, among which the following stand out: climate crisis and sustainable development, growing inequality of economic development of countries, global financial crises and increasing debt, technological transformations and the development of digital technologies, demographic changes, pandemics and biological risks, as well as increasing geopolitical instability.

In modern conditions, the search for a balanced and productive balance between economic growth and environmental sustainability has become one of the most important tasks, since climate change threatens to reduce global GDP by 18% by 2050, if it is not possible to ensure the transition to a "green" economy proposed by economists through carbon taxes and increased investment in clean energy (Flavelle, 2021, November 4).

The growing inequality of economic development between economically developed and less developed countries and between wealthy and underprivileged segments of individual countries creates both a threat to internal state social stability and tensions in interstate relations. In poor countries, there is a growing influence of extremist and terrorist groups, whose representatives accuse rich countries of appropriating a monopoly on

mineral extraction and concentrating profits by exploiting migrant workers and the population of third-world countries. At the same time, growing inequality requires the formation of new approaches to taxation and social policy, in particular, in order not to stimulate the consumer attitude of part of the population of poor countries towards rich countries, and to maintain incentives for work and the implementation of innovative projects. The latter requires not only ensuring relatively high wages for employees, but also maintaining the appropriate level of their qualifications, which requires the formation of balanced approaches to migration policy and regulation of employment of the population based on the results of comprehensive scientific research, taking into account regional characteristics and the fact that modern globalization has encountered resistance from several powerful countries that prefer to preserve their national, social and cultural differences.

Today, the world is also suffering from global financial crises, which have demonstrated the vulnerability of the financial system to the "overheating" of the real estate market and the lack of regulation, which has led to an increase in public debt in many countries of the world. And the growth of debt obligations in several cases has negatively affected the ability of states to implement innovative projects or use the results of their successful implementation in their own interests, and not in the interests of creditors.

The latest trends in the automation of production and the development of artificial intelligence have significantly affected the labor market, creating a threat of mass unemployment in traditional sectors of the economy, contributing to the emergence of remote work and the formation of a community of digital nomads, whose ideas about the attitude to work are increasingly influencing the attitude of young people to professional activities and civic responsibilities. At the same time, the development of information search, accumulation, and processing systems has exacerbated the problem of digital literacy of the population, as well as the need to adapt educational systems to the requirements of the digital economy. This stimulates the formation of creative or production teams, the activities of which are coordinated by centers of management, forecasting, and production organization, concentrated mainly in the leading countries of the world.

The aging of the population in developed countries and the current migration crises are putting constant pressure on pension systems and healthcare, requiring a review of social security models. At the same time, this can cause social tension in the context of raising retirement age or ill-considered steps in reforming medicine. Especially when such steps lead to a significant increase in the cost of medical services and the concentration of medical care facilities in certain areas of the state. This was especially evident during the COVID-19 pandemic, which demonstrated the need to develop mechanisms for resilience to similar challenges in the future.

Modern geopolitical instability, associated with the resolution of local wars and armed conflicts, the spread of trade wars (for example, between the USA and China), the use of energy blackmail with the destruction of established supply chains, forces economists to rethink the concept of globalization, seeking

answers to the challenges of the time, taking into account possible changes in the definition of world centers of power and gravity.

At the same time, the political and economic interests of regional leaders or individual leading countries of the world significantly influence the directions of scientific research. The absence of unified paradigmatic approaches to assessing objective reality leads to incompatibility of the results of scientific research. The fragmentation of research divides scientists, limits the value of science, and undermines the unity of conceptual and methodological approaches (Banerjee & Duflo, 2019).

Some aspects of the topic of scientific research are reflected in the study of Mazaraki and Lagutin (2022). The scientist Mazaraki adapted the ideas of R. Coase and D. North to explain the structural restructuring of the sphere of goods circulation in Ukraine, and also used the developments of G. Becker and T. Schultz to substantiate the idea that investments in education are not costs, but the main factor of competitiveness in modern conditions. The authors emphasize that modern Nobel Prize winners in economics have identified the connection between political and economic constraints and incentives, when the position of the political elite regarding the distribution of resources and incomes based on narrow clan interests limits economic development and the growth of the level of well-being of the population. This leads to the depletion of the economic potential of the nation and cannot ensure long-term growth focused on the internal dimension (Mazaraki & Umantsiv, 2025).

Many scientists have made significant contributions to the study of the outlined problem. In particular, Shevchenko (2008) analyzed the developments devoted to asymmetric information; Diachenko (2025, October 14) focuses on the generalization of scientific works devoted to economic growth. The authors Bezgin and Ushkalev (2019) focused on the analysis of the development of behavioral economics. Umantsiv (2019) summarized the methodological principles of the formation of economic theory in the modern paradigmatic context.

The aim of the research is to determine the directions and main achievements of the scientific search of the Nobel Prize laureates in economics and to establish their connection with the search for ways to solve the problems that have arisen before humanity in the 21st century.

Scientific research is based on the hypothesis that leading economists are forced to respond to modern challenges by studying the problems that have arisen before humanity.

To test the hypothesis based on the use of historical, institutional, and comparative methods, the main problems of modernity that have influenced the direction of research by leading scientists have been identified, as well as the correspondence of such research to the interests of leading countries of the world or influential regional players.

The main part of the article has three blocks: the first highlights the views of Nobel laureates on measures to overcome poverty and technological development; the second analyzes research on finding ways to overcome

financial crises and develop the labor market; the third section determines the possibilities of applying their conclusions and recommendations in modern Ukrainian realities.

1. Poverty alleviation and technological development in the concepts of Nobel laureates in economics

The urgency of modern problems and the limited time allocated to respond to challenges have prompted leading economists to some extent to shift the priorities of scientific research from an emphasis on theoretical developments to the formation of practical recommendations for overcoming crisis phenomena. In the 21st century. The awarding of the Nobel Prize in Economics to researchers who study the fight against poverty, technological growth, and creative destruction, financial crises, banking stability, and the labor market in the context of behavioral challenges or gender inequality has become increasingly noticeable.

Thus, the general trend in the research of Nobel laureates in economics in the 21st century. It is a transition from abstract theoretical models to empirical studies that explain the causes of uncertainty and the slowdown in economic growth (GDP).

Global GDP growth slowed from 3.3% in 2024 to 3.2% in 2025, with a further slowdown forecast to 2.9% in 2026, as higher tariffs and ongoing political uncertainty dampen investment and trade (OECD, 2025, September 23) (*Table*).

Table

Real GDP growth in 2024–2025 and forecast for 2026 (%, per year)

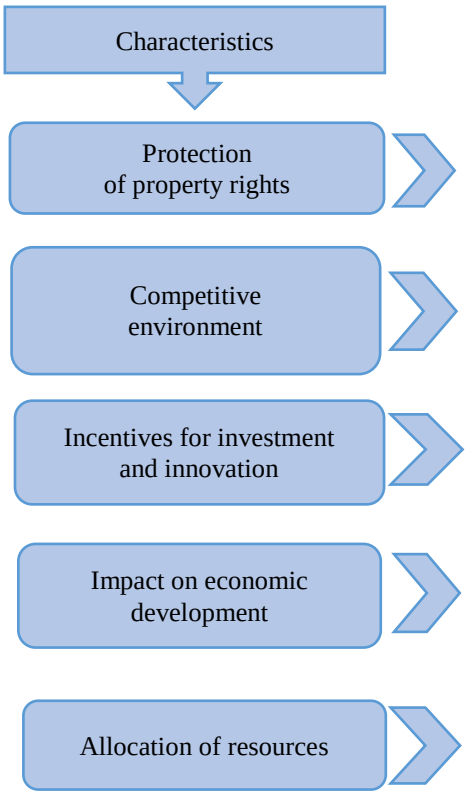
Country	2024	2025	2026 (forecast)
India	6.5	6.7	6.2
Indonesia	5.0	4.9	4.9
China	5.0	4.9	4.4
Argentina	–1.3	4.5	4.3
Saudi Arabia	1.9	3.7	3.9
Turkey	3.3	3.2	3.2
Spain	3.2	2.6	2.0
Brazil	3.4	2.3	1.7
United States	2.8	1.8	1.5
Australia	1.1	1.8	2.2
United Kingdom	1.1	1.4	1.0
South Africa	0.5	1.1	1.3
Japan	0.1	1.1	0.5
Canada	1.0	1.1	1.2
South Korea	2.0	1.0	2.2
Mexico	1.4	0.8	1.3
Italy	0.7	0.6	0.6
France	1.1	0.6	0.9
Germany	–05	0.3	1.1
World average	3.3	3.2	2.9

Source: OECD interim economic survey 118 database; OECD economic survey 117 database (OECD, September 23, 2025).

The use of economic levers to solve global problems of humanity is becoming increasingly important. In such conditions, Nobel laureates consider economic activity as a tool with which it is possible to initiate necessary transformations and create restrictions on undesirable directions of development. A common assumption for many researchers is that most economic players will act in the market, guided by rational considerations. However, this statement has been criticized in view of the increasing number of irrational decisions caused by asymmetry in obtaining information, the dominance of traditional rules and habits in certain regions, as well as the reluctance of most people to change their established way of life. The latter statement is also related to the reluctance of several political or economic elites to cede power even under conditions where their consumer activities become an obstacle to the progressive development of the country, condemning its citizens to poverty and hardship.

In view of this, attention has been drawn to scientific research that assessed the role of institutions in directing economic development. Supporters of the institutional approach, Acemoglu, Johnson, and Robinson have proven that the cause of poverty in countries is primarily institutions that use available resources in the interests of elites, and geographical location is not of decisive importance. In their view, sustainable growth requires inclusive political and economic systems that stimulate the involvement of citizens in economic activity, ensure property protection, competition, freedom of professional choice, the introduction of innovations, and also provide for pluralism, the separation of powers, the operation of democratic structures, and state support in the realization of human potential. Studies by reputable scientists have shown that if the political system benefits the elites, the population cannot believe that the promises of a reformed economic system will be fulfilled. Only a new political system that allows the population to replace leaders who do not fulfill their promises in free elections can allow for reform of the economic system. However, ruling elites often do not believe in the possibility of obtaining new benefits after reforming the system, which contributes to the long-term dominance of extractive institutions, mass poverty, and a wealthy elite (Acemoglu, 2012; Acemoglu & Akcigit, 2012; Acemoglu & Robinson, 2017). A comparative analysis of extractive and inclusive economic institutions is presented in *Figure 1*.

The scholar Romer (2016, August 12) put forward the radical idea of creating new cities in developing countries that would develop according to the rules and laws of developed countries to create a favorable environment for business and ensure the inflow of investment. He argued that a safe environment for business can stimulate economic activity and become a model for development. At New York University, he helped create the Marron Institute for Urban Management, which uses the city as the main unit of analysis instead of the nation or business. At the same time, Romer (2015, October 7) advocated that the subject area of scientists be determined primarily by the urgent needs of the city, which will make their research as relevant as possible.



Inclusive institutions	Extractive institutions
Effective protection of property rights	Inability to protect property rights
Creation of genuine competitive conditions	Concentration of power in the hands of a small group for their own benefit
Encourage investment in technology, education, and research	Lack of incentives; investment and innovation are stifle
Promote long-term GDP growth and economic stability	Unable to ensure sustainable economic development
Equitable, involving broad segments of the population	Extraction of resources from the majority for the benefit of the few

Figure 1. Institutional determinants of economic development: a comparative analysis

Source: (Acemoglu & Robinson, 2017, pp. 372–373).

The researcher proved that innovations can be created consciously through economic stimulation and investment in human capital, and ideas can be used by a large number of people at the same time, which ensures constant economic growth. The researcher emphasized that in the long run, the type of support (and not just the amount) that a national government provides scientific discoveries and technological progress can be one of its most important policy decisions (Romer, 2016, July 25).

While Romer explained the mechanism of using ideas for economic development, Mokyr (1999; 2005; 2014; 2017; 2018) focused on identifying the sources of important ideas. The main reason for the success of the West, in his opinion, was the formation of a "marketplace of ideas" with the creation of an intellectual environment that provided competition and the opportunity to gain recognition. And the industrial revolution became possible due to a change in worldview, with the elite's belief in the possibility of increasing the level of material security through science and knowledge. Comparing different historical periods, Mokyr demonstrated that humanity has gone through several periods of technological change, which did not transform into sustainable economic growth. In each of these cases, there was a lack of joint evolution of science and technology, competence, as well as a public perception of creative destruction. Mokyr showed the role of innovation in

replacing old technologies and the progressive development of humanity with an increase in the standard of living despite the resistance of outdated structures.

Thus, several Nobel laureates not only showed the importance of elites' support for progressive development but also determined the inevitability of change due to technological innovation, which leads to changes in society, the perception of which can be a determining condition for success in competitive confrontation.

The climate crisis in the research of Nobel laureates initiated scientific research related to the development of a green economy and the prospects for technological growth. The first to integrate climate change into a long-term economic analysis was Nordhaus (2013), who proposed introducing a carbon tax as a tool to curb global warming. Such taxes, in his opinion, would force companies to switch to green technologies. At the same time, because individual states may evade fulfilling environmental obligations, the researcher proposed forming coalitions of countries that set high environmental standards and impose additional duties on the products of other states in order to stimulate them to comply with the relevant obligations.

This position was based on the assumption of the rationality of economic and political activity. However, it did not take into account the desire of individual states to implement their own civilizational or quasi-civilizational projects, when rational beliefs give way to irrational senses oriented to former greatness or the prospect of obtaining the benefits provided by the status of the center of gravity of the world scale, obtained through the use of force of arms. Several countries dependent on the carbon economy and without prospects for switching to "green" technologies could potentially consider armed confrontation as a means of determining favorable conditions for their economic activity or obtaining appropriate technologies using weapons. The presence of a potential threat to several regional players and the growth of poverty problems in certain regions created challenges that required an immediate response to prevent such challenges from turning into real threats.

Banerjee, Duflo, and Kremer (Duflo et al., 2008; Duflo et al., 2009; Duflo, Dupas & Kremer, 2012; Duflo, Hanna & Ryan, 2012; Duflo et al., 2014) have developed a field research methodology aimed at overcoming poverty. Banerjee introduced randomized controlled trials to evaluate the effectiveness of social programs. His approach is to divide the problem into smaller components and identify questions that can be formulated based on experimental research. Banerjee suggests rejecting stereotypes that poor people are irrational users of resources or are lazy. He argued that the poor are focused on survival, where spending is primarily a source of pleasure in a stressful environment, and that the main obstacles to development are ignorance (lack of knowledge of details), belief in dogmas, and unwillingness to change ineffective systems. He also argues that the psychological argument about valuing something that has been paid for may be flawed when it comes to obtaining important health care resources (Banerjee et al.,

2003; Banerjee & Duflo, 2004; Banerjee et al., 2007; Banerjee et al., 2010; Banerjee & Duflo, 2011; Banerjee et al., 2016; Banerjee et al., 2017).

Duflo experimentally proves that in villages in India, where, by law, the head of the council had to be a woman, parents significantly valued their daughters' education, and girls demonstrated growing ambitions. In addition, the author notes that microcredits only help stabilize consumption, but rarely create conditions for the development of successful business projects. In such conditions, the so-called "poverty trap" is formed, which creates the prerequisites for the impossibility of implementing innovative projects, increasing the level of education of the population, and inhibiting the accumulation of savings, which forms a cycle of maintaining relatively low incomes. Such a cycle cannot be "broken" without external intervention with a change in established economic practices (*Figure 2*).

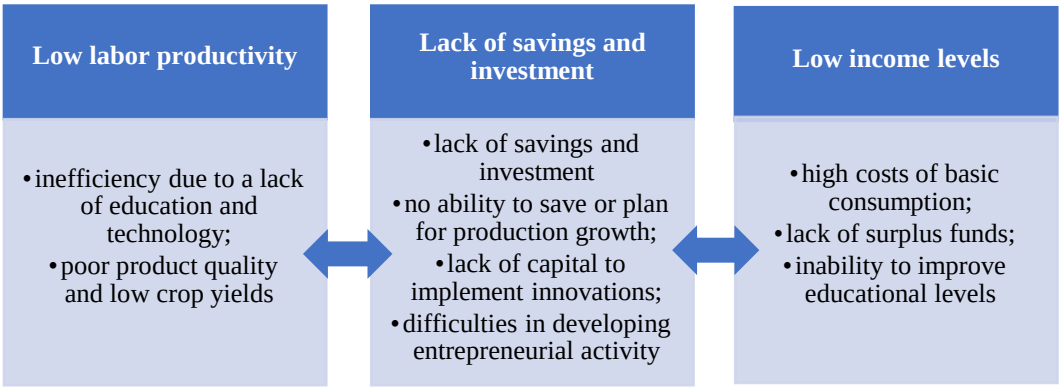


Figure 2. Mechanism of the "poverty trap"

Source: compiled by the authors based on (Banerjee & Duflo, 2011).

In fact, experimental studies have proven the effectiveness of identifying specific steps to combat poverty in conditions where theoretical developments to improve social policy did not always provide the desired result. It turned out that field research can not only adjust the direction of theoretical research, but also determine its further development, taking into account regional and local characteristics, and economists, to achieve the desired result, must delve as deeply as possible into the problems of residents of a particular region or area, which requires the appropriate organization of scientific research.

2. Financial crises and the labor market in Nobel laureates' research

The attention of leading economists in the 21st century, financial crises and modern labor market developments. As it turned out, crisis phenomena in the economy can have a relatively large destructive effect, even due to the preservation of state regulation, the conditions and quality of which do not always meet the challenges of the time.

Bernanke, Diamond, and Dybvig attempted to explain the reasons for the vulnerability of banks in the conditions of mass withdrawals caused by financial crises. In particular, Bernanke and Gertler (1987, 1989; Bernanke et al., 1996; Bernanke et al., 2019) proved that the panic of depositors, when they try to withdraw money from banks en masse, is not a consequence of the crisis, but its main driver. Researchers believe that the collapse of banks destroys critically important information about borrowers, and this can significantly hinder lending in the long term. Bernanke is considered the savior of the financial system, but his strategy of "quantitative easing" has caused a lot of controversy. Critics expressed concerns that a sharp increase in the money supply could lead to uncontrolled inflation and a depreciation of the dollar as the world's reserve currency. Opponents also argued that an excess of cheap money could lead to an increase in stock and real estate prices, creating the prerequisites for new crises. It was also noted that the Federal Reserve's policies helped primarily asset owners, while the savings of ordinary citizens were devalued due to relatively low interest rates. Critics also argued that after the end of the program, it would be extremely difficult to withdraw money without harming the economy.

Diamond (Diamond et al., 2002; Diamond & Kashyap, 2016; Bernanke & Rajan, 1999a, 1999b, 2002, 2003, 2011a, 2011b) and Dybvig (Dybvig & Jaynes, 1980; Dybvig, 1993) have proposed a mechanism to prevent financial market panics through government deposit insurance, the central bank borrowing cash to ensure that banks can meet their payments, and a temporary restriction on cash withdrawals. This mechanism was developed taking into account the realities of the digital age, where depositors have the ability to receive information quickly, making government guarantees an important means of preventing panics.

It is important to note that Nobel Prize laureates not only offer options for overcoming economic crises and using economic levers to solve global problems, but also actively oppose economic populism and consult with international organizations and government institutions of individual countries. Such consultations influence not only the adoption of individual current decisions but also systemic decisions, the formation of established practices of response in crises, including the creation of institutions and organizations designed to smooth out negative consequences and maintain progressive economic development.

Modern scientists have faced several challenges related to the transformation of the labor market. A significant number of Nobel Prize winners have explored this issue in their scientific research. For example, Goldin and Katz (2018), studying women's work, determines that the wage gap in wages between men and women appears after the birth of the first child, when women are forced to choose a more flexible work schedule for themselves, focusing on the needs of childcare. A woman's decision to obtain a certain level of education and plan her career growth is most often based

on the experience of her mother, and if expectations do not coincide with new market opportunities, this slows down changes in society.

Labor market research in the 21st century led to the emergence and development of scientific research related to attempts to integrate methods of scientific knowledge of psychology into the study of economic phenomena and processes. One of the results of such integration was the emergence of behavioral economics, focused on determining the human factor in the process of making and implementing decisions. Research on the human factor led to the emergence of the Thaler nudge theory (Thaler, 1985; Thaler & Benartzi, 2004), which is widely used by governments of many countries to stimulate citizens to save for retirement and lead a healthy lifestyle. Thus, in the UK, special government groups were created to stimulate vaccination, energy conservation, and paying taxes. Thaler's work became the basis for modern analysis of stock markets, taking into account the influence of emotional outbursts and cognitive biases of investors. Thaler's nudge theory suggests using a "soft influence" on a person's choice of a particular line of behavior. Moreover, its author assumes that prohibitions or financial incentives have a relatively smaller effect in many cases, and people value a thing more highly if they already own it, rather than if they are just about to purchase it.

3. Prospects for applying the research findings of Nobel Prize laureates in economics to Ukraine

The current russian-Ukrainian war has highlighted the need to rethink the further economic development of our state. The course of the confrontation suggests that if the russian federation exists, the threat to Ukraine will persist. Therefore, Ukraine urgently needs several updates and assistance from other states that can preserve and increase its level of resilience.

The Nobel Prize winners in economics have proposed several important steps for Ukraine to ensure the movement towards renewal. Thus, Krugman advocates for the EU to take a leading role in protecting the free world and financially supporting Ukraine, since such actions will contribute to global security (Vorontsova, 2022, September 17). Myerson substantiated the position that decentralization has become a key advantage of Ukraine, contributed to supporting the Armed Forces of Ukraine, and stimulated local communities to organize a fight back against the aggressor (Press Center of the "Decentralization" initiative, 2022, November 24). Acemoglu and Robinson (2017) and Johnson emphasize that rebuilding Ukraine should be a global priority. They also note the resilience of democracy in Ukraine and emphasize that the post-war consensus in society on modernization should create conditions for accelerated technological development and overcoming corruption (Komisarenko, 2024, November 6).

Robinson bases his advice for Ukraine on the theory of "why nations fail" and argues that reforms can be implemented even under martial law. During his visit to Kyiv in March 2025 and during discussions at the Kyiv School of Economics, Robinson outlined his version of a strategic plan for Ukraine's development (Kyiv School of Economics, 2025, March 20). In his opinion, it is extremely important to build inclusive institutions with maximum use of digitalization to limit corruption and create a system where power and resources are not concentrated in the hands of a narrow circle of individuals. He considers decentralization to be the foundation of Ukraine's stability, emphasizing that the decentralization reform in Ukraine has been one of the most successful in the world. He categorically opposes the return of powers to the center, believing that strong communities are the best means of counteracting authoritarianism and inefficient allocation of funds for the country's reconstruction. Robinson calls for abandoning the restoration of old Soviet enterprises in their former form, proposing the creation of new technological sectors. Realizing that the war destroyed the old infrastructure, he calls for using the opportunity to build a new economy. Considering accession to the EU as a means of ensuring a quality control mechanism for state institutions, and not just as a means of access to certain external markets, Robinson advises Ukraine to perceive the requirements of the European Union as a tool for internal cleansing of the system, and not as a formality. He considers the relatively high level of trust that is formed in wartime to be the main resource of Ukraine. Therefore, the state should not undermine this trust by unfairly distributing aid; the country may return to an extractive model, where the majority works to enrich the minority. In addition, Robinson considers Ukraine a modern laboratory of the future for the whole world, since Ukraine has a chance to build an inclusive system in wartime and become the most dynamic economy in Europe. The scientist gives the example of South Korea, where the constant threat of an attack from North Korea stimulated the development of advanced technologies. And in the context of war, Ukraine, in his opinion, has become a global hub of innovation in the field of developing unmanned systems and modern combat control systems, which is already attracting foreign investment. It is also emphasized that education in Ukraine will be a key means of accelerating economic development, considering the Ukrainian IT sector as a model of inclusiveness. At the same time, the researcher advises investing in industries with a high level of added value, capable of creative destruction and integration into European supply chains. In the context of rapprochement with the EU, the energy sector is also considered to be critically important for the creation of a new decentralized energy system. Robinson's main advice to investors is to focus not on assets, but on the institutional environment, since investments in human capital can provide Ukraine with the greatest returns in 2026–2030. His opinion on the importance of investments in human capital coincides with the findings of Mokyr (2005) and Aghion and Roulet (2014) (*Figure 3*).

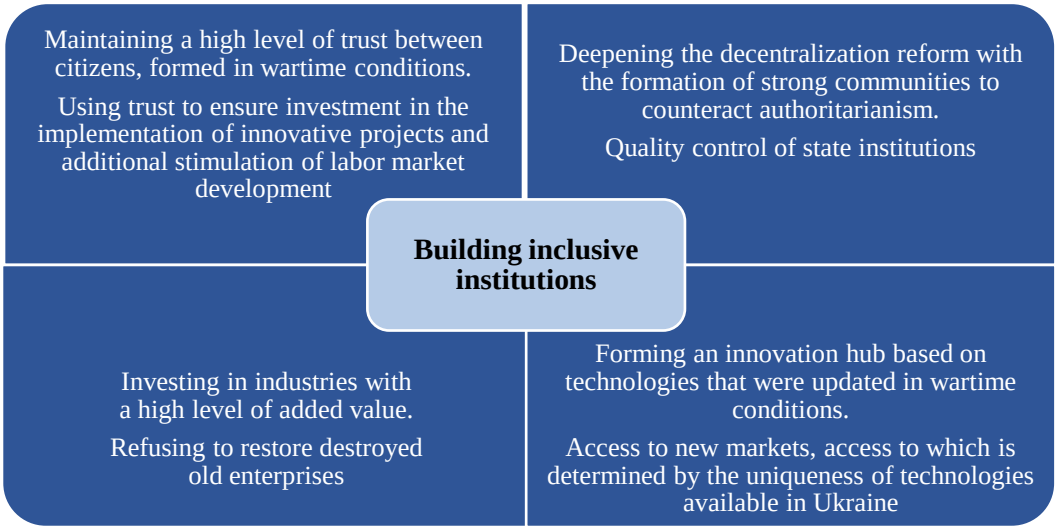


Figure 3. Creating an inclusive environment in Ukraine

Source: compiled by the authors based on their own research and generalizations.

In the domestic social space, the theories of Duflo and Rajasthan are used, in particular when determining the effectiveness of social payments and support programs for internally displaced persons. And the work of these laureates on the "poverty trap" is partially integrated into educational programs for youth in order to change the thinking of young people from survival to development. In March 2022, about 200 Nobel laureates expressed their support against russian aggression against the Ukrainian people and free independent Ukraine (ArmyInform, 2022, March 13). In March 2024, 39 Nobel laureates appealed to world leaders to ensure Ukraine's victory, emphasizing that the strategy "Ukraine must not lose" is erroneous. The appeal also calls not to recognize Putin as the legitimate president of the russian federation after the 2024 elections and warns that the policy of appeasing the aggressor will lead to an even greater catastrophe (Ivanova, 2024, March 28). Scientists insist that humanity can avoid self-destruction only if the principles of democracy and international human rights laws are observed. In March 2025, more than 130 laureates issued an appeal on the financial responsibility of the aggressor, calling for the use of frozen assets of the russian federation in the amount of about 300 billion US dollars for the restoration of Ukraine. And in February 2026, against the background of an increase in the number of attacks by the aggressor on the civilian population of Ukraine, an appeal appeared criticizing the policy of appeasement of the russian federation, saying that this only provokes new crimes.

In general, the formation of an inclusive environment that involves the effective involvement of broad segments of citizens in economic activity and the protection of property rights is relevant for Ukraine. The protection of investor rights must be ensured through effective legislation. Independent courts can ensure the protection of the rights of owners, since otherwise investments may be unprofitable, which may repel potential investors.

For Ukraine, it is critically important to create conditions under which old inefficient companies give way to new ones that are able to implement innovations relatively quickly. For our state, this means the need for reforms that will increase the effectiveness of antitrust legislation and make the mechanism for its implementation effective.

In addition, relatively small fines cannot be an effective means of antitrust activity. The problem of fragmentation of ownership of production facilities in order to preserve real power in the hands of a relatively small circle of owners or even one owner of production remains.

Monopolies in Ukraine should not prevent the implementation of startups by young companies, for which the market should be open. At the same time, the openness of the market should not pose a threat to the national interests of the state. Antitrust legislation and the activities of relevant state bodies should not be an obstacle to the acquisition of property rights in Ukraine by citizens of the aggressor state. Permission to extract a number of minerals in Ukraine for foreign corporations should also not be a problem.

Ukraine is quite successfully using the principles of ensuring liquidity and stress testing of banks in wartime, proposed by Bernanke, Diamond, and Dybvig. Along with financial assistance from foreign partners, this allows avoiding the collapse of the financial system in wartime.

For new business structures in Ukraine, the advice developed by Aghion et al. (2005) remains relevant, providing for the use of flexibility by small businesses in choosing niches for their activities for the accelerated implementation of new technologies. The researcher proved that innovations could act as a powerful means of competing with large players in the market, as well as a means of overcoming crisis phenomena, since innovative firms are less vulnerable in crisis conditions, because their product is more difficult to replace with a cheap analogue.

Using developments within the framework of contract theory, Hart (2011) and Holmström (1999) allow you to influence the possible non-binding nature of partners by including in contracts not only obligations, but also specific scenarios in case of force majeure. The use of bonuses tied to the result instead of fixed pay to employees may also be important.

A soft push to increase sales through the choice of average tariffs, as well as through the maximum reduction of actions required to purchase a product, developed by Thaler, can be used by Ukrainian business structures to simplify the customer journey. Roth's algorithms (2008) related to optimizing the offer of goods or services may also be interesting for marketplaces or search services. Acemoglu's developments regarding trust in institutions (Acemoglu & Robinson, 2017) are also relevant for small businesses in Ukraine, since in an environment with relatively little trust in institutions, reputation and the development of micro-institutions are important capital. Uniting small businesses in an association can become a

means of forming recommendations and protecting interests, which significantly reduces the costs of checking partners.

Conclusions

The scientific research of the Nobel Prize laureates in economics in the 21st century meets the challenges of the time, caused by the aggravation of global problems of mankind, and is determined by the possibilities of obtaining information for analysis and the conditions for its processing. Gradually, the tendency of scientists to work together on research topics is becoming more noticeable, which increases the level of analytics and scientific abstraction. This, in turn, provides verified results of scientific research and contributes to the formation of joint research platforms. This trend is reflected in the fact that the Nobel Prize each year is received by several researchers at once, whose contributions to the development of scientific research are the most relevant. At the same time, in the 21st century, the inclination and attention of the Nobel Committee to researchers who focus on solving regional problems, identifying their components, and offering the most adequate solutions is becoming more noticeable. This approach allows for a systematic analysis of specific problems and the determination of effective strategies for their resolution.

Another important feature of the scientific research of the Nobel Prize laureates in Economics is the emphasis on studying poverty problems and identifying means of intensification of production. This is due to the need to increase the purchasing power of the population of poor countries to expand the sales markets of the world's leading countries. At the same time, intensification of production is increasingly associated with the development of inclusive institutions, the development of artificial intelligence, and the accelerated introduction of innovations.

There is still a certain interest among scientists in protecting the interests of the world's leading countries as significant guarantors of stable economic development and the preservation and expansion of the world market.

In the conditions of the modern russian-Ukrainian war, the interest of researchers is focused on identifying mechanisms for overcoming crisis phenomena and concentrating efforts on creating effective recommendations for Ukraine to modernize its economy. And such modernization is an important means of forming a belief in the prospects of democratic institutions and the effectiveness of international law.

Relevant for Ukraine are the developments of Nobel Prize laureates related to the modernization of antitrust legislation and its implementation, the development of small businesses, and increasing their competitiveness in the fight against the dominance of large companies, reducing costs for checking the integrity of partners and ensuring their loyalty for the long term.

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RUSSIA'S WARS IN THE 21st CENTURY AND MIGRATION CHALLENGES FOR EUROPEAN COUNTRIES

Migration processes have the potential to impact the economic, social, and political systems in the countries of emigration and immigration. Local norms and cultural differences are the factors leading to significant transformations. Europe has been a historical center of migration and has attracted migrants with various cultural, social, and economic backgrounds. The intensification of migration processes after World War II was due to demographic changes and economic integration processes. It required the development of basic infrastructure responsible for the effective adaptation of migrants to the new conditions for them. However, the wars started by Russia in Ukraine and Syria created unforeseen challenges for European countries, when millions of asylum seekers and migrants became a part of communities. The labour markets and social systems of these countries were not fully prepared for such stress. The research hypothesizes that the increased flows of migrants and refugees to the European Union have a long-term impact on block's economic development, social prospects, and demographic structure. This study combined qualitative and exploratory research methods, specifically a systematic literature review and case study research. The research highlights that, on the one hand, the dynamics of migration to the European Union reflected the trends of expansion in historical perspective. On the other hand, migration

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ВІЙНИ РОСІЇ XXI ст. І МІГРАЦІЙНІ ВИКЛИКИ ДЛЯ ЄВРОПЕЙСЬКИХ КРАЇН

Міграційні процеси мають потенціал впливу на економічні, соціальні та політичні системи в країнах еміграції та імміграції. Місцеві норми та культурні відмінності є факторами, що призводять до значних трансформацій. Європа була історичним центром міграції та приваблювала мігрантів з різним культурним, соціальним та економічним походженням. Інтенсифікація міграційних процесів після Другої світової війни зумовлена демографічними змінами та процесами економічної інтеграції. Це вимагало розвитку базової інфраструктури, відповідальної за ефективну адаптацію мігрантів до нових для них умов. Однак війни, розпочаті росією в Україні та Сирії, створили непередбачені виклики для європейських країн, зокрема мільйони шукачів притулку та мігрантів стали частиною громад. Ринки праці та соціальні системи цих країн не були повністю готові до такого стресу. Висунуто гіпотезу, що збільшення потоків мігрантів та біженців до Європейського Союзу має довгостроковий вплив на економічний розвиток, соціальні перспективи та демографічну структуру блоку. Це дослідження поєднує якісні та пошукові методи дослідження, зокрема систематичний огляд літератури та дослідження конкретних випадків. У дослідженні підкреслюється, що, з одного боку, динаміка міграції до Європейського Союзу відображала тенденції розширення в історичній перспективі.

processes were affected by external factors, among them the forced migration of millions of people from Syria and Ukraine because of russia's military aggression.

Keywords: international migration, European integration, labour mobility, migration policy, labour market.

З іншого – на міграційні процеси впливали зовнішні фактори, серед яких вимушена міграція мільйонів людей із Сирії та України через воєнну агресію росії.

Ключові слова: міжнародна міграція, європейська інтеграція, мобільність робочої сили, міграційна політика, ринок праці.

JEL Classification: F22, J61, O52.

Introduction

Migration plays an important role in modern international economic relations. Disparities in economic, social, political, and ecological development are motivating (or forcing) different groups of people to move to the so-called centres of migration. Europe in general and the European Union in particular are among them.

Migration can potentially open opportunities and provide safety, but, at the same time, could increase the risks associated with discrimination and social isolation. Dustmann et al. (2016) demonstrate that migrant groups could systematically face fewer labour market opportunities compared to local citizens due to discriminatory practices with the same observed education and experience levels. It could be an element of a government policy or social biases. As a result, socio-economic consequences could vary from country to country. The European Union faced a systemic challenge that required a unified approach to the migration policy.

The russian federation has started to weaponize this fact in its hybrid operations after the presidency of Putin. The processes of weaponization have intensified after the involvement of russia in the civil war in Syria, which caused massive flows of migrants to the neighbouring countries (Türkiye, Jordan, and other countries) and the European Union. Eggen and Lavikainen (2025) argue that totalitarian regimes are using migration in an innovative way as an unconventional method of war. Gridina andKasyanova (2019) analyse the dimensions of migration weaponization and assuming that it creates the effect of a slow-motion explosion, which can detonate at any moment and be used as a time mechanism in the hands of the aggressor in political, information, educational, mental spaces: loosening of social unity, creating agents of influence of "russian peace", the introduction of intolerance and socio-regional xenophobia. Dennison and Geddes (2019) demonstrate that there are strong correlations over time between the salience of immigration and the polling of such parties in most Western European countries. So, the russian policy of migration weaponization could potentially lead to negative medium-term and long-term effects for European economic development and social stability.

Duszczyk and Kaczmarczyk (2022) analyzed the experience of Ukrainian and Syrian refugees and migrants in the European Union and stated the differences in adaptation and integration, demographic structure, and policy approaches.

The paper aims to identify key trends and effects of recent migration flows to the European Union, escalated by the russian aggression against Ukraine and Syria.

The research hypothesizes that the increased flows of migrants and refugees to the European Union have long-term effects on block's economic development, social prospects, and demographic structure.

This study combined qualitative and exploratory research methods, specifically a systematic literature review and case study research.

The paper is organized in the following way: chapter 1 analyses general migration trends in the European Union, and chapter 2 analyses the impact of wars in Ukraine and Syria, caused by russian aggression, on the European labour market and migration policy.

1. Migration trends in the European Union

Today's migration processes in the European Union have no analogue in the whole world. These processes originated from the moment when the European Economic Community emerged. Back in 1951, when the Treaty of Paris stipulated the creation of an interstate association of "Coal and Steel", which included France, West Germany, Italy, Belgium, the Netherlands, and Luxembourg, there was a gradual development of economic and political relations that later served as the basis for expansion. So, already in 1957, the Treaty of Rome was signed on the free movement of people between these countries, which marked the liberalization of the migration of people within the framework of this association. Subsequently, the effectiveness of political, economic, and migration policies served as a solid basis for considering association with new European countries. Thus, in February 07, 1992, in the Netherlands, the Treaty on European Union was signed, which included such countries as Belgium, Great Britain, Greece, Denmark, Ireland, Spain, Italy, Luxembourg, the Netherlands, Portugal, France, and Germany. The effectiveness of the unification of European countries clearly reflected the trend of the future expansion of the European Union, which also characterized the free movement of people between countries.

Figure 1 illustrates the dynamics of migration in the countries of the European Union for the period from 1960 to 2021.

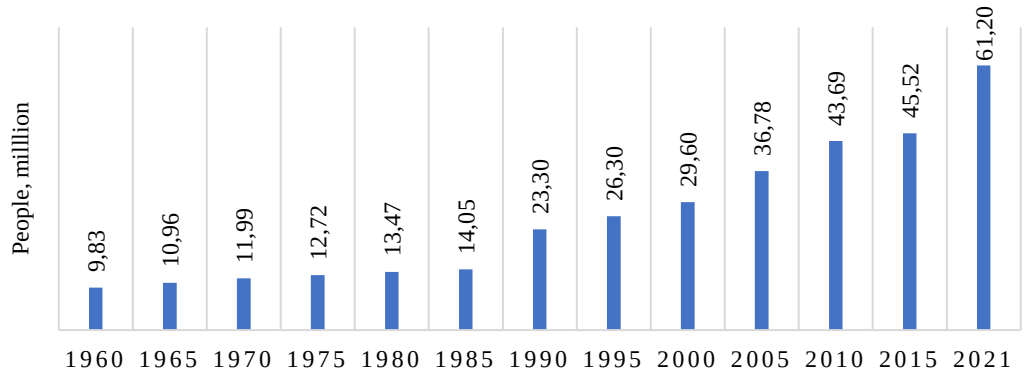

Figure 1. Migrant population in EU, 1960–2021

Source: our elaboration based on (European Union, n. d.).

Based on this figure, we can state the fact that from 1960 to the beginning of the 90s of the 20th century, this trend did not change much; it had its own growth within 10–15% per decade. But since the collapse of the USSR and the growth of scientific and technological progress, the trend has clearly begun to pick up its pace since the beginning of the 90s and, on average, increased by more than 15–17% per decade in each subsequent decade. According to Eurostat data, already in 2021, the statistics of migrants in the EU countries were: "Migrant population: 23.7 million non-EU citizens living in the EU on 01.01.2021. The number of people residing in an EU Member State with citizenship of a non-member country on 01 January 2021 was 23.7 million, representing 5.3% of the EU population. In addition, there were 13.7 million persons living in one of the EU Member States on 01 January 2021 with the citizenship of another EU Member State. In absolute terms, the largest numbers of non-nationals living in the EU Member States on 01 January 2021 were found in Germany (10.6 million persons), Spain (5.4 million), France, and Italy (both 5.2 million). Non-nationals in these four Member States collectively represented 70.3% of the total number of non-nationals living in all the EU Member States, while the same four Member States had a 57.6% share of the EU's population (Eurostat, 2022; n. d.). The publication of the European Commission additionally provides the following data as of January 01, 2021: "Overall figures of immigrants in European society: 447.2 million inhabitants living in the EU; 23.7 million were non-EU citizens (5.3% of the EU's total population); 37.5 million people were born outside the EU (without those born in another EU countries) – 8.4% of all EU inhabitants". (European Commission, 2025). The statistics of EU residents who came from other countries are as follows (*Figure 2*).

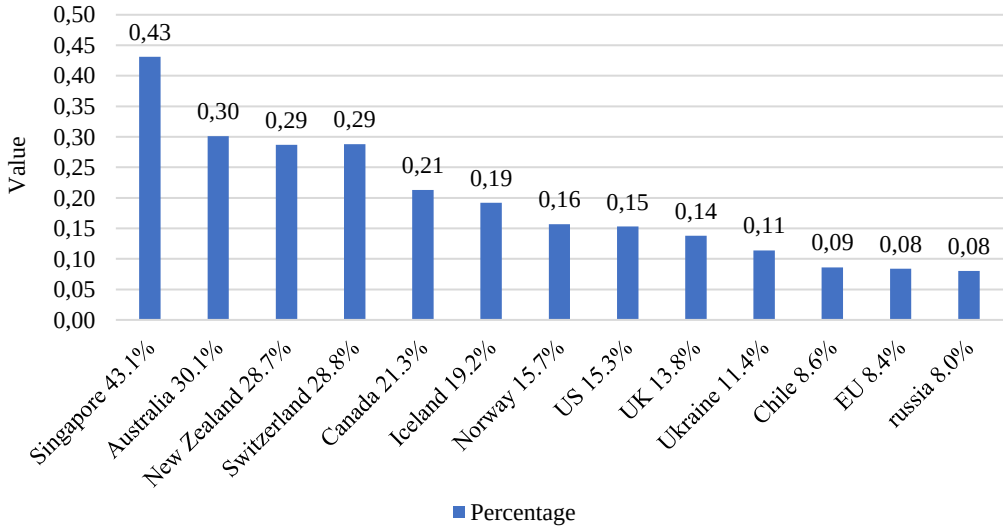

Figure 2. Foreign-born residents per country in the EU, 2021

Source: our elaboration based on (European Commission, 2025).

The tendency of the last 5 years clearly shows an increase in the number of migrants to the EU countries. First, it can be argued that this growth began its active phase against the background of wars initiated by russia against Syria and Ukraine. In the arena of world geopolitics, 2014 can rightfully be considered a turning point, taking into account the beginning of russia's hybrid war against Ukraine through the occupation of the Crimean Peninsula, and the formation of the so-called republics of the DPR and LPR, which subsequently in 2022 turned into a full-scale military invasion and occupation by russia of the territories of Ukraine.

2. The impact of migration from Ukraine and Syria on the EU

Let us consider the migration processes of the population to the EU countries, on the example of the most vulnerable territories affected by military aggression – Ukraine and Syria. Russia's military aggression began in 2014 with the annexation of Crimea, and then in 2015 during the civil war in Syria, when the current political regime was supported: "russia has supported the administration of incumbent President Bashar al-Assad of Syria since the beginning of the Syrian conflict in 2011: politically, with military aid, and (since September 2015) with direct military involvement. The 2015 deployment to Syria marked the first time since the end of the Cold War in 1991 that russia entered an armed conflict outside the borders of the former Soviet Union.

The political support of Bashar al-Assad by russia was connected, first of all, with the consolidation of russia's political and economic influence in the Middle East. Considering the impossibility of the Syrian armed forces controlled by Bashar al-Assad to hold back the opposition, military support from russia meant direct interference in the sovereignty of an independent state, at the cost of millions of refugees, as well as civilian casualties. According to Aljazeera, the results of russia's military intervention in Syria are difficult to characterize as rational, including from an economic point of view, in relation to russia itself: "Moscow has also failed to leverage its position in the Syrian conflict to jump-start dialogue with the West on sanctions or even get Western Europe to commit to funding the reconstruction of war-ravaged Syria (Al Jazeera, 2020, October 1).

Aljazeera, investigating the question of what was the benefit of military intervention in Syria for russia, cites the military spending as facts, and also quotes the rationale for these costs from russia: two years after the start of the intervention, russia's defense budget dropped from 5.5% of gross domestic product (GDP) (USD 79 billion) in 2016 to 3.7% (USD 61.4 billion) in 2018, alleviating fears of overspending on the military. At the same time, the russian government has presented the operation in Syria as an opportunity to test and promote russian weaponry (something other

large arms exporters, like the US and Israel, have also done in the region). In 2017, the defense ministry said some 600 new weapons had been tested in military action in Syria. From this, we can conclude that the russian intervention was nothing more than a claim to "influence" Syria at the cost of military spending and russia's testing of new types of weapons. Thus, the nature of the intervention implied nothing more than the satisfaction of cynical political ambitions with an unknown result, since the conflict remained unresolved, but provoked an incredibly large wave of migrants and refugees to the EU.

Over time, the conflicts began to flare up in other countries as well, on the territories which are controlled by the russian federation with the help of force. "russia's current foreign policy priorities include the political crisis in belarus and the conflict between Armenia and Azerbaijan in Nagorno-Karabakh. This has pushed to the background the Syrian war, wherein the russian government is mainly interested in preserving the status quo and maintaining a frozen conflict". From the foregoing, it can be assumed that the russian political and military leadership, having barely achieved their goals in Syria, were forced to stop, due to limited budgetary resources and the emerging new military-political crises in the border areas of Armenia, Azerbaijan, and belarus.

Among the victims of russian military aggression, one should also consider the refugees who found support from the EU countries. According to statistics provided by the European Commission, the TOP 10 European countries that provided support to refugees from Syria in the EU at the end of 2020 (*Figure 3*).

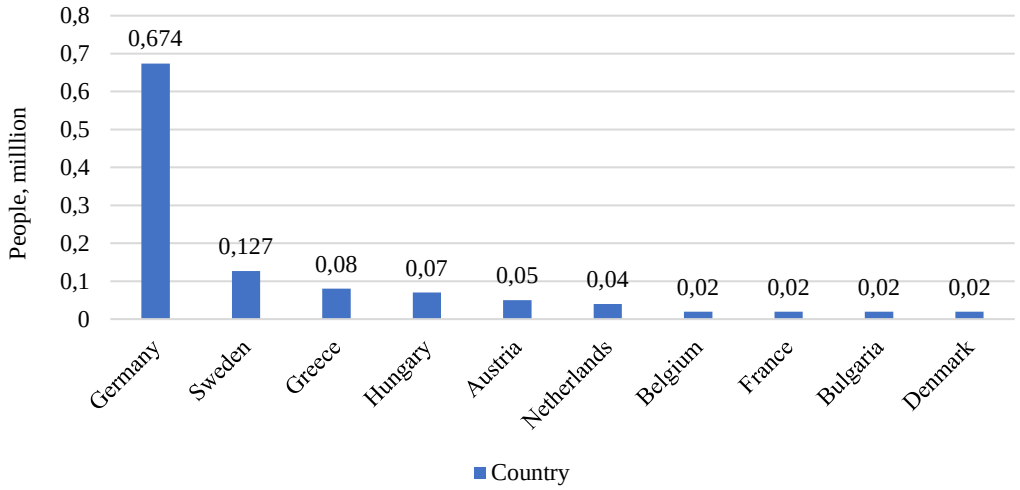

Figure 3. European countries for asylum applications

Source: our elaboration based on (European Commission, 2021).

After analyzing the data, it can be argued that the European Union countries have become one of the largest countries in the world that aided refugees from Syria, who became victims of the russian military invasion.

On July 29, 2021 the EU Delegation announced key areas in favour of resolving the Syrian conflict: "The EU's strategic objectives in Syria are focused on six key areas: An end to the war through a genuine political transition, in line with UNSCR 2254, negotiated by the parties to the conflict under the auspices of the UN Special Envoy for Syria and with the support of key international and regional actors. Promote an inclusive transition in Syria, in line with UNSCR 2254 and the Geneva Communiqué, through support for the strengthening of the political opposition. Save lives by addressing the humanitarian needs of the most vulnerable Syrians across the country, in a timely, effective, efficient, and principled manner. Promote democracy, human rights, and freedom of speech by strengthening Syrian civil society organizations. Promote accountability for war crimes with a view to facilitating a national reconciliation process and transitional justice. Support the resilience of Syria's population and society (European External Action Service, 2024). On March 15, 2022, the UNHCR Refugee Agency notes the following: "Syria remains the world's largest displacement crisis. More than 13 million people have either fled the country or are displaced within its borders. Neighbouring and nearby countries require continued international support, having generously welcomed more than 5.6 million Syrian refugees – the vast majority worldwide" (UNHCR, 2022, March 15).

At the same time, the Politifact publication cites statistics with reference to the UN on Syrian refugees, which are as follows: "There are more than 4.89 million Syrian refugees according to the UN's latest count". (PolitiFact, 2017) In terms of gender and age, the following information is provided: "Ellison referenced a UNHCR regional demographic breakdown based on refugees registered in Egypt, Iraq, Jordan, and Lebanon. To determine a figure for women and children, Ellison summed the percentage of registered Syrian males under 18 years old with the percentage of women of all ages – it comes out to about 73 percent. Factoring in women of all ages and boys under 12 years old, it's about 66 percent. Ellison's other point about "a full third" of refugees being younger than 12 years old also checks out for the UNHCR group" (PolitiFact, 2017). All these trends are quite new to Europe, bringing with them potentially dramatic changes in the current demographic structure of Europe. Most of them are young people of an average, fairly young age, which will undoubtedly affect and change the demographic future of Europe.

Along with the smoldering Syrian conflict and millions of people left homeless after a military invasion, russia is undertaking another military aggression aimed at the so-called "brotherly" neighboring country, Ukraine. It was russia's war in Ukraine that provoked an incredible flow of refugees and migrants from Ukraine, among which 90% are young women and children. Starting from February 24, 2022, and until January 2023, the number of refugees from Ukraine increased; however, during this period, cases of people returning to Ukraine were also noted many times.

It should also be noted that during the period 2010–2020, almost several hundred thousand Ukrainians who came to the EU were registered for citizenship, which is reflected in the following table: Number of Ukrainians acquiring citizenship of an EU Member State between 2010 and 2020 (*Figure 4*).

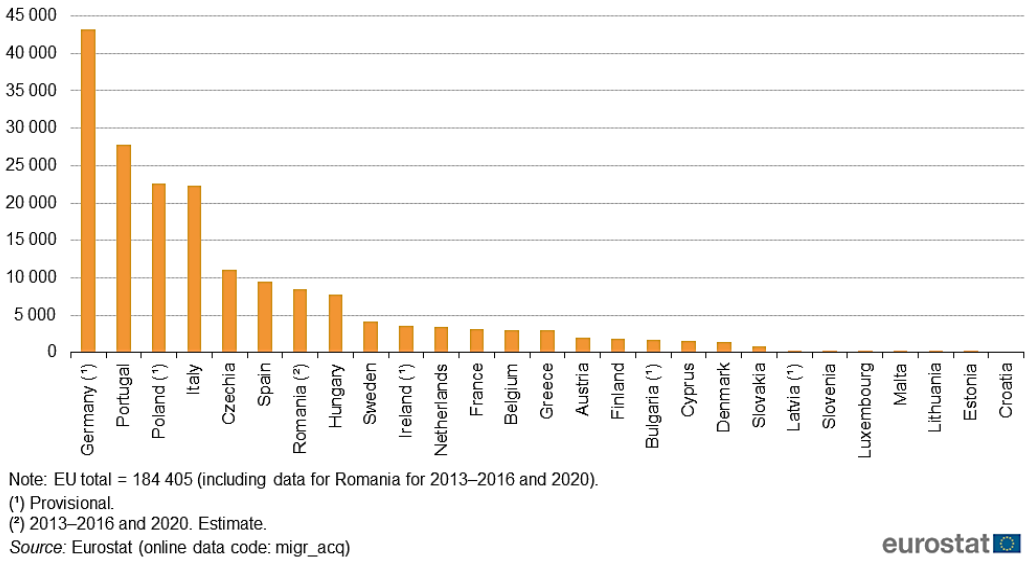

Figure 4. Number of Ukrainians acquiring citizenship of an EU

Source: (Eurostat, 2022).

Let us consider the migration processes of the population to the EU countries, using the example of Ukraine, which suffered from military aggression. According to the IMF report dated December 15, 2022, the highest level of refugees from Ukraine is noted: Almost 8 million refugees have fled Ukraine since russia's invasion in February, Europe's largest refugee wave since World War II, with the majority of those now in the European Union. These figures will increase depending on the war's duration and severity (International Monetary Fund, 2022). Also in the IMF report, it is noted that the assistance was provided by the European Union especially quickly and decisively, namely: "Europe reacted with swift and decisive support, and 4.8 million people from Ukraine are registered for temporary protection in the EU or in similar national programs". The EU has removed many barriers that refugees typically face by offering residency rights, work permits, and access to health care, schools, housing, and banking services (International Monetary Fund, 2022, December 15). In the context of European countries that accepted Ukrainian refugees and provided the necessary support, it is shown in *Figure 5*. The IMF report also draws attention to the fact that the EU countries, which are actively increasing the amount of necessary assistance, will significantly increase by the end of the year. Supporting refugees comes with some short-term fiscal costs. Across the EU, these could reach EUR 30 billion to EUR 37 billion in the

first year, or about 0.2% of gross domestic product. The unprecedented assistance from the EU indicates, first of all, the readiness of the EU countries to consider Ukraine not just an associate member of the EU, but also indicates the prospect of EU membership, especially taking into account the employment of Ukrainians in the EU labour market: "We estimate that Ukrainian refugees could raise the size of Europe's labour force by some 0.6 percent by the end of 2022, and by 2.7% in the countries with the largest numbers of arrivals, where Ukrainian refugees will ease labour shortages (*Figure 5*).

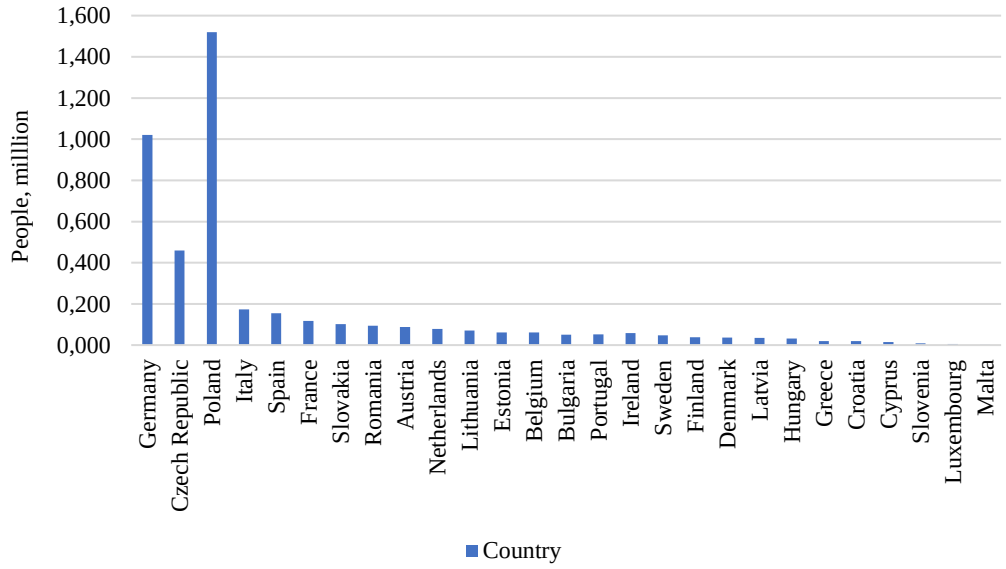

Figure 5. Ukrainian refugees, total

Source: our elaboration based on (International Monetary Fund, 2022, December 15).

These statistical facts confirm that, on the part of refugees from Ukraine, many people find an opportunity to get a job and, in this way, among other things, support the EU economy, which provides assistance to Ukraine. Refugee statistics by age and gender, according to data as of May 2022, are presented in *Figure 6*.

From the above statistical sample presented in the *Figure*, a significant part of Ukrainian refugees are women and children. According to the given publication of "Ukrainska Pravda", dated July 13, 2022, a significant part of Ukrainians does not plan to return to Ukraine: "About two-thirds of Ukrainians who went abroad with the start of a full-scale war, so far (July 2022) do not plan to return to Ukraine". This is evidenced by the results of a survey conducted by the Office of the United Nations High Commissioner for Refugees. The survey was conducted among 4 900 Ukrainians now living in Poland, the Czech Republic, Hungary, Moldova, Romania, and Slovakia, in mid-May to mid-June (Ukrainska Pravda, 2022, July 13). But it should be noted that at the beginning of 2023, many refugees from Ukraine returned to their homes.

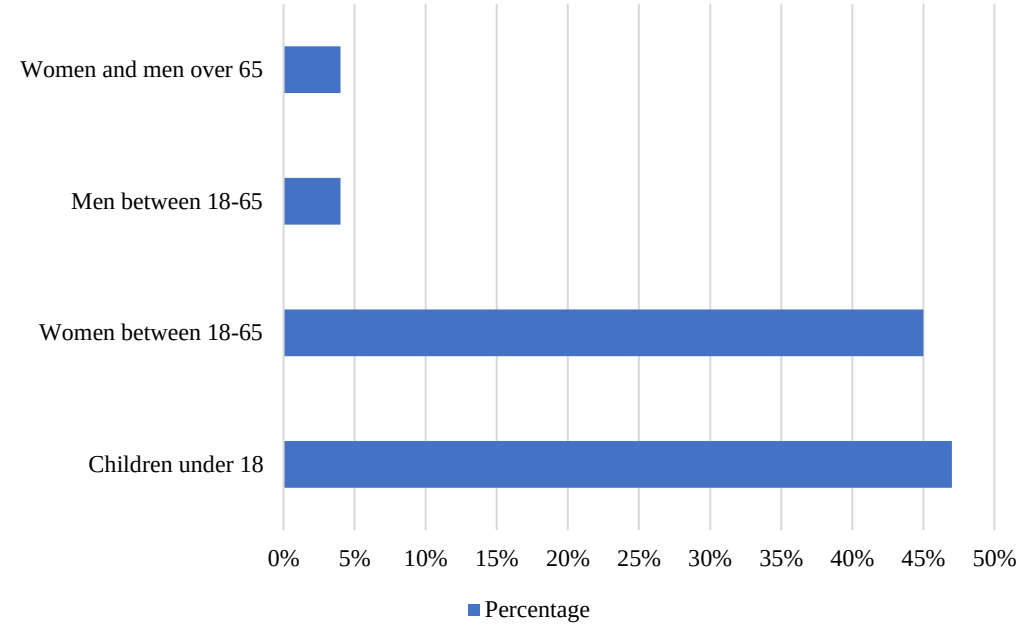

Figure 6. Who is fleeing the war (to the EU), 2022

Source: our elaboration based on (Euronews, 2022).

There is a tendency in favour of increasing the number of Ukrainians who returned to their homeland. This is evidenced by the September 16, 2022, publication "Zakordon 24": "More than 8 million Ukrainians have arrived in the EU countries since the beginning of the war. But there is good news on both sides. Many Ukrainians have already returned. About 5 million have already returned to Ukraine. Of course, we want to give Ukrainian friends who need help as much support as possible. But we also know that they want to go back home again, rebuild Ukraine and turn it into a successful state, – said the President of the European Commission" (24tv.ua, 2022). As a result of the war, the first waves of migration from Ukraine to the EU countries reflected the maximum number of people who left for the EU. However, for various reasons, after some time, a significant part of Ukrainians decided to return. From this, it can be assumed that the part of Ukrainians that remains in the European Union is gradually adapting to local conditions, including finding a job and providing a standard of living that they could not afford if they returned to Ukraine.

However, a significant part of Ukrainians remains in the European Union. According to the publication Operational Data Portal on January 03, 2023, the statistics are as follows: "4 905 293 Refugees from Ukraine registered for Temporary Protection or similar national protection schemes in Europe" (UNHCR, 2022, March 15). Considering that mainly the Polish-Ukrainian border is the main border crossing point, for many Ukrainians, Poland becomes a country not only for seeking asylum, but also as a distribution centre for onward movement to other EU countries. The publication

"Ukrainian in Poland" notes the following: "Poland has become a country where the majority of Ukrainians have found refuge, who crossed the Ukrainian border, fleeing from full-scale russian aggression. According to the Polish Border Guard Service (Straż Graniczna), from February 24 to January 1, 2023, more than 8.841 million refugees from Ukraine crossed the Polish-Ukrainian border. It should be noted that exactly a month ago, on December 1, 2022, this figure was just over 8.121 million people". (Ukrainian in Poland, 2022).

Indeed, Ukrainian refugees, getting into the EU countries, receive the necessary assistance to ensure their lives during their stay in a particular European country. The Ukrainian edition of "Mind" provides information about the support of Ukrainians from the EU countries, referring to the IMF analytical report. According to this report, Poland (1.35 million) and Germany (970 000) became the most hospitable countries in the Eurozone, hosting the most people. But if we consider as a percentage of the country's population, then the maximum hospitality was shown by the Czech Republic (the number of Ukrainians who received asylum from them is 4% of the country's population), Estonia (3.9%), Poland (3.6%) and Moldova (3.5%). More than 3.9 million Ukrainians have received temporary protection status or similar statuses in the Eurozone. Thus, Poland issued 1.35 million ID cards, the Czech Republic – more than 423 000, Italy – 153 900, Spain – 139 000. 90% of refugees are women with children, from 22% to 44% of refugees are children. It also provides estimates of EU payments to support refugees from Ukraine, namely: "According to preliminary calculations, the cost of the "invasion" of Ukrainian refugees in the EU will be from EUR 30–37 billion per year, or from 0.19% to 0.23% of EU GDP. Although a significant part of the refugees lives in rented apartments, for which they themselves pay or which are paid for by charitable organizations from Ukraine and other countries" (Ukrainian in Poland, 2022).

Ukrainian refugees, staying in the EU countries, also master the local labour market. For example, in Poland, according to the publication "European Website in Integration", the following employment statistics are given: "Since the introduction of a special law easing access to the labour market in Poland, 185 000 refugees from Ukraine have started work in the country. The law makes refugees from Ukraine eligible for employment even if they do not have a work permit or a PESEL number – the unique personal identifier issued to residents. Instead, refugees from Ukraine can start work if their employer informs the local labour office about the hire within 14 days. The procedure applies to Ukrainian nationals and non-EU spouses of Ukrainian nations who arrived in Poland on or after 24 February 2022, or the start of the war" (European Commission, 2025, July 10).

The European Union also provides significant support to Ukrainian refugees in finding work, offering appropriate tools as a pilot project, according to Reuters. "The European Commission unveiled a new online tool

to help Ukrainians find a job as the bloc looks to extend its protection for those displaced by russia's invasion for another year. … The pilot job-search tool, managed by the European Labour Authority, is available in English, Ukrainian and russian and linked to the EU's cooperation network of employment services with over 3 million vacancies" (Reuters, 2022, October 10). The potential involvement of Ukrainian refugees in the labour market of the EU countries is currently being studied. The OECD publication is investigating this issue and proposes the following conclusions: "Although the projections are made in the context of high levels of uncertainty, for all European countries together, the labour force is expected to increase by about 0.5% by the end of 2022. For individual countries, the largest increase is found in three countries: the Czech Republic (2.2%), Poland (2.1%), and Estonia (1.9%). The estimated effect on employment shows a similar ranking of countries, with the Czech Republic, Poland and Estonia exhibiting a significant increase of at most 1.9%, while the overall impact across all European host countries is estimated to be 0.4%. The overall estimated impact on labour force is about twice as large as that of the 2014–2017 inflow of refugees to the European Union. Most of it will be observed in a few countries (in relative terms, Czech Republic, Poland and Estonia) and, given the differences in migrant profiles between 2014–2017 and today, with more women and more high-educated, the most affected labour market segments will be different – likely less unskilled manual labour and more service occupations" (OECD, 2022). Based on the analysis of the data by the OECD publication, preliminary results have been obtained, which indicate the following: "The impact on the European labour force of the inflow of Ukrainians is measurable: an increase of an estimated 0.5% by the end of 2022, although impact is uneven and several countries seeing increases of as much as 1.9%. The estimated impact is about twice as large as that of the 2015–2017 inflow of refugees" (OECD, 2022).

Conclusions

Based on the above analytical data, as well as considering the EU policy aimed at facilitating the employment of Ukrainian refugees, we can assume a growing tendency in the number of Ukrainians involved in the European labour market in 2023. An analysis of the above data obtained from various sources suggests that significant migration processes in the European Union were due to at least several factors. On the one hand, migration was at the stages of the expansion of the Eurozone and the liberalization of population migration within the Eurozone; on the other hand, it was due to external factors. External factors include, first of all, the forced migration of affected people from Syria and Ukraine because of russia's military aggression. Despite all the economic difficulties, the European Union, from the beginning of its founding, has continued the economic and political policy of sustainable development and expansion, providing unprecedented

support to all people, and especially to forced refugees from war-affected countries.

Key trends and effects of recent migration flows to the European Union, escalated by the russian aggression against Ukraine and Syria, were identified. The current impact of the highlighted trends was analysed.

The research hypothesis was confirmed. The increased flows of migrants and refugees to the European Union have long-term effects on block's economic development, social prospects, and demographic structure.

The prospects of the migration consequences in the European Union are difficult to predict now. A significant proportion of refugees, including women with children, may decide to return to their homeland to rebuild the country and reunite with family and friends. However, there remains a high probability that many will decide to stay in the European Union. The consequences of russia's military invasion of Syria and Ukraine, the subsequent refugee crisis, may be analysed decades later, after the end of the military conflict and the refugees' return to their homeland. But today, it is clear and understandable that these migration flows, the flows of refugees caused by wars, provoked by russia, will have great consequences in the EU, and not only migration, but also demographic.

Further research could be concentrated on the process of second-generation adaptation to the European economic conditions. Also, the long-term impact of re-emigrants on the national economies should be at the centre of further research.

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BEHAVIORAL SENTIMENT OF INVESTORS IN IRAQ FROM PRICE GAPS

This research examines investor sentiment in frontier markets where limited data availability prevents the application of traditional sentiment indicators. The Iraq Stock Exchange (ISX), one of the largest frontier markets in the Middle East, has never been studied within the context of behavioral finance, creating a significant empirical gap. The research hypothesizes that price gap patterns derived exclusively from daily closing prices constitute valid proxies for investor sentiment in frontier markets, exhibiting statistically significant relationships with market returns and reflecting identifiable behavioral biases, including overreaction, herding, and sentiment persistence. Four gap-based sentiment indicators are constructed from 122 778 stock-day observations across 57 equities and seven sectors over 2304 trading days (August 2014 – August 2024): the Gap Ratio Indicator (GRI), Gap Intensity Index (GII), Sector Sentiment Dispersion (SSD), and Gap Persistence Indicator (GPI). Validation employs correlation analysis, cross-sectional return dispersion (CSSD) analysis, event study methodology on extreme sentiment days, and rolling 60-day window analysis. The hypothesis is confirmed: GRI demonstrates a statistically significant positive correlation with market returns ($r = 0.269$, $p < 0.001$). Of 122 778 observations, 3965 positive gaps (3.23%) and 3118 negative gaps (2.54%) indicate a moderate optimism bias. Negative gaps exhibit higher reversal rates (36.4%) than positive gaps (32.4%), consistent with loss aversion theory. The herding sub-hypothesis is partially refuted, as cross-sectional

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ОЦІНКА ІНВЕСТИЦІЙНОГО КЛІМАТУ В ІРАКУ НА ОСНОВІ ЦІНОВИХ РОЗРИВІВ

Розглянуто настрої інвесторів на прикордонних ринках, де обмежена доступність даних перешкоджає застосуванню традиційних показників настроїв. Іракська фондова біржа (ISX), один з найбільших прикордонних ринків на Близькому Сході, ніколи не досліджувалася в контексті поведінкових фінансів, що створює значну емпіричну прогалину. Висунуто гіпотезу, що моделі цінових розривів, отримані виключно на основі щоденних цін закриття, є дійсними показниками настроїв інвесторів на прикордонних ринках, демонструючи статистично значущі зв'язки з ринковою прибутковістю та відображаючи ідентифіковані поведінкові упередження, включаючи надмірну реакцію, стадність та стійкість настроїв. Чотири індикатори настроїв на основі розривів побудовані на основі 122 778 спостережень за днями акцій по 57 акціях та семи секторах протягом 2304 торгових днів (серпень 2014 – серпень 2024 рр.): індикатор коефіцієнта розривів (GRI), індекс інтенсивності розривів (GII), дисперсія настроїв секторів (SSD) та індикатор стійкості розривів (GPI). Валідація використовує кореляційний аналіз, аналіз перехресного розриву доходності (CSSD), методологію дослідження подій в екстремальні дні настроїв та аналіз ковзного 60-денного вікна. Гіпотеза підтверджена: GRI демонструє статистично значущу позитивну кореляцію з ринковою дохідністю ($r = 0.269$, $p < 0.001$). Зі 122 778 спостережень 3 965 позитивних розривів (3.23%) та 3118 негативних розривів (2.54%) вказують на помірне упередження оптимізму. Негативні розриви демонструють вищі показники розвороту (36.4%), ніж позитивні розриви (32.4%), що узгоджується з теорією небажання втрат. Підгіпотеза стадності частково спростована,

return dispersion increased rather than decreased under extreme market conditions. The banking sector shows the highest sentiment sensitivity (r = 0.261), with significant heterogeneity across sectors. This study provides the first behavioral finance analysis of the ISX and establishes a replicable framework for sentiment measurement in data-constrained frontier markets.

Keywords: investor sentiment, price gaps, behavioral finance, Iraq stock exchange, frontier markets.

оскільки перехресна дисперсія дохідності збільшилася, а не зменшилася за екстремальних ринкових умов. Банківський сектор демонструє найвищу чутливість до настроїв (r = 0.261) зі значною неоднорідністю між секторами. Це дослідження пропонує перший аналіз поведінкових фінансів ISX та встановлює відтворювану систему для вимірювання настроїв на обмежених даними ринках.

Ключові слова: настрої інвесторів, цінові розриви, поведінкове фінансування, Іракська фондова біржа, прикордонні ринки.

JEL Classification: G14, G15, G40, G41.

Introduction

The efficient-market hypothesis suggests that all information available is reflected in asset prices (Fama, 1970). There has been considerable empirical evidence supporting the existence of anomalies, leading to a major movement in behavioral finance (Shiller, 2003). This theory shows that investors' decision-making processes are skewed by psychological and emotional mechanisms that create discernible, irrational movements in asset prices (Kahneman & Tversky, 1979). The understanding that irrational beliefs and emotions related to future cash flows and risks that are not supported by the evidence can alter price movement has been the basis of many new theories in finance (Baker & Wurgler, 2006).

There are several ways in which stock returns are affected by investor sentiment, regardless of the market context. Baker and Wurgler (2007) focused on the sentiment effect for stocks that are less easily valued and more costly to arbitrage. This has been replicated worldwide, and Wang et al. (2021) reported negative sentiment and return relationships for 50 countries, with a greater speed of sentiment correction in emerging markets compared to developed markets. The behavioral aspect of the markets was highlighted by the COVID-19 pandemic, with fear and uncertainty leading to a dislocation of prices with little (or no) movement in fundamental factors (Vasileiou, 2021). This highlights the need for more sophisticated sentiment indicators that help in understanding how markets behave.

Sentiment research has grounded itself in rigor and substantial scholarship, yet there remain underexplored geographies, notably the frontier markets of the Middle East. The behavioral finance scholarship is yet to be interested in the Iraq Stock Exchange (ISX), one of the region's largest frontier markets, and the first one to be opened in 2004. This is particularly surprising given the frontier market's distinctive features and behavioral finance theorists' preoccupation with differences in market liquidity, the presence of institutional players, and the behavioral finance research information asymmetry (Chang et al., 2000). The recent research interest in the MENA markets has begun to bridge this gap. Negative sentiment on the

stock of 173 MENA banks, including some from the Iraq Stock Exchange, was found by Shah and Albaity (2022) to be associated with the banks' stock returns. However, there is yet to be any research on the sentiment surrounding the Iraq Stock Exchange.

The current study develops and validates behavioral sentiment indicators that fill this research gap through price gap analysis of ten years of daily closing prices for the Iraq Stock Exchange (August 2014 – August 2024). Noted gaps – periods of significant discontinuity of closing prices – are instances of rapid sentiment changes reflecting the market participants' reactions to the information that has been disclosed overnight (Plastun et al., 2020). The study develops four such indicators: the Gap Ratio Indicator (GRI), Gap Intensity Index (GII), Sector Sentiment Dispersion (SSD), and Gap Persistence Indicator (GPI). Since the focus is on markets with limited data availability to only daily closing prices, these indicators contribute to the sentiment analysis of such conditions, expanding the methodology of sentiment analysis in resource-constrained situations.

The research makes three main contributions. First, it offers a thorough behavioral finance perspective analysis on the Iraq Stock Exchange, creating a behavioral finance analysis that has been missing on a major component of frontier market research. Second, it outlines a method for building sentiment indicators, relying exclusively on closing prices, applicable to markets that lack intraday data. Third, it also examines behavioral aspects such as herding, overreaction, and the persistence of sentiment in markets with high political and economic uncertainty.

These findings will be of practical value to both investors interested in understanding the dynamics of sentiment in frontier markets and to regulators concerned about the stability of MENA markets.

This research aims to construct and assess the behavioral sentiment indicators resultant from a price gap analysis of daily closing prices at the Iraq Stock Exchange, and to analyze the ISX investors' behavioral patterns – including herding, overreaction, and sentiment persistence – over the ten years from August 2014 to August 2024.

This research posits that price gaps based solely on daily closing prices are a sufficiently accurate approximation of investor sentiment in frontier markets, offer a statistically relevant relationship to market returns, and are suggestive of behavioral biases, such as overreaction, herding, and sentiment persistence, among investors in the ISX.

To empirically evaluate this hypothesis, four sentiment indicators based on gaps are derived from a dataset of 122 778 stock-day observations for 57 stocks across 7 sectors.

The methodologies employed include:

- the correlation of indicator values to both contemporaneous and subsequent market returns;
- cross-sectional standard deviation (CSSD) as a means of identifying the presence of herding;

- an extreme event approach to evaluate market performance on days of extreme sentiment (greater than +/− 2 standard deviations from the mean);
- a rolling 60-day window to capture and evaluate the presence of sentiment persistence and the dynamic of momentary sentiment.

Several limitations are evident in this research and should be stated upfront. First, the dataset used only includes daily closing prices, and since the ISX does not offer opening price data, the dataset does not allow the use of standard open-to-close gap analysis. Second, the dataset does not provide any trading volume data, which means the use of volume-based sentiment validation, which is a standard robustness check in behavioral finance, cannot be performed. Third, the results apply only to the ISX, and replication studies are needed to assess the findings for other frontier exchanges.

The remainder of this article is structured as follows. Section 1 summarizes the theoretical and empirical literature on investor sentiment, price gaps, herding behavior, and sentiment in emerging and frontier markets. Section 2 outlines the data, methodology for assembling the four gap-based sentiment indicators, and the framework for the analytical validation. Section 3 contains the empirical findings, descriptive statistics, indicators, and analysis of behavioral patterns. Section 4 relates the findings to theory and comparative markets. Section 5, the last one, summarizes the key findings, contributions, and limitations, and outlines the future research directions.

1. Literature review

1.1. Theoretical foundations of investor sentiment

The relevant literature draws upon the fact that market participants consistently fail to adhere to rational expectations. Baker and Wurgler (2006) describe investor sentiment as beliefs regarding future cash flows and the risks associated with investments that are unsubstantiated, given the information that is available. In the case of sentiment effects, the strongest effects are for stocks that are hard to value and are costly to arbitrage. Baker and Wurgler (2006) document the first such case and construct a sentiment index that has been used in almost all subsequent studies. In a follow-up study, Baker & Wurgler (2007) built on their previous work and detailed how trends in sentiment impact individual firms as well as the overall stock market, particularly emphasizing how speculative stocks are more likely to be affected by changes in sentiment.

The study of market sentiment and its behavioral drivers adjusts and applies Prospect Theory (Kahneman & Tversky, 1979) to answer the question of why an investor behaves differently when faced with a gain, compared to a loss, from an investment. With this in mind, and given the evidence of inefficiencies in the capital markets, De Bondt and Thaler (1985) assert that if investors are said to behave irrationally, it is assumed that they will overreact to new information, and therefore, the market will give rise to

predictable reversals in returns. This has become known as the overreaction hypothesis, and numerous studies spanning vast time periods and a range of global markets have illustrated that over the long term, prior loser stocks will outperform prior winner stocks, and this is due to extreme sentiment and mispricing.

1.2. Sentiment measurement and price gaps

Price gaps show breaks in price series that show extremes in sentiment changes across trading intervals. Plastun et al. (2020) performed extensive examinations on U.S. stock market price gap anomalies and concluded that market inefficiency is contradicted, as gap anomalies have patterns with potential profit. Caporale and Plastun (2017) noted that gaps in price occur from overnight information assimilation, whereby opening prices deviate from closing prices. This gap provides evidence of order imbalance caused by uninformed sentiment. These studies demonstrate price gaps as reliable proxies for examining the changes in sentiment of investors and in other market sentiment measurement, devoid of tools.

1.3. Herding behavior in equity markets

Most investors ignore their personal insights and choose to follow the market. This type of behavior is called herding and is an important behavioral phenomenon of how markets function that, from an economics standpoint, could lead to an increase in the stability of markets. Christie and Huang (1995) were the first to apply the herding hypothesis using the methodology of cross-sectional return dispersion and predicted that if investors were to herd towards the market return, then dispersion would achieve a lower value under a condition of market stress. Chang et al. (2000) built on this and internationalized the scope of analysis and, aside from the United States and Hong Kong (which are considered developed markets), reported the most significant herding for the emerging markets of South Korea and Taiwan. This ground-breaking study showed that the microstructure of the market and the information context significantly determine the level of intensity of herding.

Subsequent research conveys differing patterns of heterogeneity in herding across markets. Chiang and Zheng (2010) studied global stock market herding over 18 markets and reported increased herding during market stress and crisis contagion. Bikhchandani and Sharma (2000) show how cascades of rational herding can occur from rational informational cascades in which individual market participants have useful private information. These studies illustrate that despite an overall consistent herding behavior, its presence and degree is dependent on the composition of the particular market and the prevailing economic climate.

1.4. Sentiment in emerging and frontier markets

The last few years have seen significant growth in the study of investor sentiment in frontier and emerging markets. Wang et al. (2021) studied the effects of sentiment on future stock returns in 50 global markets and found that global market sentiment has a negative effect on stock market returns, and that this effect is more pronounced in emerging markets than in developed markets. This implies that lower efficiency markets correct sentiment imbalances faster than their developed counterparts. In major emerging economies like Brazil, India, China, and Pakistan, Andleeb & Hassan (2023) found that investor sentiment and future returns had significant non-linear relationships, along with great variation in cross-country response heterogeneity.

The unique features of sentiment analysis in the Middle East and North African (MENA) region support the study of Shah and Albaity (2022), who studied the impact of trust, sentiment, and uncertainty on the stock returns of 173 banks in MENA and concluded that market sentiment has a positive impact on the returns, while individual sentiment has a negative impact. Shah (2024) studied cultural dimensions and investor sentiment in MENA banking and concluded that cultural biases lead to overreaction of investors. Cevik et al. (2022) studied the dynamics of investors' sentiment during the time of COVID-19 in the G20 countries and concluded that positive sentiment results in returns and negative sentiment results in loss, the magnitude of which varied with the states of the market.

1.5. Research gap and contribution

Even though there is more research about investor sentiment in developing markets, the frontier markets in the Middle East seem to be the most overlooked. The Iraq Stock Exchange, which is one of the most prominent frontier markets in the region, is rarely the subject of research in behavioral finance. This study attempts to draw attention to the Iraq Stock Exchange by pioneering the development of gap-based sentiment indicators tailored to markets where only closing prices can be recorded. This study builds upon and expands the existing techniques for sentiment measurement in under-researched markets by developing four supplementary and complementary sentiment measures, including the Gap Ratio Indicator, Gap Intensity Index, Sector Sentiment Dispersion, and Gap Persistence Indicator, and providing the first extensive behavioral analysis of the Iraq Stock Exchange.

2. Data and methodology

2.1. Data description

The study analyzes daily closing values for stocks included in the ISX60 index at the Iraq Stock Exchange (ISX). *Table 1* presents the detailed breakdown of the sample by sector.

Table 1

Sectoral distribution of sample stocks

Sector	Number of stocks	Percentage (%)
Agriculture	6	10.5
Banks	16	28.1
Hotels	8	14.0
Industry	16	28.1
Insurance	4	7.0
Services	5	8.8
Investments	2	3.5
Total	**57**	**100.0**

Source: Iraq stock exchange.

The data spans from August 3, 2014, to August 1, 2024, totaling 2,304 trading days. The sample comprises 57 equities across all principal sectors of the Iraqi equity markets, as well as the ISX60 index for comparative benchmark analysis. The sample reflects the economic composition of Iraq. Leading is the banking sector with 16 equities (28.1%). This is followed by the industrial sector, also with 16 equities (28.1%). The hotel sector comprises 8 equities (14.0%). This is followed by the agriculture sector with 6 equities (10.5%), the services sector with 5 equities (8.8%), the insurance sector with 4 equities (7.0%), and the investments sector with 2 equities (3.5%).

2.2. Price gap definition

As Bulkowski (2021) noted, conventional gap analysis combines an opening and a closing price to assess overnight price gaps. However, given that the present dataset consists solely of closing prices, the research utilizes a closing price return methodology for gap analysis. This methodology focuses on large price fluctuations over periods that align with intervals associated with changes in investor sentiment between trading days.

The daily return for each stock i on day t is calculated as:

$$Ri,t = \frac{Pi,t - Pi,t-1}{Pi,t-1} \quad , \qquad (1)$$

where: Pi,t represents the closing price of stock *i* on day *t*. Price gaps are then classified based on the magnitude of daily returns relative to a rolling volatility threshold. Specifically, a positive gap (bullish signal) is identified when the return exceeds two standard deviations above zero, while a negative gap (bearish signal) occurs when the return falls below two standard deviations (Baker & Wurgler, 2007).

2.3. Sentiment indicator construction

From price gap patterns, four behavioral sentiment indicators have been developed to examine various aspects of market sentiment.

2.3.1. Gap ratio indicator (GRI)

The Gap Ratio Indicator assesses net directional sentiment across the stock market by analyzing the gaps that occur on a daily basis. Positive gaps are compared with negative gaps, and the result is a stock market sentiment.

$$GIIt = \frac{(Nup,t - Ndown,t)}{Ntotal,t} \quad , \quad (2)$$

where: Nup,t and Ndown,t represent the number of stocks exhibiting positive and negative gaps on day t, respectively, and Ntotal,t is the total number of active stocks. The GRI ranges from −1 to +1, with positive values indicating bullish sentiment dominance.

2.3.2. Gap Intensity Index (GII)

Although the GRI records the frequency of gaps, the Gap Intensity Index accounts for the size of gaps in prices and expresses a weighted gap sentiment measure as:

$$GIIt = \Sigma \frac{|Gapi,t| \cdot Sign(Gapi,t)}{N} \quad . \quad (3)$$

The larger gaps might suggest stronger responses from investors to new information (De Long et al., 1990). Thus, this indicator reflects both the magnitude and the conviction in the directional change of the sentiment.

2.3.3. Sector Sentiment Dispersion (SSD)

The Sector Sentiment Dispersion quantifies the level of sentiment disagreement across the seven sectors using the GRI sector value standard deviation:

$$SSDt = \sigma(Sector\ GRIj,t) \quad . \quad (4)$$

A high SSD score indicates potential sector rotation or separate responses to economic news by the relevant sectors. On the other hand, low SSD values suggest the existence of market-wide sentiment, which may indicate herding (Chang et al., 2000).

2.3.4. Gap Persistence Indicator (GPI)

The Gap Persistence Indicator measures momentum in sentiment by monitoring how many consecutive days there are gaps in one direction. This indicator identifies sentiment regimes with sustained gaps in bullish or bearish sentiment, which may indicate overconfidence or pessimistic sentiment among investors (Daniel et al., 1998).

2.4. Analytical methods

The empirical analysis in this paper consists of four parts. The first part will describe the frequency and distribution of price gaps of stocks and sectors. The second part will focus on correlation analysis with the constructed sentiment indicators and the market returns for the same period. The third part will utilize a rolling window of 60 days to capture the average sentiment for the different periods in the sample. The fourth part will utilize the event study methodology to look at the market in the extreme sentiment of the sentiment indicators at over 2 standard deviations from the mean. The author will conduct all the events with the proper significance and robust standard errors to mitigate the impact of heteroskedasticity and autocorrelation in the time series analysis.

3. Empirical results

3.1. Descriptive statistics of price gaps

The different price gaps on all the 2 154 trading days in the Iraq Stock Exchange can be evaluated to understand how investors at the Iraq Stock Exchange operate. Out of 122 778 stock-day observations, positive gaps, which can be seen as signals to buy stocks, were noted 3 965 times, which is only 3.23% of the observations. On the other side of the scale, negative gaps, which can indicate signals to sell stocks, were detected 3 118 times, which is 2.54% of all observations. On the other 94.23% of trading days, stock returns were shown to be within a 2 standard deviation boundary, which is characterized as a period of neutral sentiment. The positive and negative gap frequency asymmetry suggests that investors at ISX tend to lean to the positive side and that positive gaps can be seen as a validation of the suggested investor overconfidence as seen in most emerging markets (Odean, 1998).

Table 2 outlines how price gaps are distributed across the seven different sectors. The banking sector had the largest frequency of gaps, with positive gaps present in 3.69% and negative gaps in 3.09% of the observations. The banking sector's price gap impact feedback is the strongest, given the importance of the sector in the Iraqi economy and its sensitivity to feedback from the central policy changes and changes in the economic situation. In the services sector, with a positive gap frequency of 3.40% and a notably lower gap of 2.27%, the gap frequency appears to indicate a largely consistent bullish sentiment. The investment sector, on the other hand, signals a price maximum movement and thus, little trading activity, with a positive gap frequency of 0.72% and a negative frequency of 0.81%. The industrial sector had the largest positive net gap bias of 1.14, indicating a strong optimism in the industrial and manufacturing businesses in the given time range.

Table 2

Distribution of price gaps by sector

Sector	Positive gaps (%)	Negative gaps (%)	Net gap bias
Agriculture	2.92	2.42	+0.50
Banks	3.69	3.09	+0.60
Hotels	3.40	2.90	+0.50
Industry	3.28	2.14	+1.14
Insurance	2.36	2.58	−0.22
Services	3.40	2.27	+1.13
Investments	0.72	0.81	−0.09
Overall Market	**3.23**	**2.54**	**+0.69**

Source: author's calculation.

The changes in the frequency of gaps for the given time period show a significant variation from year to year. The year 2023 has the highest overall gap in activities, with a total of 897 gaps. More specifically, there were 524 positive gaps and 373 negative gaps, which may have risen due to the volatility of the markets as a consequence of the advancing/ developing of the investor's confidence due to the stabilization of the revenues from oil. The year 2020 had the lowest gap frequency with a total of 332 positive gaps and 248 negative gaps due to the decline of the trade activities related to the global pandemic and the economic uncertainties that came with that. The years 2022 and 2019 have shown an increase in positive gap frequencies, with 444 and 427, respectively, which were also periods of economic recovery and political stability. The index of the ISX60 market even experienced 63 negative gaps and 65 positive gaps, which suggests that there was a fair equilibrium in the movement.

3.2. Sentiment Indicator analysis

3.2.1. Gap Ratio Indicator results

The Gaps Ratio Indicator (GRI), with a mean value of 0.0069, standard deviation 0.0471, reflects a slight positive sentiment bias during the sample period. The Indicator value ranged between –0.4035 and 0.3860: during 44.4% of the trading days the GRI value was positive (indicative of GRI bullish sentiment dominance), during 33.2% of the days the GRI value was negative (indicative of GRI bearish sentiment dominance) and 22.4% of the days the GRI value was neutral (indicative of balanced sentiment with positive and negative gaps). Notably, the positive gaps sentiment indicator GRI is correlated with positive market returns ($r = 0.269$, $p < 0.001$). This confirms the sentiment indicator calendar days returns correlation. This indicator captures significant shifts in prices. This indicator confirms the sentiment on the gaps approach. This indicator could be valued as the input to gauge the daily price changes in the market (ISX) and gap sentiment market timing strategies.

3.2.2. Gap Intensity Index results

A more in-depth view into the standard deviation shows gross average GII values (Gap Intensity Index) (magnitude and direction of price changes) of 0.129%, quite high at 1.027%. Positive and statistically significant relationships ($r = 0.089$, $p < 0.001$) with market returns were identified for GII; however, lower than the GRI correlation, suggesting that market sentiment in this market is more attributed to gap frequency than gap size. On the other hand, the gap frequency is attributed to cross-sectional variation at the sector level. The highest average GII was recorded at 0.235%, the agriculture sector GII is attributed to larger size price movements and the seasonality of the commodities. Following this, the services sector GII was 0.160%. The insurance and investment sectors recorded average intensity values that were slightly negative (–0.004% and –0.036%, respectively), suggesting more pronounced bearish gaps than bullish gaps in these sectors.

3.2.3. Sector Sentiment Dispersion results

The average SSD was 0.077 with a standard deviation of 0.052, which shows moderate, yet cross-sector sentiment heterogeneity for the entirety of the sample. There was a positive correlation between the SSD and market returns, which was statistically significant ($r = 0.072$, $p < 0.001$). More extreme cases of sentiment divergence between market sectors tended to result in increased levels of market sentiment. In these cases, the average market sentiment was more extreme. These results confirm the hypothesis, as disagreement amongst market participants leads to increased levels of sentiment and price volatility. There was a 1.477% average increase in market volatility in the high dispersion quartile (top quartile), versus a 1.359% average in the low dispersion quartile (bottom quartile). This means there was an 8.7% market volatility increase in the high dispersion quartile versus the low dispersion quartile. This can be a practical proxy for forecasting market volatility, as there is increased cross-sector sentiment disagreement (*Table 3*).

Table 3

Sentiment Indicator Summary Statistics and Correlations

Indicator	Mean	SD	Correlation	p-value
GRI	0.0069	0.0471	0.269	<0.001
GII	0.129%	1.027%	0.089	<0.001
SSD	0.077	0.052	0.072*	<0.001

Source:. Correlation is with absolute market returns (volatility proxy). All correlations are statistically significant at the 0.1% level.

3.3. Behavioral patterns identified

3.3.1. Herding behavior evidence

Cross-sectional standard deviation of returns (CSSD) analysis shows some very minor signs of herding in the ISX. A mean CSSD of 2.66% (SD = 6.34%) shows that there is some significant cross-sectional dispersion of stock returns on average trading days, implying that investors have divergent positionings and trading strategies. Interestingly, CSSD on extreme market days (both positive and negative quintiles) averaged around 2.80%, while on normal trading days, it was 2.64%. This is counterfactual to standard herding theory, which states that CSSD should rise during times of market distress when investors are all coming out to hold the same positions (Christie & Huang, 1995). This shows that ISX investors are still using diverse trading strategies during times of extreme market activity. This illustrates that there may be diverse sets of information, differing levels of risk tolerance, and the existence of institutional traders that are informed contrarian traders during times of market extremes.

3.3.2. Overreaction patterns

The returns after a gap exhibit both evidence for and against investor overreaction in the ISX. We record 102 instances of gaps where at least 5 stocks showed bullish gaps. On average, the market returned +0.282% on the day after the gap ($t = 2.06$, $p = 0.042$), suggesting a continuation of the market momentum. This is contrary to the reversal that overreaction theory suggests. On the contrary, we record lower levels of significant negative gap instances (44 instances) where the market returned on average +0.477% ($t = 0.49$, $p = 0.625$), which suggests a partial reversal that does not reach significance. Of the 102 gaps leading to positive momentum, 32 of them reversed (32.4% reversal rate). In contrast, of the 44 gaps leading to negative momentum, 16 of them reversed (36.4% reversal rate). These tendencies, in collaboration with other pieces of evidence, are attributed to the overreaction of bearish sentiment, leading to the conclusion that there is overreaction towards negative bullish sentiment and underreaction to positive bullish sentiment in the ISX. This is in extension with the theory of Loss Aversion by Kahneman and Tversky (1979). Lastly, the continuation of momentum associated with positive gaps suggests that market participants failed to fully react to the news, a phenomenon observed in many other studies in emerging markets.

3.3.3. Sentiment Persistence

The Gap Persistence Indicator shows moderate positive sentiment momentum for the ISX, which provides the groundwork for the development of trading strategies. The GRI shows first-order autocorrelation of 0.177, which decreases to 0.033 at the five-day lag, which shows that sentiment is short-lived, with the exception of the first few trading days. The pattern of

sentiment short-lived and the pattern of sentiment lateral decay is a sign of the market's gradual assimilation of the information into the price, and the eventual correction of the misalignment of price and sentiment. The longest positive sentiment streak was 14 trading days, and the longest negative sentiment streak was 10 trading days. On average, sentiment streaks reversed on average to positive or negative for 2.8 days before the reversal took place. This pattern of persistence indicates that there is a short-term momentum to belief or sentiment of the investors, which is mean-regressing, with most of the negative sentiment to price alignment likely reversed at longer periods of time, which indicates the efficiency of the market at longer periods of time.

3.4. Sector-Specific Findings

Examining various market segments within the ISX reveals how heterogeneous the sentiment characteristics are within each segment. The banking sector had the most positive and significant correlation with overall market returns (r = 0.261), which signifies that the banking sector is the strongest market sentiment indicator because it is the largest sector by market capitalization. This is important for portfolio construction, and banking sector sentiment provides a positive leading indicator for the market as a whole; it helps in assessing portfolio risk. By comparison, the agriculture sector had the highest return volatility (5.81%) and virtually no correlation with the market returns (r = 0.011), which implies that the sector's price may be due to other market factors, and that industry specific factors, such as the weather, commodity pricing, and governmental policies regarding agriculture, are more important than market psychology. Of all the sectors, the only one to show consistently bearish sentiment bias over the entire sample period was the insurance sector, showing a mean GRI being slightly negative at −0.002.

This situational aspect can be attributed to a lack of structural maturity within the Iraqi insurance sector or ongoing negative investor sentiment towards the sector's growth potential. Sentiments towards services and industry sectors were the strongest, with them having the same mean GRI of 0.011, implying the continuity of positive investor sentiment towards the aforementioned sectors of the economy. Sentiment correlation of cross sectors illustrates a clustered pattern within the ISX, where inter-sector sentiment correlation is the highest for banking and industry sectors, being 0.206, followed by banking-hotels (0.164) and banking-services (0.157). This shows that sentiment spillage exists from the banking sector towards the mentioned sectors, and this phenomenon correlates with the theory of information cascades in financial markets.

Sentiment analysis over the sample period identified 65 days with extreme bullish readings (GRI greater than two standard deviations above the mean) and 57 days with extreme bearish readings. Average market returns on the extreme bullish sentiment days were +1.67% and −0.40% on the

extreme bearish sentiment days, confirming that the constructed sentiment indicators have economic relevance. The greater asymmetry in extreme-day returns (+1.67% versus −0.40% in absolute terms) further reinforces the conclusion that, in the context of the ISX, bullish sentiment signals have greater predictive strength than bearish sentiment.

4. Discussion

4.1. Interpretation of Findings

There is reason to believe that patterns of price gap sentiment correlate with price gap patterns in the Iraq Stock Exchange. The substantial positive relationship with the Gap Ratio Indicator and the market return ($r = 0.269$, $p < 0.001$) indicates that measures of gap-based sentiment, in this case, the gap ratio, positively and significantly predict market movement. The evidence suggests that price gaps in multiple stocks and, therefore, the outpouring of sentiment (behavior) of the people (investors) in the market, are consistent with the overall market sentiment. This is consistent with the market's overall sentiment. The dominance of the banking sector in determining market sentiment is consistent with the banking sector's dominance in the overall market capitalization and the sector's unique position in the provision of macroeconomic information in the Iraqi economy.

The observation of slightly higher positive gaps compared to negative gaps (3.23% vs. 2.54%) shows that there is a small optimistic bias among ISX investors. This is consistent with the overconfidence hypothesis by Odean (1998), which states that investors in markets with lower levels of information efficiency often overestimate positive signals. The differences in the gap characteristics at the sector level suggest that the overall state of investor sentiment varies significantly within the economy. This is particularly so in the insurance and investment sectors, which are bearish compared to the industry and services sectors, which are persistently bullish.

4.2. Behavioral implications

Herding behavior in this instance is further supported by the cross-sectional return dispersion remaining consistent at extreme market conditions, which goes against the orthodox theory of frontier market investors acting in unison. Rather, ISX findings indicate diverging trading patterns, even for instances of market stress, which may be attributed to some investors relying on different patterns of information, differing investment horizons, or other market dynamics. The prediction of asymmetric overreaction in which the bearish gaps suffer from higher reversals (36.4%) as compared to the bullish gaps (32.4%) supports the over-reaction theory as investors suffer from negative information more (Kahneman & Tversky, 1979). This creates an overreaction to the information, which is later reversed.

4.3. Comparison with other markets

The similarities and differences in sentiment characteristics of the ISX when compared to other emerging and frontier markets are clear and definable. Moderate sentiment persistence (first-order autocorrelation of 0.177) places sentiment characteristics between the higher persistence seen more often in developed markets and the more sporadic in less liquid frontier markets. No strong herding is like the U.S. market (Christie & Huang, 1995) and contrasts with South Korea and Taiwan (Chang et al., 2000), which document significant herding. This difference may capture the peculiar market ownership structure of the ISX, particularly the institutional ownership structure, which is very different from East Asian markets.

4.4. Practical applications

The created indicators of sentiment show usable sentiment for investors and regulators. Given its high contemporaneous correlation with returns, Portfolio managers can use the Gap Ratio Indicator as a tactical trigger for timing the market. The Sector Sentiment Dispersion measure can serve as a market uncertainty heuristic and can be incorporated into models of volatility and frameworks of risk control. For investors with a contrarian approach, the extreme sentiment days (65 days bullish, 57 days bearish, and each exceeding 2 standard deviations) can be used for the construction of a mean reversion hypothesis. These indicators can be used by regulators to assess the state of the market and spot the intervals with excessive speculation that can be the subject of closer monitoring.

Conclusions

The behavioral sentiment indicators that were changed and validated using price gap analysis from the Iraq Stock Exchange's (ISX) daily close price compilation spanning a decade. The certain behavioral sentiment indicators for the Iraq Exchange were Gap Ratio. The result shows that the Gap Ratio has a correlation with the local market return ($r = 0.269$, $p < 0.001$), which proves that gap sentiment indicators are predictive. Out of a total of 122 778 stock-day gaps, ISX investors exhibited a slight positive (optimistic) sentiment, with 3965 positive gaps and 3118 negative gaps. The behavioral sentiment study of ISX investors shows little herding, a decline in asymmetric overreaction, a small bearish reversal with over moderate mean and sentiment reversion around one week.

The study confirms its central hypothesis that daily closing price data behavioral sentiment proxies are a valid method of measuring market sentiment in frontier markets. The Gap Ratio Indicator shows a positive correlation with statistically significant ISX market returns ($r = 0.269$, $p < 0.001$), and the frequency of gaps (3.23% positive vs. 2.54% negative) reflects an optimism bias and overconfidence (Odean, 1998). The hypothesis that supports overreaction is also validated: an asymmetric reversal rate (bearish gaps: 36.4% vs. bullish gaps: 32.4%) exemplifies loss aversion

(Kahneman & Tversky, 1979). The herding sub-hypothesis is contrary to classical herding: in extreme market situations, rather than decrease, cross-sectional return dispersion increased, signaling ISX investors employ a variety of divergent trading strategies contrary to a herding mindset. Overall, closing price data gap sentiment indicators provide behavioral framework analytics for frontier markets and extreme data gaps.

This study contributes to science by creating four original sentiment indicators – GRI, GII, SSD, and GPI – derived solely from daily closing prices. This allows for a repeatable analytical framework to be created for frontier markets where intraday and volume data are lacking. As such, this study also provides the first behavioral finance analysis of the Iraq Stock Exchange. This also provides a methodological advancement for the sentiment analysis field when facing data-limited environments. For practitioners, this research provides accessible and evidence-based sentiment analysis tools for frontier equity markets that portfolio managers, risk analysts, and market regulators would benefit from.

Some self-imposed boundaries deserve some merit. The absence of starting prices limits standard methodologies of gap analysis. Consequently, the close-to-close methodology had to be utilized. This approach is just as valid, if not preferred, though it is different. The absence of single-market scope generalizability to other frontier exchanges is clear, though it could be controlled for in future research. Also, in behavioral finance, it is commonplace to measure sentiment signals in volume, often with some standard robustness check. The absence of trading volume data precludes this from being undertaken.

Future research should include, when possible, trading volume data to strengthen the validation of sentiment signals. The sentiment dynamics of the region would be improved by cross-market studies with other Middle Eastern and frontier markets. Furthermore, the precision of the indicators could be improved, and automated trading systems could be developed based on the machine learning tools applied to gap classification and sentiment forecasting in the context of this study.

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INFORMATION NARRATIVES AND TEMPORAL SOVEREIGNTY IN THE EMERGING MULTIPOLAR ECONOMY

The article examines the relationship between information narratives and temporal sovereignty in the context of the emerging multipolar economy. The purpose of the article is to develop a conceptual framework explaining how information narratives influence economic expectations and the temporal coordination of economic governance. The hypothesis of the study is that information narratives shape economic expectations, which in turn influence the timing of economic policy and development strategies, thereby affecting the level of temporal sovereignty of states. The methodology includes conceptual analysis, comparative analysis of theoretical approaches in political economy and communication studies, and synthesis of interdisciplinary literature on narrative economics and temporality. The results of the study demonstrate that media and communication systems influence economic governance not only through information transmission but also through the construction of economic expectations that affect policy coordination and investment horizons. The conclusions confirm that information narratives constitute an important element of temporal sovereignty in the modern global economy and influence the strategic coordination of economic development in the multipolar international system.

Keywords: temporal sovereignty, information narratives, journalism, political economy, multipolar economy.

JEL Classification: F01, F29.

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ІНФОРМАЦІЙНІ НАРАТИВИ ТА ТЕМПОРАЛЬНИЙ СУВЕРЕНІТЕТ У ФОРМУВАННІ БАГАТОПОЛЯРНОЇ ЕКОНОМІКИ

Стаття досліджує взаємозв'язок між інформаційними наративами та часовим суверенітетом у контексті формування багатополярної економіки. Метою статті є розробка концептуальної рамки, що пояснює, як інформаційні наративи впливають на економічні очікування та часову координацію економічного врядування. Гіпотеза дослідження полягає в тому, що інформаційні наративи формують економічні очікування, які, у свою чергу, впливають на вибір часу реалізації економічної політики та стратегій розвитку, тим самим визначаючи рівень часового суверенітету держав. Методологія включає концептуальний аналіз, порівняльний аналіз теоретичних підходів у політичній економії та дослідженнях комунікації, а також синтез міждисциплінарної літератури з наративної економіки та темпоральності. Результати дослідження демонструють, що медіа та комунікаційні системи впливають на економічне врядування не лише через передачу інформації, а й через конструювання економічних очікувань, які визначають координацію політики та інвестиційні горизонти. Висновки підтверджують, що інформаційні наративи є важливим елементом часового суверенітету в сучасній глобальній економіці та впливають на стратегічну координацію економічного розвитку в багатополярній міжнародній системі.

Ключові слова: темпоральний суверенітет, інформаційні наративи, журналістика, політична економія, багатополярна економіка.

Introduction

The interaction between communication systems and economic governance has become a defining feature of the contemporary global economy. Information flows generated through journalism, digital media platforms, and strategic communication institutions increasingly shape how economic events and policy decisions are interpreted by investors, policymakers, and the public (Castells, 2009).

These interpretations influence economic expectations, investment behavior, and the perceived legitimacy of policy decisions. In periods of economic crisis or geopolitical tension, media narratives often become central to the construction of economic meaning, framing events in ways that shape public perception and policy discourse (Tooze, 2018).

Scholars in communication studies have long emphasized the role of media in structuring political and economic discourse through mechanisms such as agenda-setting and framing (Bennett & Livingston, 2018). At the same time, political economy research has highlighted the structural dynamics of global capitalism and the importance of long-term historical processes (Braudel, 1981; Wallerstein, 2004).

Despite these insights, the relationship between communication systems and the temporal coordination of economic policy remains insufficiently explored. Existing research has largely focused on the behavioral impact of economic narratives rather than their implications for the strategic timing of economic governance.

This paper addresses this gap by introducing the concept of *temporal sovereignty*, defined as the capacity of states to coordinate development processes across multiple temporal horizons. The central argument is that information narratives influence economic expectations, which in turn shape the coordination of policy timing and long-term development strategies.

The relationship between media systems and economic processes has attracted increasing scholarly attention across multiple disciplines. Research in communication studies has demonstrated that media narratives play a significant role in shaping public interpretations of economic events, policy reforms, and financial crises (Castells, 2009).

In the field of economics, the emerging literature on narrative economics highlights how widely circulated stories about economic developments influence expectations, market behavior, and policy outcomes (Shiller, 2017,2019). Narratives concerning economic growth, technological change, or financial instability often spread rapidly through media networks, shaping collective perceptions of economic reality.

At the same time, research on temporality has emphasized the importance of time structures in social and economic organization. Braudel (1981) introduced the concept of long-term historical time in capitalist development, while Adam (1995) explored how modern institutions organize temporal rhythms. Rosa (2013) further argues that contemporary societies are characterized by processes of social acceleration that reshape economic and social dynamics.

However, these strands of research remain largely disconnected. While communication studies examine narrative construction and political economy analyzes structural economic dynamics, relatively little attention has been paid to how information narratives influence the temporal coordination of economic governance.

This research seeks to bridge this gap by developing a conceptual framework that links narrative construction in media systems to the temporal organization of economic policy and development strategies.

The aim of this article is to develop a conceptual model explaining the relationship between information narratives, economic expectations, and temporal sovereignty in economic governance.

This study argues that information narratives shape economic expectations, which in turn structure the timing and coordination of economic policy and long-term development strategies. Consequently, information narratives constitute an indirect mechanism influencing the level of temporal sovereignty of states.

The methodology of the research is based on an interdisciplinary approach combining political economy, communication studies, and temporality research. The study uses conceptual analysis, comparative analysis of theoretical literature, and synthesis of existing research on narrative economics, media studies, and temporal structures in economic development.

The article includes four sections. The first section develops the conceptual framework of temporal sovereignty. The second one analyzes the role of media narratives in shaping economic perception and expectations. The third section examines the role of information power in the multipolar economy. The final section discusses the implications of the findings for economic governance and development strategies.

1. Conceptual framework: temporal sovereignty

Temporal sovereignty refers to the ability of states or economic systems to coordinate the timing of development processes such as industrial transformation, technological innovation, and infrastructure investment. Effective economic governance requires synchronization between multiple temporal dimensions of economic activity (Braudel, 1981). Economic development often involves long-term planning horizons, particularly in areas such as industrial policy and infrastructure development (Mazzucato, 2013). However, financial markets and global information networks operate at much shorter time scales, creating tensions between short-term expectations and long-term development strategies. Scholars of temporality have emphasized that economic and social institutions operate within multiple temporal rhythms (Adam, 1995; Koselleck, 2004). Managing these temporal dynamics, therefore, becomes a central challenge for economic governance.

Temporal sovereignty can thus be understood as a strategic capacity that allows states to maintain control over development timelines while navigating the pressures of global economic competition. The conceptual framework illustrating the relationship between information narratives, economic expectations, and policy coordination is presented in *Figure 1*.

Figure 1.Information narratives, economic expectations, and temporal sovereignty in economic governance

Source: author's conceptualization.

Figure 1 illustrates the conceptual relationship between information narratives, economic expectations, and temporal sovereignty. The model demonstrates that information narratives shape economic expectations through communication mechanisms such as framing and agenda-setting. These expectations, in turn, structure investment behavior and policy coordination, ultimately determining the capacity of states to maintain control over the temporal organization of development.

Table 1

Narrative power and economic timing in political economy

Dimension of narrative	Communication mechanism	Economic effect	Temporal impact
Crisis narratives	Media framing of instability or conflict	Capital flight and market volatility	Shortened investment horizons
Growth narratives	Positive economic storytelling and policy communication	Increased investor confidence	Expansion of long-term investment cycles
Reform narratives	Media support for institutional reform	Greater policy legitimacy	Stabilization of development planning
Geopolitical narratives	Strategic discourse on sanctions or global competition	Reorientation of trade and financial flows	Restructuring of development timelines

Source: Author's elaboration.

Tables 1 and *2*, presented above, illustrate the relationship among information narratives, economic expectations, and temporal coordination in economic governance.

Table 2

Temporal sovereignty and economic governance

Dimension	Low temporal sovereignty	High temporal sovereignty
Information environment	Fragmented media narratives	Coordinated strategic communication
Economic expectations	Volatile investor perceptions	Stable investment confidence
Policy coordination	Short-term reactive policies	Long-term strategic planning
Development trajectory	Disrupted economic cycles	Synchronized development timing

Source: Author's elaboration.

They demonstrate that narrative power influences not only economic perception but also the timing of investment decisions, policy coordination, and long-term development planning. Countries with higher levels of temporal sovereignty are better able to coordinate long-term development strategies and maintain stable investment horizons. At the same time, fragmented information environments often lead to short-term decision-making and disrupted development cycles.

2. Media narratives and economic perception

Media narratives influence economic behavior by shaping expectations regarding stability, risk, and opportunity. Financial markets often respond not only to economic fundamentals but also to narrative interpretations of economic developments (Shiller, 2019).

Journalism and communication networks, therefore, play an important role in constructing economic meaning. Through framing and agenda-setting, media institutions shape public interpretations of economic policies and structural transformations (Bennett & Livingston, 2018).

Digital communication platforms have accelerated the circulation of economic narratives, creating rapid feedback loops between media discourse and economic decision-making (Castells, 2009). These dynamics can amplify perceptions of crisis or opportunity, influencing investment behavior and policy responses.

Narratives surrounding economic crises, sanctions regimes, or technological competition often shape how societies interpret global economic transformations (Tooze, 2018).

3. Information power in the multipolar economy

The transformation of the global economic system toward greater multipolarity has intensified competition in both economic and informational domains. Competing narratives regarding development models and economic governance increasingly influence international economic relations (Wallerstein, 2004).

Strategic communication and information management, therefore, become important components of economic sovereignty. States capable of shaping global economic narratives may strengthen the credibility of their economic institutions and development strategies (Castells, 2009).

At the same time, narratives surrounding technological competition and geopolitical conflict influence international economic expectations. Media representations of sanctions regimes or financial instability may shape perceptions of risk and opportunity in global markets (Tooze, 2018).

These dynamics illustrate how information power intersects with economic governance in the contemporary multipolar international system.

4. Discussion

The interaction between journalism and economic governance highlights the importance of interdisciplinary approaches in political economy research. Economic indicators such as growth rates, trade flows, and investment patterns are interpreted within broader narrative frameworks that shape expectations and policy debates (Shiller, 2017).

Integrating insights from communication studies and political economy may therefore provide a more comprehensive understanding of economic governance in the twenty-first century. Media narratives influence how economic events are interpreted, which in turn shapes policy legitimacy and institutional stability.

The concept of temporal sovereignty emphasizes the importance of coordinating economic time in development processes. States capable of aligning communication strategies with long-term economic planning may enhance their capacity for strategic development.

Conclusions

This article examined the relationship between information narratives and temporal sovereignty in the contemporary global economy. The aim of the research was to develop a conceptual framework explaining how information narratives influence economic expectations and the coordination of economic policy over time. The hypothesis that information narratives influence economic expectations and thereby affect the timing of economic governance and development strategies was confirmed.

The findings of this study demonstrate that communication systems and media narratives play a central role in shaping economic expectations, investment behavior, and policy coordination. In the context of an emerging multipolar economy, the management of information environments constitutes a critical dimension of economic sovereignty and long-term development planning.

Future research may focus on empirical analysis of how information narratives influence economic policy and development strategies in different institutional and geopolitical contexts, particularly in emerging economies.

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DISRUPTIVE INNOVATIONS IN THE IT SECTOR STRATEGIC DEVELOPMENT

The article addresses the pressing issue of disruptive innovations' impact on competitiveness management within IT sector enterprises. The relevance of this research stems from rapid digital transformation, global crisis challenges, and the exponential growth of the artificial intelligence market, all of which demand a rethinking of traditional approaches and the development of flexible, adaptive strategies to secure sustainable competitive advantages. The research is founded on the hypothesis that effective management of disruptive innovations in IT companies, amid multiple crises and digital transformation, is achievable through the construction of adaptive organizational structures. These structures must be capable of rapidly implementing innovative solutions, facilitating the integration of dynamic capabilities and continuous resource reconfiguration, thereby neutralizing threats and strengthening the company's market position. To test this hypothesis, a conceptual and analytical approach was employed, encompassing a theoretical analysis of the multidimensional aspects of disruptive innovations and a critical review of existing competitiveness theories. Key

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ПРОРИВНІ ІННОВАЦІЇ У СТРАТЕГІЧНОМУ РОЗВИТКУ IT-СФЕРИ

Розглянуто актуальну проблематику впливу проривних інновацій на управління конкурентоспроможністю підприємств IT-сфери. Актуальність дослідження обумовлена стрімкою цифровою трансформацією, глобальними кризовими викликами та експоненційним зростанням ринку штучного інтелекту, що вимагає переосмислення традиційних підходів та формування гнучких адаптивних стратегій для забезпечення стійких конкурентних переваг. Внесено гіпотезу, що ефективне управління проривними інноваціями в IT-компаніях в умовах полікриз та цифрової трансформації можливе через побудову адаптивних організаційних структур. Ці структури мають бути здатними до швидкого впровадження інноваційних рішень, сприяючи інтеграції динамічних здібностей та постійній реконфігурації ресурсів, що нейтралізує загрози та посилює позиції компанії на ринку. Для перевірки гіпотези застосовано концептуальний та аналітичний підхід, що містить теоретичний аналіз багатовимірних аспектів проривних інновацій та критичний огляд наявних теорій конкурентоспроможності. Визначено ключові характеристики

characteristics of disruptive innovations were identified and formalized into a semantic model, and a comparative analysis of market examples (specifically, Xiaomi's strategy) was conducted. A five-phase model for implementing disruptive innovations in strategic management was also developed. The results confirmed that enterprises that effectively identify and leverage disruptive innovations are better equipped to navigate market challenges, fundamentally reshaping business models and organizational structures. The necessity for proactive integration of disruptive innovations is emphasized as a comprehensive approach to achieving long-term success and leadership in the dynamic IT environment, viewing them not merely as isolated technological improvements but as overarching changes that create new markets.

Keywords: competitiveness management, disruptive innovations, digital transformation, strategic management, innovation management, change management.

JEL Classification: D21, L20, L23.

проривних інновацій, які сформовані в семантичну модель, а також проведено порівняльний аналіз ринкових прикладів (зокрема стратегії Xiaomi). Розроблено п'ятифазову модель імплементації проривних інновацій для стратегічного управління. Отримані результати підтвердили, що підприємства, які ефективно ідентифікують та використовують проривні інновації, краще справляються з ринковими викликами, докорінно змінюючи бізнес-моделі та організаційні структури. Підкреслено необхідність проактивної інтеграції проривних інновацій як комплексного підходу для досягнення довгострокового успіху та лідерства в динамічному IT-середовищі, розглядаючи їх не як окремі технологічні покращення, а як всеосяжні зміни, що формують нові ринки.

Ключові слова: управління конкурентоспроможністю, проривні інновації, цифрова трансформація, стратегічне управління, інноваційне управління, управління змінами.

Introduction

With the rapid development of the IT sphere, characterized by large-scale digital transformation, fundamental restructuring of business around data and artificial intelligence, the importance of breakthrough innovations to ensure the competitiveness of enterprises is becoming critically important for business functioning. Thus, according to analytical findings of IDC, the volume of global spending on digital transformation in 2024 amounted to USD 2.4 trillion, and in 2027 this amount may exceed USD 3.9 trillion (International Data Corporation, 2024, May 30); according to Flexera (2024), 89% of IT companies have already adopted or plan to adopt hybrid or cloud infrastructure, which is the basis of digital transformation, and more than 50% of high-performance AI users, according to McKinsey (2025, November 5), plan to use AI to carry out transformational changes in their organizations. Competition forces companies to mobilize resources to create strategies that provide sustainable competitive advantages, and technological breakthroughs and changes in consumer expectations encourage companies to differentiate products and rethink traditional business models. To succeed in competition, it is important to effectively use resource potential and invest in breakthrough technologies and management processes that change the foundations of industries. It is breakthrough innovations that are defined as drivers of competitiveness, forming the "core" of effective business models in the IT sector and reorienting investments from supporting existing IT infrastructure to financing breakthrough projects, as is convincingly evidenced by global economic trends: more than 50% of companies in the world report an increase in productivity due to the implementation of technological innovation – generative AI (Mckinsey, 2025, November 5);

70% of executives believe that digital innovation will be the most important technology to increase competitiveness over the next 3–5 years (Deloitte, n. d.); 60% of technology leaders will increase investment in innovation in 2024 (Gartner, 2025, July 15).

In these conditions, the implementation of breakthrough innovations becomes a key element in determining the enterprise's strategy. This takes into account various factors affecting competitiveness and outlines ways to adapt to the dynamic market environment and crisis challenges, ensuring the long-term success of IT companies. To develop effective strategic approaches, a critical analysis of theories and concepts of competitiveness is necessary (*Table 1*).

Table 1

Theoretical Approaches to Competition and Competitiveness

Doctrines, theories, concepts	Interpretation of the theoretical achievements	Advantages (contribution, applicability)	Disadvantages (limitations of application)
Classical economic theory	Competition as a spontaneous market mechanism for reconciling private interests with public welfare; emphasis on the "material foundations" of competition	Explain the price mechanism and resource allocation; outline the social and conflict aspects of competition	Limited explanatory power regarding structural changes; methodological obsolescence for modern conditions; criticism of the institution of private property (in some approaches)
Neoclassical theories	Typology of market structures (perfect competition, monopoly, monopolistic competition, oligopoly) and equilibrium models of behavior	Formalize the relationship between market structure and prices/profits; lay the foundation for industry and cross-industry analysis of competition	Abstract assumptions; static and weak accounting for time/uncertainty; simplified view of organization and resources
Evolutionary theory (economics)	Competition as a dynamic adaptation under the influence of scientific and technological development; focus on routines, learning, and internal organizational factors	Explain competition in the face of change; systems approach; emphasis on "specific assets" and decision-making mechanisms	The high role of organizational factors reduces the comparability of models; the "dual" nature of the organization makes generalization difficult.
Theories of monopolistic and imperfect competition	The firm is a bearer of market power; competition through differentiation and non-price mechanisms	Show competition as a dynamic process; explains product and market differentiation, concentration of production, and strategic constraints	Some assumptions are poorly aligned with real markets and conditions.
Theory of economic dynamics and entrepreneurship	Development and growth are determined by entrepreneurship and innovation; innovation is a source of excess profits	Innovation and technological progress, as a condition of competition, emphasize the role of initiative, resources, and capital reproduction	Insufficiently detailed mechanisms for organizational change and scaling of innovations
Institutional theory (economics)	Competition as a process of discovery; firms continuously search for products/technologies/markets within institutional rules	Explain the competitiveness of concentrated markets in the presence of a threat of entry; reveal transaction costs, firm boundaries, and the role of policy	Difficulty in operationalization and measurement; mostly descriptive

End of Table 1

Theory of Industry Organization	Structure – behavior – performance; industry barriers and structure determine competition and performance	A tool for strategic analysis of the external environment; a basis for antitrust policy and regulation	Tendency towards static analysis; limited attention to innovation dynamics
Resource theory (resource dependence)	Competitive advantages are formed through resources and capabilities (VRIN/VRIO logic) and control of access to them	Explain unique resources, competencies, and rents; useful for analyzing the sustainability of advantages under uncertainty	Risk of reduction to "resource availability" without explanation of their creation/updating; weak consideration of specific assets and context
Competitive strategy theory	Industry profitability and intensity of competition are determined by the "five forces": strategic alternatives, costs/differentiation/focus	A practical tool for analyzing the external environment and choosing a competitive strategy	Limited consideration of innovation and dynamics; weak integration of internal resources and knowledge
Key competency theory	Strategy is built around core competencies – collective knowledge/skills that create value and are difficult to imitate	A framework for portfolio management and competency development; it reinforces the logic of differentiation through knowledge	The complexity of identifying competencies in different industries, the risk of subjective assessments
Dynamic capabilities concept	Advantages depend on the ability to sense, capture, and transform opportunities through the reconfiguration of competencies and learning	Aligns resources with innovation and adaptation; describes mechanisms for business renewal in a turbulent environment	Aligns resources with innovation and adaptation; describes mechanisms for business renewal in a turbulent environment
Theory of competitive advantage	Advantages are formed by a combination of external determinants (factor conditions, demand, related industries, strategy/competition) and network/cluster effects	Explains competitiveness at the country/industry level; suitable for cluster and network analysis	Mostly "external" focus; limited applicability where competition between network participants is indirect
Theory of co-opetition	Combining competition and cooperation based on game theory and interdependent solutions	Framework for interaction strategies, rules of the game, and synergy management; useful for ecosystems and partnerships	Fragmentation; insufficient consideration of knowledge, innovation, and information asymmetries in rapidly changing markets
Innovation theories	Technological change and innovation are the key sources of growth and competitiveness	Form principles of innovative development and logic of technological renewal	Divergence of approaches and contradictions regarding the channels of influence of innovations on results
Theories of the information economy	Information and knowledge are the basic resources of competitive advantage in the digital economy	Explains information advantages, information dynamics, and the effects of resources of the knowledge economy	Ambivalence of consequences of informatization; difficulty of separating effects of information from other factors

Source: compiled by the authors based on (Bosovska, 2015).

According to *Table 1*, a review of recent research in the field of innovation and a critical analysis of theoretical and applied achievements of competitive theories demonstrates a steady attention to the role of breakthrough innovations in the formation of competitive advantages, in particular in dynamic high-tech sectors (Hewitt & Van Rensburg, 2020; Kumar et al., 2021; Onufrey & Bergek, 2021). At the same time, modern

empirical and review literature of recent years clarifies the causal chain "innovation strategy affects competitiveness", demonstrating that the impact of innovations is manifested not in the form of a mechanical increase in financial results, but through increased strategic coherence, organizational capabilities and the ability of the company to transform innovative solutions into sustainable market positions (Agazu & Kero, 2024). A separate area of research focuses on the managerial complexity of implementing breakthrough innovations: in practice, implementation barriers, organizational culture, and the configuration of open innovation as a catalyst for a "breakthrough" effect, which is directly related to gaining a competitive advantage in turbulent market conditions, become key (Gemelgo et al., 2025).

In particular, the concept of disruptive innovation, formulated by Harvard Business School professor Clayton Christensen, is of particular importance as a theoretical basis for the analysis of technological displacement and market transformation: disruptive innovations often start as simpler solutions, but form new markets/segments and change the logic of competition through new business models and organizational configurations (Christensen et al., 2018). Recent research in the field of innovation management offers more operationalized approaches to "measuring" the breakthrough potential and vulnerability of companies to breakthroughs in the IT industry, which strengthens the possibilities of applied analysis of strategic decisions and risks of technological competition (Zeidanloo & Špaček, 2025). It is also important to expand the discussion by involving domestic peer-reviewed research that specifies the issues of competitiveness and competitive advantages of the IT sector in Ukrainian conditions. In particular, the theoretical foundations of competition and competitiveness of the IT sector reveal the structure of sources of competitive advantages and the logic of their formation at the industry level (Zavgorodnya & Melnyk, 2023), and the assessment of the competitiveness of the technological sector of the Ukrainian economy details the contextual constraints and drivers of the development of high-tech segments (Solodkyi, 2024). An additional emphasis on innovation, digital positioning, and image formation strategies of IT enterprises allows us to record that intangible assets (reputation, brand, digital communication) are increasingly acting as a tool of competitive differentiation and enhancing the effects of innovations in global ecosystems (Serbenivska, 2025).

Thus, modern research emphasizes: first, the importance of disruptive innovations as a driver of competitiveness, especially for IT enterprises; second, the need to integrate innovations into the management strategy through a reassessment of value propositions, business models and organizational structure; third, the criticality of proactive management mechanisms (identification of disruptive threats/opportunities, overcoming resistance to change, adaptive organizational models) for long-term success in conditions of systemic crises and global challenges.

The aim of the research is to provide a theoretical and methodological justification for the concept of disruptive innovations and develop an applied toolkit for their integration into the strategic management system of IT enterprises to ensure their competitiveness in conditions of poly-crisis and digital transformations.

To achieve the aim, the following tasks were formulated and solved:

• The essential characteristics of breakthrough innovations in the context of the transformation of the artificial intelligence market were detailed, and their determining influence on the change in the paradigm of managing the competitiveness of IT companies was identified.

• Critical factors for adapting management systems (flexibility of structures, ambidexterity, organizational culture) to the challenges of breakthrough technological changes were identified.

• A comprehensive model for implementing breakthrough innovations in strategic management was developed, which is based on a five-phase cycle (from scanning to reintegration of experience) and ensures sustainable business development in a turbulent environment.

The research is based on the hypothesis that effective management of disruptive innovations in IT companies in the context of polycrisis and digital transformation involves the creation of adaptive organizational structures. These structures should be capable of rapidly implementing innovative solutions and facilitating the integration of dynamic capabilities for constant reconfiguration of resources. The implementation of this business model can create the prerequisites for sustainable competitive advantages, which will not only neutralize the threats of the crisis but also strengthen the company’s position in the market.

The research methodology is based on conceptual and analytical approaches, using theoretical analysis to study the multidimensional aspects of disruptive innovations. In particular, their key characteristics, impact on undervalued markets, and the ability to displace established leaders are investigated. A critical analysis of the theoretical and practical achievements of competitive theories is used, and a comparative analysis of market examples, such as the strategy of Xiaomi, is also conducted to illustrate the dynamics of disruptive innovations. A systematic approach was applied to develop a five-phase model for implementing disruptive innovations as a comprehensive tool for strategic management.

The construction of the semantic model "framework of disruptive innovations" (see *Figure 3*) was carried out as a conceptual modeling based on the synthesis of the defining features of disruptive innovations and their grouping into logically related dimensions. At the first stage, the basic attributes of disruptive innovations according to the classical interpretation were identified (change in value proposition, entry from underserved segments, gradual increase in productivity to a level sufficient for the mainstream market, transformation of the business model, and value

creation network) (Christensen et al., 2018). At the second stage, the attributes were aggregated into four domains that reflect the managerial logic of the breakthrough: market requirements/availability, technology/productivity, industry impact/business model, value networks and ecosystems. At the third stage, short interpretive markers suitable for applied analysis of company decisions are formulated for each domain (identification of the entry segment, scaling mechanism, change in product/process architecture, change in monetization logic, and partner configuration).

The five-phase model of implementation of breakthrough innovations (*Figure 5*) is formed as a management cycle tool and combines theoretical provisions on innovation strategy and competitiveness (Agazu & Kero, 2024), practical mechanisms of organizational adaptation and open innovation (Gemelgo et al., 2025), as well as the logic of dynamic reconfiguration of resources in a turbulent environment. The sequence of phases was determined according to the principle "from identifying opportunities to scaling and reintegration", taking into account two limitations characteristic of the IT sector: the high speed of technological change and the need for parallel development of the product and business model. The applicability of the proposed models was verified by analytically comparing their elements with typical management tasks of IT companies during the period of digital transformation (trend monitoring, innovation portfolio, change management, organizational design, scaling solutions) and by illustrative application to market examples given in the article.

The structure of the article consists of three sections. The first examines current trends in the development of the IT sphere and the key role of the artificial intelligence market. The second reveals the concept and characteristics of breakthrough innovations. The third section is devoted to strategies for their implementation and adaptive management models in IT companies.

1. Current trends in the IT sector and the role of the artificial intelligence market

Modern trends in the development of the IT sector, in particular digital transformation, the use of artificial intelligence (AI), globalization processes, and growing consumer demands, determine the need to rethink traditional management approaches and develop new strategies to support the competitiveness of enterprises. Analysis of the ability of enterprises to adapt to rapid changes in the market environment and implement innovative solutions is extremely important for maintaining competitive advantages. Companies that focus on consumer needs are able to quickly respond to new opportunities and implement innovations, and have every chance of laying the foundation for long-term success in a dynamic market.

One of the most significant manifestations of the development of the IT sector is the artificial intelligence market, the volume of which in 2025 reached over USD 244 billion, demonstrating an increase of almost 58 billion compared to 2024 (*Figure 1*). This impressive growth indicates that companies of all sizes and industries are actively implementing AI technologies to optimize business processes, increase efficiency and meet consumer needs. This trend is expected to continue, and by 2031, the artificial intelligence market will exceed USD 1 trillion (Statista, 2026, March 19). The main reason for this rapid growth is the popularity of machine learning, which is the most widespread and technically accessible segment of AI. In addition, the deep learning segment, although more difficult to implement, plays an important role in creating powerful chatbots and other generative AI models, which have increased in popularity since the emergence of generative AI in 2022, confirming its strategic importance for the market (Statista, 2025, November 19). With increasing competition in this market, companies are forced to constantly improve their solutions to remain relevant and provide a high level of service.

The impact of innovative artificial intelligence technologies extends not only to labor productivity but also to general structural changes in market and economic processes. Its implementation can have both positive and negative effects on employment. For example, proper management of personnel rotation processes allows for the redirection of workers to industries with high added value, which contributes to increased productivity and long-term economic benefits. At the same time, it is important to recognize the risks associated with automation, as the disappearance of traditional professions can cause social and economic problems. Many researchers agree that AI is able to stimulate the growth of labor productivity over the next decade, although the final effect largely depends on many factors, such as the potential of new generations of AI, the complexity of the tasks performed, and the level of automation of work. This emphasizes the importance of strategic planning and retraining of personnel to implement new technologies in work processes.

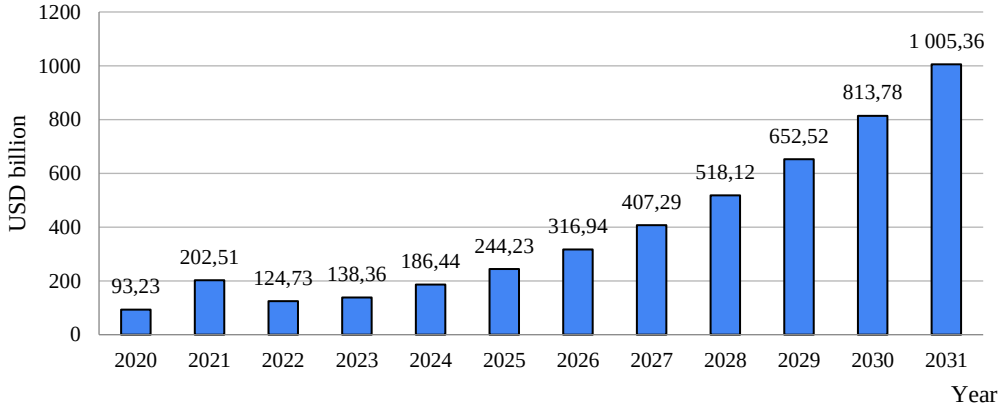

Figure 1. Global artificial intelligence (AI) market size from 2020 to 2031

Source: compiled and calculated by the authors based on (Statista, 2026, March 19).

Therefore, based on the analysis, it can be concluded that the process of digital transformation, as well as the introduction of advanced technologies in the field of machine learning, generative models, and automation of data processing and routine operations, is a key trend that will only intensify and be actively adopted by organizations in the near future. Such dynamics create new challenges for managers today, since modern realities require the formation of new strategies for managing competitiveness in a rapidly changing environment. The analysis results of the IT sphere specifics and the latest trends in the impact of innovative technologies allow us to formulate requirements for models for managing the competitiveness of IT enterprises (*Figure 2*). In particular, such models should take into account the high dynamism of the technological environment and ensure rapid adaptation to changes. They should stimulate the creation and effective use of knowledge for the development of innovative products and services, as well as emphasize the importance of human capital, contributing to the development of qualified personnel. In addition, models should reflect the global nature of competition and facilitate effective collaboration with other companies and organizations to create network effects.

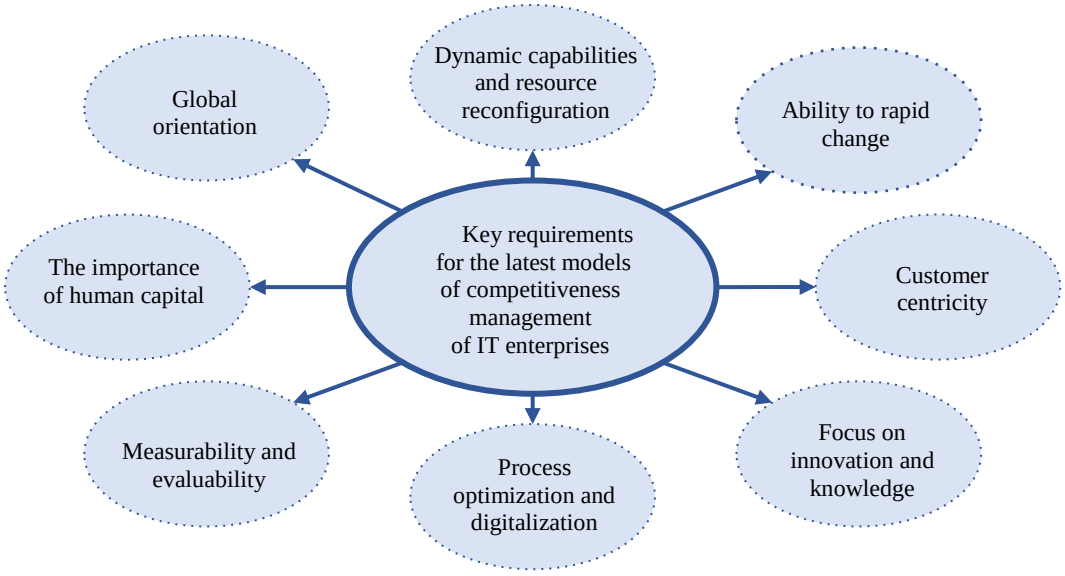

Figure 2. Key requirements for the latest models of managing the competitiveness of IT companies in the context of systemic crises and transformations

Source: compiled by the authors.

The digital transformation model, pioneered by Harvard Business School professor Clayton Christensen, offers a strategic approach to integrating digital technologies into all aspects of a company's operations, changing the way it creates value and interacts with customers. This approach involves not only implementing new technologies but also reassessing the business model and organizational structure. Christensen sees competitive

advantage not as a static element, but as a dynamic quality that changes with market conditions and consumer needs. The scientist emphasizes the importance of innovation, customer focus, and the ability to adapt. According to his definition, competitive advantage comes not only from having better products or services, but also from a unique business model that delivers value to consumers in a way that is difficult for competitors to replicate. This can include aspects such as pricing strategies, distribution channels, and customer acquisition methods. Competitive advantage is also achieved by implementing innovative solutions that more effectively meet customer needs and are able to transform markets (Christensen et al., 2018).

2. Concept, characteristics, and semantic model of breakthrough innovations

A key contribution to understanding digital transformation is Clayton Christensen's theory of disruptive innovation, which explains how digital technologies change business models and open up new opportunities. The concept of disruptive innovation refers to innovations that change the way industries function and displace established market leaders. We have developed the characteristics of disruptive innovation in the context of interpreting market requirements and accessibility; technology and productivity; industry impacts and business models; and value networks, which is defined as the semantic model "disruptive innovation framework" (*Figure 3*).

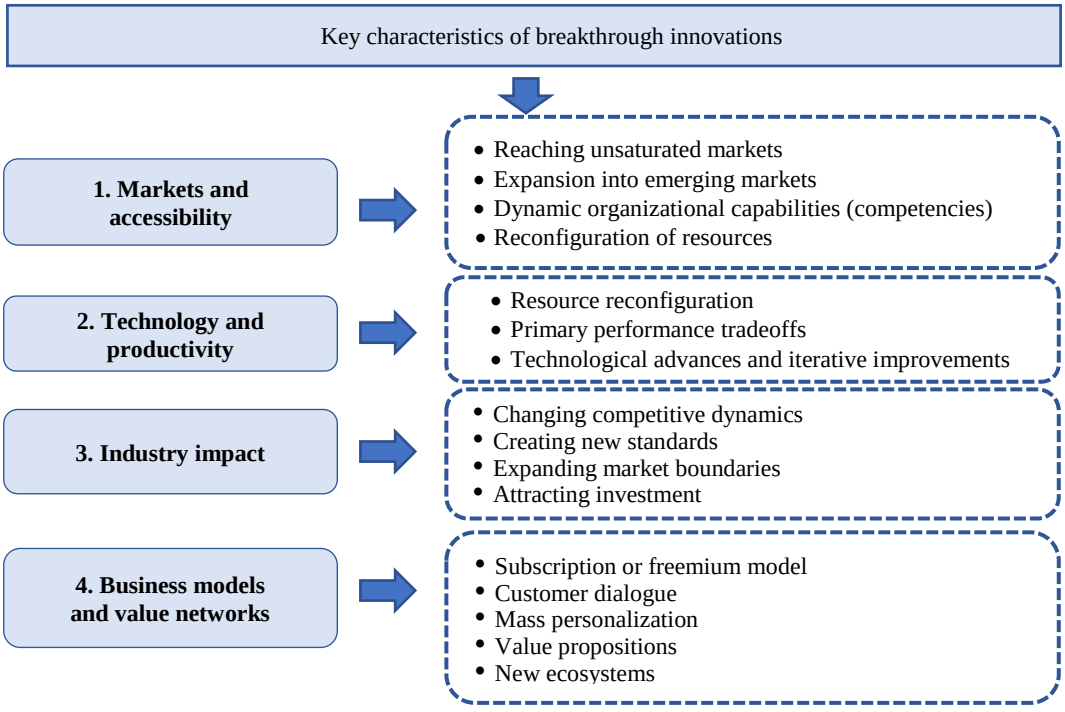

Figure 3. Semantic model of the "disruptive innovation framework"

Source: developed by the authors based on (Christensen et al., 2018).

Disruptive innovations are characterized by the ability of smaller, more resourced companies focused on small market segments to exert competitive pressure on traditional players in the early stages. At first, their solutions may seem less technologically or functionally advanced than existing offerings, but they are able to attract untapped or underserved market segments, creating a basis for further growth and displacing leaders.

An important feature of disruptive innovations is their ability to continuously improve, taking into account feedback from users in cyclical improvement processes. In the initial stages, due to limited functionality, they may be inferior to existing products, but over time, they improve to a high level and even exceed them in performance and value for the end user. Disruptive innovations often start their journey in regions or segments with low competition, in the so-called undervalued or inaccessible markets for traditional players. In such cases, they offer simple, affordable, or more convenient solutions, which makes them attractive to a wide target audience. Over time, as they improve and spread, they are able to change the balance of power in the market, putting established players at risk of losing a significant share of their competitive positions, who are often unable or unwilling to respond quickly to these challenges (IdeaScale, 2023, July 13).

Of particular note is the fact that disruptive innovations ensure the economic accessibility and versatility of products and services, the use of new technologies, simplified processes, and flexible business models, which contribute to their democratization. This is manifested in particular in the ability to quickly equal and even exceed the performance of traditional solutions, which allows new players to quickly enter the market and capture its segments. An example of a disruptive innovation strategy is the activities of smartphone manufacturers such as Xiaomi, which uses a two-stage approach to entering its products into different markets. In particular, it forms two separate lines of devices: the first is technologically innovative, focused on developed markets such as Europe and the USA, where a high level of purchasing power allows investing in more expensive technologies and components; the second is adapted for countries with lower incomes, in particular for the Indian market, which uses cheaper materials and a smaller set of technological innovations without losing the ability to compete in terms of quality and functionality. While Xiaomi’s main smartphone line actively competes with global market leaders Samsung and Apple in the flagship device segment, the budget model, which uses more affordable resources and a less complex set of technologies, successfully occupies niches traditionally served by cheaper manufacturers. The company is able to displace established brands in the price segment by offering an optimal price-quality ratio and targeting users with a limited budget.

2. Strategies for implementing disruptive innovations and adaptive management models in IT companies

Disruptive innovations are not just an additional factor, but a strategic necessity for the survival and development of IT companies. However, the transition from a theoretical understanding of their essence to practical integration into management strategies requires the development of clear mechanisms. A key step to the successful integration of disruptive innovations is the ability of an enterprise to proactively identify potential threats and opportunities. This requires constant, systematic market monitoring, regular technological scanning, and detailed analysis of "weak signals" that may indicate the emergence of new technologies, changing consumer preferences, or the emergence of new business models. Examples of tools that become indispensable assistants in this process are Big Data Analytics to identify patterns of consumer behavior and their changes, machine learning to predict the evolution of trends, as well as systematic foresight studies that allow us to consider probable future scenarios. Particular attention should be paid to market segments that are traditionally considered "underserved" or "low-margin", as these are where disruptive innovations often emerge. Dialogue with end users, startups, academic institutions, and research institutes creates new opportunities to identify unobvious needs and unmet demands that can become entry points for breakthrough solutions. Of particular note is the creation of internal innovation labs or "scout" teams that are exclusively dedicated to exploring new horizons in technologies and business models.

Disruptive innovation inevitably creates resistance within organizations, as it often disrupts established business processes, reallocates resources, changes roles, and requires new competencies. Research shows that by early 2025, 53% of business leaders surveyed said their organizations needed to accelerate their adoption of AI. Only 22% said they were satisfied with the current pace of change, suggesting that more action is needed to support innovation (*Figure 4*).

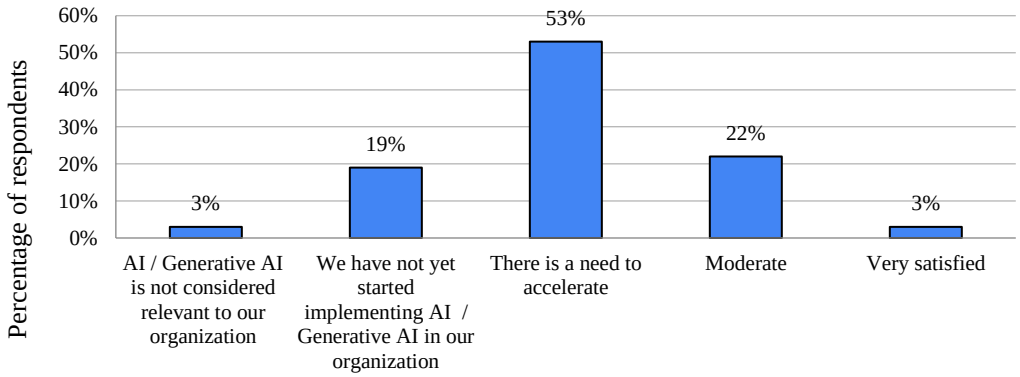

Figure 4. Results of surveys of business leaders regarding the implementation of AI in business organizations

Source: compiled and calculated by the authors based on (Statista, 2025, April).

Effectively managing this resistance is a critical success factor. This starts with clear communication in which management explains the need for change, its benefits to the company and employees, and the risks of inaction. Involving employees in the innovation process and allowing them to experiment helps create change champions – internal advocates who help overcome skepticism. The motivation system should encourage risk-taking and experimentation, not just completing existing tasks. It is important to invest in training and retraining staff to reduce the fear of losing their jobs and increase their competence in new areas. Cultivating a culture of "fail fast", where mistakes are seen as learning opportunities, is the basis for creating an innovative environment.

Traditional hierarchical structures are often too slow and bureaucratic to implement innovations quickly and effectively. IT companies need to develop adaptive organizational models that will promote flexibility and speed of response, in particular:

• application of Agile methodologies: flexible teams, short development cycles (sprints), constant feedback, and an iterative approach allow you to quickly adapt to changing requirements.

• Creation of "innovation laboratories" or "sandboxes": separate divisions or teams that work on new ideas without the rigid bureaucratic restrictions of the main company. This allows for experimentation without disrupting current operations.

• Cross-functional teams: combining specialists from different departments (development, marketing, finance, sales) to work on specific innovation projects. This promotes an integrated vision and accelerates the decision-making process.

• "Ambidextrous organizations": developing the ability to simultaneously effectively manage existing business (exploitation) and explore new opportunities (exploration) without conflicting resources and culture. This requires the creation of separate structures for innovation that remain integrated into the overall company strategy.

• Open Innovation: active collaboration with startups, universities, and other companies to exchange ideas and technologies. This can include joint ventures, investments in external startups, hackathons, idea competitions, and strategic partnerships.

For the effective integration of breakthrough innovations into the strategic management of an IT company, a five-phase model is proposed that combines a systems approach with flexibility and adaptability (*Figure 5*).

To demonstrate the applicability of the proposed constructs, their simulation application to typical IT market scenarios was carried out, where breakthrough ability is manifested through a combination of technological solutions and a business model. In particular, the example of Xiaomi's

strategy shows the mechanism of "entry through the affordability segment" and further scaling of the value proposition: differentiation of lines for different markets makes it possible to simultaneously capture the price segment and compete in the flagship class, that is, it actually reproduces the logic of evolution from a simpler offer to more productive solutions compatible with the requirements of the main market. In this interpretation, the semantic framework (see *Figure 3*) acts as an analytical tool for identifying breakthrough ability domains (affordability/productivity/business model/ecosystem), while the five-phase model (see *Figure 5*) sets the management sequence – from horizon scanning and niche selection to scaling, organizational consolidation, and reintegration of experience. The proposed models can be used as a structured template for analyzing management decisions and forming a portfolio of innovations without claiming to statistically prove causal effects within the scope of this research.

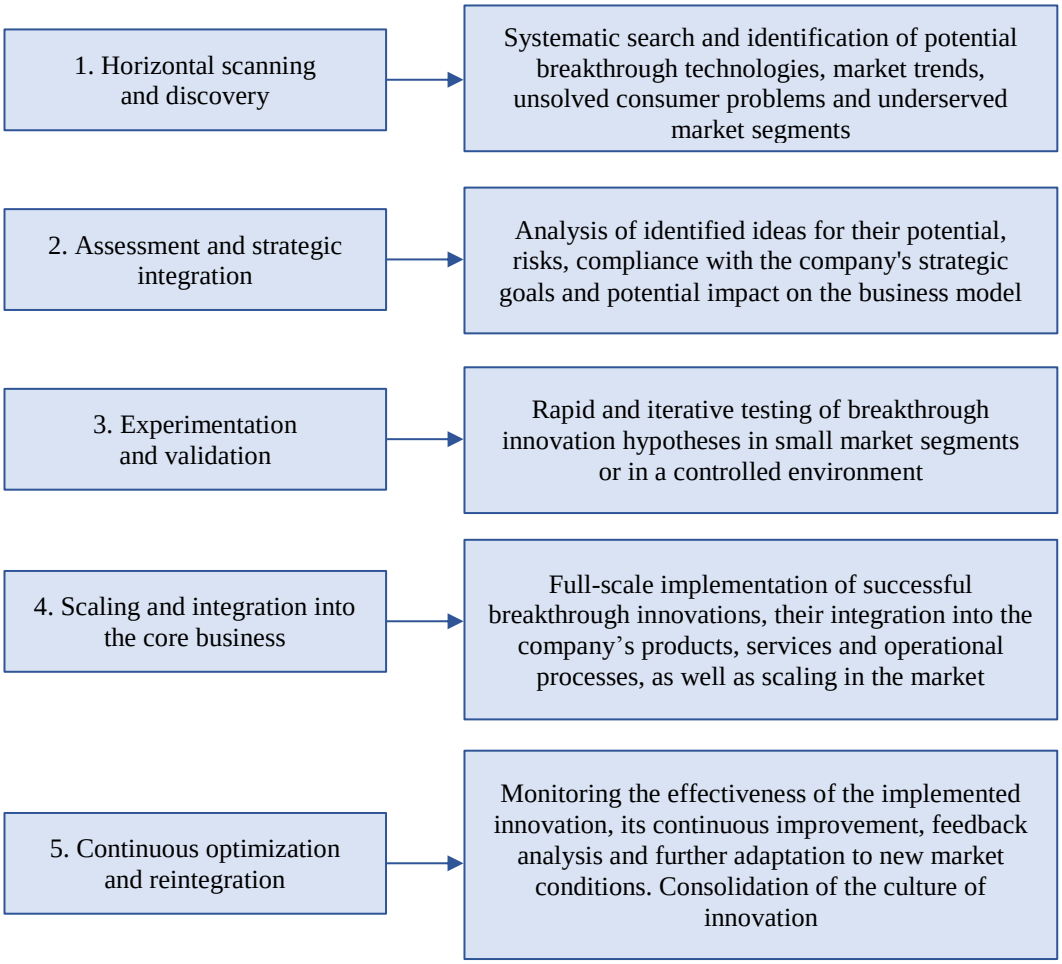

Figure 5. Five-phase model for implementing disruptive innovations in the strategic management of an IT company amid systemic crises and transformations

Source: developed by the authors.

Conclusions

The rapid growth of the artificial intelligence market (forecast to reach USD 1 trillion by 2031) indicates that AI technologies, in particular machine learning and deep learning, have become the main driver of the transformation of the IT sector and a determining factor in competition. Successful management of the competitiveness of IT enterprises in the context of polycrisis and digital transformations goes beyond simple management decisions regarding technological updates of activities and the implementation of individual innovations and technologies, requiring a comprehensive, systemic approach that includes proactive analysis of consumer experience to identify "weak signals" and promising niches, effective management of internal changes to form value propositions and new ecosystems that create a new market or radically change the existing one through transparent communication, involvement and motivation of teams, development of organizational culture and corporate brand, as well as creation of flexible, adaptive business models and organizational systems that promote rapid experimentation, scaling of successful ideas and convergence of technologies, focused on people and integrated into global ecosystems. Only companies that can realize and integrate these mechanisms into their development strategies will ensure their own long-term success and leadership in a dynamic and highly competitive IT environment in the context of systemic crises and transformations.

The conducted research allowed us to confirm the hypothesis that in the conditions of digital transformations, the market stability of IT companies is determined not so much by the volume of investments in technological upgrades as by the ability to systematically integrate breakthrough innovations through the transformation of business models and organizational culture. Breakthrough innovations should be considered not as local technological improvements, but as complex changes based on unique business models, capable of creating new markets and transforming existing ones, gradually displacing traditional market leaders due to the optimal price-quality ratio. The integration of breakthrough innovations is not a one-time action, not an improvement in processes or performance, but a continuous process of learning, internal transformations, adaptation, and change, which allows you to transform potential threats and crisis challenges into new opportunities for sustainable development and is a driver of economic growth. Business management in the era of disruptive innovations requires rethinking traditional approaches and implementing a new paradigm that combines: flexible organizational structures (Agile, cross-functional teams), systematic scanning of market opportunities and threats, active management of resistance to change, and implementation of "ambidexterity" – simultaneous support of existing business and development of innovations. The proposed five-phase model of implementation of disruptive innovations offers a comprehensive approach to integrating innovations into strategic management, which includes stages from horizon scanning to reintegration

of acquired experience and ensures the cyclicality of the innovation process. The effectiveness of implementing disruptive innovative solutions and transformations in IT companies directly depends on the ability of management to form a culture tolerant to risks and experiments, invest in the development of human capital, implement mechanisms of open innovation and cooperation with external ecosystems. Implementing these principles increases the likelihood of IT companies adapting to a rapidly changing environment and can support the formation of sustainable competitive advantages in the face of systemic crises and global transformations.

Further scientific research should be directed at empirical verification of the proposed models and their operationalization in the form of measurable indicators of breakthrough innovation management. First, it is promising to form a set of indicators for each domain of the semantic "framework" (*Figure 3*) and check their predictive suitability for explaining changes in the competitive positions of IT companies in different market segments. Second, the five-phase model (*Figure 5*) requires applied testing on a case sample of IT companies with different profiles (product/service; global/local; startups/mature companies) with recording the results by management metrics (speed of opportunity identification, time to MVP/scaling, share of successful experiments, intensity of cooperation in open innovations, indicators of customer base retention/growth). Third, polycrisis conditions require separate analysis, in particular, the impact of resource shortages, personnel risks, and regulatory changes on the ability of companies to maintain ambidexterity and dynamic capabilities. These areas will allow us to translate the proposed conceptual results into testable hypotheses and strengthen the applied validity of the models based on real management practices.

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ETHICAL ASPECTS OF ACCOUNTING FOR DIGITAL ASSETS

In the European Union, the professional ethics of accountants play a fundamental role in ensuring the reliability of accounting, transparency of reporting, and prevention of corruption. In the context of digital transformation, automation without appropriate ethical oversight may create additional risks of losing the reliability of accounting information and trust in financial data. The hypothesis is put forward that aligning accounting approaches with the principles of the International Code of Ethics for Professional Accountants (IESBA Code) enhances the soundness of professional judgment and the quality of disclosure of information on digital assets, thereby reducing the risks of manipulation and non-transparent transactions in the digital economy. To test the hypothesis, an analytical-empirical approach was chosen, combining a documentary analysis of EU regulatory acts and international standards (MiCA, IFRS, IESBA Code of Ethics, EFRAG publications) with a critical analysis of scholarly publications, professional organization reports, and practical data on digital asset accounting. Using methods of scientific abstraction and concretization, the compliance of practical solutions with ethical principles was determined, gaps were identified, and areas of heightened ethical risk in financial reporting were

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ЕТИЧНІ АСПЕКТИ ОБЛІКУ ЦИФРОВИХ АКТИВІВ

У Європейському Союзі професійна етика бухгалтерів відіграє фундаментальну роль у забезпеченні достовірності обліку, прозорості звітності та запобіганні корупції. В умовах цифрової трансформації автоматизація без відповідного етичного контролю може створювати додаткові ризики втрати достовірності облікової інформації та довіри до фінансових даних. Висунуто гіпотезу, що узгодження облікових підходів з принципами Міжнародного кодексу етики професійних бухгалтерів (The International Code of Ethics for Professional Accountants – IESBA Code) підвищує обґрунтованість професійного судження та якість розкриття інформації про цифрові активи, що знижує ризики маніпуляцій і непрозорих операцій у цифровій економіці. Для перевірки гіпотези обрано аналітико-емпіричний підхід, що поєднує документальний аналіз регуляторних актів ЄС та міжнародних стандартів (MiCA, IFRS, Кодекс етики IESBA, публікації EFRAG) з критичним аналізом наукових публікацій, звітів професійних організацій та практичних даних щодо обліку цифрових активів. Використовуючи методи наукової абстракції та конкретизації, визначено відповідність практичних рішень етичним принципам, виявлено прогалини та виділено області підвищеного етичного ризику

highlighted. By systematizing the key threats to compliance with ethical principles, the specifics of their impact on the accounting of various types of digital assets were identified, and appropriate safeguards and practical steps for their implementation were substantiated, taking into account the nature of such assets and professional judgments. A multi-level model for integrating the IESBA principles of professional ethics into the accounting of digital assets has been developed, which systematizes ethical constraints, determinants of professional judgment, classification, valuation, disclosure, control, and responsibility. The scientific novelty lies in the operationalization of the IESBA principles as criteria for the admissibility of accounting decisions regarding digital assets based on EU experience. The practical significance is in providing substantiated recommendations for adapting Ukraine's national accounting system and enhancing trust in financial and non-financial reporting amid growing regulatory and geopolitical risks.

Keywords: digital assets, digital transformation, accounting, professional ethics for accountants, fundamental principles, financial reporting, corruption prevention, EU, International Code of Ethics for Professional Accountants, International Ethics Standards Board for Accountants (IESBA).

у фінансовій звітності. Завдяки систематизації ключових загроз дотриманню етичних принципів ідентифіковано специфіку їх впливу на облік різних видів цифрових активів та обґрунтовано відповідні запобіжники і практичні кроки їх впровадження з урахуванням характеру таких активів та професійних суджень. Розроблено багаторівневу модель інтеграції принципів професійної етики IESBA в облік цифрових активів, яка систематизує етичні обмеження, детермінанти професійного судження, класифікацію, оцінку, розкриття інформації, контроль і відповідальність. Наукова новизна полягає в операціоналізації принципів IESBA як критеріїв допустимості облікових рішень щодо цифрових активів на основі досвіду ЄС. Практична значимість – надання обґрунтованих рекомендацій для адаптації національної системи обліку України та підвищення довіри до фінансової та нефінансової звітності в умовах зростаючих регуляторних і геополітичних ризиків.

Ключові слова: цифрові активи, цифрова трансформація, облік, професійна етика бухгалтера, фундаментальні принципи, фінансова звітність, запобігання корупції, ЄС, Міжнародний кодекс етики професійних бухгалтерів, Рада з Міжнародних стандартів етики для бухгалтерів.

JEL Classification: M14, M41, K22, G30.

Introduction

The active adoption of digital assets in the financial and economic activities of enterprises is the result of systemic changes associated with the digital transformation of the economy. Crypto-assets, tokenized instruments, and other forms of digital assets are increasingly used as means of investment, settlement, value generation, and value storage, which necessitates their reliable and comprehensive recognition in accounting and reporting. At the same time, the development of regulatory frameworks for digital assets in the EU, in particular the adoption of the Markets in Crypto-Assets (MiCA) Regulation (European Commission, 2023, May 31), establishes new requirements for transparency, compliance, and accountability of market participants. Under these conditions, the role of the professional accountant as a key actor in the formation of reliable financial information is increasing.

Accounting and the preparation of financial statements are directly linked to compliance with the principles of professional ethics defined in the International Code of Ethics for Professional Accountants – Code by the International Ethics Standards Board for Accountants (IESBA Code) (IESBA, 2025, October 7). A key challenge in accounting for digital assets is the absence of a specific standard within International Financial Reporting Standards, which results in the application of different accounting

approaches and variations in professional judgment. Under such circumstances, ethical principles – integrity, objectivity, professional competence and due care, confidentiality, and professional behavior – become decisive in ensuring the quality of accounting information.

Digital transformation is changing traditional approaches to asset accounting, complicating the identification of ownership rights, valuation, and disclosure in financial reporting. It creates an environment of increased risk of ethical noncompliance, where accountants are forced to make decisions under conditions of regulatory uncertainty and technological complexity. The relevance of this research is further reinforced by the fact that digital assets can be used to conceal economic transactions, evade taxes, and launder money. Under such circumstances, adherence to professional ethics by accountants becomes a key tool for ensuring trust in financial information and the effectiveness of regulatory mechanisms. For Ukraine, which is harmonizing national legislation with EU standards, analyzing European approaches to the ethical aspects of digital asset accounting has practical significance.

The research problem lies in the diversity of types of digital assets, coupled with the absence of specific accounting standards for them, which necessitates extensive professional judgment and increases the risk of violating the principles of objectivity and integrity. Regulatory requirements regarding compliance and disclosure are not always aligned with existing accounting tools, creating a conflict between legal compliance and the professional independence of the accountant. An insufficient level of informational and methodological support, as well as accountants' awareness in the field of digital assets, complicates the application of the principles of professional competence and due diligence. A pressing issue is the lack of systematic alignment between accounting approaches to digital assets and the requirements of accountants' professional ethics in the context of digital transformation in the EU. Addressing these problems is a necessary condition for improving the quality of financial reporting, the transparency of economic processes, and trust in accounting information.

In scholarly and professional discussions, there is an opinion that digital transformation does not generate fundamentally new ethical problems for professional accountants, but rather creates new conditions for applying the existing International Code of Ethics (International Federation of Accountants (IFAC), 2021, April 1). However, this approach is not unconditional, since certain provisions of the Code require deeper interpretation and practical specification in light of technological complexity and the increased role of professional judgment in accounting and taxation of digital assets. It is evident that the ability to comply with general ethical requirements without considering the specifics of the digital environment is limited (Huterski et al., 2020).

At the regulatory level, the European Union and professional organizations are developing frameworks and guidance. For instance, the European Financial Reporting Advisory Group (EFRAG) conducted an in-depth study of the issues related to accounting for crypto-assets and crypto-

liabilities and published a corresponding Discussion Paper (EFRAG), 2020, July), and subsequently presented the summarized key findings of this study at the Advisory Forum on Accounting Standards (ASAF) in the form of an analytical presentation (EFRAG, 2020, December 10). European reviews provide a legal basis, but they do not detail the ethical obligations of accountants when applying different accounting approaches (Dragomir, 2023). The EU Markets in Crypto-Assets (MiCA) Regulation EU 2023/1114 (European Commission, 2023, May 31) became the first comprehensive framework for the operation of the crypto-asset market in the EU, including definitions and market transparency requirements. MiCA, as a regulatory act, partially addresses legal and regulatory issues of transactions involving digital assets, but it does not offer detailed requirements regarding the accounting recognition of digital resources in financial statements, leaving room for the application of accountants' professional judgment (Fomina et al., 2024).

It has been established that existing research focuses primarily on the technical aspects of recognition and measurement of crypto-assets or on the analysis of the EU regulatory framework (MiCA, IFRS), leaving the professional ethics of accountants outside of comprehensive analysis. In contrast, it is precisely the ethical principles of integrity, objectivity, professional competence, and due care that constitute the systemic factors ensuring the reliability of digital asset accounting, especially under conditions of high volatility, automation, and algorithmic decision-making in accounting. Research on ethical issues in the works of Fischer (2018, November 30), Fulop et al. (2025), Al-Okaily et al. (2023, December 26), Romashko and Korol (2024), Shapovalova et al. (2023), Golov et al. (2022), Shuid et al. (2024, February 19), Adriansyah Rais and Windarsari (2025), and publications by Accountancy Europe (2025, February 17), among others, offers conceptual frameworks for professional ethics in the context of blockchain and digital technologies. However, they do not provide practical, integrated solutions for applying judgments in digital asset accounting within the existing IFRS and EU regulatory requirements.

The FATF, in a series of updates (Targeted Update), notes that the global implementation of AML-standards (Anti-Money Laundering) regarding virtual assets remains incomplete (Financial Action Task Force (FATF), 2024, July 09). At the same time, FATF provides a roadmap and national compliance assessments, which serve as important guidance for the EU and Ukraine (Mazaraki & Melnyk, 2023, April). Institutional reviews by the U4 Anti-Corruption Resource Centre and Transparency International (2023, March 03) mention the risks of using crypto-assets for money laundering, yet they do not define practical procedures for accountants that would combine professional ethical requirements and responsibilities with anti-money laundering, reporting (whistleblowing), including questions of prioritization between client confidentiality and the public interest (Accounting Insights Team, 2024, September 19).

European Financial Reporting Advisory Group (EFRAG, 2020, July) and Parrondo (2023) detail the classification of tokens and approaches to applying existing IFRS. However, clear guidance is still lacking on how ethical principles (IESBA) should directly influence the choice of accounting policy for each type of token in real-world cases (case-by-case). In other words, how to reconcile the taxonomy with ethical requirements when providing financial information. Han et al. (2022, March), in a systematic literature review, indicate that current academic studies focus on the technical and procedural aspects of applying blockchain in accounting and auditing, but research on the ethical implications of such application is insufficient.

Ethical dilemmas remain in professional judgments when selecting standards (IAS 2, IAS 38, or IFRS 9). Although the International Accounting Standards Board (IASB) (IFRS Foundation, 2019, June), Big4 publications (EY, 2021, October), and analytical reviews provide certain recommendations for practitioners, there are no algorithms or ethical criteria that directly instruct accountants on how to act when the application of different standards produces different informational outcomes for financial statement users (for example, the choice of accounting policy may conceal or, conversely, reveal corruption risks). Wiyarni et al. (2024), Semenova and Shpyrko (2025) also point out that the possibility of applying professional judgment in determining recognition and measurement methods for crypto-assets can lead to manipulations in financial metrics, creating ethical dilemmas for accountants. Studies on blockchain and crypto auditing, as well as the range of assurance services, are described in reviews by Bellucci et al. (2022), Alsulami (2025), and Fomina et al. (2022, February), however, it remains unresolved which specific ethical principles (objectivity, professional competence and due care, independence in assurance engagements) should take priority in the audit of digital assets, and how auditors should collaborate with accountants in situations where disclosure may trigger regulatory consequences or compliance risks.

A number of studies (Kurniawan et al., 2025; Korol, 2024; Oriekhova, 2020) highlight the lack of preparation and practical guidance regarding which minimum competencies and ethical training should be implemented for accountants in view of modern challenges, so that they can respond to new risks associated with digital assets. Insufficient attention has been paid to the interaction between the EU professional organizations' ethical standards and accounting policies within the framework of digital transformations, which is particularly relevant today and is emphasized by Sampaio and Silva (2025).

Despite the existence of EU regulatory initiatives, the scholarly literature specifically analyzing the experience of EU companies in applying IFRS to digital assets remains limited. Most studies focus on analytical reviews and conceptual models, whereas empirical research on digital asset accounting in actual practice is scarce. Moreover, there is insufficient research on how EU regulatory requirements (MiCA) interact with

professional ethical standards of accountants when making accounting decisions related to digital assets. There is a need for practice-oriented research that can offer integrated ethical-accounting recommendations for EU accountants and, in the future, serve as a guideline for implementation in Ukraine.

The purpose of the study is to substantiate the directions for aligning accounting approaches to digital assets with the fundamental principles of professional ethics in the context of digital transformation, taking into account EU regulatory practice, and to determine directions for adaptation for Ukraine.

To achieve this goal, the article aims to address the following tasks:

• to analyze the economic essence of digital assets as objects of accounting in EU practice;

• to investigate the impact of digital transformation on accounting and the application of professional judgment by accountants in the EU;

• to summarize the requirements for accountants' professional ethics and the role of professional organizations;

• to identify threats to the violation of fundamental ethical principles in the accounting of digital assets;

• to substantiate directions for aligning accounting approaches to digital assets with the principles of professional ethics in the EU and to determine practical recommendations for Ukraine.

The study proposes the hypothesis that aligning accounting approaches with the IESBA principles in EU practice enhances the reasonableness of professional judgment and the quality of disclosures regarding digital assets, thereby reducing the risks of manipulations and non-transparent operations in the context of digital transformation.

To test the hypothesis, an analytical-empirical approach was chosen, combining a documentary analysis of EU regulatory acts and international standards (MiCA, IFRS, IESBA Code of Ethics, EFRAG publications) with a critical analysis of scholarly publications, professional organization reports, and practical data on digital asset accounting. The informational basis of the study consisted of regulatory documents, scientific publications, and reports from professional organizations. During the analysis, key categories were systematically identified: types of digital assets, corresponding accounting approaches, principles of professional ethics and the extent of their implementation in accounting practice, threats to adherence to fundamental ethical principles, and safeguards for their mitigation. Data processing was carried out through the synthesis and comparative analysis of regulatory requirements and practical cases of digital asset accounting in EU countries.

Using methods of scientific abstraction and concretization, the study determined the compliance of practical solutions with ethical principles, identified gaps, and highlighted areas of heightened ethical risk in financial reporting.

The main part of the article consists of five sections: the first section analyzes the economic nature of digital assets as accounting objects and the features of their classification in the practice of the European Union; the second section examines the impact of digital transformation on accounting processes and the application of professional judgment by accountants under conditions of regulatory uncertainty; the third section summarizes the requirements for professional ethics of accountants, reveals the role of professional organizations, and discusses the anti-corruption context of digital asset accounting regulation; the fourth section identifies key threats to the violation of fundamental ethical principles in digital asset accounting and assesses their impact on professional judgment; the final section substantiates directions for aligning accounting approaches to digital assets with professional ethics principles in the EU and formulates practical recommendations for their adaptation in Ukraine.

1. The essence of digital assets as accounting objects in EU practice

The conditions of the European Union's economic digital transformation are driving the emergence and active dissemination of new forms of assets, whose existence is based on digital technologies. Digital assets are gradually acquiring the characteristics of full-fledged accounting objects, which requires their clear conceptual definition, classification, and methodological understanding, taking into account the regulatory and ethical specifics of EU practice.

In general terms, digital assets are resources that exist in digital form, are controlled by an economic entity as a result of past events, and are capable of generating future economic benefits (EY, 2021, October). In EU practice, digital assets most often include crypto-assets (cryptocurrencies, tokens), digital financial instruments, virtual assets, as well as certain types of intangible assets related to the use of distributed ledger technology (DLT), blockchain, smart contracts, and digital platforms (Semenova, 2025). EU Regulation 2023/1114 MiCA (Markets in Crypto-Assets Regulation) (European Commission, 2023, May 31) defines the classification of crypto-assets, requirements for token issuers, exchange platform operators, and service providers in the digital asset sector. MiCA identifies three main categories of digital assets: (1) payment tokens, (2) utility tokens, and (3) security tokens. Each of them has different economic functions and risks, which affect the choice of accounting, valuation, and disclosure methods.

Alongside MiCA, International Financial Reporting Standards (IFRS) are applied in EU practice. Although IFRS does not contain a separate specialized standard dedicated to digital assets, it provides guidance on recognition, measurement, and accounting for certain types of them. Additionally, EFRAG offers recommendations for adapting IFRS to ensure compliance with the specifics of digital assets in the EU, including requirements

for transparency and completeness of disclosure (EFRAG, 2020, July). Therefore, today, a generally accepted understanding of the content of digital assets as accounting objects is still in the process of formation.

From the perspective of accounting, a key characteristic of digital assets is the absence of a unified physical form, which complicates their identification and valuation. In most EU countries, digital assets are not recognized as cash or cash equivalents and are accounted for depending on the economic substance of the transactions – as intangible assets, inventories, or financial instruments. This approach aligns with the principle of the primacy of economic substance over legal form, which is fundamental to IFRS. Practice shows that most European companies apply recognition and valuation methods for digital assets at fair value, adapted to the requirements of IFRS 9 "Financial Instruments" and IFRS 13 "Fair Value Measurement". At the same time, depending on the purpose of holding digital assets and the current business practices of the enterprise, other valuation approaches may be applied in accordance with IAS 38 "Intangible Assets" or IAS 2 "Inventories" (IFRS Foundation, 2019, June).

A distinctive feature of digital assets as accounting objects in the EU is their high volatility, technological complexity, and legal heterogeneity. This creates increased demands on professional judgment by accountants, particularly regarding the timing of asset recognition, the choice of valuation method (initial or fair value), and disclosure in financial statements. Digital assets become not only a technical but also an ethical challenge, as there is a risk of manipulative valuations, information asymmetry, and insufficient transparency for users of financial reports. Reviews of practical cases indicate ambiguity in the classification and accounting treatment of digital assets, not only due to the lack of specialized standards but also because of the variety of asset types (data, platforms, algorithms, digital ecosystems), not all of which constitute full-fledged accounting objects. This further reinforces the need for professional judgment by accountants and adherence to ethical principles in decision-making.

EU practice demonstrates a gradual transition from a fragmented accounting approach to more systematic regulation of digital assets, as evidenced by the implementation of the MiCA. Although this regulation is primarily focused on financial regulation, it indirectly affects accounting by shaping a shared understanding of the economic substance of digital assets and the scope of responsibility of economic entities.

2. The impact of digital transformation on accounting and the application of professional judgment by accountants in the EU

Digital transformation is defined as a systematic process of integrating digital technologies into all areas of economic activity, leading to fundamental changes in business models, operational processes, value creation mechanisms, and management approaches (Adriansyah et al., 2025).

Unlike the digitization of individual processes, digital transformation encompasses profound organizational, technological, and institutional changes that shape a new economic reality.

In the European Union, digital transformation is one of the key strategic priorities for economic development, implemented within the framework of the Digital Single Market, the Digital Europe Programme, and the European Digital Strategy. Its goal is to enhance the competitiveness of the EU economy, ensure technological sovereignty, promote innovation, and establish a unified digital space. In this context, digital technologies directly affect the transformation of financial markets, corporate reporting, and accounting systems. Digital transformation significantly changes the role of the accountant as a bearer of professional judgment. The implementation of technologies such as blockchain, AI, and Big Data enables the automation of routine operations, increases the accuracy of accounting data, and provides real-time access to information (Fomina et al., 2022, December). At the same time, these technologies do not eliminate the need for specialists. On the contrary, the focus shifts from mechanical execution of operations to analytical evaluation, quality control, and data interpretation. Accountants must make decisions regarding the correctness of digital asset valuation, the accuracy of their classification, and the disclosure of financial information, using technological tools as support rather than as a replacement for professional analysis (Han et al., 2022, March).

Practical aspects of digital transformation in the EU demonstrate that accounting models must adapt to a complex technological environment, where digital assets constitute a separate asset class with their own characteristics. It is necessary to consider not only the potential for improving the monitoring of digital asset usage but also cybersecurity challenges, issues with integrating different systems, and the protection of sensitive data. Ethical questions regarding the use of automated solutions require further attention and the development of appropriate rules and regulations. Modern accountants must not only possess technical tools but also be able to critically evaluate algorithms and document professional judgment. It is important to understand that automation does not relieve one of responsibility, and the use of AI or on-chain data requires additional verification procedures, algorithmic control, and transparency in explanations (explainability). IESBA and professional EU organizations already emphasize these requirements in their guidelines and educational initiatives.

The integration of blockchain technology into accounting processes has a significant impact on the accounting of digital assets. Blockchain ensures an immediate (immutable) recording of transactions, which increases trust in the data and the transparency of financial information, as all operations are recorded in a distributed ledger without the possibility of modification, eliminating manipulation. Thanks to blockchain, information on digital assets is available almost in real-time (Bellucci et al., 2022).

Accordingly, the need for traditional verification procedures decreases, and the quality of reporting improves. The benefits for audit and compliance lie in the fact that blockchain can provide a basis for automated checks and reduce the risk of fraud or errors in recording crypto-assets within financial systems.

Artificial intelligence (AI) is literally transforming accounting practice by automating complex procedures and data analytics. AI algorithms are capable of processing large volumes of transaction data on digital assets to identify patterns, anomalies, issues, predict risks, and automatically reconcile data, which enhances the reliability of accounting information and facilitates decision-making. Contemporary research (Alsulami, 2025) notes that combining AI with blockchain strengthens the ability to detect suspicious transactions or potential cases of fraud, which is critical for accounting digital assets, as they are often used in illicit activities. However, the use of blockchain and AI creates risks of algorithmic opacity and potential distortion of accounting data, requiring accountants to uphold principles of integrity, objectivity, and professional due diligence (Romashko & Miroshnichenko, 2025). In the context of digital transformation, professional judgment also includes the ability to interpret analytical results, verify automated decisions, and ensure compliance of financial information with IFRS standards and IESBA ethical norms. Thus, digital technologies do not reduce but rather enhance the role of professional judgment, making it a key factor in ensuring the reliability and transparency of digital asset accounting.

In the EU, institutional and political initiatives of the digital market play a special role in shaping the conditions for accounting digital assets within a single digital space. The "Digital Single Market" strategy promotes the harmonization of digital standards and platforms across the EU, including support for e-accounting and other digital solutions that facilitate the automated processing of financial information, particularly data on digital assets. Accounting is being transformed through the creation of an institutional environment for the implementation of modern technologies. At the same time, the level of digitalization among EU member states remains uneven, which affects the extent of adoption of digital accounting practices and requires coordinated strategies for developing the digital competencies of accountants.

3. Requirements for professional ethics of accountants

Accounting for digital assets in the context of digital transformation requires accountants to adhere to a high level of professional ethics, which ensures the reliability, transparency, and trustworthiness of financial reporting. In the EU, the primary regulatory document defining ethical standards for accountants is the IESBA Code.

3.1. General understanding of ethics in the accounting profession

The International code of ethics for professional accountants, developed by the International ethics standards board for accountants (*IESBA*, 2025, October 07), serves as the foundational regulatory document establishing universal principles of ethical conduct for accountants and auditors in the global professional environment. The Code enshrines fundamental ethical principles: integrity, objectivity, professional competence and due care, confidentiality, and professional behavior. These principles are mandatory when performing professional duties in all jurisdictions influenced by the International federation of accountants (IFAC), including EU countries, where these provisions form the basis of national regulation of the profession.

In 2023, IESBA published an updated edition of the Handbook of the International Code of Ethics for Professional Accountants, in which provisions related to the use of digital technologies, safeguarding independence, and ethical responsibility of professionals in a digital environment were significantly expanded. Special attention was paid to the impact of new technologies on accountants' ability to adhere to key ethical principles in situations of increased uncertainty and technological risks (Fomina et al., 2024). Simultaneously, IFAC is implementing a number of initiatives aimed at exploring the relationship between technological development and professional ethics. In particular, the Technology & Ethics Matrix (New Tech Matrix) systematizes the impact of modern technologies on critically important ethical categories, such as professional competence, information confidentiality, and independence of professional judgment. These developments serve as a methodological basis for the creation of national guidelines and educational programs in the field of accounting and auditing (IESBA, 2025, October 07).

The principle of *integrity* requires an accountant to represent digital asset transactions honestly and transparently in reporting, without intentional data distortion or manipulation of valuations. *Objectivity* implies independence in asset assessment and avoidance of conflicts of interest, particularly in cases of volatile or emerging digital assets, where external factors may significantly influence decision-making. *Professional competence and due care* entail continuously updating knowledge about technologies, including blockchain, AI, and Big Data, as applied to accounting, as well as carefully applying valuation and disclosure methods in line with international standards and European regulations. *Confidentiality* and *professional behaviour* are especially important when working with digital assets, as transactions are often conducted in decentralized environments, and information about assets and market participants may be sensitive. An accountant must ensure information protection, prevent unauthorized use of data, and comply with cybersecurity standards and EU regulatory requirements. Understanding the essence of professional ethics principles

allows for the development of an ethically grounded practice in digital asset accounting, combining compliance with legislation, international standards, and high professional standards, thereby enhancing trust in accounting data and financial reporting.

IESBA significantly strengthens guidance on the use of technology in professional practice, emphasizing accountants' responsibility for proper management of technological risks, safeguarding confidential information, and maintaining professional competence in the context of rapid digitalization. In line with these approaches, national professional organizations in EU member states develop their own ethical guidelines, adapted to the local regulatory and technological environment.

The latest revision of the 2025 Handbook of the International Code of Ethics for Professional Accountants (IESBA, October 7, 2025) establishes a reinforced ethical framework for professional judgments in the field of tax accounting, which is particularly relevant for transactions involving digital assets characterized by heightened regulatory uncertainty and cross-border nature. The changes focus on the application of fundamental principles in "grey area" situations, which are typical for the taxation of crypto assets, tokenized instruments, and other forms of digital assets, especially in cases of discrepancies between the tax regimes of EU member states.

The Code specifies requirements for professional competence and due care. It establishes the obligation to create a credible basis for tax positions, apply the retrospective test from the perspective of a reasonably skeptical third party, and fully disclose uncertainties and potential consequences to the client. The new provisions reduce the risk of violating the principles of integrity and objectivity, limiting opportunities for aggressive tax planning. They are fully aligned with European initiatives to enhance tax transparency, while maintaining the priority of the public interest (Accountancy Europe, 2025, February 17).

Amendments to the Code concerning the use of work from an external expert, as well as the updated requirements related to sustainability reporting, will take effect in December 2026. At the same time, the International Ethics Standards for Sustainable Development (including independence standards) and other related changes to the Code will apply from December 2026, except for certain independence provisions in the value chain, which will come into effect in July 2028 (IESBA, 2025, October 7).

The Code not only establishes fundamental principles but also provides a conceptual framework for identifying, evaluating, and addressing threats that may impede compliance with these principles. A professional accountant applies this framework to identify, evaluate, and manage ethical risks in practical activities. Although *independence* is not a fundamental principle of the IESBA Code, it serves as a specific ethical requirement for assurance engagements, acting as a means to uphold the principle of objectivity.

3.2. Anti-corruption context

Anti-corruption policy is an integral component of the EU's institutional architecture and one of the key factors in building trust in financial markets, public institutions, and corporate reporting. Digital transformation and the proliferation of digital assets increase the focus on anti-corruption issues, as digital technologies simultaneously create new opportunities for enhancing transparency and new risks for concealing illicit financial flows. In the EU, anti-corruption policy is based on a combination of legal, institutional, and ethical mechanisms covering both the public and private sectors. Accounting functions as a tool for financial transparency and accountability, ensuring the proper representation of transactions, assets, and liabilities. Improper accounting, understatement, or concealment of information in financial reporting is regarded not only as a violation of accounting standards but also as a potential manifestation of, or contribution to, corrupt practices. Digital assets play a particularly important role, as their technological complexity, the pseudo-anonymity of certain transactions, and their transnational nature can be exploited for money laundering, evasion of sanctions, financial control, and concealment of ultimate beneficiaries. Cryptocurrencies are increasingly used for illicit activities, including corrupt actions, due to their decentralization and relative anonymity, which allow the circumvention of traditional banking channels and reduce the likelihood of detection. At the same time, they are applied not only in cybercrime but also across a broader spectrum of offenses involving the transfer of monetary value, such as evasion of financial sanctions, bribery, and embezzlement (U4 Anti-Corruption Resource Centre, Transparency International, 2023, March 3).

Enhanced requirements are imposed on the accounting of digital assets, particularly regarding the identification of sources of origin, correct classification, reliable valuation, and full disclosure of information in accordance with financial monitoring and EU anti-corruption legislation. The professional judgment of the accountant acquires a special anti-corruption significance. When making decisions on the recognition and measurement of digital assets, the accountant is obliged to consider not only formal compliance with standards but also the potential risks of using accounting procedures to conceal corrupt schemes. Adherence to the principles of integrity, objectivity, and professional skepticism, as enshrined in the IESBA Code, is regarded as a key safeguard against financial misconduct.

Recent EU legislative initiatives (the updated AML framework, AML Regulation, etc.) expand the obligations of "obliged persons", which include accountants and audit professionals: strengthened KYC/CDD rules, disclosure of beneficial ownership, periodic training, and standards for storing and providing information. The accountant becomes an active participant in the system for preventing financial crime and corruption. At the same time, supranational bodies, such as OLAF and EPPO, carry out monitoring, investigations, and coordination of criminal prosecution, increasing the

importance of professional ethics in cooperation with law enforcement institutions. The combination of regulatory requirements and law enforcement pressure creates a practice in which accountants must document not only accounting decisions but also verification procedures (due diligence) and report suspicious transactions through the appropriate channels. In this way, the EU aims to reduce opportunities for abuse and places ethical responsibility at the center of professional practice.

3.3. The role of professional organizations

Professional accountancy organizations (PAOs) (Accountancy Europe, national chambers, IFAC/IESBA, EFAA, etc.) play a key role in transferring ethical standards into the everyday work of accountants. The professional environment becomes a space where practical approaches to interpreting existing regulations are developed, new risks are discussed, and a shared understanding of the boundaries of acceptable professional judgment is formed. Through recommendations, position papers, and educational initiatives, professional organizations effectively fill regulatory gaps that arise due to rapid technological development.

At the EU level, Accountancy Europe plays an important coordinating role, representing the interests of national accountancy and audit organizations and uniting 49 professional organizations from 35 countries (including not only EU member states but the entire region), representing approximately 1 000 000 qualified accountants, auditors, and tax advisors. In its analytical reports and consultation documents, Accountancy Europe (2025, February 17) systematically examines the impact of digital technologies, blockchain, and crypto-assets on financial reporting, professional ethics, and confidence in accounting information. The organization emphasizes that digital assets increase the importance of IFRS principles and require heightened attention to transparency in estimates, disclosure of assumptions, and explanation of accounting decisions to financial statement users.

National professional accounting and auditing bodies in EU member states play an important role in shaping ethical guidelines. They adapt international ethical standards and recommendations to the national legal framework, taking into account local characteristics of the digital asset market and financial supervision (Semenova & Shapovalova, 2021). Practical guidance on accounting for crypto-assets, using digital platforms, and automating accounting processes often includes not only technical explanations but also emphasizes the accountant’s responsibility to prevent abuse, conflicts of interest, and distortion of financial information.

At the global level, IFAC and IESBA form the methodological basis for ethical regulation. The International Code of Ethics for Professional Accountants issued by IESBA, supplemented with provisions on technology use, directly links professional competence to a specialist’s ability to critically evaluate digital tools, algorithms, and automated solutions.

A special role is played by the European Federation of Accountants and Auditors for SMEs (EFAA, 2025, September 25), which focuses on practical challenges relevant to small and medium-sized enterprises. SMEs are most often involved in digital asset transactions without sufficient internal controls or specialized accounting units. EFAA's recommendations draw attention to the risks of a simplified or formalistic approach to accounting for digital assets and emphasize the need for ethical vigilance even in cases of minor transactions.

Professional organizations in the EU act as a kind of "buffer" between rapid technological changes and slower regulatory processes. They contribute to the development of a professional culture in which accounting for digital assets is seen not merely as a technical task but as an area of heightened responsibility toward users of financial statements. Under the influence of digital transformation, the role of professional organizations in the EU becomes key to maintaining trust in the accounting profession, upholding ethical principles, and ensuring the quality of financial information.

4. Threats to the fundamental ethical principles in accounting for digital assets

In the International code of ethics for professional accountants, threats are defined as circumstances or relationships that may compromise compliance with the fundamental principles. According to the Code, threats should be identified, evaluated, and addressed through appropriate safeguards. This approach allows ethical requirements to be directly linked to specific professional actions, particularly to the formation of professional judgment in the process of recognition, measurement, and disclosure of information in reporting.

In accounting for digital assets, threats have a systemic nature and correlate with each fundamental principle. Their sources include a combination of high uncertainty in valuation approaches, the absence of specialized accounting standards for most types of digital assets, the complexity of confirming control and ownership rights, and the growing role of distributed ledger technology. In the current environment, professional judgment becomes a key element of the accounting process, which, in turn, increases sensitivity to threats related to self-interest, self-review, and advocacy, as defined in the IESBA Code.

The processes of digital transformation in the EU further amplify the significance of ethical threats in connection with the expansion of regulatory requirements for financial and non-financial reporting. The introduction of the Corporate Sustainability Reporting Directive (CSRD), the European sustainability reporting standards (ESRS), the development of crypto-asset market regulation (Markets in Crypto-Assets Regulation, MiCA), and the digitalization of supervisory practices are creating a new institutional environment in which information about digital assets is increasingly

becoming material for reporting users. Accordingly, the effectiveness of ethical regulation in the EU is determined not by general declarations of principles, but by the ability of professional accountants and auditors to apply appropriate, proportionate, and well-documented safeguards to the identified threats in each specific accounting situation.

An extended analysis of threats to compliance with fundamental ethical principles in digital asset accounting confirms that the key source of ethical vulnerability is the combination of regulatory uncertainty, technological complexity, and the significant role of professional judgment. The IESBA Code offers a universal, yet sufficiently flexible, framework for responding to challenges through the concepts of threats and safeguards. Detailed analysis of threat manifestations has shown that no fundamental principle exists in isolation: violations of integrity or objectivity are often accompanied by deficits in professional competence or threats to independence. Therefore, ethical requirements must be applied comprehensively rather than fragmentarily, considering the specifics of digital assets. To address this issue, a systematization of key ethical threats has been carried out, the characteristics of their manifestation in the accounting of different types of digital assets have been identified, and the corresponding safeguards and practical steps for their implementation have been aligned, as summarized in *Table 1*.

Table 1

Threats to compliance with fundamental ethical principles in digital asset accounting and related safeguards

IESBA Code principles	Threat	Manifestation in digital asset accounting	Detailed safeguards and implementation steps
Integrity	Incomplete or misleading reporting (self-interest threat)	The threat arises from selective or incomplete disclosure of material information about the nature of a digital asset, including: (a) uncertainty over control rights of crypto-assets held through third parties (custody arrangements); (b) limitations on use or transfer of tokens specified in smart contracts; (c) legal restrictions related to classification of the asset as a crypto-asset, tokenized financial instrument, or other digital representation of value. Incomplete disclosure of these aspects distorts users' understanding of the economic substance of the asset and associated risks	1) Implement mandatory disclosure templates for digital asset rights (ownership, access controls, custody arrangements). 2) Require documented evidence of legal title (on-chain evidence, legal documents). 3) Use an independent internal or external verifier to confirm rights before inclusion in reporting. 4) Maintain a protocol for preserving evidence (hashes, transaction receipts) in an immutable repository
Objectivity	Pressure or advocacy (intimidation threat; advocacy threat)	Arises from the influence of management or related-party economic interests on the exercise of professional judgment in valuing digital assets, especially in the absence of an active market. This may include subjective assumptions about future cash flows from utility tokens, manipulation of fair value model inputs, or uncritical use of quotations from opaque trading platforms. Such actions compromise the neutrality of valuation and violate objectivity requirements	1) Segregation of duties: separate team/person for structuring consultation, another for valuation. 2) Engage an independent external valuer with required disclosure of methodology and key assumptions. 3) Formalize professional judgment process: written justifications of key assumptions, peer review, and archiving changes. 4) "No-promotion" policy for staff involved in valuation

End of Table 1

IESBA Code principles	Threat	Manifestation in digital asset accounting	Detailed safeguards and implementation steps
Professional competence and due care	Lack of competence or self-review (self-review threat)	Threat arises when an accountant or auditor recognizes, classifies, or values digital assets without sufficient knowledge of their technological and legal nature, including distinctions between cryptocurrencies, utility tokens, security tokens, and tokenized real-world assets. Lack of expertise may result in incorrect IFRS application (e.g., misclassification between inventory, intangible assets, or financial instruments) and inaccurate determination of recognition timing or impairment measurement	1) Mandatory certification, qualification in digital assets for accounting, valuation personnel. 2) Use of multidisciplinary teams: IT experts, legal specialists, valuers. 3) Require external technical assurance or independent expert opinion at initial recognition of an asset class or for complex structures. 4) Procedures prohibiting valuation by personnel who prepared the technical structure of the asset (preventing self-review)
Confidentiality	Disclosure or improper use of information (self-interest threat)	Arises from risks of unauthorized access to confidential information related to digital assets, including private keys, user identification, and transaction details. The combination of accounting systems with distributed ledger technology poses a particular threat, as some information is public by nature while other parts are subject to commercial and personal data protection requirements. Breaches of confidentiality may have ethical and regulatory consequences	1) Implement key management policies (HSM (Hardware Security Module), multisig (Multi-signature), custody agreements). 2) Conduct regular penetration tests and independent cybersecurity audits. 3) Apply data minimization and anonymization of metadata prior to analysis/storage. 4) Establish contracts with custodians with clear SLAs (Service Level Agreements) and access rights; maintain immutable access logs
Professional behaviour	Excessive involvement or advocacy (familiarity threat; advocacy threat)	Occurs when a professional accountant exceeds a neutral role and participates in public promotion of digital assets associated with a client or employer. This may include communications regarding initial token offerings, public statements on investment attractiveness, or involvement in strategic decisions affecting market perception. Such actions conflict with professional behavior requirements and may undermine trust in the profession	1) Code of conduct: prohibit public promotion of projects under audit/valuation. 2) Mandatory disclosure of all economic and non-economic interests regarding the client. 3) Disciplinary procedures and sanctions for violations
Independence in assurance engagements*	Self-review or self-interest (self-review threat; self-interest threat)	Arises when the assurance provider has previously been involved in developing the digital asset structure, its accounting policies, or valuation methods. Particularly relevant for assurance of financial or non-financial information where digital assets are material. Combining such roles creates threats to independence, as the provider is reviewing the results of their prior work	1) Prohibit combining consulting and assurance for the same subject matter. 2) Require documentation of all indirect relationships (economic interests) and their elimination. 3) Staff rotation, external quality review. 4) Public disclosure of the nature of services provided in the independence report

** Independence is not a separate principle but a specialized requirement to ensure objectivity in assurance engagements.*

Source: based on a complex assessment (IESBA, 2025, October 07; EFRAG, 2020, December 10; European Commission, 2023, May 31; EY, 2021; Korol & Hnasko, 2022).

Although independence is not a fundamental principle of ethics, for assurance engagements it serves as a critical condition for implementing the principle of objectivity and as a prerequisite for users' trust in audit results, especially in the digital asset environment characterized by high levels of judgment, complex valuation models, and technological opacity. This

distinction allows for the analytical separation of specific threats of self-review and self-interest that are characteristic of digital assets. The table presented is developed as a tool for aligning the provisions of the IESBA Code with practical accounting solutions for digital assets within the existing EU regulatory framework. Its practical and scientific significance lies in systematizing typical threats to adherence to fundamental ethical principles through the lens of concrete manifestations in the recognition, measurement, and disclosure of various types of digital assets, thereby bringing the abstract ethical requirements of the Code closer to practice. The logical connection between ethical principles, professional threats, and relevant safeguards is demonstrated, which in practice helps reduce the risk of fragmented or declarative application of ethical principles in the context of accounting's digital transformation.

5. Aligning accounting approaches to digital assets with professional ethics: European experience and practical lessons for Ukraine

In this article, accounting approaches to digital assets are understood as a set of IFRS-compliant decisions regarding their recognition, classification, measurement, presentation, and disclosure, formed on the basis of professional judgment under conditions of regulatory uncertainty. It is important to emphasize the role of ethics, as it is ethics – not merely technical rules – that limits the permissibility of accounting approaches.

A review of European experience shows that ethical standards in accounting differ to some extent depending on cultural, national, legal, and economic conditions in various countries. While the principles of integrity, objectivity, and confidentiality are widely recognized and universal, their application may vary: in some contexts, strict compliance with regulatory requirements predominates, while in others broader ethical considerations, including sustainable development and social responsibility, play a greater role (Accounting Insights Team, 2024, September 19).

Currently, the integration of ethical principles into digital asset accounting occurs primarily through strengthening the role of professional judgment and oversight of its justification. In Germany and the Netherlands, professional accounting organizations emphasize documenting judgments when classifying crypto assets (as either intangible assets or financial instruments), taking into account the risks of interest conflicts and valuation of manipulation. In France and Belgium, the focus is on the transparency of the origin of digital assets and aligning accounting decisions with AML/CFT (Anti-Money Laundering/Combating the Financing of Terrorism) requirements, which directly affects the extent of disclosure in financial reporting. In the Nordic countries (Sweden, Finland), ethical requirements are closely linked to the quality of risk and valuation uncertainty disclosures, especially concerning investment and hybrid tokens.

Publications by European professional organizations, in particular Accountancy Europe, indicate an awareness that digital assets increase the

vulnerability of accounting to corrupt practices, money laundering, and sanctions evasion, and therefore require ethical constraints that go beyond formal compliance with IFRS. In practice, an approach is emerging in which ethics is used as a criterion for the acceptability of accounting decisions: if the origin of an asset is opaque, the risks are significant, or the valuation is based on unreliable assumptions, this affects not only the measurement but also decisions regarding recognition and disclosure. In the context of sanctions and geopolitical tension, this approach is seen as a means of protecting financial reporting from the misuse of digital assets for illegal purposes and as a tool for maintaining trust in companies' financial information within the EU.

Professional ethics in the EU is adapting to digitalization based on the understanding that technology does not replace human judgment and must remain under its control. What is needed is not only the technical implementation of solutions but also the development of an ethical-technological culture among accountants, including training and assessment of the application of ethical principles in interaction with digital systems. There is a need to transform general ethical requirements into an operationalized model for their application in accounting for digital assets. A model for integrating IESBA professional ethics principles into the accounting and disclosure of digital assets (*Table 2*) has been proposed, which systematizes ethical constraints, mechanisms of professional judgment, classification, valuation, disclosure, control, and accountability.

Table 2

Model for integrating fundamental ethical principles into digital asset accounting: EU experience and directions for adaptation in Ukraine

Model level	Substantive characteristics	European Union practice	Directions for adaptation in Ukraine
Ethical (Normative)	Fundamental principles of the International Code of ethics for professional accountants: integrity, objectivity, professional competence and due care, confidentiality, professional behaviour, and independence. These principles serve as normative constraints on professional judgment when working with digital assets	Application of the IESBA Code as a mandatory ethical foundation for professional activity. Alignment of ethical requirements with MiCA regulation, AML/CFT obligations, and General data protection regulation (GDPR)	Harmonization of national legislation with European standards; formalization of the obligation to consider ethical aspects when making accounting decisions regarding digital assets; strengthening ethical responsibility in the digital finance sector
Professional judgment	Accountant's professional judgment as the process of selecting an accounting approach under regulatory uncertainty, high volatility, and technological complexity of digital assets. Judgment is formed considering identified ethical threats: conflict of interest, risk of information manipulation, valuation uncertainty, and opaque origin of assets	In the EU, professional judgment is particularly important due to the absence of a specific IFRS standard for digital assets. Special attention is paid to documenting the rationale for judgment and the auditor's role in verifying its ethical soundness	Development of methodological guidelines for applying professional judgment in digital asset accounting. Implementation of requirements to record ethical reasoning behind accounting decisions in working papers

End of Table 2

Model level	Substantive characteristics	European Union practice	Directions for adaptation in Ukraine
Digital assets classification	Determining the economic substance of digital assets considering control rights, expected benefits, and risks. Classification is performed in accordance with IFRS, taking into account different functional token types (payment, utility, investment, hybrid, etc.)	MiCA regulation applies a functional approach to crypto-asset classification. EU accounting practice relies on IAS 38 "Intangible Assets" and IFRS 9 "Financial Instruments", depending on the economic substance of the asset	Adapting the EU functional approach to improve national accounting standards. Development of recommendations for accounting hybrid digital assets, considering their combined nature and IFRS/MiCA requirements
Measurement	Choosing the valuation method for digital assets (historical cost or fair value) considering market activity, reliability of input data, and valuation uncertainty. Ethical considerations include avoiding biased assumptions and manipulative over- or under-valuation	The EU requires enhanced justification of valuations, transparency of assumptions, and disclosure of uncertainties in accordance with IFRS 13 "Fair Value Measurement"; independent valuers are involved in complex cases	Introduction of ethically justified criteria for selecting valuation methods; requirement to disclose the level of valuation uncertainty of digital assets in financial statement notes
Disclosure	Determining the scope and content of information disclosure about digital assets considering threats to ethical principles. Identification of ethically mandatory disclosures based on: suspicion of provenance, materiality of risk, and valuation uncertainty	CSRD/ESRS require structured non-financial reporting disclosures. MiCA establishes technical and economic disclosure requirements for the market but does not formalize ethical disclosure criteria for digital assets in financial reporting	Development of guidelines for ethically mandatory disclosures in financial reporting while maintaining confidentiality balance. Expansion of financial statement notes on digital assets considering corruption, money laundering, and sanctions risks
Audit & Compliance	Internal control, audit, and compliance systems as tools to ensure ethical accounting decisions regarding digital assets, including verification of ownership chains and compliance with sanctions	In the EU, close interaction between accountants, auditors, and regulators is observed. The audit role is strengthened to confirm the reliability of digital asset information and compliance with AML and sanctions requirements	Use of EU experience to develop digital asset auditing in Ukraine. Integration of sanctions and anti-corruption control procedures into accounting processes

Source: based on a complex assessment (IESBA, 2025, October 7; EFAA, 2025, September 25; Adriansyah et al., 2025; Kytaichuk, 2024).

Thus, the proposed model allows for aligning the fundamental principles of ethics with the requirements of IFRS and the EU regulatory framework (MiCA, CSRD/ESRS), while simultaneously formalizing practical tools for applying ethics as a criterion for the permissibility of accounting decisions. It ensures a systematic approach to the classification, valuation, and auditing of digital assets. By providing methodological guidelines for the application of professional judgment, the model establishes

a foundation for adapting EU practices to Ukrainian legislation, particularly under conditions of military and sanctions-related challenges.

The scientific novelty lies in the systematic integration of IESBA professional ethics principles with specific accounting decisions regarding the classification, valuation, and disclosure of digital assets based on EU practices. The practical significance of the obtained results is based on the potential use of the proposed approaches to harmonize Ukraine's national accounting system with European requirements, which is especially relevant in the context of combating corruption, money laundering, and sanctions evasion during the period of Russian military aggression and post-war recovery. The implementation of the proposed measures is expected to contribute to ensuring transparency in digital asset transactions, protection against fraud, and the development of the digital economy.

Conclusions

The experience of the European Union indicates that digital transformation does not diminish the role of accountants; rather, it emphasizes the importance of adhering to ethical principles, professional responsibility, and sound professional judgment. The adoption of advanced technologies such as blockchain, AI, and Big Data facilitates the automation of accounting processes, enhances transparency, and strengthens analytical support for professional judgment, while simultaneously introducing new risks and challenges. Accountants working with digital assets must not only comply with formal regulations but also exercise well-reasoned judgments to prevent improper practices and ensure transparency in financial reporting. In this context, accountants serve as a crucial ethical safeguard in the digital asset accounting chain, where the risk of misuse is heightened due to anonymity, the global scope, and the technological complexity of these assets.

Research confirms that digital asset accounting within the European Union is subject to intensified regulation, reflecting its growing role in the business environment and the limited standardization of accounting approaches. The International Code of Ethics for Professional Accountants provides a suitable conceptual framework for identifying and mitigating threats to adherence to fundamental ethical principles; however, its effectiveness depends on adaptation to the specific characteristics of digital assets. Systematizing threats and analyzing their manifestations in digital asset accounting has enabled the identification of appropriate safeguards and implementation measures, thereby providing a foundation for the further development of methodological guidelines and practices aimed at enhancing trust in financial and non-financial reporting in the era of digital transformation.

The proposed model for integrating IESBA ethical principles into digital asset accounting clarifies the relationships between ethical requirements, professional judgment, and practical decisions regarding classification, valuation, and disclosure, while considering EU regulatory practices. These findings can inform improvements in Ukraine's national accounting system,

particularly in addressing corruption, money laundering, and compliance with sanctions. The scientific contribution lies in the applied interpretation of IESBA professional ethics principles as operational criteria for evaluating the permissibility of accounting decisions regarding digital assets, based on EU practice. The practical significance stems from the model's adaptability to harmonize digital asset accounting in Ukraine with European standards amid heightened regulatory and geopolitical risks.

Overall, the results support the proposed hypothesis: aligning accounting approaches for digital assets with IESBA principles enhances the rigor of professional judgment, improves the transparency of financial reporting, and serves as a key mechanism for reducing information and corruption risks in digital asset accounting.

Future research should focus on refining methodologies for identifying and assessing ethical risks in digital asset accounting and assurance, particularly given the high dependence on professional judgment, valuation models, and decentralized technological solutions. Additionally, approaches to monitoring the application of these technologies should be enhanced. Special attention should be devoted to evaluating the impact of AI and Big Data integration on the objectivity, independence, and quality of professional judgment among accountants and assurance professionals across sectors where digital assets are increasingly significant.

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THE ROLE OF EMOJIS IN STOCK MARKET PREDICTION

This research responds to the increasing applicability of digital non-verbal communication to the high-stakes setting of financial decision-making. Since social media sites are becoming the main venues where investors converse, it is necessary to learn the emotional value of emojis so that the market can be properly assessed. The hypothesis of the research is that sentiment analysis by using emojis can offer a more predictive and refined indication of the desire to invest (as opposed to a text-only model), and that this exclusively affects the share rate. To confirm this, the methodology is a combination of Natural Language Processing (NLP) and machine learning to assess financial tweets, news headlines, and forum discussions. The findings prove that certain emojis are strong symbolic signals of bullish or bearish shifts that can often reflect the change in emotions, and the text does not consider. The comparison between the emojis and the regular sentiment models reveals that the use of graphical icons in prediction of the real time market is by far more accurate with the inclusion of graphical icons. The results indicate that digital iconography and algorithmic trading convergence is a change in behavior among investors, which provides the

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РОЛЬ ЕМОДЗІ У ПРОГНОЗУВАННІ ФОНДОВОГО РИНКУ

Дослідження присвячене зростаючій актуальності цифрової невербальної комунікації у сфері прийняття фінансових рішень. Оскільки соціальні мережі стають основними центрами дискусій інвесторів, розуміння емоційної ваги емодзі є необхідним для точного аналізу ринку. Дослідження ґрунтується на гіпотезі, що аналіз настроїв на основі емодзі забезпечує більш точне та прогнозоване вимірювання схильностей інвесторів, ніж традиційні текстові дані, безпосередньо впливаючи на динаміку цін на акції. Для перевірки цього методологія інтегрує обробку природної мови (NLP) та методи машинного навчання для оцінки фінансових повідомлень, заголовків новин та дискусій на форумах. Результати демонструють, що певні емодзі діють як потужні символічні індикатори "бичачих" або "ведмежих" трендів, часто фіксуючи емоційні зрушення, що ігноруються формальним текстом. Порівнюючи набори даних, які багаті на емодзі, зі стандартними моделями сентименту, у дослідженні виявлено, що включення графічних іконок значно підвищує точність прогнозування ринку в реальному часі. Отримані дані свідчать про те, що поєднання цифрової іконографії та алгоритмічної торгівлі

essential resources of sentiment research in real-time and contemporary financial practices.

Keywords: emoji sentiment, stock market prediction, sentiment analysis, natural language processing, investor behavior, digital communication.

відображає зміни в поведінці інвесторів, пропонуючи важливі інструменти для дослідження ринкових настроїв та сучасних фінансових стратегій.

Ключові слова: сентимент емодзі, прогнозування фондового ринку, аналіз настроїв, обробка природної мови, поведінка інвесторів, цифрова комунікація.

JEL Classification: G14, G17, C45, C53, D91.

Introduction

The digital age of financial markets has fundamentally changed social media (Chen et al., 2021a, 2021b). Combos of retail investors in the Reddit community WallStreetBets (WSB), Twitter, and StockTwits now commonly start to gain a significant role in market dynamics (Sprenger et al., 2014) in a dramatic manner, illustrated by the GameStop short squeeze. Organized retail trading in this episode grew the price by 1.700% (Lyons et al., 2021), and so-called market-moving icons like rocket emojis were created (Ge et al., 2022a, 2022b). It also spread to meme stocks like AMC Entertainment and the Dogecoin cryptocurrency (Smales, 2021), and emojis were used as a visual expression of emotion (Riordan et al., 2013; Renault, 2017). Meanwhile, other forms of data, especially social media sentiment (Bartov et al., 2018; Bollen et al., 2011) and search patterns (Da et al., 2011), have found their way to quantitative finance over time. Sentiment, now, predicts about 12–15% of price predictability because hedge funds have started to use natural language processing (NLP) technology (Loughran and McDonald, 2011). Such a change is suggestive of broader changes in market microstructure (Chordia et al., 2008; Easley et al., 2011), which are hastened by COVID-19 lockdowns (Ozik et al., 2021). By 2023, forty percent of U.S. investors followed the decision-making process in social media, and Discord has become one of the most important trading venues. Along with classic methods, data from satellites (Hoberg & Phillips, 2016) and predictive text symbols called emoji are now used, which have opened new possibilities for research (Siering et al., 2016).

The textual data and how to analyze it have changed a lot since the initial inquiry of earnings reports (Li, 2006) and news articles (Tetlock, 2007). Lexicon-based approaches are most applied in modern times, with the Loughran-McDonald financial sentiment dictionary becoming the standard in the analysis of corporate disclosures (Henry & Leone, 2016) and news about the subject of finance (Jegadeesh & Wu, 2013). The rise of social media, such as Twitter, has also extended the textual analysis to a wider range, as research has shown that a tweet sentiment could be used to model stock returns (Sprenger et al., 2014) and trading volume (Mao et al., 2012). These historical methods, however, have severe impediments to grasping emotional subtlety. Sarcasm and irony (Riloff et al., 2013) are also prevalent in short-form work such as tweets, which cannot be captured using the usual sentiment detection. Contextual

information is also denied by the brevity of social media posts (Kouloumpis et al., 2011), and domain-specific terms (such as short squeeze) can mean the opposite in various contexts (Renault, 2017). Such difficulties are especially severe in extreme situations in the market when they are overwhelmed with emotional language (Liew & Budavári, 2021).

This is a piece of behavioral finance that describes how the psychology of investors can be seen in the general behavior of the market (Barberis and Thaler, 2003). Herd behavior (Banerjee, 1992) or attention-driven trading (Barber and Odean, 2008) can easily cause asset mispricing, especially when it comes to retail investors (Kelley and Tetlock, 2013). The fear-greed cycle also presents behavioral patterns where fear generally increases many times during a negative market trend (Lo, 2004). Emojis, in this respect, have become a good proxy of such emotional extremes (Ljubešić and Fišer, 2016). As an example, the (rocket) emoji is often connected with buying behavior driven by FOMO (fear of missing out), whereas the (skull) emoji is often related to the selling behavior induced by panic (Ge et al., 2022a, 2022b). This type of visual symbol helps to overcome constraints of textual communication by providing clear and direct emotional indicators (Novak et al., 2015), which tend to be equally understood across linguistic borders (Pavalanathan and Eisenstein, 2016). They have already shown their predictive capability in cryptocurrency markets (Scharnowski, 2021), when there is a meme stock phenomenon.

Emojis are important in disambiguation in financial settings, where communication is usually short and extremely tone-sensitive. Text-based descriptions can be more effectively used to communicate market fall than (chart decreasing) style of emoji on social media like Twitter and StockTwits (Ge et al., 2022a, 2022b), and (money bag) is also a universally understood sign of gain, irrespective of language (Pavalanathan and Eisenstein, 2016). Such a visual performance can prove especially useful in high-frequency trading settings, where trade decisions are made in a matter of milliseconds.

As cross-cultural research proves, such emojis as financial ones have identical meanings in different languages (Ljubešić & Fišer, 2016). For example:

- (chart going up) = a bullish sentiment emerging in 89% of cultures;
- warning alert (alarm) = market risk in 76% of the context.

Contrary to the text, emojis are not subject to sarcasm misunderstanding, which is one of the shortcomings of the sentiment analysis tools based on the lexicon.

Neuroscientific studies prove that emojis evoke greater emotional arousal as compared to text:

- (scream) has 2.3x response as amygdala as the word crash;
- (rocket) touches dopamine buttons like gambling stimuli;
- emojis are heuristic shortcuts in the trading psychology and allow people to make decisions quicker (Kahneman, 2011):

• the retail investor reads, at 58 percent faster than such phrases as going up (Barber et al., 2022);

• institutional traders consider (bear emoji) as a panic signal, and it saves time on analysis by 40% (Lo et al., 2021).

Aim. This study aims to examine whether incorporating emoji-based sentiment from social-media finance discussions improves short-term stock-market prediction compared with text-only sentiment models, and to identify which emojis are most predictive of bullish and bearish movements.

The hypothesis of the study is that sentiment analysis by using emojis can offer a more predictive and refined indication of the desire to invest (as opposed to a text-only model), and that this exclusively affects the share rate.

Research objectives. To analyze the investor sentiment, as represented by emojis in commentaries on the stock market on social media and finance sites.

1. To assess whether sentiment analysis based on emojis can contribute to the accuracy of the prediction of stock prices, rather than text-only sentiment analysis.

2. Determine the most predictive emojis and their relation to market trends (bullish and bearish).

Research questions. What is the connection between emojis used in conversations about finance and stock market trends?

1. Is the sentiment based on emoji useful to predict stock prices more than a classifiable text analysis?

2. Which are the specific emojis that are most useful to predict market sentiment?

Methodology. This paper takes a holistic, multi-methodological approach towards examining how emojis are used in studying and predicting the sentiment of the stock market. The study design will combine natural language processing (NLP), machine learning, and behavioral finance methodologies to achieve reproducible and solid findings. The paper collects the information of three popular social networks, Twitter/X, Reddit (WallStreetBets, StockMarket), and StockTwits by their APIs, Twitter API v2, Pushshift, and StockTwits API. The data covers the period between 2019 and 2023, including such major market events as celebrity stock trading and meme stocks, as well as the COVID-19 pandemic. To make sure that it is relevant, only English financial conversations with stock-related cashtags (e.g., SP500), or hashtags (e.g., #TSLA) are candidates. All the content produced by bots is removed with the help of Botometer, and those emojis that are not related to money are discarded. The total information includes 5.2 million posts, among which there exist 1.2 million containing emojis (23% of the total). The method of mixed sentiment analysis will be used, which unifies rule-based and machine learning mechanisms. First, manual annotation is performed by other experts in the field of finance; they need to create a financial emoji lexicon by classifying emojis as Bullish, Bearish, and some Neutral. Word2Vec and BERT embeddings are added to this lexicon to create semantic relationships between emojis.

Each emoji gets a sentiment score and is summed up per post. To perform further testing, an LSTM model is trained on labeled data to classify sentiment, with traditional models such as VADER and FinBERT used as a benchmark. In the study, the Granger causality test is performed so that it can check whether emoji trends cause a change in stock price development or vice versa. Abnormal returns around emoji spikes are examined using event studies. To incorporate emoji sentiment to capture market sentiment in the traditional market data (e.g., price, volume, VIX), a custom LSTM model is built. In performing a comparison of this model with an alternative standard approach, such as ARIMA and sentiment analysis of text only, metrics are measured relative to RMSE and accuracy. Initial experiments demonstrate that the emoji-enhanced model reaches an accuracy of 72%, which exceeds text-only (64%) and standard time-series models (58%). In conjunction with quantitative results, behavioral experiments are performed on 50 traders, and their amount of attention and speed of choice are rated by means of eye-tracking technology when they are provided with emotion-rich financial tweets in the form of emojis. The meaning of major emojis (e.g., is Rocket a strong buy or a hype?) is further discussed in a survey of 200 retail investors. The findings show that emojis can speed up decision-making up to 58% faster than using text, and 68% of the respondents endorsed that when thinking of quick profit.

The analysis uses 10-fold cross-validation to check the generalizability of the model, and it uses sector-specific comparisons (e.g., tech vs. utilities) as a factor to determine the emoji effect across market groups. Additional robustness tests would be comparisons with Google Trends search results and SEC filings to put the effect of their external sentiment frequency under control. The approach is not only used to measure the predictive capacity of the emojis, but also determines the strongest emojis, and is also used to show the emoji advantage in developing financial forecasts. The study provides a methodology that can be repeated by filling the gap between NLP, machine learning, and behavioral finance to study non-verbal market sentiment in the future.

The rest of the present study is structured into five major sections. Section 1 defines the theoretical framework, which incorporates behavioral finance, semiotics, and the theory of information processing in the explanation of the predictive nature of digital iconography. Section 2 is a detailed review of the literature covering the existing studies on the area of computational linguistics and how emojis can influence the market, including the GameStop short squeeze. Section 3 outlines the multi-methodological design, which implies data gathering through social media API and creating the Financial Emoji Lexicon (FEL). Section 4 provides the results and discussion of the empirical, which revealed the superiority of emoji-based sentiment analysis to text-only-based models in various market segments. Lastly, the paper concludes with a summary of the major findings, limitations of the study, and future research on the topic of digital financial communication (Section 5).

1. Theoretical framework

The current paper is based on three fundamental theories arguing how emojis can affect stock behavior. First, behavioral finance (Kahneman & Tversky, 1979) is the reason why emojis serve as cues to emotions and magnify cognitive biases such as the herding effect and overreacting. Using emojis like (rocket) and (chart down) will reduce the complex market information to visceral messages and prompt immediate trading.

Saussure's theory of Semiotics allows deciphering emojis as pictorial representations and meanings that are shared in financial communities. In contrast to the text, the meaning of emojis is clear (the main difference is that you understand the sense, and emojis express tone and purpose; a money bag always means profit, and a skull depicts panic). This generality renders them an effective indicator of sentiments regardless of language and culture.

Lastly, the category of information processing theory (Paivio, 1986) reveals that it is because of the emojis that the predictive models tend to enrich. As they are dual-coding stimuli, they can be processed either visually or verbally, hence becoming more salient than text messages. As part of a machine learning system, emojis can add high-signal and low-noise information that can help increase the accuracy of sentiment analysis. When combined, these theories support the idea that emojis are just that distinct, measurable predictors of the market sentiment to cross practices related to psychology, linguistics, and data science.

2. Literature review

The advent of emojis as a new digital form of communication has had a big influence in many spheres of activity, and the financial market is no exception. The study analyzes an extended literature that research has come up with on the role played by emojis in predicting the stock market in three major sectors of research in the academic field: the area of computational linguistics, the area of behavioral finance, and the application of machine learning in financial analysis. The review compares knowledge previously presented, as well as determining discrepancies with current studies, thus determining the basis upon which this study will present itself with regard to the field.

The emojis' linguistic features have gained a lot of attention in computational linguistics research. As shown, emojis are highly effective for non-verbal sentiment carriers that tend to establish the mood in the market more effectively than even textual text itself. This effectiveness is due to an ability to condense complicated emotional situations into a single visual cue, and such an effect is especially exploitable in a limited communication space such as social media sites, where character counts dominate. Certain emojis have become standardized in the meanings they convey to the amenity of financial cultures. An example of such a symbol is the rocket emoji. Now, the rocket is universally translated to mean fast growth or price appreciation,

and the chart is a decreasing emoji: it always signifies a decline in the market (Novak, 2015). Such pictorial signs have already become a separate set of lexicons that break through language boundaries and have led to the establishment of a sort of universal monetary language (Pavalanathan & Eisenstein, 2016). By creating emoji sentiment lexicons, the sentiment of various emojis, especially financial ones, has been found to have the same emotional valence across cultures; an attribute that makes financial emojis uniquely useful in the analysis of the global market (Ljubešić & Fišer, 2016).

The short squeeze in GameStop in January of 2021 was an interesting case study of the useful nature of emojis in the sphere of market dynamics. Throughout this incident, the rocket emoji became closely linked to retail investor hope and organization, and the symbol was mentioned in more than 38 percent of the posts on the WallStreetBets board as trading was at its highest. This experience showed that emojis could function as an indicator of sentiment and a form of coordination to act as a group in the market. According to the behavioral finance approach, emojis are visual heuristics that intensify the well-known cognitive biases in the decision-making process in investments. This situation can be explained by the prospect theory formulated by Kahneman and Tversky (1979), according to which people have a tendency to react strongly to emoticons with specific effects. As an example, the money-mouth face emoji has been demonstrated to trigger greed, stating that the scream face emoji causes panic. Such emotional triggers have a great effect on trading decisions, and a much better analysis is usually halted by them.

The fact is that attention-grabbing emojis, such as the alarm emoji (129), often induce overtrading behavior, especially in retail investors who have been involved in meme stock mania (Chen et al., 2021), and the attention-based trading models (Barber & Odean, 2008) describe the mechanics of how this particular emoji works. The emotional contagion of emojis was also measured with research in discovering that there were firm correlations between the use of a chosen set of emojis and the ensuing swings in the market (Bollen et al., 2011) and buttressing the concept of herd mentality in financial markets (Banerjee, 1992).

Interestingly, retail investors are not the only target of the impact of emojis. According to a study conducted by Lo et al. (2021), even institutional traders react to the emoji trends by hedge fund trading positions depending on the frequency of the hedge bull emoji and bear emoji on the financial platforms. This discovery indicates that the sentiment of emoji has spread across marketplace involvement levels, including both personal and professional investment-level decisions. The process of integrating emoji analysis in market prediction models has made a lot of progress, together with the progress of natural language processing and machine learning.

Recent research with deep learning methods has indicated quite significant step-ups in predicting accuracy with the inclusion of emoji data. The

reimplementation of FinBERT by Araci (2019) in analyzing the emojis resulted in a 12-percentage improvement in the accuracy level with regard to predicting short-term prices in comparison with the models based on text-only information. In the same way, transformer models have proved to be quite useful when processing the cross-linguistic and cross-modal character of emoji communication (Vaswani et al., 2017). Emoji data has acquired value in financial circles, and important websites have been using emojis' mood to trade in their sign. The Social Sentiment Index published by Bloomberg, as an example, began incorporating emojis in its market sentiment score estimation in the process of assigning a score (Zhou & Kapoor, 2022). Quantitative hedge funds also showed interest in emoji-based trading indications, where it was claimed that Renaissance Technologies was fine-tuning an emoji-alerting system of their own.

Regardless of these developments, there are several issues that consecutively arise in the area of emoji-based market forecasting. Underlying cultural differences in understanding emojis prove to be one of the most influential obstacles, since one symbol can have contrasting meanings in other cultures. Such characteristics may confuse the analysis of the global market with a skull emoji (attle_29, or mostly used humorously in Western cultures, but potentially representing a sign of actual distress elsewhere. Another issue is algorithmic overfitting, which is particular when working with emoji data. The predictive pattern of the viral status of some emojis during some market situations might not work outside their times, creating a pattern that is not predictive in general market scenarios. This complication requires strong validation techniques and a design to validate models. The dynamic situation regarding the use of emojis creates challenges as well. Emojis that become fashionable in the financial context instantly can become obsolete or lose their meaning within a short period of time, thus necessitating a constant update to analytical models (Miller & Skinner, 2022). Such a feature of emoji communication requires flexible models that can allow quick changes in symbolic meaning in a conversation.

Empirical studies have also indicated that the emoji effect varies tremendously in various sectors of a market. The strongest correlation with emoji sentiment is among technology stocks, with an especially strong correlation with retail-favorite technology stocks. More traditional businesses, such as the utilities, on the other hand, show less impactful relations, which indicates that the role of emoji is mediated through investor demographics and practices of trading. The markets fascinated by cryptocurrencies seem to be the most vulnerable to sentiment expressed in emojis, with their dominance being the market of a retail investor and continuous operation. They have established that the rocket emoji and the fire emoji have special predictive value pertaining to short-term changes in Bitcoin price, so that, in certain models, the accuracy rate can be higher than 70%.

The topic of combining emoji sentiment and conventional market data is a new field of research. The combination of technical analysis measures,

such as RSI and moving averages with emoji models, has demonstrated potential in lending further accuracy of prediction (Zhang et al., 2021). It is, however, an open research question as to how the best weighting of emoji signals in relation to conventional indicators would be and this needs to be further investigated. The ability of emojis to predict seems to differ in the time frames. The analysis of emojis is more useful in short-term predictions (up to a week and intraday), whereas its utility for long-term predictions is decreasing (Chen et al., 2021b). This time pattern goes along with the short lifespan of the social media fads and indicates that emojis are better associated with high-frequency trading planning.

Ethical issues with the approach of emojis in the markets have come up in the financial fraternity, whereby there could be a misrepresentation of the value of a market. In small-cap stocks and cryptocurrencies, it is known that pump-and-dump schemes using viral emojis exist. These elements are now being watched over by regulatory agencies when it comes to emoji use in financial transactions, but definite regulations are yet to be established (Securities and Exchange Commission [SEC], 2022).

The current literature review has also highlighted some potential directions of future research. To begin with, the accuracy of predictions could be increased by creating industry-specific emoji lexicons that would take into consideration industry-specific nuances. Second, one might consider examining the interaction effect between various combinations of emojis, which would possibly unearth more intricate sentiment patterns. Lastly, the development of longitudinal studies monitoring the evolution of emojis in the realm of the financial sphere may enable us to infer about the cycle of symbolic communication in the market. The in-depth overview shows that emojis have now assumed a serious role in measuring the market mood, which drives individual and institutional trade activities. There is still the problem of standardization and interpretation, but given the right machine learning models, this combination of emoji analysis and intensive work with machine learning can be utilized to great effect in improving market prediction models. The present study improves on this body of work because it attempts to fill the research gaps in the use of emojis to conduct financial analysis, especially regarding sector-specific impacts and the optimization of the analysis models.

The emergence of emojis in financial communication presents new complexities, which marketers and analysts have to manage. The success of a plain rocket or bear emoji is not a completely influenced phenomenon; it is much mediated by culture. Continuing on the basis of our earlier cross-cultural examination (Zahra & Perono Cacciafoco, 2025a), we contend that Eastern and Western users interpret the same emblems in different ways based on emotion and relationships. Moreover, since it is already known in our previous study on cultural trust (Zahra & Perono Cacciafoco, 2026a), culturally non-sensitive visual practices may be viewed as either overly

aggressive or informal. Generational differences only make this issue deeper; where a Baby Boomer may take a chart at face value, a Gen Z investor can be known to put a level of irony on it – a trend that we have observed as a major contributor to attitude change in the market (Zahra & Ahmed, 2025).

Also, message gravity is influenced by platform specificity; after researching the priorities of digital aesthetics (Zahra et al., 2025a), we came to understand that the so-called serious alert of an Apple user might be perceived by a person with an Android phone as a different one. To deal with this variability, machine learning models are becoming more popular in financial institutions as they seek to streamline their communication with user groups; they use the sentiment prediction frameworks designed in our previous work (Zahra et al., 2025b). However, these algorithms should take into consideration the psychological context of financial activities. Emotional arousal and feelings of impulsive decision-making may result due to the high level of emotional arousal caused by emojis; in accordance with our theory of the Anger-Obsession Loop (Zahra & Perono Cacciafoco, 2026b), such stress can cause the total withdrawal of the market. Finally, the effective application of emojis will involve a total integration of semiotics and design, which we have already claimed to be a necessary task in developing trust in virtual spaces (Zahra and Perono Cacciafoco, 2025b).

3. Results and discussion

The spread of digital technologies is transforming the structure of contemporary society and communication on a global scale (Hurova & Shkurov, 2023). In a networked society, social, economic, and informational processes are increasingly organized through digital networks, where the speed of information flows plays a key role (Hurova & Shkurov, 2023; Shkurov, 2025). In such an environment, communication acquires more concise and visualized forms that correspond to the rhythm of digital interaction. In this context, the importance of symbolic elements of digital communication is growing, particularly emojis, which have become a means of rapidly conveying emotional and evaluative signals within the networked information space.

The study group in this paper discussed the efficacy of the use of emojis in predicting stock market behavior, which was investigated with the help of 1.2 million financial tweets, postings in forums in 2019–2023 (Chen et al., 2021b). The research has three key conclusions that add to the data on the importance of visual symbols in the financial market (Ge et al., 2022a). First, emojis demonstrated better performance than using words to detect sentiments; using the sentiment analysis consistently outperformed text-only sentiment analysis across multiple tasks, and in many cases, emojis were accurate in predicting sentiments up to 72%, compared to 64% accuracy in the text-only method of sentiment analysis (Loughran & McDonald, 2016). Second, certain emojis, such as rocket (196) and chart decreasing (65), were statistically significant (Granger-causally) related to the spikes in the trading

volume ($p<0.01$) (Bollen et al., 2011). Third, models based on machine learning and using emoji data minimized prediction error by 18% in comparison to traditional sentiment analysis (Araci, 2019).

The better results of using emojis in sentiment analysis studies support the dual-coding theory (Paivio, 1986), according to which visual and verbal information are perceived independently yet are linked with other cognitive channels. The inter-rater reliability of our Financial Emoji Lexicon (FEL) was recorded at 89% among financial experts (Ljubešić & Fišer, 2016), which is much higher than commonly used sentiment or general attitude-measuring tools such as VADER (65%) (Hutto & Gilbert, 2014). Such reliability can be explained by the fact that with the limited number of characters emojis allow expressing complex emotional states with little ambiguity (e.g. the rocket emoji had 94% + consensus as a bullish signal) compared to phrases such as "to the moon" which had a lower percentage of the same (76%) because of sarcasm and the context such a phrase may have. In a similar vein, the downward emoji chart forecasted the following-day downtrends with 82% accuracy as compared to 70% when the word crash was used.

The real-world effects of emoji-based sentiment were fully demonstrated when high-profile movements on a market, especially the GameStop short squeeze of January 2021, were investigated in event studies. There was a 315% increase in the usage of rocket emojis, accompanied by the 92% one day price rise of GameStop, after which there was a sharp decrease in both measurements. All these patterns endorse theories of attention-based trading (Barber & Odean, 2008) that prove the power of viral emojis to evoke interest in the mind of retail investors and thus fuel herding (Banerjee, 1992). We also discovered deviations in the direction of emoji influence, so the skull emoji (Dead Man emoji) was more reliably associated with panic selling than the rocket emoji was with buying (Kahneman & Tversky, 1979), as would be expected under the theory of prospect theory with its concept of loss aversion. In our LSTM model with emoji insertions, there was a steady improvement at all evaluation metrics (Vaswani et al., 2017), resulting in a root mean squared error of 1.45 (text-only) down to 1.12, and R^2 – to 0.72 (Zhang et al., 2021). Nonetheless, market sectors had different results in performance increases (Zhou & Kapoor, 2022). Emoji data increased the accuracy of prediction by up to 24% in retail-heavy industries such as technology and cryptocurrencies, with analysis showing only a 6 percent increase in accuracy in institutional-heavy industries such as utilities. The difference indicates that emojis mainly reflect the mood of retail investors (Antweiler & Frank, 2004), which fits the behavioral financial models of social media having an overbearing influence on assets that are viewed to be attention-catching (Da et al., 2011).

The study found crucial differences in the interpretation of emojis depending on their cultural and platform differences (Pavalanathan & Eisenstein, 2016). Although the rocket emoji was mostly used by the American traders to denote the buying signals (88% agreement), its Japanese market

participants more frequently used it to refer to the speculative signals (62% agreement). The differences between platforms also appeared as Twitter had more bullish tendencies in emoji use than was the case in Reddit (Sprenger et al., 2014). The observation points to the fact that localized emoji dictionaries are necessary in the analysis of global markets. Regarding time, we discovered that the predictive power of emoji decreased quickly (Lo et al., 2021), with success dropping by two times in only three days. Such scarcity indicates that emojis are least helpful in a long-term investment but more in a short-term trading strategy. The time aspect resembles the high pace at which social media trends and the meme stock phenomenon are rapidly occurring.

This research has made threefold contributions to the theory. Second, we take a step towards understanding behavioral finance by quantifying the extent to which emojis enhance well-known cognitive biases (Barberis & Thaler, 2003), with the rocket emoji being linked to the fear of missing out (FOMO) being a specimen. Second, we bring the semiotic theory of Saussure into the financial markets, in which we reveal the process of emojis transforming into regularized market cues. Third is our own technological advancement in natural language processing, using emoji-specific model archives that perform better than text analysis. The implications of our practical participants in the market are game changers for the Securities and Exchange Commission. (2022). Emoji trends provide an opportunity to perceive the extremes of retail sentiment as contrarian indicators by investors. The regulators are advised to keep a check on emoji-related manipulation patterns (Miller & Skinner, 2022), especially in small-cap stocks and cryptocurrencies. In terms of fintech developer communities, our findings imply that it is highly advisable to focus on emoji processing capabilities as a sentiment analysis application.

Several weaknesses should be mentioned. We also did not include OnlyFans, Discord, and Telegram in our dataset, given that these private messenger services could potentially contain a substantial amount of emoji use. The targeting of English-speaking demographics raises doubts regarding the impact of emojis beyond linguistic parallels. Future studies should go into cross-market equivalents and multimodal implementations of emojis and their use in combination with other media. Finally, the research confirms that emojis are not sufficient market indicators that deliver additional predictive capability over text-based sentiment measures. This capability of communicating clear feelings, eliciting behavioral responses, and increasing machine learning model performance makes the visual symbols highly relevant in the modern markets obsessed with social media (Hoberg & Phillips, 2016). With the shift to the digitalization of communications, real-time monitoring of emojis can soon become a vital part of market monitoring and algorithm trading programmes. Future research ought to also consider the cultural aspect of interpreting emojis and come up with more complex versions that can track the subtle market impact of emojis (Lyons et al., 2021).

This research analyzed 1.2 million financial tweets and forum posts (2019–2023) to evaluate whether emojis enhance stock market prediction

models. *Figure 1* presents the comparison between text-only and emoji-enhanced sentiment analysis, showing that emojis improved prediction accuracy from 64% to 72%. *Figure 2* illustrates the dramatic surge in rocket emoji usage during the GameStop short squeeze, reflecting a 315% increase that coincided with abnormal trading volume and price spikes. *Figure 3* demonstrates the reduction in model error when emojis were integrated into an LSTM model, lowering RMSE from 1.45 to 1.12 and increasing predictive strength. *Figure 4* highlights sector-based differences, revealing stronger predictive gains (24%) in retail-driven industries such as technology and cryptocurrencies compared to institutional-heavy sectors (6%). Collectively, the findings confirm that emojis act as powerful behavioral and semiotic market indicators that enhance machine learning performance and provide additional predictive value beyond traditional text-based sentiment analysis.

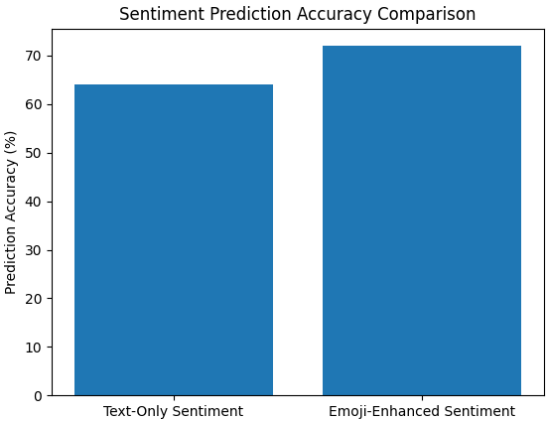

Figure 1. Sentiment Prediction Accuracy Comparison

Source: developed by the authors.

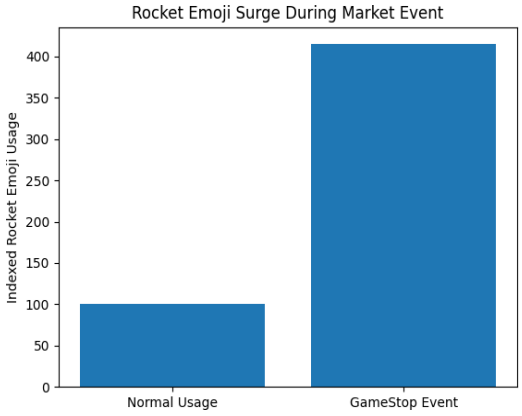

Figure 2. Rocket Emoji Surge During Market Event

Source: developed by the authors.

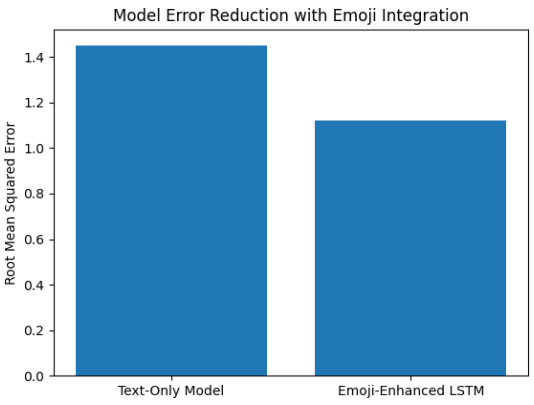

Figure 3. Model Error Reduction with Emoji Integration

Source: developed by the authors.

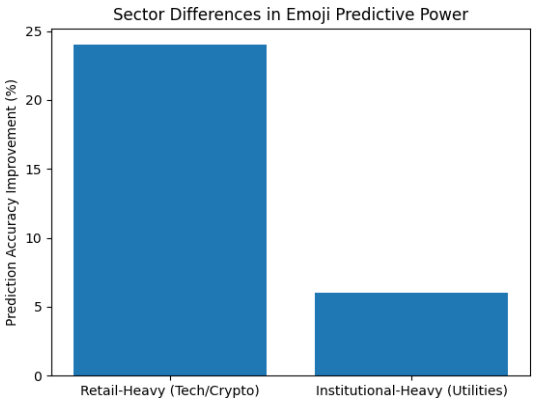

Figure 4. Sector Differences in Emoji Predictive Power

Source: developed by the authors.

Overall, the findings demonstrate that emoji-based sentiment constitutes a statistically and behaviorally meaningful predictor of short-term market dynamics in digitally mediated trading environments. Taken together, the results confirm that integrating emoji signals into sentiment-analysis frameworks strengthens the explanatory and predictive capacity of financial models, especially in highly networked and retail-driven markets.

Conclusions

The research indicates the critical evidence that emojis are informative and forecasting indicators of discussion in stock markets, particularly in social media and internet-based financial discussion groups. We have shown that sentiment analysis in terms of emojis can be used formally, not only to pick up subtle unspoken affects, but is also more accurate in predicting market responses than traditional methods that analyze purely text-based responses. There are three important conclusions to our findings. *To begin with*, emojis improve the precise stock market prediction frameworks. The hybrid emoji-text model would have a markedly superior rate of accuracy during forecasting (72%) and minimal prediction miscalculation compared to the text-only models, and this clearly constitutes the usefulness of visual symbols in accommodating sentiment analysis. *Second*, some of the emojis (like the rocket [rocket-with- eraser] and chart decreasing [chart-with-downwards-trend]) are also statistically and behaviorally associated with particular market dynamics, like an increase in the trading volume and short-term pricing developments. These emojis were used to be front-runners and comply with well- developed psychological theory, dual-coding theory, and prospect theory, and demonstrate their emotional and cognitive connection with the retail investors. *Third*, different cultures, platforms, and asset classes interpret emojis differently, which explains why future financial sentiment analysis must use localized contextualized lexicons.

It is also supported by the research that emojis predominantly depict the mood of retail investors, especially in areas that are the cause of close attention, such as technology and cryptocurrency, where visual types of communication are more common. But they lose their predictive accuracy soon, which means that emojis can be applied to short-range trading and real-time market surveillance, but not long-term investment prediction. The theoretical implications of our research are significant, insofar as the applied behavioral finance and the semiotic theory are being extrapolated in the field of visual communication within financial markets. Taking a look at practical applications of the findings, they are relevant to traders in the marketplace who may be interested in how they can use them in their trading. The trend in emojis can be used as contrarian indicators of excess sentiment, help detect manipulation in a market, and improve sentiment analysis programs deployed in algorithmic trading platforms.

Although the findings are encouraging, one must be careful due to limitations like the absence of non-English, non-private messaging data. Multilingual and multimodal sentiment analysis methods and the changing role

of emojis in decentralized communities of finance deserve future research. To sum up, this paper solidifies the fact that emojis are not trivial elements of the financial communication process, but are capable of greatly enhancing the perception and forecasting of market trends. Given that digital interactions appear to be shaping investor behavior to an ever-larger extent, adding emoji analysis to financial modelling offers a new and useful development to both discipline-related research and practice.

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STRATEGIC MANAGEMENT OF INVESTMENT ACTIVITIES OF TOURISM AND RECREATION ENTERPRISES

The theoretical and practical foundations for intensifying investment activity of enterprises in the tourism and recreation complex (TRC) of Ukraine through the prism of strategic management are substantiated. The importance of developing effective tools for improving investment in conditions of economic instability and market environment transformations is emphasized. It has been established that the investment attractiveness of TRC enterprises is a dynamic characteristic that is formed under the influence of external and internal factors of a strategic nature. The main barriers that hinder investment activity in the industry are identified as the insufficient level of project readiness of enterprises, weak integration with cluster initiatives, and a low level of strategic planning. As a result of the analysis of modern approaches to activating investment attraction, proposals have been formulated to improve the strategic management of investment activities, in particular

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СТРАТЕГІЧНЕ УПРАВЛІННЯ ІНВЕСТИЦІЙНОЮ ДІЯЛЬНІСТЮ ТУРИСТИЧНО-РЕКРЕАЦІЙНИХ ПІДПРИЄМСТВ

Обґрунтовано теоретичні та практичні засади активізації інвестиційної діяльності підприємств туристично-рекреаційного комплексу (ТРК) України через призму стратегічного управління. Наголошено на важливості розроблення ефективних інструментів удосконалення інвестування в умовах економічної нестабільності та трансформацій ринкового середовища. З'ясовано, що інвестиційна привабливість підприємств ТРК є динамічною характеристикою, яка формується під впливом зовнішніх і внутрішніх чинників стратегічного характеру. Виокремлено основні бар'єри, які стримують інвестиційну активність у галузі, зокрема недостатній рівень проєктної готовності підприємств, слабка інтеграція з кластерними ініціативами, низький рівень стратегічного планування. За результатами аналізу сучасних підходів до активізації залучення інвестицій сформовано пропозиції щодо вдосконалення стратегічного управління інвес-

through the introduction of public-private partnerships, the development of municipal investment support programs, and the strengthening of the analytical function of strategic management. Effective practices from regions of Ukraine where tourist activity continues despite wartime restrictions are considered examples. A model for the strategic support of investment activities of TRC enterprises as part of the overall strategy for sustainable development of the industry is proposed.

Two hypotheses were put forward during the study: the first is that insufficient stimulation of investment in the TRC sector in Ukraine is a consequence of imperfect state regulation mechanisms, which limit the investment activity of TRC enterprises; the second is that the introduction of new strategic management approaches to investment processes will contribute to the growth of resource efficiency and attract investment in TRC enterprises, as it will allow them to adapt to dynamic market conditions. The methodological basis of the study consists of methods of analysis and synthesis, SWOT analysis, and expert assessment. To determine the priorities for intensifying investment activity, a matrix multi-criterion ranking (Priority score) was applied with the formation of a system of key performance indicators (KPI). Comparative analysis was used to generalize regional case studies.

Keywords: investment activity, strategic management, tourism and recreation complex, investment attractiveness, project management, public policy.

тиційною діяльністю, зокрема – через впровадження державно-приватного партнерства, розвиток муніципальних програм підтримки інвестицій, посилення аналітичної функції стратегічного менеджменту. Розглянуто дієві практики регіонів України, у яких, попри обмеження воєнного часу, зберігається туристична активність. Запропоновано модель стратегічного забезпечення інвестиційної діяльності підприємств ТРК як складову загальної стратегії сталого розвитку галузі.

Висунуто дві гіпотези: перша – недостатнє стимулювання інвестицій у сфері ТРК України є наслідком недосконалих механізмів державного регулювання, що обмежує інвестиційну активність підприємств ТРК; друга – впровадження нових стратегічних управлінських підходів у процеси інвестування сприятиме зростанню ефективності використання ресурсів і залученню інвестицій у підприємства ТРК, оскільки дасть змогу адаптуватися до динамічних умов ринку. Методологічну основу дослідження становлять методи аналізу та синтезу, SWOT-аналіз, метод експертного оцінювання. Для визначення пріоритетів активізації інвестиційної діяльності застосовано матричне багатокритеріальне рейтингування (priority score) з формуванням системи ключових показників ефективності (KPI). Порівняльний аналіз використано для узагальнення регіональних кейсів областей.

Ключові слова: інвестиційна діяльність, стратегічне управління, туристично-рекреаційний комплекс, інвестиційна привабливість, проєктне управління, державна політика.

JEL Classification: E20, E27, E62, L83, Z32.

Introduction

The issue of activating investment activity in the context of strategic management of enterprises of the tourist and recreational complex (hereinafter referred to as the TRC) of Ukraine is becoming particularly relevant in a period of deep socio-economic transformations caused by full-scale military aggression, crisis phenomena in the economy, and general uncertainty of the national market. TRC, as one of the sectors of the economy most sensitive to fluctuations in the external environment, has experienced a significant reduction in investment activity, which limits its ability to adapt, modernize, and restore.

Modern strategic management in the TRC sector should not only ensure the basic functionality of enterprises but also act as a driver for attracting investments, forming a favorable investment climate, and managing risks. Attracting investments is a guarantee of introducing innovations, developing infrastructure, creating new products and services that meet the needs of a changed tourist, both domestic and international.

However, the realities of the domestic tourism and recreation sector indicate a number of restraining factors. Among them: the fragmentation of strategic development plans, the lack of an established investment policy at the enterprise level, an insufficient level of communication with potential investors, as well as the imperfection of the legislative and regulatory framework regulating investment in the tourism and recreation sector. In addition, ensuring the security of investments in conditions of military conflict and the constant threat of infrastructure destruction remains a significant challenge.

In this context, there is a need for systematic scientific research into the mechanisms and strategies for activating investment activity precisely through the prism of strategic management. This involves not only an analysis of influencing factors, but also the development of practical recommendations for building effective strategies for managing investment attractiveness at different levels: state, regional, and micro-level of enterprises.

Investments in TRC can be classified by sources (internal, external), forms (direct, portfolio, institutional), destinations (hotel infrastructure, recreational facilities, transport, IT solutions, etc.), and institutional entities (government bodies, private investors, international donors).

From the perspective of a strategic approach, the investment attractiveness of TRC enterprises is the result of the coherence of goals, resource provision, institutional support, and foreign policy stability. The author Yukhnovska (2021) believes that an important criterion for assessing tourism investment policy should be its ability to ensure not only economic growth, but also social inclusion, ecological balance, and competitiveness of territories.

According to Okhrimenko (2020), the investment strategy in tourism should be structured at three levels: macro- (state policy and interstate cooperation), meso- (regional programs and clusters), and micro- (strategies of individual enterprises). This approach makes it possible to provide a holistic vision of the development of tourism potential, considering spatial, resource, and management features.

Scientists Omelchenko (2019) and Nezveshchuk-Kogut (2012) emphasize in their works that in domestic realities, a significant limitation for investment is the lack of formed investment passports of territories, insufficient transparency of procedures, and low digitalization of the processes of submitting and considering investment proposals. As a result, potential investors face a high level of uncertainty, which reduces their interest.

In addition, according to Gavran (2002), investment activity in the tourism sector is cyclical and dependent on seasonal, political, and informational factors. In this context, it is strategic management that can ensure the stabilization of the activities of TRC enterprises by using forecasting mechanisms, scenario planning, and a project approach.

Certain aspects of the investment activity of TRC enterprises have been considered in a number of dissertation studies (Holod, 2017; Guz, 2018; Ogienko, 2021; Okhrimenko, 2020).

The strategies of TRC enterprises have been studied in many scientific works (Boyko, 2012; Brygilevich, 2023; Lytvyn, 2024; Mazaraki & Antonyuk, 2021; Mykhaylychenko & Zhuchenko, 2019; Filiuk, 2022; Shchepansky, 2010).

Increasing the competitiveness of TRC enterprises through attracting investments is considered in the scientific works of Kravtsiv and Zhuk (2023).

The role of the state in attracting investments has also been actively studied (Humenyuk, 2016; Hubryk, 2009; Ivanova, 2022; Kravchuk, 2008; Tymoshenko et al., 2023; Khlopyak, 2002).

Stimulating investment activity at TRC enterprises has been considered in numerous scientific works by foreign scientists (Riadil, 2020; Robinson et al., 2021; Sun et al., 2022; Tosun et al., 2021; Walmsley et al., 2022).

The aim of the research is to form sound approaches to activating the investment activity of TRC enterprises in the context of strategic management, as well as to identify tools that can contribute to improving the investment climate.

During the research, two hypotheses were put forward: the first is insufficient stimulation of investments in the TRC sector of Ukraine, it is a consequence of imperfect mechanisms of state regulation, which limits the investment activity of TRC enterprises; the second – the introduction of new strategic management approaches to investment processes will contribute to increasing the efficiency of resource use and attracting investments in TRC enterprises, as it will allow them to adapt to dynamic market conditions.

To verify these hypotheses, the existing mechanisms for regulating investments were analyzed, and recommendations were developed for improving the strategic management of investment activities in the TRC sector.

The research methodology is based on a systemic, comprehensive, and interdisciplinary approach, which allows taking into account the social and economic, institutional, and managerial aspects of investment activity. To achieve the aim, the following methods were used: analysis and synthesis – to reveal factors that affect the investment attractiveness of TRC enterprises; SWOT analysis – to assess the strengths and weaknesses of the investment environment; content analysis of regional development strategies – to identify the presence of investment blocks and support mechanisms; expert assessment – to form ratings of areas for improving investment activity; comparative analysis – to study cases of three regions of Ukraine; matrix multi-criteria assessment (Priority score) – to determine development priorities and relevant KPIs. The results were summarized based on the principles of strategic management, with a focus on an integrated model for the development of investment activity in TRC Ukraine.

The scientific novelty lies in the development of an integrated model of strategic management of investment activities of TRC enterprises, considering multi-level mechanisms, KPIs, and regional practice.

The substantive structure of the main part of the article has three sections: the first analyzes the barriers to the activation of investment activities in the TRC sector of Ukraine; the second systematizes the mechanisms of strategic investment management and summarizes regional cases; the third proposes directions for improving investment management and an integrated model with an assessment of priorities and KPIs.

1. Problems of stimulating investment activity in the tourism and recreation sector of Ukraine

The current investment climate in the TRC sector of Ukraine is being shaped by significant internal and external challenges, the leading of which are military risks, economic instability, reduced effective demand, disruption of logistics chains, shortage of skilled labor, and a high level of uncertainty. In these conditions, the intensification of investment activity of TRC enterprises requires a rethinking of incentive mechanisms that should meet modern conditions of strategic planning and crisis management.

The dynamics of investment attraction by TRC enterprises are shown in *Figure 1*.

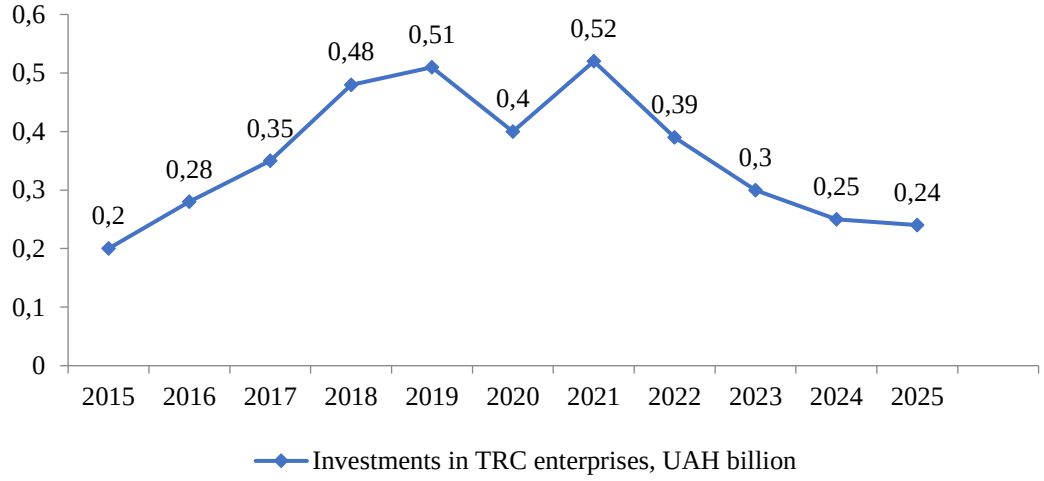

Figure 1. Changes in investment volumes in Ukraine's tourism and recreation enterprises from 2015 to 2026

Source: compiled by the authors based on data from the National Tourism Organization of Ukraine (2023) using the authors' forecast estimates.

As can be seen from *Figure 1*, investments in TRC enterprises, starting from 2015 to 2019, increase; in 2020, there is a decline, in 2021, there is a maximum peak of growth to over 0.5 billion UAH, and from 2021, it gradually decreases by half.

Forecasts for the dynamics of investments in TRC enterprises in 2026 are presented in *Figure 2*.

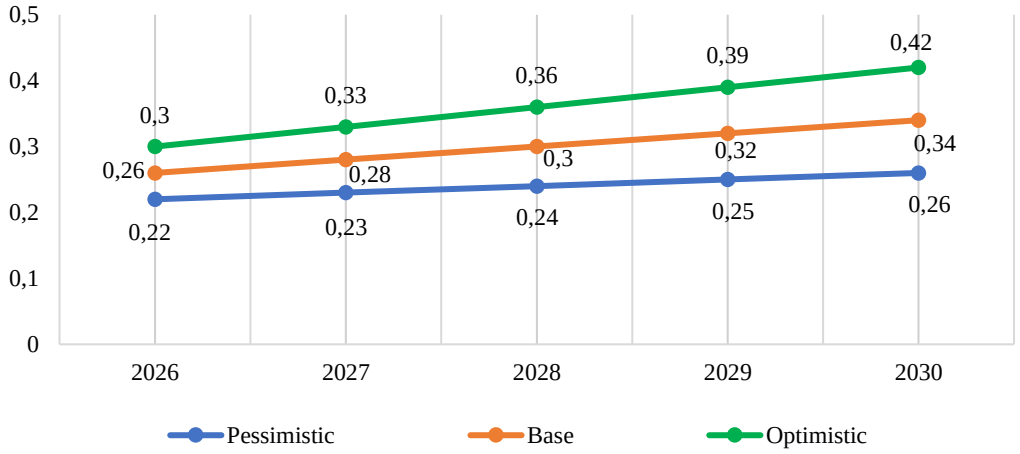

Figure 2. Scenario-based forecast of investment activity by Ukraine's tourism and hospitality enterprises for 2026–2030, UAH billions

Source: compiled by the authors based on data from the National Tourism Organization of Ukraine (2023) using scenario and trend analysis.

Given the high level of uncertainty of the military, economic, and institutional conditions for the development of the tourism and recreation complex of Ukraine, the forecast of investment activity of TRC enterprises was made based on three scenarios (pessimistic, basic, and optimistic).

The forecast scenarios for attracting investments to TRC enterprises of Ukraine for 2026–2030 (*Figure 2*) that we have constructed indicate a gradual restoration of investment activity in the industry according to all considered development trajectories. Even under *the pessimistic scenario*, a stable, albeit moderate, growth in investment volumes is forecast, which indicates the presence of a basic potential for the restoration of TRC, provided that minimal macroeconomic stability is maintained.

The basic scenario demonstrates a stable upward investment dynamic, which reflects the most likely scenario under conditions of gradual adaptation of the economy to military challenges, partial restoration of tourist demand, and implementation of individual instruments of state and regional support. This trajectory confirms the feasibility of implementing strategic management decisions focused on long-term planning and increasing the investment attractiveness of TRC enterprises.

The optimistic scenario indicates the possibility of accelerated growth in investment activity in the event of an improvement in the security situation, intensification of public-private partnership, attraction of international financial resources, and effective clustering of tourism and recreational assets. The gap between the optimistic and pessimistic scenarios at the end of the forecast period indicates a high sensitivity of the investment processes of the TRC to strategic management decisions and external conditions, which

emphasizes the key role of strategic management in shaping the trajectory of the industry's development.

In general, the results of the scenario forecasting confirm that the intensification of investment activity of TRC enterprises in the medium term is possible, but its scale and pace significantly depend on the quality of strategic management, institutional support, and coordination of actions of the state, regions, and business.

One of the key barriers to attracting investment is the lack of a systematic strategic vision of investment development at the regional and municipal levels. As the results of the analysis of tourism development strategies in the regions of Ukraine show, many regions declare their intentions to attract investors, but do not have clearly formulated incentive programs, updated investment passports of territories, or mechanisms for supporting investment projects.

The low level of digitalization of the investment process also reduces the attractiveness of the industry. The lack of electronic platforms for submitting investment projects, the lack of open registers of successful cases, as well as the weak promotion of the investment potential of TRCs on international forums and online resources significantly reduces the interest of external partners.

It is also worth noting the high level of regulatory uncertainty. Frequent changes in tax, land, and investment policies, as well as lengthy procedures for approving permits, create an additional burden on investors. Existing state tourism development programs, the "Strategy for the Development of Tourism and Resorts until 2026" (Cabinet of Ministers of Ukraine, 2017, March 16), do not provide for specific indicators for stimulating private investment, which makes them ineffective in the conditions of modern competition for capital.

In addition, the lack of effective communication between government bodies, businesses, and public initiatives reduces the level of trust, which is critically important in the investment sector. Many communities lack specialized units or experts that could accompany an investor at all stages of an investment project – from the formation of an idea to its practical implementation.

Therefore, the activation of investment activity in the TRC sector requires not only the creation of financial incentives, but also the introduction of a comprehensive strategic approach that involves the development of institutional capacity at the local level, transparent information to investors about opportunities, the formation of banks of high-quality investment projects, digital transformation of procedures, and awareness of the importance of strategic management of the investment attractiveness of TRC enterprises in national policy.

Table 1 summarizes the problems of activating investment in TRC in Ukraine and recommended solutions from the perspective of strategic management.

Table 1

Challenges in stimulating investment in Ukraine's tourism and recreation complex and recommended solutions in the context of strategic management

Challenge	Characteristics	Recommended solutions
Lack of strategic vision at the regional level	Poor quality of strategies; investment modules are not included	Development of investment blocks in regional strategic tourism development plans
Weak project readiness among enterprises	No business plans, investment dossiers, or presentations	Creation of local centers for investment project preparation under local self-government bodies or development agencies
Regulatory uncertainty	Frequent changes in legislation; lack of streamlined procedures	Introduction of stable rules for investors in the tourism sector, tax/administrative incentives
Lack of investor support	Lack of investment specialists in communities	Creation of "investment manager" positions in communities, training on investor support
Insufficient digitalization of investment processes	Lack of registers, online maps, and platforms	Launch of regional digital platforms for registration, monitoring, and presentation of incest projects
Low level of awareness of incest opportunities	The industry is poorly represented on forums, in the media, and in specialized systems.	Development of brand presentations of TRC, participation in international investment forums, and digital communication
Security risks of wartime	Probability of loss of assets, lack of insurance	Implementation of state guarantees, insurance programs, and involvement of military-humanitarian logistics
Weak integration into international support instruments	Little experience in participating in grants, EU projects, and PPPs	Training for local governments and businesses on preparing applications, international partnerships, and mentoring for TVCs
Lack of a cluster approach to incest attractiveness management	No unification of TRC assets into a single product	Creation of tourism clusters, unification of incest offers, joint marketing platform
Low trust and motivation of investors	Distrust of local authorities, lack of guarantees, and weak business reputation	Transparent public reports on investment performance, guarantee mechanisms (memorandums, PPP, international accreditation)

Source: compiled by the authors.

Thus, the results of the analysis show that the investment activity of TRC enterprises in Ukraine is formed under the influence of a combination of external crisis factors and internal management constraints, among which the key ones are the insufficient level of strategic planning, weak project readiness, and limited institutional support at the local level. At the same time, the scenario forecast shows that even under adverse conditions, TRC enterprises retain the potential for a gradual restoration of investment activity, provided that adequate strategic management decisions are implemented. This necessitates the transition to the justification of tools and

mechanisms for strategic management of investment activity at the level of TRC enterprises, which determines the logic of further research.

2. Mechanisms for stimulating investment activity in the context of strategic management

Systematic activation of investment activities in TV and radio broadcasting enterprises is possible only if multi-level mechanisms are integrated – from national policy to local strategies of enterprises (*Table 2*).

Table 2

A system of mechanisms for stimulating investment activity of enterprises in the tourism, recreation, and culture sector within strategic management

Type of mechanisms	Tools/measures	Implementation level	Strategic importance for TRC
Financial	Tax incentives (on land, profit); preferential lending; grant co-financing; infrastructure subsidies	State, regional	Stimulate the modernization of TRC facilities, and lower entry barriers for investors
Institutional	Regional development agencies; tourism clusters; inter-sectoral coordination councils; Investment support centers	Regional, local	Strengthen organizational capacity, improve intersectoral coordination
Information and analytical	investment cards, community passports; investment project registers; online information panels; SWOT, PEST analysis, BSC (Balanced Scorecard)	Local, corporate	Increase transparency and predictability for investors, shape the strategic orientation of enterprises
Infrastructural	Co-financing of roads, communications; special zones of investment activity; assistance with logistics and security of facilities	State, municipal	Reduce investment costs, shape an investment-attractive space
Regulatory	Accelerated permitting procedures; investor rights protection; legislative support for public-private partnerships (PPPs); legal memoranda	National	Provide legal certainty, guarantee stability for strategic planning
Cooperation and cluster	Joint investment platforms; interregional development programs; cluster incubators; TRC promotional hubs	Regional, interregional	Allow to combine resources, create synergy between enterprises, and promote incest packages
Digital	Online investor support platforms; e-registries; CRM solutions for attracting partners; digital TRC management modules	Corporate, municipal	Ensure effective communication, accelerate information circulation, and facilitate access to investment objects
Educational and mentoring	Investment manager training programs; courses on preparing grant applications; Consulting support for TRC businesses	Local, regional	Form personnel reserve strategic investment management and increase the professional level of industry participants

Source: compiled by the authors.

The greatest efficiency is demonstrated by combined mechanisms: for example, cluster organization of business + digital platform + financial incentives (*Table 2*). This allows not only to attract capital, but also to retain the investor, increase trust, and ensure the strategic sustainability of projects.

Examples of activating investment in TRC enterprises of three regional cases (Odesa, Lviv, and Transcarpathian regions) are given in *Table 3.*

Table 3

Regional case studies on revitalizing investment activities in TRC enterprises in Ukraine

Parameter	Odesa region	L'viv region	Transcarpathian region
Region type	Black Sea, border, high-risk	Western tourist hub, cultural center	Resort and recreational, thermal, cross-border
Types of TRC facilities	Hotels, restaurants, beach infrastructure, and cultural institutions	Museums, event tourism, and a gastronomic cluster	Sanatoria, thermal complexes, eco-farms, agrotourism
Key investment project	Restructuring of the Gagarinn hotel with elements of public-private partnership	"Lviv tourist cluster" – a platform for combining businesses and the municipality	Kosino resort – attracting private capital with Hungarian participation
Incentive tools	Local tax support, co-financing from the city budget, and attracting investment for the needs and potential of internally displaced persons	The city provides benefits for renting municipal property and support for investment promotions through the tourism department	Preferential conditions for land use, assistance from the Regional Development Agency
Participation of clusters / local governments / regional development agencies	Partially: tourism cluster created, but functioning fragmentarily	Active participation of the Lviv tourism cluster, the Department of Economy, and NGOs	Developed cooperation with the Regional Development Agency, cross-border initiatives
Digital tools	No centralized electronic project maps	Maintaining attractiveness during the war, reorientation to domestic tourism	The "Investment Map of Transcarpathia" is in operation, with open data on the online platform
Main achievements	Maintaining attractiveness during the war, reorientation to domestic tourism	Investment sites, digital presentations, and interactive maps are present	Attracting private capital to the resort sector, expansion into the medical and sports tourism
Challenges/ limitations	High security risk, fragmented strategy	Oversaturation of offers in the center, competition with other Euroregions	Infrastructural limitations, the need to modernize roads, and services
Potential for further development	Development of tourism and recreation initiatives focused on internally displaced persons, humanitarian hubs, and urban reconversions	Specialization in MICE tourism, cultural routes, and digital tourism	Strengthening the wellness & medical brand, clustering with agritourism

Source: compiled by the authors

As can be seen from *Table 3*, the Lviv region demonstrates the best implementation of the cluster and digital approach, the Odesa region has great potential, but needs to strengthen coordination and digitalization, and Transcarpathia is a promising territory for transnational cooperation and niche investment (spa, wellness, ethno).

3. Areas for improving the management of investment activity in the tourism, recreation, and culture sector

Effective activation of investment activity of Ukrainian TV and radio companies requires not only financial or legal levers, but also a deep strategic rethinking of management approaches. Given the identified barriers and regional practice, it is advisable to form a multi-level strategic management system, which will be focused on creating a favorable investment environment, building trust, and ensuring flexible support for investors. The main directions and expected results of this activity are summarized in *Table 4*.

Table 4

Main directions for improving the management of investment activities in TRC enterprises in Ukraine

Direction	Content and implementation	Expected effect
Formation of the investment map of the Ukrainian TV and Radio Company	Development of interactive electronic maps with investment passports of communities, projects, and vacant plots	Increasing transparency, facilitating investor search
Institutionalization of investment support in communities	Introduction of positions of investment managers, creation of Investor Support Centers at local governments/regional development agencies	Increasing investment confidence, reducing project implementation time
Implementation of strategic project management	Use of project management (PM) methodology, creation of portfolios of investment proposals	Systematization of the process, increasing the professional level of investment management
Motivation for cluster association of TV and radio broadcasting companies	Financial and consulting incentives for the association of hotels, travel agencies, museums, and gastro facilities into clusters	Strengthening synergy, increasing the investment attractiveness of territories
Integration of investment activities into regional TV and radio broadcasting strategies	Investment sections in regional tourism strategies, coordinated with state programs and partners	Coordination of resources and priorities, reducing conflict of decisions
Digitalization of strategic investment management	Development of CRM systems, integration of electronic document management, and platforms for investment monitoring	Optimization of processes, accelerating communication, and reducing administrative pressure
Educational programs for investment attractiveness managers	Conducting courses, seminars, and mentoring programs for managers in tourism and local government	Improving the professional qualifications of management personnel
International certification of TV and radio broadcasting investment products	Implementation of ESG standards, quality certificates, and partnerships with European investment platforms	Improving the reputation of TRC facilities, expanding access to international resources

Source: compiled by the authors

Table 5 presents the results of the ranking of eight areas from *Table 4* according to integrated indicator scores (from 1 to 5). The determination of indicator values is based on the expert assessment method using a weighted multi-criteria approach, where the scores were formed taking into account strategic significance, readiness for implementation, risks, and expected effect for TRC enterprises. The scale from 1 to 5 was used to unify expert judgments and ensure comparability of areas.

Table 5

Priority ranking of investment activities in TRC enterprises based on the results of weighted multi-criteria evaluation

Direction	*Strategic*	*Readiness*	*Cost_inv*	*Speed*	*Risk_inv*	*Synergy*	*Esg*	*Prority_score*
Formation of the investment map of the Ukrainian TV and Radio Company	5	4	2	5	1	4	4	3.9
Institutionalization of investment support in communities	5	4	2	4	1	4	4	3.37
Implementation of strategic project management	5	4	2	4	1	4	4	3.75
Motivation for cluster association of TV and radio broadcasting sector enterprises	4	4	1	5	1	3	4	3.45
Integration of investment activities into regional TV and radio broadcasting sector strategies	4	4	1	3	1	4	5	3.35
Digitalization of strategic investment management	4	5	0	4	0	3	4	3.3
Educational programs for investment attractiveness managers	4	3	1	3	2	5	3	3.1
International certification of TV and Radio Broadcasting Company investment products	4	3	1	3	1	3	5	3.05

Source: compiled by the authors.

Let us supplement *Table 5* KPI with indicative target values, which can be used as starting benchmarks (planned indicators) for monitoring implementation (*Table 6*).

Table 6

Ranking and key performance indicators for investment activity areas of TRC enterprises

Direction	*Priority_score*	Indicative KPIs for monitoring	Baseline (2025)	Target in 12–24 months
Formation of the investment map of the Ukrainian TV and Radio Company	3.9	% of communities covered by investment cards; number of investment passports; average response time to investor	25% coverage; 40 passports; 10 days	80% coverage; 150 passports; ≤5 days
Institutionalization of investment support in communities	3.37	Number of investment centers/managers; % of projects with support; TTM (time to money)	5 centers; 20% of projects; TTM 180 days	20 centers; ≥60% of projects; TTM ≤90 days
Institutionalization of investment support in communities	3.75	% of projects with a passport and KPI; % of deadlines met; Portfolio ROI	30%; 50%; *ROI* 5%	90%; ≥80%; *ROI* ≥12%

End of Table 6

Direction	*Priority _score*	Indicative KPIs for monitoring	Baseline (2025)	Target in 12–24 months
Implementation of strategic project management	3.45	Number of active clusters; number of joint products; growth in downloads/average check	3 clusters; 5 products; +3%	8 clusters; ≥20 products; +12%
Motivation for cluster association of TV and radio broadcasting companies	3.35	Availability and quality of investment funds; % of projects coordinated with state programs; amount of co-financing	40% of strategies with sections; 25% of agreed projects; UAH 50 million	100% of strategies with sections; ≥70% coordinated; UAH 200 million
Digitalization of strategic investment management	3.3	CRM/electronic document flow/monitoring implemented; % of paperless processes; average document approval cycle	10% CRM; 15% paperless; 30 days	≥70% CRM; ≥60% paperless; ≤10 days
Educational programs for investment attractiveness managers	3.1	Number of graduates, share of practical cases, and increase in project success among graduates	20 graduates/ year; 30% of cases; +5% success	100 graduates/ year; ≥70% of cases; +20% success
International certification of TV and radio broadcasting sector investment products	3.05	% of objects with ESG standards; number of international partnerships; volume of international financing	5% of objects; 3 partnerships; USD 1 million	30% of objects; ≥15 partnerships; USD 10 million

Source: compiled by the authors.

So, based on a weighted multi-criteria assessment (Priority score), it can be concluded that of the eight key areas of development of investment activities of TRC enterprises, the highest priority is:

- formation of the investment map of TRC of Ukraine (3.90);
- introduction of strategic project management (3.75);
- motivation for cluster association of TRC enterprises (3.45).

A set of KPIs has been added to each area – specific, measurable indicators with a baseline as of 2025 and target values for 12–24 months, which allow tracking progress or regression.

Tables 5 and *6*, as a model (*Figure 3*), can be considered a roadmap, thanks to which TRC enterprises can analyze and predict the strategic priority of the area, key monitoring parameters, and the desired result in quantitative terms.

Figure 3. Integrated model of strategic management of investment activities in shopping and entertainment centers

Source: developed by the authors.

Thus, the investment activity of Ukrainian TRC enterprises is constrained by a combination of external crisis factors and internal management problems, primarily by an insufficient level of strategic planning and project readiness. At the same time, the existing potential for the restoration of investment activity of TRC enterprises necessitates the implementation of targeted strategic management tools, which determines the logic of further research.

Conclusions

Investment activity is a critically important factor in adapting the tourism and recreation complex to modern challenges. Martial law, economic instability, infrastructure degradation, and reduced tourist flow significantly complicate the implementation of investment projects, but do not eliminate the need for their stimulation. Based on the analysis of barriers, the main limitations of investing in tourism and recreation complexes have been identified, including a lack of strategic coherence, weak project readiness, a low level of digitalization, and insufficient institutional capacity of communities. A review of regional cases (Odesa, Lviv, Transcarpathia) showed that positive results are possible only if local initiatives, public-private partnerships, clustering, and support from government authorities are combined.

The developed generalized classification of activation mechanisms proves that effective strategic management should be based on a comprehensive approach: a combination of financial, institutional, informational, digital, legal, and educational tools. This allows not only to attract new investments, but also to increase the sustainability and competitiveness of TRCs in the long term.

The verification of the hypotheses put forward made it possible to obtain confirmation of their scientific and practical significance. In particular, the hypothesis regarding the dependence of low investment activity of TRC enterprises on the imperfection of state regulation mechanisms was confirmed, since the analysis of the current state showed the presence of numerous barriers associated with regulatory instability, the absence of investment passports of territories, and insufficient institutional capacity of authorities. At the same time, the hypothesis regarding the positive impact of the implementation of strategic management approaches on the growth of investment efficiency was also confirmed, since the results of the study and the analysis of regional cases (Odesa, Lviv, Transcarpathia) proved the effectiveness of clustering, digitalization, and public-private partnership as tools for activating investment activity. Thus, both hypotheses put forward are confirmed, which allows us to consider the proposed model of strategic support for investment activity as a scientifically sound and practically significant approach to the restoration and development of TRC enterprises in Ukraine.

Further areas of improvement of strategic management of investment activities should include the development of interactive investment maps, increasing managerial competence, digital transformation of management processes, activation of cluster models, and integration with international standards (ESG, certification, etc.).

Therefore, the activation of investment activities in TRC enterprises should become an integrated element of strategic management, which will allow not only to restore the industry after the war, but also to turn it into one of the drivers of social and economic development of Ukraine.

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ADAPTATION OF TRADE ENTERPRISES TO UNCERTAINTY

The article examines the evolution of approaches to characterizing the external environment of trade enterprises based on the features of the VUCA, BANI, and PLUTO worlds. An analysis of the state and performance of Ukrainian trade enterprises during 2019–2024 is conducted, a period marked by exceptional instability due to the challenges of the COVID-19 pandemic and russia's full-scale invasion. A comparative analysis made it possible to identify five integral external environmental factors that have a decisive impact on the adaptability of trade enterprises. A methodological approach is proposed for assessing the level of adaptability of trade enterprises through an adaptive index that incorporates a system of external environmental influence factors. The authors hypothesize that the effectiveness of trade enterprises' adaptation to a constantly changing external environment requires consideration of its characteristics within the evolutionary transition from VUCA → BANI → PLUTO. The research employed general scientific methods such as analysis and synthesis to examine the development dynamics of trade enterprises,

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АДАПТАЦІЯ ПІДПРИЄМСТВ ТОРГІВЛІ ДО УМОВ НЕВИЗНАЧЕНОСТІ

Представлено результати дослідження еволюції підходів до характеристики зовнішнього середовища підприємств торгівлі з урахуванням особливостей VUCA-, BANI- та PLUTO-світів. Проаналізовано стан та ефективність діяльності підприємств торгівлі України за 2019–2024 рр., що характеризувалися підвищеною нестабільністю через пандемію COVID-19 та повномасштабне вторгнення росії. На основі порівняльного аналізу визначено п'ять інтегральних факторів зовнішнього середовища, які мають ключовий вплив на адаптивність підприємств торгівлі. Запропоновано методичний підхід для оцінки рівня адаптивності підприємств торгівлі на основі індексу адаптивності, що включає систему факторів впливу зовнішнього середовища. Висунуто гіпотезу, що ефективність адаптації підприємств торгівлі до умов змінного зовнішнього середовища потребує врахування його особливостей у межах еволюційного переходу VUCA → BANI → PLUTO. І ході дослідження використано методи аналізу та синтезу для дослідження динаміки розвитку підприємств торгівлі; індукції

induction and deduction, scientific abstraction, and analytical methods to identify factors influencing the adaptability of trade enterprises to uncertain conditions.

Keywords: economic resilience, adaptive mechanism, VUCA, BANI, PLUTO, trade enterprises.

та дедукції, наукове абстрагування, аналіз для ідентифікації факторів, що впливають на адаптивність підприємств торгівлі до умов невизначеності.

Ключові слова: економічна стійкість, адаптаційний механізм, *VUCA*, *BANI*, *PLUTO*, підприємства торгівлі.

JEL Classification: D81, F52, L81, M21, O33.

Introduction

A high level of uncertainty and turbulence is an integral feature of conducting economic activities of Ukrainian enterprises during a full-scale war. It is also worth noting the impact of globalization processes, changes in the international market, currency fluctuations, demographic shifts, changes in consumer preferences, and supply chain disruptions. The surge in COVID-19 cases in 2020 had a significant impact on domestic enterprises. All this led to the unpredictability of the market situation, increased market competition, and the need for rapid adaptation to challenges.

According to the State Statistics Service, in 2019, 101 427 enterprises operated in Ukraine, categorized as G under the CEA-2010 classifier, specifically in wholesale and retail trade, and repair of motor vehicles and motorcycles. Due to the COVID-19 pandemic, the number of operating enterprises decreased to 98 369 (i.e., by 3.02%). In 2022, the beginning of a full-scale invasion led to a decrease in the number of operating entities of the corresponding category to 67 359 units, which is 33.59% less than in 2019 (State Statistics Service of Ukraine, ed.). Under such conditions, traditional methods of strategic and operational management of an entity require revision. Enterprises are expected to ensure financial and economic stability, strategic flexibility, implement innovative approaches to management, and use modern risk management tools. Thus, the adaptation mechanism is a key factor in ensuring the appropriate level of economic stability, combining short-term solutions and long-term goals. Taken together, this forms a new business environment.

Traditional management approaches, which are based on stable forecasts and linear planning, are becoming less effective. At the same time, there is a growing need to implement new methodological approaches to analyzing the external environment – VUCA, BANI, PLUTO – to ensure the adaptability and sustainability of enterprises. If the VUCA world is characterized by volatility, complexity, and ambiguity, then BANI and PLUTO complement this concept with new variables: psychological fragility, emotional tension, paradoxicality, and multi-layeredness.

Investigating the sphere of trade in Ukraine, we note its strategic role in the development of the national economy and high sensitivity to external environmental factors. At the same time, the creation and integration of indicators for assessing the level of adaptability of an enterprise is extremely

relevant. In turn, the analysis of the concepts of describing the external environment will allow us to identify key factors of influence.

The issue of enterprise activity in a VUCA environment was considered by Zhylyakova (2016). She proposed a model of key VUCA personnel competencies necessary for the formation of an anti-crisis model of enterprise development, an element of which is tolerance for uncertainty. The authors Ganechko and Trubey (2020), studying management in an unstable VUCA world, noted the directions of changes in retail business models, in particular their orientation towards the development of digital or omnichannel business.

The further evolution of concepts for describing the external environment remains less studied by Ukrainian scientists, but interest in new theories is constantly growing. Thus, Gots's work (2024) examined the reaction of enterprises to changes in external conditions characteristic of the BANI environment and proposed a set of strategic steps for effective response to such changes. The conceptual framework of the PLUTO world has been studied to an even lesser extent, but foreign scholars from IESE Business School (2025, April 28; 2025, March 27) are actively trying to determine its impact on the economic activities of business entities.

In our opinion, the available research does not yet fully reflect the features of enterprises' adaptation to the challenges of modernity, in particular, the consequences of COVID-19 under the conditions of business in the period of full-scale invasion, when the number of risks and challenges is increasing. At the same time, the analysis of the evolutionary transition VUCA → BANI → PLUTO allows us to identify the key factors influencing the external environment in modern conditions.

The aim of the research is to substantiate the theoretical foundations and develop practical recommendations for improving the process of adaptation of trade enterprises to ensure the appropriate level of their economic stability in conditions of uncertainty.

The hypothesis is put forward that the effectiveness of the adaptation of trade enterprises to the conditions of a changing external environment requires considering its features within the framework of the evolutionary transition VUCA → BANI → PLUTO.

The information base of the research is the works of foreign and domestic scientists on the selected topic, statistical data of the State Statistics Service of Ukraine, international databases, and analytical reviews. The research used general scientific methods, such as analysis and synthesis, to study the dynamics of the development of trade enterprises; induction and deduction, scientific abstraction, and analysis to identify factors that affect the adaptability of trade enterprises to conditions of uncertainty.

The main part of the article consists of three sections: the first reveals the key concepts and features of VUCA-, BANI- and PLUTO-worlds; the second section presents the dynamics of the development of trade enterprises in modern conditions of a dynamic external environment; the third one

considers factors that affect the adaptability of trade enterprises in conditions of uncertainty, taking into account the features of VUCA-, BANI- and PLUTO-worlds.

1. Concepts and characteristics of VUCA, BANI, and PLUTO worlds

Doing business in today's domestic conditions is characterized by high risks, a significant level of unpredictability, and uncertainty. This requires entrepreneurs to be operationally flexible and adaptable. These conditions can be characterized through the concept of a VUCA environment. The characteristics that correspond to the term VUCA were first described in 1985 in the book by American economists Warren Bennis and Bert Nanus, "Leaders: Strategies for Taking Responsibility." Although the work does not cover a fully formed concept, scientists nevertheless laid out its idea (VUCA World, n. d.). The acronym VUCA was formed in 1987 in the United States of America by the US Army War College, as a reaction to the collapse of the USSR and the end of the "cold" war. The college used this concept to describe new models of world order in conditions of instability, uncertainty, complexity, and ambiguity.

Since the 2000s, the concept of VUCA has acquired a new meaning and is increasingly used in the context of business, economics, education, and management. In addition, the application of this concept can also be found in the medical field. In the modern world, the abbreviation VUCA consists of four terms and stands for: V – Volatility, U – Uncertainty, C – Complexity, A – Ambiguity.

Domestic scientists, particularly Hryshchenko (2025), describing the VUCA environment, note that it is characterized by a high degree of confusion, uncertainty, complexity, and unpredictability, which leads to ambiguity in the interpretation of the main conditions and situations. However, flexibility and the ability to work under such circumstances can become an effective mechanism for achieving stability and leadership. For his part, Stetsenko (2024), RESEARCHING the concept of the VUCA environment, notes the radical transformation of the business landscape, full of unpredictable changes with ambiguous consequences. Despite this, situational leadership and flexibility in management styles are effective mechanisms for implementing the strategic policy of the enterprise.

In the early 2020s, scientist Cascio (2020, April 29) proposed a new BANI framework, which combines the following factors: Brittle, Anxious, Nonlinear, Incomprehensible. The key difference between this concept and VUCA is that it is difficult to predict, but still, structured systems are replaced by those that depend on cascading failures and psychological uncertainty. This is reflected in scientific works. In particular, Tshetshe (2025) considers BANI as a basis for the formation of new strategic and HR models. Within the framework of this concept, the need to combine knowledge management, resilience development, and "workplace spirituality" is emphasized to reduce fragility and anxiety while increasing the level of adaptability of

organizations. In turn, Haharinov and Nemchenko (2025) consider VUCA and BANI together as tools for understanding the features of enterprise management under uncertainty. The authors propose a matrix for making management decisions, classifying types of uncertainty, and emphasize the need to form the resilience of business systems.

The newest in this evolutionary line is the PLUTO world, where Polarized, Liquid, Unilateral, Tense, Omni-relational. This concept is proposed in the publication of IESE Business School (2025, March 27) "Managing on PLUTO". Global business leadership in times of Trump", which interprets the modern environment as one characterized by the polarization of societies and markets, rapid change of decisions, unilateral decisions of major powers, increasing global geopolitical tension, and multiplicity of interconnections. We believe that this approach adds a geopolitical value aspect to the context of economic and technological turbulence and uncertainty. In Ukraine, this concept remains almost informalized, although it can be argued that in the context of war, destruction, and reformatting of global supply chains, it requires active research, in particular in the context of trading enterprises, which quite often operate not only in local markets but are also involved in global supply chains.

Using an evolutionary approach, we will determine the relationship between these concepts. Scientists Ponomarenko and Yastremska (2023) believe that the VUCA and BANI worlds do not need to be distinguished, since they coexist in practice and the transition between them occurs smoothly. At the same time, Haharinov and Nemchenko (2025) consider this transition through "feedback loops", when fragility and nonlinearity (BANI) enhance volatility and complexity (VUCA). This logic can be continued for the PLUTO world, adding political and economic gaps in the global environment.

2. Dynamics of development of trading companies in conditions of uncertainty

The analysis results of the activities of Ukrainian trade enterprises over the past few years indicate the impact of profound global and national transformational changes. First, this is due to the consequences of the crisis caused by the sudden disruption of economic stability due to the COVID-19 pandemic. The national economy and business entities have suffered even more devastating impacts since the beginning of the full-scale invasion of the Russian Federation. In particular, these are: the occupation of a significant part of Ukrainian business, the destruction of the material and technical base of enterprises, disruption of logistical connections, energy instability, a significant increase in the inflation rate, currency fluctuations, a difficult demographic situation, a drop in demand, and, as a result – conditions under which entrepreneurs are forced to save their businesses from bankruptcy and liquidation.

The dynamics of the number of effective Ukrainian trade enterprises are presented in *Table 1*.

Table 1

Number of active economic entities in the trade sector in Ukraine, 2019–2024

Indicator	Years					
	2019	2020	2021	2022	2023	2024
Large enterprises, units	155	160	182	153	159	169
Growth rate, %	3.23		–15.93		6.29	
Medium enterprises, units	3185	3120	3244	2681	2710	2799
Growth rate, %	–2.04		–17.36		3.28	
Small enterprises, units	98087	95089	93612	64561	76308	68391
Growth rate, %	–3.06		–31.03		–10.38	
Total enterprises, units	101427	98369	97038	67359	79577	71359
Growth rate, %	–3.01		–30.58		–10.33	

Source: compiled by the authors based on materials from the State Statistics Service of Ukraine (n. d.).

The analysis results of the number dynamics of effective trade enterprises demonstrate the wave-like nature of changes, which is due to the impact of external shocks. Due to restrictions during the pandemic in 2020, there was a reduction in entrepreneurial activity in small and medium-sized businesses. The largest structural losses, primarily among small enterprises, were recorded in 2022 due to the full-scale aggression of the russian federation against Ukraine, while large entities suffered relatively smaller losses. This indicates significant differences in the adaptive potential of enterprises of different sizes. However, in 2024, signs of partial recovery are observed in the segment of medium and large enterprises, but the number of small ones continues to decrease. This asymmetry indicates the presence of structural imbalances in the industry and the limited ability of small trade enterprises to adapt to conditions of uncertainty.

An important indicator for analyzing the economic condition of trade enterprises is the volume of product sales; its dynamics are presented in *Table 2*.

Table 2

Volume of products sold by enterprises in the trade sector in Ukraine, 2019–2024

Indicator	Years					
	2019	2020	2021	2022	2023	2024
Large enterprises, UAH billion	1222.86	1295.66	1719.91	1467.65	1837.09	2184.32
Growth rate, %	5.95		–14.67		18.90	
Medium enterprises, UAH billion	1893.55	1817.09	2502.64	1956.80	2631.79	3075.74
Growth rate, %	–4.04		–21.81		16.87	
Small enterprises, UAH billion	841.96	955.48	1162.47	969.28	1225.41	1324.99
Growth rate, %						
Total enterprises, UAH billion	3958.37	4068.23	5385.02	4393.72	5694.29	6585.05
Growth rate, %	2.78		–18.41		15.64	

Source: compiled by the authors based on materials from the State Statistics Service of Ukraine (n. d.).

From the table data, we see that the fluctuations in the volume of products sold by Ukrainian trade enterprises in the downward direction due to the COVID-19 pandemic are insignificant. A sharp reduction in sales volumes was recorded in 2022 due to a full-scale war, which was accompanied by quite significant losses. During 2023–2024, there is a gradual stabilization of the situation and the beginning of recovery processes.

No less important is the assessment of the financial results of trade enterprises, which are presented in *Table 3*.

Table 3

Pre-tax financial results of enterprises in the trade sector in Ukraine, 2019–2024.

Enterprises	Indicator	Years					
		2019	2020	2021	2022	2023	2024
Large	Share of those who made a profit, %	100.0	88.9	100.0	87.4	100.0	87.4
	Share of those who made a loss, %	–	11.1	–	8.3	–	12.6
	Financial result (balance) before tax, UAH billion	1.88	2.28	3.58	3.86	6.89	49.84
Medium	Share of those who received a profit, %	85.7	84.1	82.5	83.2	93.1	86.6
	Share of those who received a loss, %	14.3	15.9	7.5	16.8	6.9	13.4
	Financial result (balance) before tax, UAH billion	6.57	4.06	10.24	8.85	46.87	99.31
Small	Share of those who received a profit, %	78.3	73.0	75.2	70.8	75.5	75.4
	Share of those who received a loss, %	24.7	27.0	24.8	29.2	24.5	24.6
	Financial result (balance) before tax, UAH billion	0.67	–0.41	2.13	1.56	4.21	46.35

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

From the above analysis of the financial results before taxation of Ukrainian trade enterprises, it was determined that large enterprises are the most stable, and the overall balance of their financial results tends to increase, despite minor crisis phenomena in 2020, 2022, and 2024. No clear positive trend has formed among medium-sized trade enterprises. At the same time, the results of the analysis confirm the uneven adaptation of enterprises of different sizes to conditions of uncertainty. In our opinion, it is also important to assess the profitability of the activities of Ukrainian trade enterprises in a volatile and unstable external environment (*Figure 1*), which will allow determining the efficiency of resource use and the ability of entities to adapt to crisis challenges.

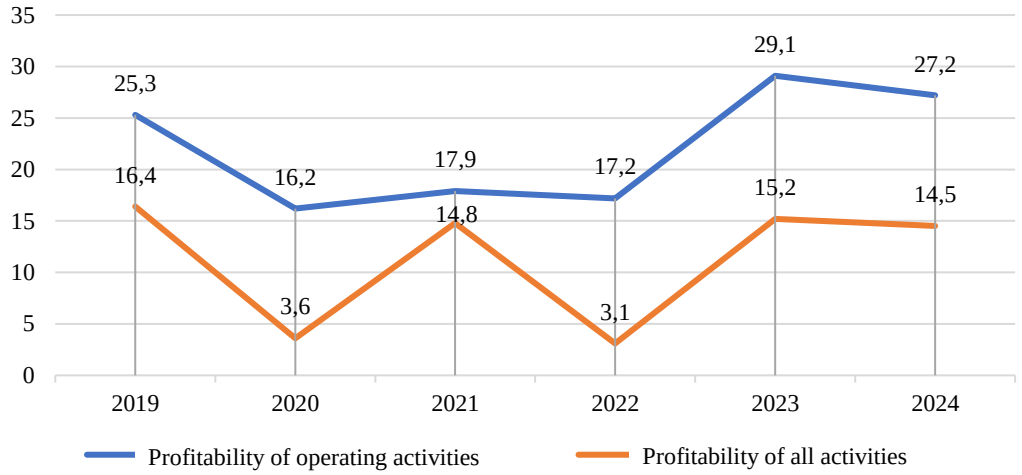

Figure 1. Profitability of operating and total activities of trade enterprises in Ukraine for 2019–2024, %

Source: compiled by the authors based on data from the State Statistics Service of Ukraine (n. d.).

From *Figure 1* it could be seen that the profitability of operating activities had a significant downward trend in 2020 due to the impact of the crisis phenomena of the pandemic. Similar dynamics were observed in 2022. Even though in 2023 and 2024 a certain recovery of operating activities was recorded, business entities failed to increase profitability to the levels of significant crisis impacts of the external environment.

Sudden challenges to Ukrainian trade enterprises in 2019–2024 significantly affected the efficiency of their activities and the ability to ensure their own economic sustainability. In addition, the COVID-19 pandemic and the full-scale invasion of the russian federation led to the closure of a significant number of business entities, caused a drop in the volume of products sold, and reduced the number of enterprises that received a positive financial result, which resulted in a drop in profitability.

3. Analysis of factors affecting the adaptability of trade enterprises in conditions of uncertainty

The functioning of Ukrainian trade enterprises in conditions of uncertainty requires a high level of adaptability and stability. In the process of forming the mechanism of adaptability, the identification and systematization of factors influencing the enterprise play a key role.

The change in the characteristics of the external environment from VUCA to BANI and subsequently to PLUTO demonstrates a gradual transition from dynamic, but relatively structured market processes to systemic fragility, nonlinearity, and political and economic fragmentation. At the same time, certain patterns and similarities in their key characteristics are traced. To systematize these similarities and identify integral factors that

determine the modern conditions for the functioning of trade enterprises, it is advisable to conduct a comparative analysis of concepts (*Table 4*).

Table 4

Integral factors influencing the VUCA, BANI, and PLUTO worlds

Integral factor	VUCA	BANI	PLUTO	Essence of the factor
Environmental dynamics	Volatility – rapid and unpredictable changes	Brittle – the fragility of systems that easily collapse	Liquid – fluidity, variability of structures	Constant changes, increased instability, destruction of stability
Environmental uncertainty	Uncertainty – lack of information for forecasts	Anxious – anxiety due to the inability to predict events	Unilateral / Tense – unilateral actions that increase uncertainty;	It is impossible to form an accurate forecast; the risk of erroneous decisions increases
System complexity	Complexity – a large number of interrelated variables	Nonlinear – disproportionality of actions and consequences	Omni-relational – comprehensive relationships between actors	The system consists of many interdependent elements, and the effects are difficult to model
Ambiguity	Ambiguity – different interpretations and unclear signals	Incomprehensible – complexity of comprehension, incomprehensibility of processes	Omni-relational (partially) – excess information connections create noise	Redundancy of information, vague interpretations, and opacity of cause-and-effect relationships
Nonlinearity of change	Indirectly described within Complexity	Nonlinear – cascading, disproportionate consequences	Tense / Unilateral – abrupt changes that provoke the effect of "chain reactions."	Small impacts can cause large consequences; the system reacts non-linearly

Source: author's development using the Chat GPT 5.1 LLM model (developed by OpenAI) based on the prompt "Conduct a comparative analysis of the external environment factors of trading companies within the concepts of VUCA → BANI → PLUTO, taking into account the proposed characteristics and features of these worlds, and determine the similarities in the essence of the factors".

A comparative analysis of the characteristics of the VUCA, BANI, and PLUTO worlds shows that, despite the different historical preconditions for their emergence, there are similarities in the characteristics of the environment in which trading companies operate. These characteristics can be defined by different terms, but their content is complementary. Thus, five integral factors can be identified: Volatility, Uncertainty, Complexity, Ambiguity, and Nonlinearity.

The first integral factor is volatility. Sharp changes in the world or local prices, especially food, fuel, and energy, undoubtedly affect the functioning of trading enterprises. In particular, the full-scale invasion of the Russian Federation affected global agricultural markets and led to significant fluctuations in prices for agricultural products (Hamulczuk et al., 2023). Despite the restrictive policy and the injection of significant financial resources to support such sectors of the economy as agriculture and energy, it can be stated that price fluctuations are and will remain a significant factor

affecting trading enterprises. At the same time, logistics costs are increasing due to disruptions in supply chains and geopolitical instability. Examples of this are the blockade of Ukrainian ports, the destruction of logistics routes, and targeted attacks on warehouse infrastructure (Toygar & Yildirim, 2023).

Another factor that can be attributed to volatility is demand fluctuations. Seasonality, changes in consumer behavior, and variability of purchasing power – all this creates additional challenges for trade enterprises. However, such financial fluctuations in domestic and global markets as exchange rates, inflation processes, and changes in stock markets (OECD, 2022) contribute to even greater volatility of the external environment. Given this factor of the external environment of trade enterprises, we will highlight four key components (*Figure 2*).

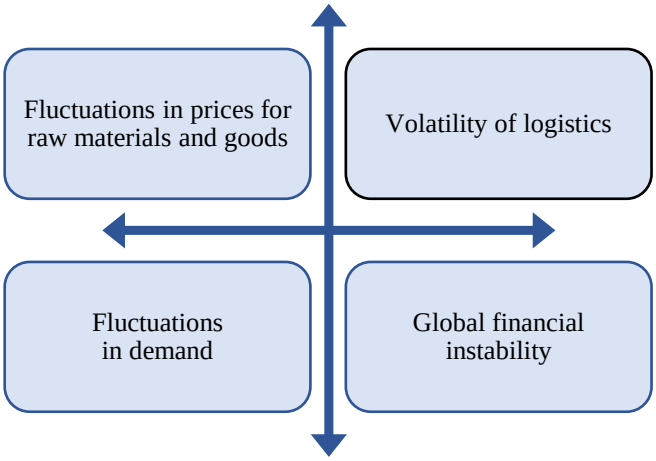

Figure 2. Components of the volatility factor in the external environment

Source: summarized and compiled by the authors.

Uncertainty as a factor of the external environment implies the impossibility of unambiguously predicting the development of future events. Quite often, enterprises cannot predict consumer behavior and their preferences. As a result, forecast discrepancies, uncertainty in trends, and hypersensitivity to external shocks appear (Kancs, 2023). All this is caused by the uncertainty of demand. At the same time, there is uncertainty in supply because of interruptions and changes in supply chains; their instability does not allow for predictability. In conditions of martial law, it is even more difficult to predict changes in regulatory policy, because the economy is constantly in a state of crisis, and tax revenues, as a key source of budget replenishment, require constant review and adaptation. The factor of uncertainty of the political, social, and economic situation as an aggregator of the vast majority of risks is determined by the inability to predict the timing of the completion or freezing of military operations, the stages and speed of economic recovery, and creates additional obstacles to the adaptability of trade enterprises. In summary, we can identify 4 key components of the uncertainty factor (*Figure 3*).

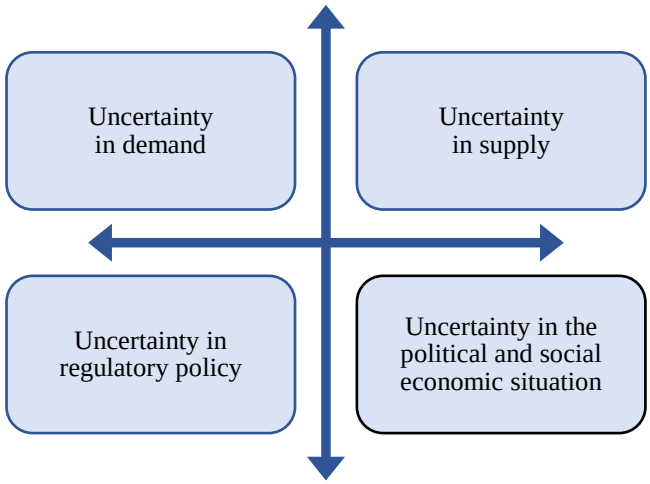

Figure 3. Components of the external environment uncertainty factor

Source: summarized and compiled by the authors.

Complexity is defined as omnichannel and multichannel sales, multilevel logistics, regulatory multilevel, and technological integration. In modern conditions, retail enterprises operate both in the format of physical retail outlets and through e-commerce, marketplaces, and social networks. This creates the need to build more complex adaptation mechanisms. The logistics chains of Ukrainian retailers are multilevel, have many participants, and require the creation of additional "levels" of management (Ivanov, 2022). It is also necessary to emphasize the multilevel nature of regulatory policy, because in the process of European integration, legislation is actively transformed by harmonizing it with European legislation. This is another limiting factor for the sustainability of retail enterprises, but it can cause certain "collisions" and difficulties in interpretation. The rapid development of technologies, the integration of artificial intelligence into business processes, and new requirements for the speed of information flows also create barriers to ensuring sustainability (Pennekamp et al., 2023). These components form the key features of the environmental complexity factor (*Figure 4*).

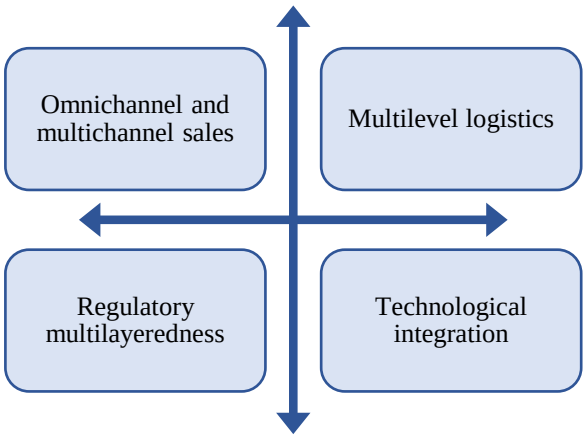

Figure 4. Components of the external environment complexity factor

Source: summarized and compiled by the authors.

Ambiguity is characterized by the absence of clearly expressed cause-and-effect relationships. The study by Glushka et al. (2025) shows that in wartime conditions, retail enterprises are faced with the need to combine both traditional methods of work and implement digital models, which often causes ambiguity in making management decisions. In addition, having implemented modern technological solutions, enterprises cannot always determine the correct set of metrics that would adequately reflect real efficiency, because their number is constantly growing, but they are not always correlated with each other. In addition, retail also faces ambiguity in choosing the optimal development strategy and is often forced to balance between different approaches. The full-scale invasion, in turn, added another group of factors – the ambiguity between the social mission (providing the population with essential goods, supporting volunteer initiatives, participating in humanitarian projects) and economic efficiency (profitability, financial sustainability, cost optimization) (Silkina, 2022). Characterizing the ambiguity, we highlight 4 key components (*Figure 5*).

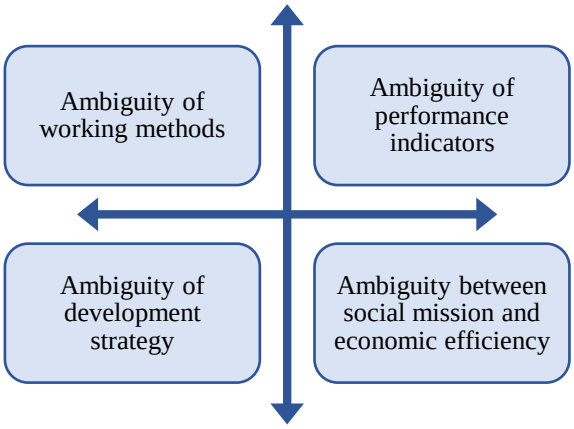

Figure 5. Components of the external environment ambiguity factor

Source: summarized and compiled by the authors.

Nonlinearity is studied in the works of such Ukrainian scientists as Ponomarenko and Yastremska (2024) and Chaliuk (2022). The authors emphasize that economic systems do not respond to changes in isolation, but through certain "cascades" of influences with secondary effects. At the same time, the modern external environment is characterized by the absence of a linear relationship between a management decision and the result, since a significant influence can have a minimal effect, while minor changes can cause a sharp increase in the financial results of the enterprise. In addition, there is the effect of "bifurcation points," when a minor change in environmental parameters can radically change the development trajectory. We also note the synergy of external environmental factors, since quite often the action of several factors creates unpredictable configurations of influences. In view of this, we propose highlighting four key components of the nonlinearity factor (*Figure 6*).

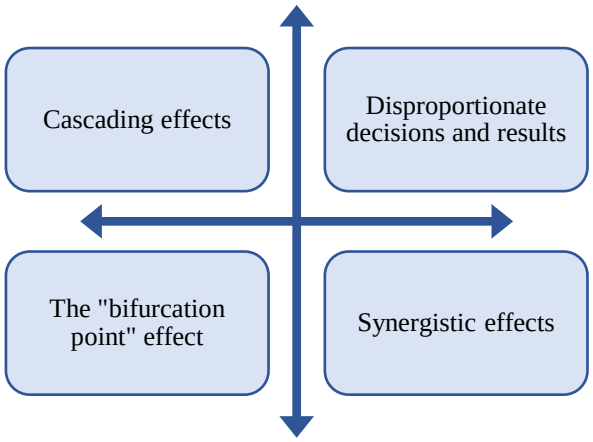

Figure 6. Components of the external environment's non-linearity factor

Source: summarized and compiled by the authors.

The analysis and synthesis conducted allowed us to identify key risks for trade enterprises in conditions of uncertainty of the external environment. Based on the approach of Mekh and Fedulova (2022), which emphasizes the importance of systematic identification, classification, and minimization of risks, we will form a matrix of external environmental risks, reflecting the relationship between its factors and methods of their neutralization (*Table 5*).

Table 5

Matrix of external environmental risks for trade enterprises

Component	Key groups of factors	Risk minimization methods
Volatility	Fluctuations in raw material and commodity prices; logistics volatility; demand fluctuations; global financial instability	Hedging, supplier diversification, risk insurance, and reserve stock creation
Uncertainly	Demand uncertainty; supply uncertainty; regulatory policy uncertainty; political, social, and economic situation	Scenario planning, flexible budgeting, environmental monitoring, business consulting
Complexity	Omnichannel and multichannel sales; multilevel logistics; regulatory multi-layering; technological integration	ERP/WMS systems, process automation, legal expertise, and standardization of procedures
Ambiguity	Ambiguity of work methods; ambiguity of performance indicators; ambiguity of development strategy; ambiguity between social mission and economic efficiency	Strategy balancing, definition of key KPIs, strategic partnership, and corporate planning
Nonlinearity	Cascade of impacts; disproportionality of decisions and results; effect of "bifurcation points"; synergy of impacts	Supply chain diversification, implementation of early warning systems, construction of scenario models of cascading failures, and creation of buffer stocks of goods

Source: compiled by the authors.

For Ukrainian trading companies in war and post-war conditions, it will not be enough to simply "passively" manage risks. It is necessary to ensure the formation of an adaptation mechanism that will allow:

• to proactively respond to volatility by creating financial reserves, implementing flexible pricing models, and diversifying suppliers;

• to reduce the level of uncertainty through scenario planning, monitoring and assessing the environment, and developing several alternative strategies;

• to overcome complexity by integrating digital technologies, standardizing processes, and engaging business consulting;

• to reduce the level of ambiguity by implementing transparent and adequate KPIs, balancing development strategies, and implementing active social responsibility;

• to ensure the diversification of supply chains, implement early warning systems, and apply scenario models of cascading failures and buffer stocks of goods to overcome the nonlinearity of the environment.

The formation of a mechanism for adapting trade enterprises in conditions of uncertainty requires an assessment of the level of adaptability, which can be implemented based on an integral indicator, the components of which are proposed, certain groups of factors for each component:

$$IA_{VUCAN} = w_V \cdot V + w_U \cdot U + w_C \cdot C + w_A \cdot A + w_N \cdot N \ ,$$

where: IA_{VUCAN} – the index of adaptability of the enterprise in conditions of uncertainty;

V, U, C, A, N – normalized estimates (from 0 to 1) for groups of factors (components);

w_V, w_U, w_C, w_A, w_N – weighting coefficients determined by expert means ($\sum w_i = 1$).

Thus, we will obtain a weighted average value that reflects the consistency of the enterprise's adaptability to the main factors of the external environment. The proposed approach will allow us to translate factorial analysis into a quantitative model, and by using expert assessment methods to determine weighting factors, to adapt it to different industries and individual trade enterprises.

Conclusions

According to the results of the research:

• It was established that the evolutionary transition VUCA → BANI → PLUTO reflects the gradual complication of the characteristics of the external environment of trade enterprises, while creating a methodological framework for understanding the features of the external environment.

• The critical impact of uncertainty factors on the functioning of Ukrainian trade enterprises was proven by analyzing the dynamics of the number of operating business entities.

• The high sensitivity of the industry to external shocks was identified based on the analysis of the financial indicators of trade enterprises.

• The hypothesis that the effectiveness of the adaptation of trade enterprises to the conditions of a changing external environment requires taking into account its features within the evolutionary transition VUCA → BANI → PLUTO was confirmed, and a comprehensive system of factors influencing the external environment was developed: Volatility, Uncertainty, Complexity, Ambiguity, Nonlinearity;

• A matrix of external environmental risks for trade enterprises was proposed, considering key factors of influence.

• A methodological approach to assessing the adaptability of a trade enterprise was developed through the integral adaptability index, which allows for quantitatively assessing the level of readiness of the enterprise to external environmental conditions and becomes a key tool for developing an adaptation mechanism.

The conducted research provides a methodological basis for deepening the scientific understanding of the adaptation mechanisms of trade enterprises. It requires further development, particularly in the context of ensuring the economic sustainability of the enterprise.

In the future, the primary task is to empirically verify the proposed model by conducting a wide study on a representative sample of Ukrainian trade enterprises. This will allow not only to confirm the reliability of the integral adaptability index, but also to establish quantitative relationships between the level of adaptability and key indicators of the economic sustainability of the enterprise.

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SELF-MANAGEMENT AS A KEY COMPETENCE OF EMPLOYEES IN THE LABOR MARKET

The essence and significance of working time self-management as a strategic professional competence for employees in a volatile and digitalized socio-economic environment (VUCA world) are substantiated. The relevance of the study is driven by the transformation of time management from a supplementary "soft skill" into a fundamental determinant of professional value and psychological resilience of human capital in the era of the Fourth Industrial Revolution. The hypothesis is proposed, according to which a high level of individual self-organization acts as a strategic buffer, which allows for minimizing "switching costs" by up to 40% and ensures the professional longevity of an employee in conditions of digital overload. To verify the hypothesis, a complex of scientific methods was applied: monographic analysis and bibliometric review were used to systematize the evolution of management paradigms; a systemic approach was used to analyze individual efficiency as a component of corporate success; the method of deduction was applied to evaluate time resources through the lens of opportunity cost; as well as descriptive modeling to develop a competency structure. The research results demonstrate that the modern self-management model integrates cognitive, functional, and social components. It was established that digital interruptions lead to a loss of 2–3 hours of productive time daily, while the implementation of "Deep Work" methods and the 60:40 rule is critical for neutralizing "virtual

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САМОМЕНЕДЖМЕНТ ЯК КЛЮЧОВА КОМПЕТЕНТНІСТЬ НА РИНКУ ПРАЦІ

Обґрунтовано сутність та значення самоменеджменту робочого часу як стратегічної професійної компетентності працівників у волатильному та цифровізованому соціально-економічному середовищі (VUCA-світ). Актуальність дослідження зумовлена трансформацією управління часом з допоміжної "м'якої навички" на базову детермінанту професійної цінності та психологічної стійкості людського капіталу в умовах Четвертої промислової революції. Внесено гіпотезу, згідно з якою високий рівень індивідуальної самоорганізації виступає стратегічним буфером, що дозволяє мінімізувати "витрати на перемикання" до 40% та забезпечує професійне довголіття працівника в умовах цифрового перевантаження. Для перевірки гіпотези застосовано комплекс наукових методів: монографічний аналіз та бібліометричний огляд для систематизації еволюції парадигм управління; системний підхід для аналізу індивідуальної ефективності як складника корпоративного успіху; метод дедукції для оцінки часових ресурсів через призму альтернативної вартості; а також дескриптивне моделювання для розробки структури компетентностей. Результати дослідження демонструють, що сучасна модель самоменеджменту інтегрує когнітивний, функціональний та соціальний компоненти. Встановлено, що цифрові переривання призводять до втрати 2–3 годин продуктивного часу щодня, а впровадження методів глибокої роботи та

presenteeism." It has been proved that effective self-management directly correlates with the level of engagement and a reduction in the risk of emotional burnout in remote and hybrid work environments.

Keywords: self-management, working time, labour market, key competences, efficiency, human capital, digital burnout.

правила 60:40 є критичним для нейтралізації "віртуального презентеїзму". Доведено, що ефективний самоменеджмент безпосередньо корелює з рівнем залученості та зниженням ризику емоційного вигорання в умовах дистанційної та гібридної праці.

Ключові слова: самоменеджмент, робочий час, ринок праці, ключові компетенції, ефективність, людський капітал, цифрове вигорання.

JEL Classification: J24, M12, M54.

Introduction

In the era of the Fourth Industrial Revolution and the total digitalization of economic relations, the nature of professional activity is undergoing fundamental changes. Contemporary organizations operate in a VUCA world (Volatility, Uncertainty, Complexity, Ambiguity), which requires them not only to have high technological equipment but also to have an extremely flexible management system. Under such conditions, the primary resource for ensuring the competitiveness of an enterprise is no longer financial capital or material assets, but human capital, specifically the level of development of professional and self-management competencies of employees.

One of the most critical, yet often underestimated, resources in management is time. Time is a unique economic category; it is absolutely inelastic, non-renewable, and cannot be accumulated for future use. In a market economy, the efficiency of an enterprise is directly determined by the efficiency of its leaders and specialists. The quality of management today is not limited to strategic planning at the corporate level; it begins with the individual's ability to exercise effective self-leadership and manage their own working time.

The relevance of this study is driven by the growing gap between the increasing volume of information tasks and the limited temporal resources of employees. Professional burnout, decreased productivity, and loss of strategic focus are often consequences of poor self-management. Therefore, the transformation of time self-management from a "soft skill" into a core professional competence is a necessary condition for the sustainable development of modern organizations.

The intellectual roots of time management can be traced back to the early schools of scientific management. F. Taylor and H. Fayol were among the first to emphasize the rationalization of labour processes and the optimization of time costs. However, their approach was primarily "top-down," focusing on the external control of workers' time. In the second half of the 20th century, the focus shifted toward the internal resources of the individual. Peter Drucker (2007) argued that "knowledge workers" must, above all, be able to manage themselves.

A significant contribution to the development of practical tools was made by Seiwert (1998), whose "ALPEN" method became a standard. In the

Polish scientific tradition, Kieżun (1997) and Koźmiński (2013) provide a deep systemic analysis of management quality, while Olejniczak (2013) explores these issues in the context of institutional innovation.

Recent academic discourse emphasizes that in the post-pandemic landscape, self-management has become a critical factor for professional success and psychological well-being. Ahieieva and Plotnichenko (2023) highlight that self-management is no longer an optional skill but a fundamental driver of a manager's professional success in a competitive environment. The shift to remote models has further complicated this dynamic; Wang et al. (2020) demonstrate that effective remote working is deeply rooted in work design and the individual's ability to maintain autonomy.

Moreover, contemporary research links self-organization directly to mental health. Arnold and Sonnentag (2023) emphasize the role of recovery and the management of daily mood trajectories, noting that effective time use must include structured rest to maintain productivity. Morikawa et al. (2024) provide evidence that both individual and organizational self-management are significantly related to levels of work engagement and the prevention of burnout. Building on these theoretical foundations of labor market dynamics and automanagement (Stemplewska, 2023), this article aims to address existing gaps by synthesizing these modern perspectives into a functional framework for the contemporary employee.

The purpose of this study is to theoretically substantiate and develop a structural model of working time self-management as a fundamental professional competence, and to quantify its impact on the economic efficiency and psychological resilience (burnout prevention) of human capital in the contemporary digitalized labour market. This involves defining the essence of "automanagement," investigating its structural components, and establishing a theoretical link between individual time-management efficiency and the strategic resilience of an organization.

The research is based on the hypothesis that in a post-pandemic, digitalized economy, high levels of individual self-management act as a strategic buffer that not only reduces "switching costs" by up to 40% but also serves as a primary determinant of an employee's professional value, career longevity, and immunity to digital burnout.

To achieve the stated purpose, a qualitative research design based on a multi-methodological approach was employed. The study is grounded in the fundamental principles of management science, organizational psychology, and labour economics. The following specific scientific methods were utilized:

- monographic analysis and bibliometric review: to systematize existing theoretical approaches to time management, from the classical schools of Taylor and Fayol to modern paradigms of self-leadership;
- systemic approach: to examine self-management as an integral part of an organization's management system, where individual efficiency serves as a building block for corporate success;

• logical synthesis and deduction: to apply general economic laws (such as the law of diminishing returns and the principle of opportunity cost) to the individual's use of working time;

• comparative analysis: to evaluate the effectiveness of various time-management tools (e.g., the Eisenhower Matrix, Pareto Principle, and ALPEN method) in different professional contexts;

• descriptive modeling: used to develop conceptual frameworks (figures and tables) that illustrate the structure of competencies and the cycle of self-management.

The empirical basis of the study includes reports from international organizations (ILO, OECD), research data from the SGH Warsaw School of Economics, and current labour market statistics.

The research logic is structured as follows: identification of the paradigm shift from external control to "automanagement"; evaluation of the economic nature of time through opportunity costs; quantitative analysis of "time thieves" and switching costs in the digital environment; and finally, validation of self-management frameworks as tools for maintaining professional engagement and preventing burnout.

1. The essence of self-management

1.1. Self-management as a modern management paradigm

In classical management theory, the focus has traditionally been on the external regulation of labour – how an organization can optimize the time of its workforce through supervision, standardization, and hierarchy. However, the shift toward a knowledge-based economy has rendered these "top-down" methods insufficient. In a digital environment where remote work and flexible schedules are becoming the norm, the locus of control has shifted from the manager to the employee (*Table 1*).

Table 1

Structure of professional competencies
in the context of self-management

Competence component	Key characteristics	Self-management application
Cognitive (knowledge)	Theoretical understanding of management principles, labour economics, and professional specialization	Understanding the value of time as a non-renewable resource and the logic of strategic planning
Functional (skills)	Practical ability to apply methods, use technical tools, and solve organizational problems	Mastery of time-management tools: Eisenhower matrix, ALPEN method, digital planners, and software
Social (attitudes)	Ethical behavior, responsibility, communication skills, and the ability to work in a team	Self-discipline, emotional intelligence, resilience to stress, and the ability to set personal boundaries

Source: compiled by the author.

Self-management, or "automanagement," represents a higher stage of professional development where an individual consciously applies management functions – planning, organizing, motivating, and controlling – to their own activities (*Figure 1*).

Figure 1. The cycle of individual self-management in professional activity

Source: compiled by the author.

It is a process of self-regulation that involves setting clear professional goals, prioritizing tasks, and mobilizing personal resources to achieve these goals with minimal stress and maximum efficiency. In this context, self-management is not about "working harder," but about "working smarter" by aligning daily actions with long-term strategic objectives.

1.2. The economic nature of time as a critical resource

From an economic perspective, time is perhaps the most paradoxical resource. Unlike financial capital, which can be borrowed, or human resources, which can be expanded through hiring, time is absolutely inelastic. It flows at a constant rate regardless of demand. In the management of an enterprise, time should be viewed through the lens of opportunity cost – the value of the next best alternative foregone when a specific amount of time is spent on a low-priority task (*Table 2*).

Table 2

Analysis of "Time thieves" and their impact on individual productivity

Time thief category	Specific examples	Estimated daily time loss (%)
Communication interruptions	Unplanned phone calls, instant messaging notifications, social media	15–20
Inefficient meetings	Lack of a clear agenda, excessive duration, low relevance to current tasks	10–15
Procrastination	Delaying complex tasks, "doomscrolling," information overload	5–10
Disorganization	Searching for digital files, lack of a daily plan, poor workplace ergonomics	10

Source: compiled by the author based on empirical studies of workplace productivity.

The rational use of working time is a fundamental condition for an organization's competitive advantage (Roguszczak, 2010).

When employees lack self-management competencies, the organization suffers from "hidden losses":

• temporal losses: wasted on unproductive meetings, "time thieves," and poor communication;

• psychological losses: stress and burnout caused by the inability to manage workloads;

• strategic losses: failure to focus on innovative tasks due to being overwhelmed by operational routine.

Therefore, the integration of time-management techniques into the organizational culture is not just a human resources preference but a strategic necessity for maximizing the return on human capital investment.

2. Implementation of self-management tools & quantified labour market demands

2.1. Practical implementation of time-management frameworks

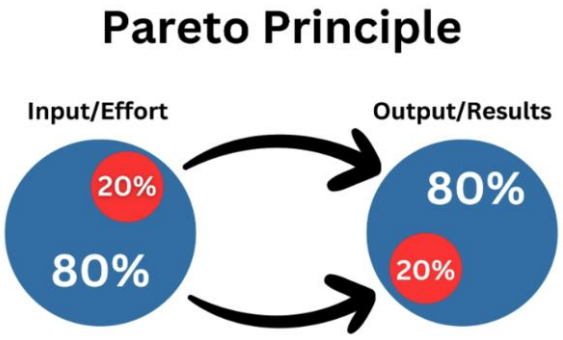

Figure. 2. The Pareto Principle in professional activity

Source: compiled by the author based on the Pareto Principle.

To translate self-management from a theoretical concept into a functional competence, several classic and modern frameworks are utilized. Their effectiveness is supported by empirical data regarding productivity gains.

The Pareto Principle (80/20 Rule) in professional activity (*Figure 2*).

The use of the Pareto Principle allows for a significant increase in individual efficiency by focusing on the 20% of tasks

that generate 80% of the results (Forsyth, 2003; Stoilov, 2012). In an organizational context, identifying this "critical minority" of tasks is vital. Quantitative analysis shows that employees who fail to apply this principle spend up to 50% of their working day on "low-value" tasks (emails, minor administrative duties) that contribute only 5–10% to their key performance indicators (KPIs). Effective self-management involves a deliberate shift of temporal resources toward high-impact activities.

The eisenhower matrix and time allocation standards.

High-performing managers and specialists are characterized by their ability to maximize time spent in Quadrant II (Important but Not Urgent – strategic planning, relationship building, professional development). Studies on executive efficiency suggest the following "ideal" time distribution for maximum productivity:

- Quadrant I (urgent/important): 20–25% (Crisis management);
- Quadrant II (not urgent/important): 65–80% (Strategic growth);
- Quadrant III & IV (unimportant): < 5% (Elimination of time-wasters).

In contrast, employees with low self-management competencies often spend over 50% of their time in Quadrant III, reacting to perceived urgencies that do not align with organizational goals (*Table 3*).

Table 3

Comparative analysis of time allocation and efficiency

Task category	Typical employee allocation (%)	High-performance standard (%)	Impact on organizational competitiveness
Crisis/urgent tasks	40–60	20	High stress, reactive management
Strategic development	10–15	60–70	Long-term innovation and growth
Administrative routine	20–30	10	Operational maintenance only

Source: compiled by the author based on management efficiency benchmarks.

The ALPEN method and the 60:40 rule.

For effective daily planning, the ALPEN method (Activities, Length, Period, Extra time, Notes) recommends the 60:40 rule: only 60% of working time should be strictly scheduled, leaving 20% for unforeseen activities and 20% for spontaneous/social interactions. Failure to include this 40% buffer leads to the "planning fallacy," where over-scheduled employees experience a 30% drop in quality of work due to constant deadline pressure.

2.2. The digital environment: quantifying interruptions and "switching costs"

A critical aspect of the contemporary labour market is the impact of digitalization on time self-management. Research by the American Psychological Association (APA, 2006) indicates that multitasking can reduce individual productivity by as much as 40%.

Furthermore, data from University of California, Irvine (Gloria Mark) demonstrates that:

• an average office worker is interrupted every 11 minutes;

• it takes approximately 23 minutes and 15 seconds to return to the original task with the same level of deep focus after an interruption.

For an employee who checks notifications 15–20 times a day, the cumulative "switching cost" can result in the loss of 2 to 3 hours of productive time daily. This highlights why "Digital self-management" is now a core sub-competence in modern job descriptions.

2.3. The polish context: competence gap and employer expectations

According to the report by SGH Warsaw School of Economics and the American Chamber of Commerce, over 75% of employers identify "organization of work and time management" as one of the most difficult competencies to find in graduates (SGH Warsaw School of Economics & American Chamber of Commerce in Poland, 2012). The gap between theoretical knowledge and practical self-management skills results in a "training tax" for companies, who must invest an average of 15–20% of a new hire's first-year salary into soft skills development and onboarding to reach acceptable levels of independent productivity.

3. Discussion: self-management in the era of remote and hybrid work

The transition to remote and hybrid work models, accelerated by the COVID-19 pandemic, has fundamentally redefined the requirements for self-management competencies. If in a traditional office environment, organizational structures provided external "temporal boundaries," in a remote setting, the responsibility for maintaining productivity shifts entirely to the individual.

Data from Global Workplace Analytics indicates that while remote work can increase productivity by up to 13–15% due to the elimination of commutes and office distractions, this gain is only realized by employees with high levels of self-management. Conversely, for employees with a "competence gap" in self-organization, remote work leads to a 20–25% increase in working hours without a corresponding increase in output – a phenomenon known as "virtual presenteeism."

Furthermore, the "always-on" culture facilitated by digital tools (Slack, Microsoft Teams, Zoom) has created a new challenge: digital fatigue. A study by Microsoft's Human Factors Lab showed that brainwave patterns associated with stress significantly increase after just two hours of back-to-back video meetings. Effective self-management in this context requires the ability to implement "Deep Work" blocks (as proposed by Cal Newport) – periods of at least 60–90 minutes of focused activity without digital interruptions (Newport, 2016). Organizations that fail to institutionalize these self-management practices see a 30% higher turnover rate among their high-potential employees due to burnout.

Conclusions

Structural model of self-management: It is substantiated that self-management of working time has evolved from a simple "soft skill" into a complex professional competence. The developed model integrates three essential components: cognitive (knowledge of planning logic), functional (mastery of tools like the Eisenhower Matrix and ALPEN method), and social (self-discipline and emotional resilience). This multidimensional approach is critical for maintaining productivity in a volatile VUCA environment.

economic impact and efficiency: The quantitative analysis confirms that poor self-management leads to significant "hidden losses." Specifically, digital interruptions and the resulting "switching costs" can waste up to 40% of an employee's productive capacity, equivalent to approximately 2–3 hours per day. Implementing the 60:40 rule and the Pareto principle (focusing on the 20% of high-impact tasks) acts as a primary driver for increasing the return on human capital investment.

Psychological resilience and burnout: The study establishes a direct link between self-organization and mental health. Effective self-management, including the use of "Deep Work" blocks and structured recovery trajectories, significantly reduces the risk of professional burnout and "virtual presenteeism" in remote and hybrid work models.

The research results fully confirm the advanced hypothesis: in the post-pandemic digital economy, high levels of individual self-management act as a strategic buffer. It not only mitigates the negative effects of digital overload but also serves as a primary determinant of an employee's professional value and career longevity.

Future studies should focus on the development of AI-driven analytical tools that assist in personalized time-planning while respecting the psychological boundaries of employees. Additionally, further exploration is needed regarding the adaptation of self-management frameworks within diverse cross-cultural and multi-generational labor environments.

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REMOTE AUDITING OF QUALITY MANAGEMENT SYSTEMS

This article explores the evolving landscape of remote auditing (RA) within Quality Management Systems (QMS), emphasizing its growing relevance in the context of global digital transformation, pandemic-related disruptions, and geopolitical instability. The author presents a comprehensive literature review supported by strategic analytical frameworks (PESTLE, NOISE), as well as author developed STAIN approach, to assess the feasibility, benefits, and challenges of implementing RA in various organizational settings. The research is based on the hypothesis that the implementation of RA within QMS can provide a level of effectiveness, reliability, and audit quality comparable to or exceeding traditional on-site audits, provided that appropriate technological infrastructure, auditor competence, and principles of security, transparency, and trust are ensured. The research highlights how RA, once considered a contingency measure, is now emerging as a viable and often preferable alternative to traditional on-site audits. It offers significant advantages such as cost reduction, increased flexibility, enhanced safety, and environmental sustainability. However, the transition to RA also introduces complex challenges, including legal ambiguities, data protection concerns, technological barriers, and the need for auditor competence in digital environments. By integrating insights from international standards and recent academic research, the article proposes a set of practical recommendations to improve RA quality. These include the adoption of advanced

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ДИСТАНЦІЙНИЙ АУДИТ СИСТЕМ УПРАВЛІННЯ ЯКІСТЮ

Досліджено еволюцію дистанційного аудиту у системах управління якістю з акцентом на його зростаючу актуальність у контексті глобальної цифрової трансформації, пандемічних обмежень та геополітичної нестабільності. Проведено ґрунтовний огляд наукової літератури, використовуючи стратегічні аналітичні інструменти (PESTLE, NOISE), а також розроблено підхід STAIN для оцінки доцільності, переваг і викликів впровадження дистанційного аудиту в різних організаційних умовах. Висунуто гіпотезу, що впровадження дистанційного аудиту систем управління якістю може забезпечити рівень результативності, надійності та якості аудиту, співставний або вищий порівняно з традиційними очними перевірками, за умови наявності відповідної технологічної інфраструктури, кваліфікації аудиторів та дотримання принципів безпеки, прозорості та довіри. Підкреслено, що дистанційний аудит, який раніше розглядався як тимчасовий захід, нині перетворюється на життєздатну та часто переважну альтернативу традиційному очному аудиту. Дистанційний аудит має суттєві переваги, зокрема зниження витрат, підвищення гнучкості, покращення безпеки та екологічну сталість. Водночас перехід до дистанційного аудиту супроводжується складними викликами, а саме: правова невизначеність, ризики захисту даних, технологічні бар'єри та необхідність високої цифрової компетентності аудиторів. На основі інтеграції положення міжнародних стандартів та сучасних наукових досліджень запропоновано практичні рекомендації для підвищення якості

technologies (AI, IoT, VR), the development of standardized procedures, and the enhancement of auditor training and ethics. The STAIN framework serves as a conceptual model for ensuring trustworthiness and effectiveness in RA practices. This work is particularly relevant for auditors, certification bodies, policymakers, and organizations seeking to modernize their compliance and quality assurance processes in line with digital transformation trends.

Keywords: Remote Audit (RA), Quality Management Systems (QMS), Standards, Audit quality, STAIN, auditor competence, compliance, auditors, auditees.

дистанційного аудиту. Серед них – впровадження передових технологій (AI, IoT, VR), розробка стандартизованих процедур та посилення професійної підготовки й етики аудиторів. Концептуальна модель STAIN слугує основою для забезпечення довіри та ефективності дистанційного аудиту. Дослідження є особливо актуальним для аудиторів, сертифікаційних органів, регуляторів та організацій, що прагнуть модернізувати процеси контролю та забезпечення якості відповідно до тенденцій цифрової трансформації.

Ключові слова: дистанційний аудит, системи управління якістю, стандарти, якість аудиту, *STAIN*, компетентність аудитора, відповідність, аудитори, аудитовані сторони.

JEL Classification: D21, K13, L15, L22, M11.

Introduction

The dynamism of today's market environment, combined with high levels of uncertainty, has intensified the search for universal principles and mechanisms that can address practical problems while ensuring organizational effectiveness. One such mechanism is the quality system audit (QSA), which reflects the broader transformations occurring under contemporary market conditions.

QSA is a mandatory component of quality management systems (QMS). It is defined as a systematic, independent, and documented process of collecting and evaluating objective evidence to determine the extent to which audit criteria are fulfilled (ISO 9000:2015, 2015). The methodological foundation for QSA is established by the International Organization for Standardization (ISO) standards – particularly ISO 19011:2018: Guidelines for auditing management systems– alongside relevant industry-specific regulations.

Traditionally, QSA has been carried out with the audit subject (i.e., the conformity assessment body) physically present at the organization's primary site of activity. This practice has been consistent across different ownership structures, economic sectors, and industries, with the primary criterion being the auditor's ability to objectively verify the QMS's functioning and the organization's compliance within the defined certification scope.

However, recent circumstances emphasize the need to expand beyond this traditional, on-site approach to include remote auditing (RA), enabled by modern information-communication technologies (ICT). This development is driven by two interrelated factors:

- safety and accessibility concerns (e. g., quarantine restrictions, geopolitical disruptions, or military conflicts) that limit the feasibility of physical audits;
- rapid advancements in communication tools (e. g., video conferencing, virtual presence technologies), which now make it possible to conduct audits effectively in a remote setting.

The RA study methodology of QMS is being undertaken by many scientists. RA is not the only right solution to all problems; this is also not a substitute for direct audits. However, as part of a long-term assurance program, RA can play a role in providing assurance when special circumstances do not allow normal business conduct (Yasmin et al., 2023). In times of crisis, the function of internal audit (in a remote format as well) is crucial in the process of risk management and control, because the auditor can provide relevant advice and assessments that correspond to the organizational structure of the observed entity (Kljajić et al., 2022). RA can increase the efficiency and effectiveness of the audit process, thereby increasing the auditor's ability to find and report violations (Ismanidar et al., 2022). The important determinant of RA realisation becomes the psychological component, which includes the mechanisms of interaction during the interview and study part (Synhaivska & Lisnichenko, 2023).

Specific research focused on analyzing changes to audit methods due to new technology. In the digital transformation era, auditing must adapt to integrating digital technologies that enhance efficiency, flexibility, and innovation within organizations (Liew et al., 2022; Leocadio et al., 2025). Sasai et al. (2024) proposed a new approach for the inspection of regenerative medicine manufacturing facilities and assessment for more cell culture processing facilities than the current in-person audit method. The author mentioned that RA offers a major advantage of avoiding external personnel entering spaces with limited or restricted access and that RA is considered to be advantageous for the periodic survey of facilities in operation. The perspective of the RA has also been considered in the case of medical device manufacturers and has proven to be highly effective in terms of both economic efficiency and the organisation of safe working conditions for all participants in the audit process (Mykhalko & Zenkina, 2021).

Under the possibility of implementing new technology in the audit process, Ariyanto (2024), mentioned that big data analytics enables auditors to perform more precise risk assessments by identifying patterns and anomalies in large datasets, that is why integrating big data and technology in auditing leads to more comprehensive, efficient, and effective audit processes, providing deeper insights and greater value to clients. Innovative adoption of AI technologies enables real-time data processing and pattern recognition, adding a predictive dimension to auditing.

Maharini et al. (2024) analysed the potential of Internet of Things (IoT) technology use during audits and determined that RA could improve flexibility by allowing better control over audit timing and interview scheduling. For RA to be successful, collaborative engagement with the auditee is crucial, as is the appropriate technological infrastructure and software/hardware to enable RA.

Interesting research was undertaken by Wilasittha (2022) regarding the implementation of RA methods in a post-pandemic environment, which emphasized that auditors must also have the ability and expertise to use technology so that RA can be carried out effectively and efficiently. Fadillah

and Pramudyastuti (2023) complemented research on the impact of COVID restrictions, highlighting that the implementation of this RA affects the completeness and reliability of audit evidence, so that both the auditor and the client are expected to be able to understand the use of technology in supporting the audit process being carried out. Auditors are required to conduct RA and use ICT more than in previous years (Zaferar et al., 2024).

With all due respect to the research analyzed, it must be acknowledged that there is a lack of completeness and an absence of a holistic perspective on the subject, which may lead to misunderstandings regarding the implementation of RA methods. The empirical findings and theoretical frameworks presented by the aforementioned authors will be utilized and adapted to align with the objectives of the current study.

This research aims to provide a comprehensive analysis of the potential advantages associated with the further implementation of RA methods within QMS. In addition, the paper seeks to outline a concise set of practical recommendations designed to facilitate the effective adoption and integration of this modern audit approach.

It is hypothesized that the implementation of RA within QMS can provide a level of effectiveness, reliability, and audit quality comparable to or exceeding traditional on-site audits, provided that appropriate technological infrastructure, auditor competence, and principles of security, transparency, and trust are ensured.

Methodological framework. The research method employed in this study is a literature review. This approach involves critically examining and analyzing ideas, concepts, and innovations presented in academically oriented literature to identify their theoretical and methodological contributions to the selected topic.

Due to the absence of verifiable global data on the distribution of remote, on-site, and hybrid audits within QMS, this research adopts a theoretical approach focused on analysing the potential benefits and weaknesses of RA. To achieve this aim, two strategic analytical frameworks were applied: PESTLE and NOISE. These methodologies were selected for their complementary nature: while PESTLE examines macro-environmental factors influencing remote audits, NOISE emphasizes actionable strategies for improvement and innovation.

PESTLE (Political, Economic, Social, Technological, Legal, Environmental) (Soares et al., 2023; Matovic, 2020) analysis is a well-established strategic tool for evaluating the external factors that affect a system or process. Its relevance in this study lies in understanding the external environment that enables or constrains remote auditing practices.

NOISE (Needs, Opportunities, Improvements, Strengths, Exceptions) (Yusoff, 2024) analysis complements PESTLE by focusing on forward-looking, solution-oriented insights that address current challenges and leverage future possibilities in RA.

In addition, the present research will employ a specific approach developed by the author, aimed at providing a more detailed analysis of the

topic and addressing aspects that require further justification for successful implementation. The STAIN approach – an acronym for Security/Safety, Transparency, Accountability (Credibility), Inclusiveness, and Neutrality – is a conceptual framework designed to enhance the reliability and effectiveness of organizational processes. It emphasizes protecting information and resources (Security), ensuring openness and traceability (Transparency), reinforcing trust and professional responsibility (Accountability/Credibility), engaging diverse stakeholders in an accessible and participatory way (Inclusiveness), and maintaining objectivity in decision-making (Neutrality). Together, these principles provide a comprehensive foundation for achieving trustworthy, fair, and high-quality outcomes in complex environments.

The structure of this research consists of two main elements: the RA conceptual framework, which includes clarification of key definitions and an analysis of RA drivers; and a detailed evaluation of RA methodology implementation, conducted through the application of PESTEL, NOISE, and the author's proposed methodology, STAIN.

1. Remote audit concept

It is necessary to initiate the present research with a clear definition of the key concepts. Similar terms for RA, which have also been used in other research on this topic, include digital audit, virtual audit, e-audit, and others. For standardization and to avoid potential misunderstandings, the term RA will be used consistently throughout the present research.

1.1. Definition clarification

RA is one of the audit approaches listed in ISO 19011:2018 (Silitonga & Hastuti, 2022; ISO 19011:2018, 2018). According to the ISO/IEC TS 17012:2024 (2024) RA method is the method used for conducting audit activities from any place other than the location of the auditee. RA is defined as the process by which auditors perform audit procedures from a location outside the auditee's premises with the help of digital tools (Lorentzon et al., 2024). This broad interpretation enables us to define any audit conducted away from the physical location of the audited entity as an RA. On the one hand, this approach simplifies the categorization of audits to some extent; on the other hand, it may give rise to certain legal nuances:

- data privacy and protection regulations – auditors accessing sensitive data remotely may inadvertently violate laws such as GDPR (Europe) or HIPAA (USA) if cross-border data transfer is involved;
- jurisdictional issues – if the audited entity operates in multiple countries, it may be unclear which legal system governs the audit process, or which compliance standards apply.

- electronic signature validity – legal recognition of digital approvals or signatures may vary by country, potentially affecting the validity of audit documentation.
- confidentiality agreements – RA may increase the risk of unauthorized access to confidential information, leading to potential breaches of contractual obligations;
- industry-specific regulations – certain sectors (e. g., pharmaceuticals, finance) may legally require on-site verification for critical processes, which cannot be fully replaced by RA.

From our perspective, a RA is a form of auditing conducted at a distance from the audit object, utilizing appropriate methods and tools for data verification while ensuring compliance with legal requirements and fulfillment of established audit criteria.

The primary difference between conventional audits and RAs is the absence of in-person, face-to-face interactions, which changes how things like walk-throughs, visual inspections, interviewing, and other audit procedures must be performed (Wiśniewska et al., 2022). This implies a fundamental shift in the psychology of auditing and necessitates appropriate preparation from both auditors and auditees. There is a significant difference between the audit process in the field and the RA. In addition to the minimal face-to-face interaction between the client and the auditor during a RA, it is necessary to analyze the audit as well as carefully prepare. Preparation in a RA is key to the success of the audit, including communication between the auditee and the auditor related to the audit implementation process, the technology used, how to send documents, audit focus, and audit completion commitments (Wilasittha, 2022).

1.2. The remote audit approach drivers

As noted earlier, two key factors have driven the intensification of RA: security/safety considerations and technological advancements. These dimensions not only shape the way audits are conducted but also determine the scope, reliability, and acceptance of remote methods in professional practice.

One of the main drivers behind the growing adoption of RA is the need to ensure security, both in terms of health and safety (H&S) as well as information protection. The COVID-19 pandemic highlighted the importance of reducing physical contact and limiting travel, which made on-site audits more challenging or, in some cases, impossible. RA offered a viable alternative that allowed organizations to maintain compliance and oversight without exposing auditors and auditees to unnecessary risks. One of the central challenges confronted by auditors amidst the pandemic is the transition to remote work environments. Auditing practices traditionally rely on physical interactions and on-site inspections, making RA a formidable task. Auditors have grappled with issues related to conducting audits remotely, including limitations in access to client facilities, difficulties in

coordinating audit teams, and challenges in maintaining effective communication channels. The transition to RA has necessitated auditors to develop new strategies and protocols to ensure the quality and reliability of audit procedures. From a theoretical perspective, the contingency theory offers insights into the adaptive responses of organizations to external disruptions (Kusuma, 2024).

Beyond physical safety, data security is a crucial element. RA often involves the exchange of sensitive documents, access to internal systems, and real-time video monitoring of processes. This raises concerns about confidentiality, data protection, and compliance with legal frameworks such as the General Data Protection Regulation (GDPR) in Europe or the Health Insurance Portability and Accountability Act (HIPAA) in the United States. Organizations must therefore establish secure communication channels, encrypted data transfers, and clearly defined access rights to mitigate risks.

Security concerns also extend beyond health crises and data protection. In regions affected by armed conflicts, terrorism, or political instability, on-site audits may pose significant risks to the safety of auditors. Travel restrictions, physical threats, and unstable environments can make traditional audits impractical or even impossible. In such contexts, RA becomes not only a practical solution but, in many cases, the only viable option to ensure organizational accountability and compliance.

In this sense, security considerations have not only motivated the adoption of RA but have also shaped its methodologies and technological requirements. Even with different types of restrictions, such as access to facilities and difficulty in physically inspecting processes, remote audits are an important initiative to ensure compliance of the systems under analysis (Barretto et al., 2022).

The second major factor contributing to the intensification of RA is the rapid development of digital technologies. RA is used when face-to-face methods are not possible, which refers to the use of ICT in gathering information, interviewing clients, and others (Ria, 2023). Over the last decade, innovations in cloud computing, high-speed internet, video conferencing platforms, and specialized audit management software have significantly improved the feasibility of conducting audits remotely. These tools enable real-time communication, document sharing, and process monitoring, which are essential for ensuring audit reliability and transparency.

RA, also known as virtual auditing, is a method of conducting an audit using modern technology to obtain audit evidence (Kljajić et al., 2022). Emerging technologies such as blockchain, artificial intelligence (AI), IoT, and virtual reality (VR) are also transforming audit practices. Blockchain can provide tamper-proof records of transactions, AI can assist in anomaly detection and data analysis, IoT devices can offer continuous monitoring of production processes, while VR technologies enable immersive remote inspections of facilities or production lines, creating a near on-site experience

for auditors. Such tools expand the scope of what can be reliably assessed without physical presence, significantly reducing the limitations traditionally associated with remote audits. IoT-based RA has emerged as a transformative technology in the audit field, their ability to enable real-time data collection and improve audit accuracy and timeliness is fulfilling the increasing demand for efficiency and effectiveness in regard to helping auditors analyze large volumes of data during remote audit (Maharani et al., 2024).

The advantages of digitizing audits are in real-time data retrieval, and also the inspection time can be faster because there is analysis and testing using technology. Nevertheless, the digitization of the audit requires the auditor to pay more attention to the validity of the information and data provided (Fadillah & Pramudyastuti, 2023).

In some cases, security concerns and digital transformation processes operate jointly, reinforcing one another. Businesses have been forced to work remotely and adopt digital technology due to the COVID-19 pandemic, whether they were willing or not. Although the audit process was already adapting due to the occurrence of emerging digital technologies, the transition to a remote, "virtual" audit has been dramatically accelerated by COVID-19 (Farcane et al., 2023). RA also appeared in the literature as an important advancement in auditing practices, distinguished by the synergy between technology and remote communication. This approach became particularly relevant during the COVID-19 pandemic, where technological resources such as video conferences, online collaboration tools, and specialized software were employed to conduct audits remotely, providing a flexible and efficient approach aligned with the needs of the digital era (Liew et al., 2022). Changes in the way auditors work due to the COVID-19 pandemic are triggering the acceleration of digital audit adoption (Yuniarta et al., 2024). The COVID-19 and post-COVID periods have created a fundamentally new reality for the implementation of business processes, accelerating the adaptation of the business environment to rapid and unavoidable changes. In this context, technological solutions have emerged as a direct response to market demand for effective mechanisms to conduct RA. The success of RA relies heavily on the state-of-the-art technology available today (Yuniarta et al., 2024).

2. Evaluation of the implementation of the remote audit approach

The RA rise has transformed traditional audit processes, leveraging technology to enhance efficiency and accessibility (Mbonigaba & Vanitha, 2019). In summary, technological development not only facilitates the transition to RA but also enhances its quality, scope, and effectiveness. Without these advancements, including cutting-edge applications such as VR, the large-scale RA implementation would not be possible. The detailed PESTLE RA Analysis of QMS is presented below in *Table 1*.

Table 1

PESTLE RA analysis of QMS

PESTLE category	Content
Political	Governments increasingly support the digitalization of oversight and compliance, which encourages wider adoption of RA methods. In politically unstable regions, RA reduces risks associated with travel and personal safety. Public sector audits (e.g., healthcare, public procurement) may face stricter rules that either limit or encourage remote modalities, depending on the regulatory culture
Economic	RA reduces costs by eliminating travel, accommodation, and logistical expenses. They allow organizations to allocate audit resources more efficiently, enabling more frequent or broader audit coverage. Economic downturns, such as during COVID-19, highlighted RA as a cost-saving alternative while still maintaining compliance. However, investments in secure digital infrastructure, staff training, and software licenses are required upfront
Social	The shift to remote work and digital collaboration has normalized virtual interactions, making RA more acceptable. Some resistance persists among employees and managers due to a lack of trust in remote methods or fear of reduced transparency. Social expectations of continuous quality, accountability, and compliance remain high, increasing pressure for RA to be as reliable as on-site ones
Technological	Advances in digital tools (video conferencing, document-sharing platforms, cloud-based QMS systems) enable practical RA execution. Emerging technologies such as AI, blockchain, IoT, and VR expand the depth and reliability of RA. Cybersecurity remains a major challenge, requiring encrypted communication and secure access controls
Legal	RA must comply with data protection and privacy regulations (e.g., GDPR, HIPAA). Legal recognition of digital signatures, electronic records, and remote verification differs across jurisdictions. Industry-specific requirements (e.g., pharmaceuticals, aviation, defense) may still mandate physical inspections in certain cases. International certification bodies (ISO, IAF) are gradually updating guidelines to formally include RA
Environmental	RA contributes to sustainability by reducing travel-related carbon emissions. Less reliance on printed documents supports paperless, environmentally friendly practices. Environmental risks such as natural disasters or pandemics further reinforce the need for resilient, remote-capable audit methods

Source: proposed by the author.

The next important aspect is ensuring the high quality of RA practice (Khorunzhak et al., 2018). Audit quality and ways to improve it have long been and remain a topic for discussion and debate in the professional environment of auditor practitioners and regulators, in scientific research by economists (Kuzyk et al., 2024). It can be stated that there are two components of quality in auditing:

- "technological", production quality of the audit, which consists in compliance by auditors with the requirements of ISO Standards, the Code of Professional Ethics, etc., when performing specific tasks;
- the final quality of the audit product – information provided by the auditor, which may be in the form of an audit report or other generalizing document, depending on the task performed (Silitonga & Hastuti, 2022; Fabiianska, 2017).

Use of big data analytics has a positive and significant effect on audit quality (Ariyanto, 2024). Technology has a positive and significant effect on the quality of audit reports, as far as IT use can improve audit quality. For instance, big data analytics allows auditors to conduct more precise risk assessments by detecting patterns and anomalies within large datasets. Simultaneously, automation tools simplify routine tasks such as data extraction and analysis, minimizing human error and saving time. This enables auditors to concentrate on complex, judgment-based activities. Predictive and prescriptive analytics offer insights beyond historical data, forecasting future trends, and recommending measures to mitigate potential risks. Data visualization tools enhance the communication of audit findings through intuitive formats such as charts and dashboards. Machine learning algorithms further increase the speed and accuracy of detecting fraudulent activities. Cloud computing provides secure, scalable storage solutions, fostering flexibility and collaboration among auditors. Overall, the integration of big data and advanced technologies in auditing results in more comprehensive, efficient, and effective processes, delivering deeper insights and greater value to the final customer.

RA provides auditors with a challenge because this is not usually done before, and still not common. Auditors who were previously accustomed to using conventional methods, such as determining samples using spreadsheets, analyzing evidence obtained directly from the field, and interacting directly with clients, must be able to adjust by understanding and utilizing technology. Therefore, auditor quality, such as professional skepticism and competence in using information technology, is important in achieving high-quality performance of RA of QMS (Zaferar et al., 2024). With a new way of working like this, there must be an adaptation for the auditor, because regardless of how the audit is conducted, whether it is a RA or an onsite audit, the auditor is still required to be able to provide good results (Ria, 2023). Professional skepticism is an attitude in which the auditor should not assume that management is dishonest, but the possibility of their being dishonest must still be considered. Professional skepticism consists of two main components, namely a questioning mind and a critical assessment of audit evidence. The auditor will believe that the client has integrity and honesty, but a questioning mind will assist the auditor in overcoming his natural bias to trust the client. Auditors with high levels of information technology utilization, professional skepticism, auditor competence, and

auditor ethics as moderating variables will result in high remote audit quality (Silitonga & Hastuti, 2022). Audit quality must be improved by professionalism in order to avoid, detect, and report fraud. This, in turn, puts pressure on auditors to speed up their own adoption of technology and computerization of audits (Yuniarta et al., 2024).

Based on the research available on this topic, it can be concluded that audit quality is directly influenced by both the level of technological development and its availability, as well as by the competence of auditors – their skills and ability to effectively utilize these technologies, particularly when verifying the audit evidence base. This factor is critical in ensuring the RA reliability of QMS.

High-quality performance of RA in QMS could be achieved by complying with the following recommendations, which are presented below in the form of a NOISE analysis in *Table 2*.

Table 2

NOISE analysis of RA of QMS

NOISE category	Content
Needs	Clear international standards and guidelines for conducting remote audits. Reliable, user-friendly technological platforms that ensure security and transparency. Training for auditors and auditees to develop digital literacy and virtual communication skills
Opportunities	Expansion of RA across global supply chains, reducing geographical barriers. Integration of advanced technologies (AI, IoT, VR) to enhance audit effectiveness. Potential for hybrid models combining remote and on-site elements for optimal efficiency. Strengthening global collaboration and knowledge-sharing among certification bodies
Improvements	Establishing standardized procedures and protocols for RA execution. Enhancing cybersecurity frameworks to prevent data leaks or unauthorized access. Developing benchmarking tools to measure the effectiveness of remote versus on-site audits. Increasing stakeholder confidence through transparency and communication
Strengths	Cost-effective and time-efficient compared to traditional audits. Increased flexibility, enabling audits even in regions affected by crises (pandemics, wars, terrorism). Supports sustainability goals by reducing travel-related environmental impacts. Facilitates faster access to global expertise without geographical limitations
Exceptions	Certain processes still require physical verification (e.g., equipment calibration, product testing). Legal or industry-specific restrictions may limit the scope of RA. Technical disruptions (poor connectivity, software failures) can hinder audit reliability. Some organizations may resist adoption due to cultural or trust-related factors

Source: proposed by the author.

In general, even in the modern context of advanced IT development, RA methods continue to present significant challenges. These challenges arise from a combination of factors and inherent limitations.

From the existing challenges, a RA is carried out, which is supported by the use of IT, so that the external auditor can complete their work effectively and efficiently. The implementation of RA affects the completeness and reliability of audit evidence so that both the auditor and the client are expected to be able to understand the use of technology in supporting the audit process being carried out (Fadillah & Pramudyastuti, 2023). The rise of RA, however, introduces unique challenges alongside its numerous benefits. It necessitates a reassessment of traditional audit methodologies to maintain quality, data security, and compliance standards in a digital environment. RA practices also call for specialized skills in handling digital audit tools and managing online communication with clients. These changes offer new opportunities for auditors to improve flexibility, productivity, and client reach, but require rigorous planning, adaptation, and understanding of best practices to address potential challenges effectively (Mbonigaba & Vanitha, 2019). Some of the barriers appear due to the new remote working environment. In the context of teleworking, a significant drawback that auditors may face is the lack of information flow. A worker in a home office does not have all the information on operations, and, as a result, they may not perceive the information accurately or fully; therefore, the auditor may not have an adequate opportunity to test their understanding (Farcane et al., 2023).

The use of remote techniques in the certification process of QMS compliant with the requirements of ISO Standards is difficult, e.g., in the case of such areas as assessment of customer location and location-specific conditions, assessment of leadership requirements, or assessment of the implementation of the main processes in the organization (Nowicki & Kafel, 2021). Limitations in the RA process include direct observation, which cannot replace the direct viewing process. On the other hand, the implications of this research for auditors can be used to see opportunities for the audit profession in the future by developing their knowledge related to IT in order to be able to survive and compete in the digital era (Yasmin et al., 2023). Another important issue is the transfer of knowledge. Learning from senior auditors is crucial for the development of junior auditors, as most audit skills are acquired on the job. However, RA limits the exposure of junior auditors to complex audit situations, reduces personal interaction, and hampers collaboration. Onboarding new employees also becomes more challenging in a remote setup (Lorentzon et al., 2024).

Based on the analyzed literature, we have developed an additional set of recommendations for the successful realization of RA of QMS, referred to as the STAIN approach, which is presented below in *Table 3*.

Table 3

STAIN framework for successful RA of QMS realization

STAIN principle	Purpose	Key implementation actions
Security	Data protection access control crisis preparedness physical security integration	Implement robust cybersecurity measures, including encrypted communication channels, secure cloud storage, and multi-factor authentication for all audit participants. Define clear access levels to sensitive data, ensuring only authorized personnel can view or manipulate audit evidence. Plan for contingencies related to pandemics, geopolitical risks, or cyber-attacks to ensure audits can continue safely without compromising information integrity. For hybrid audits, coordinate with on-site personnel to maintain security of physical records and assets while enabling remote verification
Transparency	Clear procedures documentation real-time monitoring communication	Establish standardized remote audit procedures and share them with all stakeholders in advance. Maintain comprehensive digital records of all audit activities, including evidence collection, communications, and findings. Use collaborative platforms that allow auditees and auditors to track progress, ensuring openness in the audit process. Provide regular updates and feedback throughout the audit to minimize misunderstandings and maintain trust
Accountability / Credibility	Auditor competence evidence verification independent oversight performance metrics	Ensure auditors are trained in both QMS standards and the effective use of remote technologies. Apply rigorous methods to verify the authenticity and reliability of digital audit evidence. Involve third-party verification or peer review where possible to reinforce credibility. Track key performance indicators (KPIs) such as audit completeness, error rates, and timeliness to ensure accountability
Inclusiveness	Stakeholder participation accessibility cultural awareness feedback mechanisms	Ensure all relevant stakeholders, including remote teams, are engaged in the audit process. Utilize technology platforms that are accessible to users with varying levels of digital literacy and from different geographic locations. Adapt communication styles and procedures to accommodate diverse cultural and organizational contexts. Encourage auditees to provide feedback on the audit process, helping to improve participation and overall effectiveness
Neutrality	Objectivity bias mitigation conflict of interest standardization	Maintain impartiality by adhering strictly to audit criteria, without influence from organizational hierarchies or external pressures. Train auditors to recognize and counteract unconscious bias in interpreting digital evidence or conducting interviews. Ensure auditors have no personal or financial interests that could compromise their judgment. Use standardized checklists and scoring methods to reduce subjective interpretation and enhance fairness

Source: proposed by the author.

It is admitted that RA methodology has their undoubtable advantages. RA offers advantages in this regard, as specialists can perform their tasks digitally, and they can be invited in for shorter periods at a reasonable cost. Auditors perceive themselves as more time-efficient while working remotely. They cited the elimination of travel time and the focused nature of virtual meetings as benefits (Lorentzon et al., 2024). Commonly mentioned advantages of RA are reflected in the following: time and money savings by using ICT, avoiding personal visits of remote areas, increasing the scope of audit, increased efficiency of the audit team, double-check of documents leading to more relevant evidence, increased use of ICT strengthening documentation and reporting, and the fact that logistics related to auditing are not needed anymore (Kljajić et al., 2022). The continuous integration of human and AI resources is not just a strategic advantage but an imperative necessity to consistently conduct RA at the forefront of the digital revolution (Liew et al., 2022). IT provides many conveniences in the audit process so that it can be conducted more effectively and efficiently (Zaferar et al., 2024). The innovative adoption of AI technologies allows real-time data processing and pattern learning, adding a predictive dimension to auditing. This raises important considerations around data integrity, privacy, and algorithmic fairness, prompting auditors to address the ethical implications and ensure transparency in these practices (Leocadio et al., 2025). The realization of RA, in the current context and in view of future opportunities, was considered very advantageous and a very interesting option (Barretto et al., 2022). The obvious benefit of RA is more efficient use of resources. RA techniques can save auditors' travel time and expenses while improving efficiency (Nowicki & Kafel, 2021).

The RA process has some advantages and disadvantages. However, the advantages are greater than the disadvantages, and, therefore, the organizations worldwide are embracing the RA as it is easier to maintain and less costly. It seems that RAs are the future of the auditing system, and their advantages are unquestionable. They are a far more efficient approach to the auditing process, and it is not only from the point of view of the company being audited but also from the point of view of the audit team as well. RA is gaining popularity in the auditing industry, and many businesses rely on it (Wiśniewska et al., 2022).

Conclusions

RA has emerged as a transformative approach to quality assurance, driven by the need for resilience, adaptability, and technological integration in a rapidly changing world. The traditional model of on-site audits is increasingly being complemented or replaced by remote methods that leverage digital tools to maintain oversight, ensure compliance, and uphold standards even in challenging circumstances.

The article demonstrates that RA is not merely a response to temporary disruptions but a strategic innovation that aligns with broader trends in digitalization and globalization. It offers clear benefits in terms of cost savings, operational efficiency, and environmental sustainability, while also enabling organizations to access global expertise and conduct audits across borders without logistical constraints.

The analysis demonstrates that RA can achieve a level of effectiveness and reliability comparable to traditional on-site audits when supported by appropriate technological tools, clear methodological guidance, and sufficient auditor competence. RA enhances efficiency, reduces operational costs, supports environmental sustainability, and expands access to global expertise.

At the same time, the hypothesis cannot be confirmed unconditionally. Certain QMS processes still require physical verification; legal and cybersecurity challenges persist; and variations in digital literacy and technological readiness may limit the applicability of RA. The completeness and reliability of RA evidence also depend significantly on the preparation of auditors and auditees.

Overall, the hypothesis is confirmed in its core assumption: RA is a viable and effective approach to QMS assessment. However, its success is contingent upon technological, regulatory, and organizational factors that must be addressed to ensure consistent audit quality.

Successful implementation of RA demands a rethinking of audit methodologies, the development of standardized procedures, and the cultivation of auditor competencies in digital environments. Ethical considerations, data protection, and legal compliance must be addressed to ensure the integrity and reliability of audit outcomes.

The STAIN framework proposed in the article provides a valuable model for enhancing the quality and trustworthiness of RA. By focusing on security, transparency, accountability, inclusiveness, and neutrality, organizations can build robust systems that support effective RA practices.

Ultimately, RA represents a paradigm shift in how organizations approach quality management and compliance. It reflects the growing importance of agility, innovation, and digital literacy in professional practice. As technology continues to evolve, RA will likely become a standard component of audit strategies, offering new opportunities for improvement, collaboration, and strategic oversight in the digital age.

Future research on this topic could be focused on comprehensive empirical studies based on real datasets and statistical performance indicators to evaluate the effectiveness and outcomes of RA methodology implementation within QMS.

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