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НАЦІОНАЛЬНИЙ
ТЕХНІЧНИЙ
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# ЗМІСТ/ CONTENTS

**M. Iorgachova, O. Kovalova**
Financial technologies in the development of banking activities in Ukraine's financial market....8
**М. Іоргачова, О. Ковальова**
Фінансові технології у розвитку банківської діяльності на фінансовому ринку України....8

**A. Kuchyn**
Interrelation of operational, financial, and investment activities
of an enterprise during and after the war period....25
**А. Кучин**
Взаємозв'язок операційної, фінансової та інвестиційної діяльності підприємства
у військовий період та після нього....25

**D. Umoru, B. Igbinovia, B. Odegha**
Exchange rate volatility, stock prices and returns in BRICS:
The moderating effect of inflation with wavelength analysis....38
**Д. Умору, Б. Ігбіновія, Б. Одеґа**
Коливання обмінного курсу, цін акцій та прибутковості у країнах BRICS:
модераторний вплив інфляції за допомогою аналізу хвильових довжин....38

**D. Pylypenko, N. Shevchenko, M. Pylypenko**
Economic risks of agricultural enterprises in Ukraine:
Analysis of threats and mitigation strategies to ensure financial security....58
**Д. Пилипенко, Н. Шевченко, М. Пилипенко**
Економічні ризики аграрних підприємств в Україні:
Аналіз загроз та стратегій мінімізації для гарантування фінансової безпеки....58

**T. Zubekhina, L. Matviichuk**
Methods for assessing the balanced development of entrepreneurship in the field of cultural tourism....74
**Т. Зубехіна, Л. Матвійчук**
Методи оцінювання збалансованого розвитку підприємництва у сфері культурного туризму....74

**A. Dziubynskyi, O. Pakholiuk, O. Dziubynska, O. Shehynskyi, V. Shehynskyi**
Customs policy as a tool to stimulate exports under martial law....83
**А. Дзюбинський, О. Пахолюк, О. Дзюбинська, О. Шегинський, В. Шегинський**
Митна політика як інструмент стимулювання експорту в умовах воєнного стану....83

**I.M.M. Islam**
Linking working capital efficiency to profit maximisation:
A conceptual analysis....93
**І.М.М. Ісламм**
Зв'язок ефективності управління оборотним капіталом із максимізацією прибутку:
концептуальний аналіз....93

**M. Korzh, T. Zholudenko**
Features of marketing in international pharmaceutical market in the context of digital transformation....103
**М. Корж, Т.W Жолуденко**
Особливості маркетингу на міжнародному фармацевтичному ринку в умовах цифрової трансформації....103

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# Financial technologies in the development of banking activities in Ukraine's financial market

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**Abstract.** The study of financial technology applications in banking is highly relevant, as financial technologies serve as a primary driver of change in the banking sector, facilitating the development of new products, optimising operations, and expanding access to financial services. This article aimed to examine the role of financial technologies in the development of banking activities and to identify directions for their advancement through the application of modern financial technologies. The research employed methods of analysis, synthesis, systematisation, and comparison to explore the theoretical foundations of financial technology utilisation. Grouping, tabular, and graphical methods were used to assess the current state of financial technology adoption in the banking sector, alongside abstraction and generalisation techniques. In the digital era, banks must implement innovations to maintain competitiveness. The analysis of financial technology applications has made it possible to identify current trends and potential areas of implementation in the Ukrainian banking sector, as well as to adapt decision-making processes regarding their use to the realities of the Ukrainian market, ensuring more flexible financial services for clients. It has been identified that the growing popularity of digital platforms has been accompanied by an increase in cyber risks. Therefore, the study of fintech has also contributed to ensuring cybersecurity and customer trust, with the development of effective data protection strategies emerging as a key factor in the stability of the banking system. The study also reviewed academic research confirming the relevance of financial technologies in banking, analysed the nature of fintech, its types and role in the banking sector, and assessed the state of Ukraine's fintech market. Recommendations for the development of the fintech market were proposed. The practical implementation of the recommendations provided in the study, particularly concerning the adoption of modern financial technologies such as blockchain, artificial intelligence, Big Data, and open interfaces, will enhance transparency, cybersecurity, and the adaptability of both the banking sector and the financial market of Ukraine as a whole to contemporary challenges

**Keywords:** banking system; financial services market; innovative technologies; directions for banking development; improvement of bank activities

## Introduction

From 2021 to 2024, financial technologies (fintech) have become a key driving force in the transformation of the banking sector. This is because they enable the creation of new products and services, improve the efficiency of operations, and expand access to financial resources. In the context of global digitalisation, banks face the need to

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implement innovative solutions to remain competitive. The study of fintech helps to understand current trends, assess risks and opportunities, and adapt them to the Ukrainian context. This ensures the creation of more flexible and convenient financial services for customers.

Fintech research is also important for increasing financial inclusion, which remains a relevant issue in Ukraine. Thanks to digital tools, banks can provide services remotely, which is important for rural areas, where banking infrastructure is limited. Furthermore, fintech technologies open up new opportunities for small and medium-sized businesses by providing access to alternative financial sources, such as online lending and crowdfunding.

The importance of researching financial technologies is also due to the need to ensure cybersecurity and customer trust in banking systems. The increasing popularity of online payments and digital platforms has been accompanied by an increase in the risks of fraud and cybercrime. Analysing modern technologies and their vulnerabilities has allowed the development of effective strategies for protecting customer data and financial assets, which is essential for the stability of the banking system.

Scholarly interest in the essence of the term "financial technology" has led to the emergence of various approaches to its interpretation in contemporary economic literature. This concept can be understood in both broad and narrow senses. According to R. Bezpalyi (2021), in a broad sense, financial technologies encompassed innovative solutions that find application in everyday life, business, and large-scale government programmes, facilitating their effective implementation and operation. Researchers E. Feyen *et al.* (2023) proposed a narrow definition of financial technologies, viewing them as the result of revolutionary changes in the fields of mobile internet, smartphones, and internet technologies in general. In their view, the key feature of financial technologies was the speed of their development and the dynamic expansion of their applications. Initially, they were limited to computer solutions used in the banking sector, but over time, their influence has significantly expanded, covering personal, corporate, and public finance. V. Unynets-Khodakivska (2022) noted that financial technologies were a complex of interconnected innovative solutions, including mobile networks, Big Data, cloud computing, distributed ledger technologies, artificial intelligence (AI), and data analytics. These technologies, working in synergy, form a wide range of financial operations that were transforming the industry.

Some researchers have highlighted the trend of fintech companies replacing traditional financial market participants. They defined financial technologies as technologically enabled innovations in the financial sector, capable of creating new business models, applications, processes, or products. These innovations have significantly transformed financial markets and the activities of institutions providing financial services. As researcher L. Melnyk (2024) noted, the term "financial technologies" referred to the use of modern technologies to automate, improve, and optimise financial services and operations. Fintech solutions included information technology, blockchain, AI, data analytics, mobile platforms, and other innovative tools. They contributed to the creation of new financial products, increase process efficiency, and improve the quality of customer service. Furthermore, financial technologies were used to increase the accessibility of financial services, as well as to stimulate various innovations, while strengthening competition in the financial sector.

O.M. Petruk *et al.* (2022) identified four main approaches to interpreting the concept of "financial technologies": as a technology, as an innovation and business model, as an industry, and as a service. Each of these approaches had its own advantages and justifications, but all of them were based on the latest technologies that formed the foundation of fintech. Research on the role of financial technologies in the activities of foreign banks, including Islamic banks and financial institutions, was the focus of the study by A.A.A. Rahman *et al.* (2023). The study by H. Ismanto *et al.* (2023) was dedicated to analysing the impact of financial technologies and banking system stability on credit indicators and credit availability, using the example of Indonesian state commercial banks. It was worth noting that many scientific achievements by economic scholars have been dedicated to the study of financial technologies in banking. However, given the current innovative development of financial technologies, this issue required further research.

This research aimed to investigate the role and advantages of financial technologies in the development of banking activities based on a generalisation of theoretical aspects and to identify possible directions for its development in the financial market of Ukraine through the use of modern financial technologies. To achieve this aim, the following objectives were set in the research: 1) to consider the types of financial technologies in the financial market and one of its largest segments – the banking sector; 2) to determine the significance and advantages of using financial technologies for the development of banking activities; 3) to substantiate the directions of development of financial technologies in banking activities, as a key segment of the financial market of Ukraine.

## Materials and Methods

In the process of this research, both general scientific and specialised research methods were used. When studying the theoretical foundations of the use of financial technologies in the financial market, particularly in banking, methods such as analysis and synthesis were applied; the method of comparison was used, when considering existing definitions of the term "financial technologies" by various scholars. In particular, most researchers noted the presence of an innovative

component, when considering financial technologies and their relationship to the financial market (Bezpalyi, 2021; Unynets-Khodakivska, 2022). However, other views focused on considering financial technologies as a complex system. For example, N. Demchyshak & R. Hudyma (2021), T. Staverska *et al.* (2023), and S. Viazovyi (2023) considered the field of financial technologies as a complex system that unites all financial market participants involved in ensuring its effective operation. O.M. Petruk *et al.* (2022) identified four key approaches to understanding the term "financial technologies", one of which was that financial technologies were an innovative business model. Despite the differences in interpretations, the common basis of all approaches was modern technologies, which served as the foundation of the fintech sphere.

Additionally, a system-structural method was used in the research to systematise the stages of financial technology development in the modern financial market. In the process of analysing the application of financial technologies in the Ukrainian banking system, an economic-statistical method was used to determine the proportion of financial institutions that were clients of fintech companies. Grouping, comparison, and classification methods were used in compiling a list of the main types of financial technologies in the modern global financial market and in comparing the cooperation of Ukrainian banks with fintech companies. The tabular method was used in compiling tables concerning the fintech products of individual Ukrainian banks, the use of fintech solutions in the activities of some Ukrainian banks, and the tabular presentation of the results of a comparative analysis of neobanks operating in the Ukrainian financial market. The graphical method was used to visually represent the components of financial technologies as a complex economic system, the types of payment innovations in banking, the global dynamics of transactions made using mobile wallets, and fintech funding by sector. SWOT and PEST analysis methods were conducted to identify existing prospects for the implementation of modern financial technologies in the banking activities of Ukraine. Methods of scientific abstraction and generalisation of the obtained results allowed for substantiating the prospects of using financial technologies for the development of banking activities in Ukraine.

## Results and Discussion

The rapid progress of digital technologies in various areas of the economy, business, organisational activities, and the daily lives of the population has led to the emergence and active implementation of innovations in the financial sector, known as financial technologies (fintech). A detailed periodisation of the development of the essence of financial technologies was presented in Table 1.

***Table 1.*** *Stages and features of financial technology development in the global financial market*

| Stages | Features of financial technology development | Examples |
|---|---|---|
| Initial stage (2000-2010) | This was the dawn of digital financial solutions. The internet and mobile communications began to actively integrate into the financial sector, leading to the emergence of the first online banks and electronic payment systems. Platforms like PayPal became innovative tools for convenient and fast transactions. In addition, financial institutions began to implement software solutions to automate their processes, including CRM systems, which facilitated customer relationship management | Electronic payment systems; electronic money; personal financial managers |
| Consolidation stage (2010-2015) | This period was marked by the active development of mobile applications, which made financial services accessible at any time. Peer-to-peer lending platforms emerged, offering users new ways to obtain loans and invest funds directly, without the participation of traditional financial institutions. This stage was also characterised by the emergence of contactless payment methods, such as Apple Pay, which were made possible by the development of NFC technologies. Cloud computing made financial services more scalable, flexible, and cost-effective | Mobile applications; roboadvisors; contactless payments; cloud computing; P2P platforms |
| Fintech revolution stage (2015-2020) | During this time, the world witnessed a rapid growth of fintech startups that actively attracted investment. In particular, blockchain technologies and cryptocurrencies became one of the main trends, offering decentralised solutions for financial operations. Neobanks, such as Revolut and N26, emerged, operating entirely in the digital environment, offering customers fast and simple financial services. The integration of artificial intelligence and Big Data opened up new opportunities for personalising financial products and combating fraud. In addition, regulatory automation technologies, known as RegTech, significantly simplified compliance with legal requirements | Blockchain; cryptocurrencies; AI; crowdfunding; ICOs; neobanks; analytical platforms; regulatory automation platforms |
| Active development stage (2020-present) | In this period, fintech integrated with other industries, including e-commerce, which made financial services even more accessible. Central banks began to actively develop digital currencies, such as e-CNY in China, which became a new stage in financial history. Open banking technologies expanded access to financial services for customers and businesses. Along with this, machine learning continued to improve in combating financial crimes. The development of decentralised finance, based on blockchain, also became an important trend, continuing to change the global financial ecosystem | Online banks; integration technologies; CBDC projects; decentralised financial platforms; fraud prevention technologies |

***Source:*** *based on O. Shevchenko & L. Rudych (2020), V. Unynets-Khodakivska (2022), L. Melnyk (2024)*

The data in Table 1 demonstrated that each stage of financial technology development was associated with new opportunities and innovations that have transformed the modern financial market, making it more open, convenient, and efficient. According to scholars S. Obushnyi *et al.* (2023), the key drivers of the rapid development of financial technologies included the active implementation of digital technologies, the widespread adoption of the Internet, the growth of innovative activity, increased consumer demands for convenience and speed of service delivery, as well as for the quality and reliability of information. Added to this were the dynamic development of e-commerce and the successful experience of technology companies in other sectors of the economy, which have inspired the creation of new financial solutions.

Authors O. Shevchenko & L. Rudych (2020) noted that the development of financial technologies brought several significant advantages. The ability to make payments in real-time, lower prices for consumers, and easier access to a wider range of financial services were among the main benefits. Moreover, modern financial technologies open up new opportunities for both individuals and representatives of small and medium-sized businesses in terms of access to financial resources. Their dynamic development contributed to increased competition in the market, encourages financial institutions to implement modern information technologies, and promotes the diversification of business models. Among other potential outcomes of using financial technologies in the financial sector, one can highlight improved pricing efficiency and reduced information asymmetry. At the same time, the widespread adoption of these technologies was hindered by several barriers that slow their development. The main obstacles included inadequate legislative regulation, the unpredictability of user behaviour when making decisions, and limited access for certain consumers to modern financial services due to a lack of necessary devices or the skills to use them. It was worth considering the list of the main types of financial technologies in the modern global financial market (Table 2).

***Table 2.*** *Types of financial technologies in the modern financial market*

| Category | Types |
|---|---|
| Mobile payment systems and platforms | PayPal – one of the most common platforms for online payments.<br>Apple Pay and Google Pay – mobile wallets for contactless payments.<br>Venmo – a popular platform in the USA for simple P2P transfers.<br>WeChat Pay and Alipay – leading mobile payment services in China.<br>Square – a system that provides POS solutions for small businesses |
| Technologies supporting financial services | Plaid – an API for integrating banking data with applications such as Venmo or Robinhood.<br>Stripe – solutions for processing online payments and managing business transactions.<br>Adyen – a platform that allows accepting payments through various channels (mobile, POS, online).<br>Fiserv – technological solutions for automating banking processes.<br>SAP Fioneer – systems for managing the finances of large companies |
| Blockchain and Big Data | Ethereum – a decentralised platform for creating smart contracts.<br>Ripple – technology for instant transactions between banks.<br>Chainalysis – an analytical tool for tracking transactions in the blockchain.<br>Elliptic – a transaction monitoring system for anti-money laundering (AML).<br>Cloudera – solutions for managing Big Data in the banking sector |
| Biometric technologies | Face ID (Apple) – biometric identification for access to financial applications.<br>Mastercard Identity Check – facial recognition technology for payment verification.<br>Nuance Security Suite – voice identification solutions for customer authentication.<br>BIO-key – multi-factor authentication using fingerprints.<br>EyeVerify – retina vein analysis technology for financial transaction security |
| Digital currency technologies | Bitcoin – the first and most popular cryptocurrency.<br>Tether (USDT) – a stablecoin pegged to the US dollar.<br>CBDC (Central Bank Digital Currency) – digital currencies of central banks, such as e-CNY in China.<br>Libra (Diem) – a digital currency project initiated by Meta (Facebook).<br>Binance Coin (BNB) – a cryptocurrency supporting operations on the Binance platform |
| Artificial intelligence technologies | Kensho – AI for financial market analytics.<br>Zest AI – machine learning-based credit scoring technology.<br>Kasisto – chatbots for automating customer service.<br>Darktrace – a cybersecurity system using AI to detect threats.<br>Bloomberg Terminal – uses AI to provide financial data and forecasts |

***Source:*** *based on O. Shevchenko & L. Rudych (2020), T. Staverska et al. (2023), L. Melnyk (2024)*

The pursuit of innovation and digital transformation in the financial industry was reflected in various types of financial technologies. The development of financial technologies – from payment systems and loans to blockchain and digital banks – contributed to increasing the efficiency and accessibility of financial services for different segments of users. An analysis of the research conducted by Ukrainian economists on the nature of financial technologies had identified their key characteristics:

1) they stimulate the creation of new innovative products, services, and technologies, opening up new opportunities for the market;

2) they are a key element in the formation of modern business models for both financial intermediaries and market participants, including fintech companies;

3) they are considered disruptive or radical innovations, as they change traditional financial services and transform the financial market as a whole;

4) they are the basis of financial innovations, as they are inherently innovative and determine the direction of development of the financial market.

Financial technologies can be represented as a multi-component system that integrated various spheres, including cutting-edge technologies, financial services, startups, and the infrastructure that ensured their functioning and interaction (Fig. 1). According to N. Demchyshak & R. Hudyma (2021), the financial technology market was a complex ecosystem that united all participants in the financial market involved in its functioning. Among the main participants, they highlighted fintech startups, regulatory bodies, banks, international payment systems, professional associations of bankers and financiers, and service providers. Meanwhile, according to T. Staverska *et al.* (2023), the financial technology market included financial institutions, technology companies, startups (including investors, business incubators, and accelerators), as well as end-users of financial services. Financial technologies were an innovative field that combined financial services and modern digital technologies to create efficient, accessible, and personalised financial products and services. In 2023, Ukrainian fintech companies continued to expand their target audience, changing the focus of their activities. While before 2023, the main attention was focused on large businesses, in 2023, the structure of the customer base changed (Fig. 2).

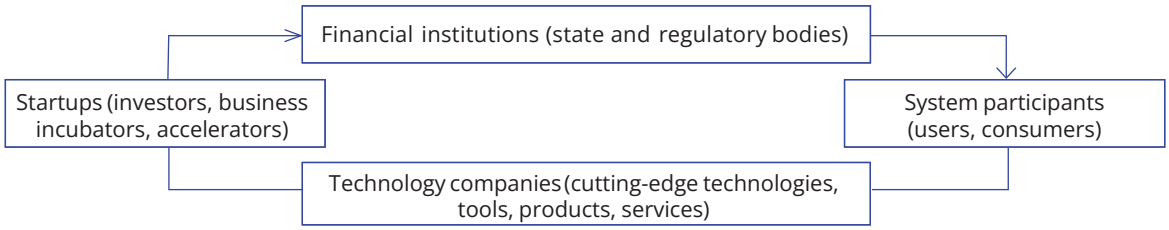


***Figure 1.*** *Financial technologies as a complex economic system*
***Source:*** *based on N. Demchyshak & R. Hudyma (2021), S. Viazovyi (2023), T. Staverska et al. (2023)*

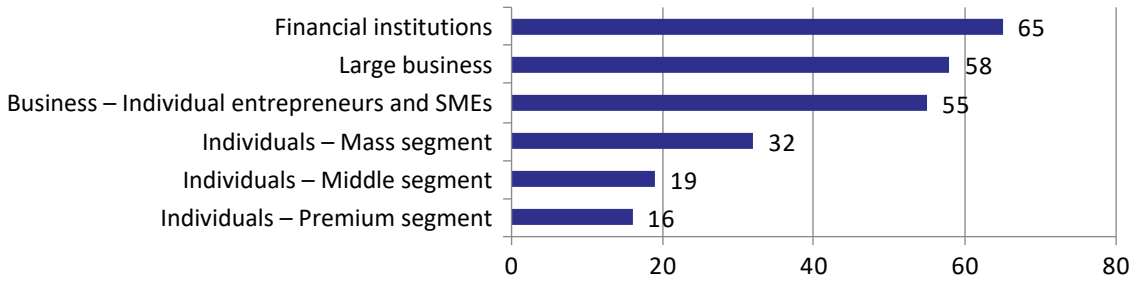


***Figure 2.*** *Target audience of Ukrainian fintech companies in 2023, %*
***Source:*** *based on Ukrainian catalogue of fintech companies 2024 (2024)*

This trend continued into early 2024. As the data showed, financial institutions remained the primary clients of Ukrainian fintech companies – this was emphasised by 65% of fintech companies. A significant proportion of clients were large businesses (58%), individual entrepreneurs and small and medium-sized businesses (55%). The individual segment was also a focus for fintech companies: 32% of companies target the mass market, 19% target the middle segment (middle class), and the smallest proportion – only a small fraction – work with the premium segment of individuals.

The National Bank of Ukraine had identified the creation of favourable conditions for the development of modern digital financial services, innovation, and the fintech industry as one of its key priorities (Strategy for the development of fintech..., 2020; Strategy for the development of the financial..., 2020). This approach was aimed at increasing the efficiency of both banking and nonbanking financial institutions, which was critical for economic growth and the post-war recovery of the country. Significant results were achieved in this direction during 2021-2023. An important step was the entry into force of the Law of Ukraine No. 1591-IX (2024), which created a basis for the qualitative transformation of the financial market. Its provisions provided an incentive for the introduction of new solutions and technologies that contributed to the development of a competitive and innovative financial ecosystem in Ukraine.

In April 2023, Ukraine transitioned to a new generation of the Electronic Payment System (EPS), which operated based on the international standard ISO 20022 and

provided the ability to conduct interbank transactions 24/7 (Implementation of ISO 20022 standard, 2023). The introduction of instant payments may lead to a reduction in the cost of cashless payments for end-users by increasing competition in the payment services market. In addition, instant payments will have several additional advantages, including:

1) reducing the costs of payment transactions, making them more accessible to the population and businesses;

2) stimulating the development of the payment services market, including the creation of innovative services by its participants;

3) promoting financial inclusion by simplifying access to financial products and services;

4) positively impacting the country's economy through GDP growth;

5) integrating into the European payment infrastructure, supporting the implementation of the EU's instant payments strategy;

6) strengthening the role of open banking and expanding its capabilities for users.

In 2023, the National Bank of Ukraine completed the development of an instant payment model based on the international standard ISO 20022 and the SEPA Instant Credit Transfer scheme (Implementation of ISO 20022 standard, 2023). This initiative was an important step in modernising Ukraine's payment infrastructure and created a foundation for a more efficient functioning of the financial market.

Analysing the impact of financial technologies on the Ukrainian banking sector, it was worth highlighting the national BankID NBU system. This tool has become a key element in expanding financial inclusion and overcoming barriers to access to financial services. The system provided instant transmission of users' personal data from banks to providers of various services, including government agencies, banks, other financial institutions, and commercial companies. Thanks to this, BankID NBU had contributed to increasing the convenience, accessibility, and speed of service for citizens and businesses.

In 2024, the BankID NBU system processed 87.7 million successful electronic identifications, compared to 42.9 million in 2023, representing a 104% (or 44.8 million transactions) increase over the 2023 figure. During this period, 22 new service provider subscribers joined the system, including 18 commercial, 3 non-commercial institutions, and 1 NBU bank identifier. The NBU made several significant adjustments to develop the BankID system. In particular, the NBU introduced separate inter-subscriber payments and standardised data sets. These innovations expanded the ability of institutions to attract new clients and provide services to existing ones through remote channels. A flexible approach to tariffs and standardisation ensured increased security of data transmission, while optimising the costs of service providers. These steps contributed to increasing the efficiency of the system's operation and stimulated its further implementation in the financial sector of Ukraine (Official website of National Bank of Ukraine, 2025).

The National Bank of Ukraine also introduced an online service that provided individuals – bank borrowers – with access to information from the Credit Registry. Clients can now obtain data on their own debt by authenticating through the BankID NBU system on a dedicated page of the regulator's official website. To enhance the convenience of interaction with subscribers, a new functionality was introduced – an automated dispute resolution system, which became available from May 2024 in the "Personal Account" of the subscriber (Official website of National Bank of Ukraine, 2025).

Considering the main aspects of fintech companies' policies in collaboration with banks, the following key areas were identified:

1. Fintech in lending (providing loans for small and medium-sized businesses, project financing, mortgage programmes, consumer loans, credit cards).

2. Support for banks through fintech services (intermediary services in lending, including application processing and verification, underwriting, credit scoring, servicing, and debt collection, BaaS (Banking as a Service) solutions, credit risk management; as well as intermediation in deposit operations, including customer acquisition (onboarding), identity verification (including KYC (Know Your Customer) and AML (Anti-Money Laundering)/CFT (Countering the Financing of Terrorism)), use of BaaS solutions).

3. Fintech in deposit attraction (accepting deposits, developing savings products and digital "wallet" tools, personal finance management, providing P2P payments).

As a result of analysing the state of banking business in Ukraine for the period 2021-2024, it was determined that financial institutions primarily focused on improving their IT systems. The main priorities were ensuring reliable protection of customer and bank data from cyberattacks, as well as reducing operating costs. The implementation of other fintech solutions was secondary. At the same time, a significant number of Ukrainian banks were already actively cooperating with fintech companies or planning such partnerships in the future. This interaction allowed financial institutions not only to reduce investment costs, but also to reduce the risks associated with the development and implementation of new technological solutions.

All respondent banks either collaborated on fintech projects or were ready to start them, according to a study conducted by the National Bank of Ukraine and the Ukrainian Financial Technology Association on the level of cooperation between Ukrainian banks and companies operating in the field of financial technologies (Table 3).

***Table 3.*** *Cooperation of Ukrainian banks with fintech companies*

| Bank | Joint projects | | | Development of own investment projects | | | Own incubation/ acceleration | | | Investments in startups | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | Planned | Yes | No | Planned | Yes | No | Planned | Yes | No | Planned | Yes |
| PrivatBank | + | | | | | + | | + | | + | | |
| Oschadbank | | | + | | + | | + | | | + | | |
| Ukrgasbank | | | + | | | + | + | | | + | | |
| Raiffeisen Bank Aval | | | + | | | + | | + | | + | | |
| Alfa Bank | | | + | | | + | + | | | + | | |
| UkrSibBank | | | + | + | + | | | | + | + | | |
| PUMB | | | + | | | + | + | | | + | | |
| Credit Agricole | | + | | | | + | | + | | + | | |
| OTP Bank | | | + | | + | | | | + | + | | |
| Tascombank | | + | | | | + | + | | | + | | |
| MegaBank | | | + | | | + | + | | | + | | |

***Source:*** *based on Ya. Drobotya et al. (2021), Ukrainian catalogue of fintech companies 2024 (2024), Official website of National Bank of Ukraine (2025)*

Typically, banks prefer joint projects instead of creating their own innovation centres, although this strategy was also present in the market. It was worth emphasising that 63% of projects were financed by banks from their own resources, and all of them had already reached the break-even point. The listed banks had their own acceleration programmes, such as Alfa Digital, POPCORP, Raiffeisen Digital HUB, Open Banking Lab, and were actively working on the development of banking fintech products, including Airpay, IPay, LigPAY, QR-PAYMENTS, Privat24, Chatbot "Online Assistant", Oshchad PAY, Oshchad 24/7, Aifa-mobile, PUMB online, PUMB mobile, UKRSIB online, Raiffeisen Pay, Raiffeisen Online, OTP Smart. The structure of the most wellknown fintech solutions of Ukrainian banks was shown in Table 4.

***Table 4.*** *Fintech products of individual Ukrainian banks*

| Bank | Banking fintech products |
|---|---|
| PrivatBank | Applications Privat24, Privat24 for Business, LiqPay terminal, PrivatPay, FacePay24, QR codes, PrivatMoney |
| Monobank | Application Monobank, Monopay, Mono terminal, QR codes, Market |
| Raiffeisen Bank Aval | Terminal in smartphone, Raiffeisen Business Online, Pay by link |
| Oschadbank | Chatbot "Online Assistant", Oshchad PAY, Oshchad 24/7 |
| Ukrgasbank | Welsend, EcoBank |

***Source:*** *based on the Official website of National Bank of Ukraine (2025)*

PrivatBank was one of the first Ukrainian banks to begin integrating fintech technologies into its operations, and it was considered one of the most innovative banks in the world. Its mobile application, Privat24, offered a wide range of services for individuals, including transfers between Visa and Mastercard cards, including international transfers; mobile phone top-ups; utility bill payments; account and card management; opening deposits and obtaining loans; insurance policy issuance; budget planning; automatic payments; searching and paying for tickets for various modes of transport (trains, planes, buses, city transport); cash ordering; generating certificates, checking credit ratings; a "Piggy Bank" function for savings (Official website of PrivatBank, 2025).

In turn, the "Privat24 for Business" application offered a range of useful functions that significantly simplify entrepreneurial activity. Among them were the "Charity" widget, which allowed support for the Ukrainian army; access to the "Terminal" application, which turned a smartphone into a POS terminal; SmartID – free cloud-based KEP (Qualified Electronic Signature) keys for quick and secure signing of electronic documents; a payroll project that allowed employees to be paid at preferential rates through the application; electronic reporting – creating and submitting reports and tax returns to regulatory authorities; business reputation dossier – a tool for checking companies and assessing cooperation risks. Additionally, "Privat24 for Business" offered many other functions that simplified the interaction of enterprises with banks, customers, and government agencies (Official website of PrivatBank, 2025).

One of PrivatBank's innovative developments was LiqPay – an in-house payment system that significantly simplified online transactions for individuals and legal entities. It supported a wide range of payment methods, including card data entry, FacePay24 – payment confirmation through facial scanning, PrivatPay – payment via transaction confirmation in Privat24, integration with

Google Pay and Apple Pay, payment using a QR code, and the "Payment in Parts" service. In addition, the bank offered the international payment system PrivatMoney, which allowed money transfers not only within Ukraine, but also abroad. PrivatBank was also working on the implementation of cutting-edge technologies, such as a behavioural biometrics system that will analyse about 300 parameters, and the "Shops and Filling Stations Instead of ATMs" programme. Thanks to innovations and adaptation to the challenges of wartime, PrivatBank was actively expanding its operations in Europe. Moreover, this bank was instrumental in launching and popularising Apple Pay in Ukraine (Official website of PrivatBank, 2025). It was worth noting that Monobank also offered various payment methods for businesses, including Google Pay and Apple Pay; QR code scanning; manual entry of details; NFC payment; the "Terminal by mono" application, which allowed not only to accept payments, but also to create daily sales statistics. However, this service had one significant drawback – it was only available to users of the Android operating system (Official website of Monobank, 2025).

Raiffeisen Bank Aval, similar to Monobank, also provided mobile applications for individuals and businesses. In addition to standard functionality, the mobile application for individuals offered: deposits with increased interest rates; and cashback in certain categories. For businesses, the application was undergoing updates, and several useful functions had already been added. Agreements on the stock market; a payroll project; monitoring of SWIFT transfers; official correspondence with the bank and other services had been added. Raiffeisen Bank Aval, like Monobank, offered the "terminal in smartphone" function. This required a mobile application, an open account with the bank, and a smartphone with Android OS. The bank also offered the Pay by Link service, which allowed the creation of QR codes or links for online invoice payments. This provided a simple and fast way to accept card payments over the Internet (Official website of Raiffeisen Bank, 2025).

Oschadbank, as one of Ukraine's state-owned banks, offered its customers a range of useful functions through its mobile application. Among its capabilities were: income and expense analysis with categorisation, which helped manage finances more effectively; online currency exchange, which allowed for convenient currency conversion without visiting a branch; biometric customer identification to ensure transaction security; and the creation of templates for recurring payments, which saved time. For businesses, Oschadbank offered the CorpLight platform, which provided all the basic functions for managing business accounts. This solution allowed for online financial transactions, making business management more convenient and efficient. One of the bank's unique developments was the My Transfer payment system, which provided fast money transfers. To use this service, customers must: visit an Oschadbank branch or My Transfer point, confirm their identity with a document, deposit the required amount, and receive a transfer control number via SMS (Official website of Oschadbank, 2025).

Ukrgasbank, although not always associated with innovation or readiness for bold fintech solutions, offers unique ideas for Ukraine, particularly in the field of eco-banking. The bank actively promoted the concept of eco-banking through its mobile application "Eco-Bank", which, in addition to standard services, offered: lending and investment in environmental projects; special conditions and rates for eco-loans. This solution was important not only for increasing the bank's revenues, but also for contributing to environmental protection and supporting the sustainable development of society. Ukrgasbank had its own payment system, Welsend, which allowed transfers both within Ukraine and abroad. Transfers were available in currencies such as UAH, USD, and EUR, providing convenience and flexibility for customers (Official website of Ukrgasbank, 2025). An analysis comparing the use of fintech solutions in the activities of Ukrainian banks was presented in Table 5.

***Table 5.*** *Use of fintech solutions in the activities of some Ukrainian banks*

| Bank | Application for individuals | Application for legal entities | Payment system | Payment service | Acquiring |
|---|---|---|---|---|---|
| PrivatBank | ✓ | ✓ | ✓ | ✓ | ✓ |
| Monobank | ✓ | – | – | ✓ | ✓ |
| Raiffeisen Bank Aval | ✓ | ✓ | – | – | ✓ |
| Oschadbank | ✓ | ✓ | ✓ | – | ✓ |
| Ukrgasbank | ✓ | – | ✓ | – | ✓ |

***Source:*** *based on Official website of National Bank of Ukraine (2025)*

After analysing the progress of financial technology implementation in leading Ukrainian banks, it can be concluded that PrivatBank was the most innovative and technologically advanced. The second position was held by the state-owned bank, Oschadbank. Following them were Monobank, Raiffeisen Bank, and Ukrgasbank. Notably, Monobank was distinguished by the most user-friendly mobile application for individuals, Raiffeisen Bank by its business tools, and Ukrgasbank by its active promotion and accessibility of eco-loans.

Analysing the 2024 data, the following key trends in the development of financial technologies in the Ukrainian banking sector can be identified:

1. Expansion of electronic channels for providing banking services, such as internet banking and mobile banking.

2. Contactless payments, both using contactless cards and smartphones and other NFC devices, were driven by the security, speed, and convenience of such transactions. Contactless payment has become an important financial innovation, the popularity of which has grown due to significant consumer demand. By the end of 2023, the market demonstrated the following indicators: the number of retail POS terminals increased to 449.5 thousand units, which was 25.5% more than in 2022; sales pointed that accept payment cards reached 459.7 thousand units, an increase of 44.9% compared to 2022; the number of ATMs was 15.8 thousand units, which was 1.1% more than in 2022; the total number of issued payment cards reached 1.151 billion units, exceeding the 2022 figure by 5%; the number of active payment cards reached 52.1 million units, which was 1.4% more than in 2023; the number of contactless payment cards reached 30.6 million units, which was 19% more than in 2022; the number of tokenised payment cards increased to 12.4 million units, which was 45% more than in 2022 (Official website of National Bank of Ukraine, 2025). As for 2024, this trend continued. The number of active POS terminals in the retail network in September 2024 increased by 8.6% compared to January (to 487.4 thousand units), and the number of points accepting payment cards increased by 10.9% (to 512.1 thousand units). The number of ATMs decreased by 1% to 15.8 thousand units. The total number of issued payment cards in the nine months of 2024 reached 122.1 million units, which was 6% more than in January 2024. The number of active cards used for expenditure operations increased by 5% – from 51.6 million to 54.1 million. The number of contactless cards increased by 9% during this period, accounting for 61.4% of all active cards. The popularity of tokenised cards also grew: their number has risen by 19% since the beginning of 2024 (to 14.9 million units), and they accounted for almost 28% of the total number of active cards. The share of contactless transactions continued to grow, reaching 94.2% by value and 95.3% by the number of transactions in the nine months of 2024. 4.23 billion transactions were made for 1349.1 billion UAH, which was significantly more than in the same period in 2023 (3.28 billion transactions for 1032.9 billion UAH). These figures indicated the rapid development of infrastructure and the growing popularity of contactless payments in Ukraine (Official website of National Bank of Ukraine, 2025).

3. Biometric identification. Among the most advanced customer identification technologies in Ukraine were: the use of fingerprints for transaction confirmation in the "Oschad 24/7" mobile application; and facial recognition through PrivatBank's FacePay24 service. These technologies were being integrated into tablets and smartphones, meeting user expectations and EU requirements for ensuring reliable identification. Their implementation contributed to increasing the security of financial transactions and ease of use.

4. Virtual internet banking technology (neobanks). Neobanks were modern banking platforms that, in terms of functionality, are not inferior to traditional financial institutions, but allowed savings on costs due to the absence of physical branches. In 2021, two new neobanks appeared on the Ukrainian market: NeoBank and Bank Vlasnyi rakhunok, and izibank exited beta testing. In addition, several banks offered their own online platforms for remote customer service, including Oschad 24/7, Privat24, iPUMB, and UniCredit Online. A comparative analysis of neobanks operating in the financial market of Ukraine was presented in Table 6.

***Table 6.*** *Comparative analysis of neobanks operating in the financial market of Ukraine*

| Financial service | NeoBank | Sportbank | Monobank | Izibank | Bank Vlasnyi rakhunok | Todobank |
|---|---|---|---|---|---|---|
| Virtual card | ✓ | – | – | ✓ | ✓ | – |
| Credit line | ✓ | ✓ | – | ✓ | – | – |
| Foreign currency account | ✓ | – | – | ✓ | ✓ | ✓ |
| Deposit | ✓ | ✓ | – | ✓ | ✓ | – |
| Expense analytics | – | – | – | ✓ | ✓ | – |
| Non-personalised cashback | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Personalised cashback | – | ✓ | – | ✓ | – | – |
| Ability to add a card from another bank | ✓ | – | ✓ | – | – | ✓ |
| Additional non-banking services | – | – | – | – | ✓ | – |
| In-app support service | – | – | – | ✓ | ✓ | ✓ |

***Source:*** *based on O. Shevchenko & L. Rudych (2020)*

According to the data in Table 6, Monobank was the leader among neobanks in terms of product diversity. Its product line included: offers for individual entrepreneurs (IEs), premium products, children's cards, the ability to buy or sell stocks, and an instalment payment function. In addition to expanding its product range, Monobank

actively invested in its own infrastructure: it launched its own acquiring service and developed unique ATMs, which strengthened its independence and functionality. NeoBank also implemented several similar products in its mobile applications, while making a clear division by service areas. NeoBank for All was aimed at individuals, and NeoBank for Business offered specialised services for IEs. In the ranking of neobanks in Ukraine by the number of activated cards and the level of mobile application functionality development, Sportbank took second place. This bank actively increased its customer base and developed digital capabilities.

SWOT analysis has become a tool for strategic planning, allowing for the assessment of strengths, weaknesses, opportunities, and threats that affect the development of a particular sector or activity. In the context of banking in Ukraine, the application of financial technologies has become an important aspect of financial market transformation, as the digitalisation of banking services has contributed to increased efficiency, accessibility, and competitiveness. Conducting a SWOT analysis has made it possible to comprehensively assess the key factors that shape the potential and challenges of fintech in the banking sector (Table 7).

***Table 7.*** *SWOT analysis of the application of financial technologies in banking in Ukraine*

| **Strengths** | **Weaknesses** |
|---|---|
| 1. Rapid implementation of innovations due to the openness of the market to fintech.<br>2. Growing popularity of digital banking services among the population.<br>3. State support in the development of the digital economy (Diia, Cashless).<br>4. Availability of qualified IT specialists in the country.<br>5. Growing investor interest in the Ukrainian fintech market | 1. Instability of the financial system due to the economic situation.<br>2. Low level of financial literacy among some customers.<br>3. High level of cyber threats and imperfect data protection systems.<br>4. Insufficient integration of banking systems with modern technologies.<br>5. Limited access to international funding due to military risks |
| **Opportunities** | **Threats** |
| 1. Integration with international payment systems and expansion of service exports.<br>2. Development of Open Banking and APIs for interaction between banks and fintech.<br>3. Implementation of artificial intelligence and Big Data for customer analysis.<br>4. Attracting new customer segments through personalised services.<br>5. Using blockchain to increase transaction transparency | 1. Increased competition from international fintech companies.<br>2. Economic instability due to military actions and political factors.<br>3. Regulatory restrictions on the implementation of new technologies.<br>4. Loss of customer confidence in the event of data security breaches.<br>5. Disruptions in the operation of critical systems due to cyberattacks |

***Source:*** *compiled by the authors*

Thus, based on the results of the SWOT analysis, the following conclusions can be drawn regarding development potential: Ukraine has significant potential for the development of financial technologies thanks to qualified personnel, state support, and demand for digital services. Integration with international systems and the implementation of cutting-edge technologies, such as AI, Big Data, and blockchain, can make the banking sector more competitive. Among the main challenges were economic instability, cyber threats, low financial literacy, and potential regulatory barriers. It was necessary to ensure the stability of the data protection system and increase customer confidence. To maximise the benefits of fintech, focus should be placed on adapting new technologies, actively educating customers, integrating with global markets, and improving cybersecurity. At the same time, it was important to actively work on stabilising the domestic economic environment and attracting investment.

The PEST analysis of financial technologies focused on the study of the macroeconomic environment in which the banking system of Ukraine operates. The political aspect considered legislative support for digitalisation, regulatory constraints, and the impact of military actions on economic stability. The economic factor analysed the inflation rate, the availability of foreign investment, and the influence of international financial markets. The social aspect covered the shift in consumer behaviour towards digital solutions and the growing demand for innovative banking products. The technological factor examined the development of Big Data, blockchain technologies, and artificial intelligence, which contributed to increasing the efficiency of financial services (Table 8).

***Table 8.*** *PEST analysis of the application of financial technologies in banking in Ukraine*

| **Factor** | **Indicators** |
|---|---|
| Political | 1. State support for digital transformation (initiatives such as Diia, the Cashless programme).<br>2. Legislative framework for fintech development (including Open Banking and electronic payment regulation).<br>3. Impact of military actions on economic stability and banking infrastructure.<br>4. Tax policy regarding digital services and international investments |

*Table 8, Continued*

| Factor | Indicators |
|---|---|
| Economic | 1. High inflation rate affecting the purchasing power of the population.<br>2. Limited access to international financial markets due to political risks.<br>3. Demand for digital services due to the growth of cashless payments.<br>4. Potential for attracting foreign investment in the Ukrainian fintech sector |
| Social | 1. Spread of digital technologies among the population and the growth of smartphone usage.<br>2. Low level of financial literacy in some regions.<br>3. Growing demand for remote banking services, especially among the younger generation.<br>4. Positive perception of innovative services, such as digital wallets and mobile banking |
| Technological | 1. Rapid development of artificial intelligence, Big Data, blockchain, and cybersecurity technologies.<br>2. Availability of highly qualified IT specialists in Ukraine.<br>3. Integration of Ukrainian banks with international payment systems (Visa, Mastercard).<br>4. Insufficient investment in cybersecurity infrastructure |

***Source:*** *compiled by the authors*

The PEST analysis of the application of financial technologies in Ukraine's banking sector led to the following conclusions:

1. Ukraine has demonstrated state support for digitalisation, which has created a favourable environment for fintech development. However, military risks and an unstable political situation have limited the full realisation of potential.

2. Economic conditions have created both challenges (inflation, and access to international capital) and opportunities (growing demand for cashless payments). It is necessary to attract investment for the stable development of fintech.

3. Social trends, such as the digitalisation of society and the popularity of mobile banking, have supported the development of fintech. At the same time, low financial literacy in some regions remains a significant obstacle.

4. Ukraine has significant technological potential thanks to a developed IT sector. However, infrastructural constraints, particularly in the field of cybersecurity, need to be addressed to ensure consumer confidence.

According to the SWOT and PEST analyses, existing opportunities for the integration of financial technologies into the Ukrainian banking system were explored, but there were also significant obstacles that needed to be addressed, including stabilising the political and economic landscape, increasing the financial literacy of the population, and developing technological infrastructure. In 2023, EY Global Financial Services Markets conducted a study to analyse fintech development trends and identify key funding sectors (Fig. 3). This analysis showed that the banking industry received the most funding in all markets studied. In China, with 92%, the highest percentage of fintech investment was in the banking sector.

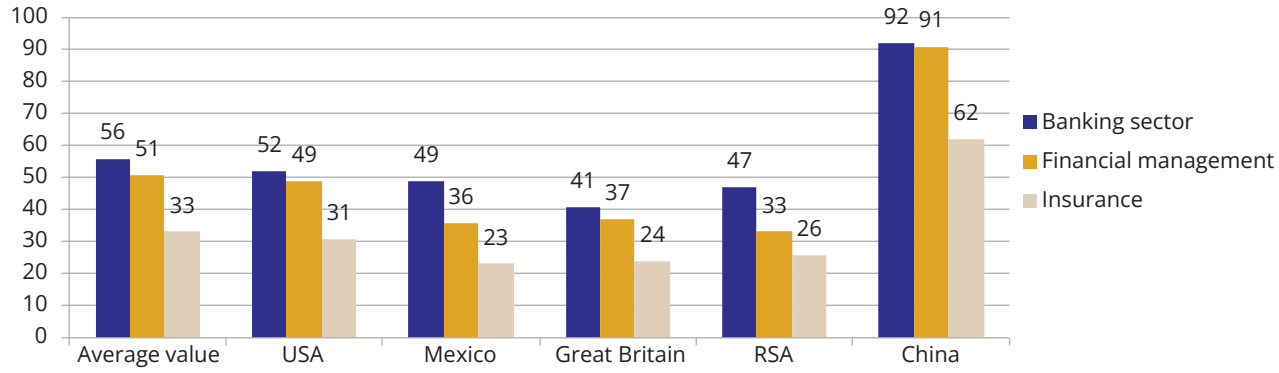


***Figure 3.*** *Fintech funding by sector in 2023, %*

***Source:*** *compiled by the authors based on E. Feyen et al. (2023)*

In the third quarter of 2024, the total amount of financial investments in the field of financial technologies reached 7.3 billion USD, which was 25% less than in the previous quarter of 2024 (Fintech trends 2025, 2025). Financial technologies in banking covered a wide range of innovative solutions that contributed to the automation, simplification, and improvement of the quality of financial services. AI and machine learning (ML) have become some of the most important innovative technologies in modern banking. Throughout 2023-2024, banks around the world actively implemented strategic approaches to the use of AI, which opened up significant prospects for its widespread application in this industry. According to forecasts from independent research, the implementation of AI can significantly optimise the operational activities of banks, allowing them to reduce their operating costs by approximately 22% by 2030 (Chui *et al.*, 2023). This highlighted the

importance of AI as a tool for increasing the efficiency and competitiveness of banking institutions on a global scale. Other important types of financial technology in modern banking included payment innovations, which included several elements (Fig. 4). Traditional physical wallets had been largely replaced by mobile wallets. These digital tools had significantly increased their audience and gained popularity as they allowed users to store and use credit cards, loyalty cards, and other payment instruments (Fig. 5).

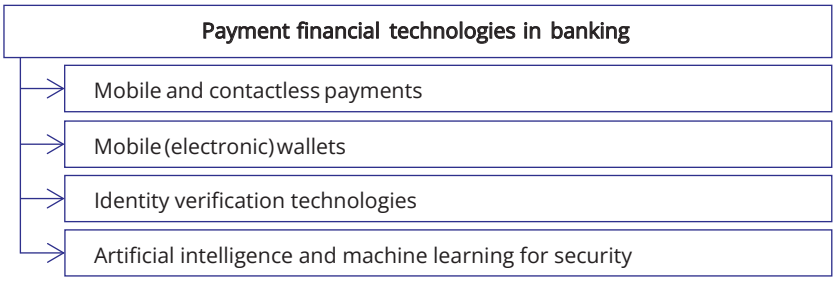


***Figure 4.*** *Types of payment innovations in banking*
***Source:*** *based on P.D. Nagorny (2020), N.O. Krykhivska et al. (2021), V. Matei & A. Buz (2022)*

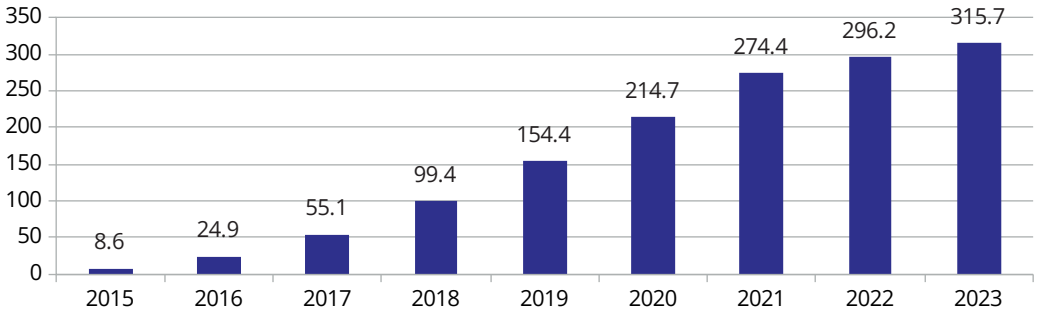


***Figure 5.*** *Global dynamics of transactions made using mobile wallets, billion USD*
***Source:*** *based on E. Feyen et al. (2023)*

The use of cloud technologies was another technology that had become increasingly popular. This was a set of information solutions that offered virtualised online access to computing power, including data processing, storage, and network resources. By using cloud platforms, customers can access the resources they need when they need them, eliminating the need to develop and manage their own physical servers and infrastructure. To increase operational efficiency and improve the quality of customer service, banking institutions were actively implementing these technologies into their operations. Cloud technologies offered several key advantages that make them indispensable for modern banking institutions:

1. Data storage and infrastructure access. By migrating their data and systems to the cloud environment, banks significantly reduce the costs of purchasing and maintaining equipment. Cloud platforms provide enhanced infrastructure reliability, allowing customers to access financial services quickly, at any time, and from any device, regardless of location.

2. Data analytics and processing. Cloud service providers offer powerful analytical tools for working with large volumes of information. This enables banks to more effectively analyse risks, optimise business processes, and improve decision-making mechanisms.

3. Cybersecurity. Cloud providers offer comprehensive solutions for protecting data and systems from cybercrime threats. These measures include real-time system monitoring, threat detection, the use of encryption to protect data, and other tools aimed at preventing and mitigating the effects of cyberattacks (Kondratska & Duma, 2023).

One of the modern financial technologies that was finding increased application in the banking sector was open banking. This was an innovative approach that enabled cooperation between banks, third-party companies, and technology solution providers, creating integrated networks for data exchange. Open banking allowed for the secure transfer of customers' financial information with their consent. For example, this could be data on spending, payment habits, or financial preferences. Through the use of API (application programming interface) and AI technologies, third-party services can access customers' banking and financial data, which enabled effective financial management, the creation of personalised services, and the improvement of customer experience (Dovhan & Halitseiska, 2021).

Open banking technology opened up opportunities for creating innovative financial products and services, including personalised payments, budget management, comparison of financial offers, optimisation of risk allocation, and other solutions. Within this technology, APIs played a critical role, ensuring the transmission of commands to third-party providers. APIs were also the basis for the functioning of the Banking-as-a-Service (BaaS) concept, which had become an important element of open banking. BaaS involved an end-to-end process of integrating fintech companies and other businesses with banking systems via APIs. This approach allowed third-party organisations to provide banking services to customers using the infrastructure of financial institutions, which contributed to accelerating innovation in the financial sector and expanding the availability of services (Bezpalyi, 2021). BaaS enabled companies without a banking licence to access a wide range of banking services. This included opening accounts, processing payments, lending, storing funds, and other financial transactions, without the need to develop their own banking infrastructure or obtain a licence. Instead, companies integrated with existing banking systems using open APIs. Open banking technology was gaining popularity at an extraordinary pace, and the number of its users was constantly growing. The largest growth had been observed in Europe, as well as in the Far East and China. The active use of open banking in these regions had created favourable conditions for the further development of the technology, expanding its capabilities, and improving its functionality.

Microservices were another important element of modern financial technologies that were actively used in banking. Their main idea was to provide high flexibility for the implementation of fintech solutions, which contributed to the creation of innovative and advanced technologies. This flexibility allowed the banking sector to quickly adapt to competitive conditions and dynamic market changes. Microservices allowed for the development of independent, modular applications, each of which can be specifically configured to solve individual tasks and meet the unique needs of the banking business. This approach increased efficiency, ensured scalability, and allowed for rapid response to new challenges.

Traditional monolithic banking systems were built on a single code base to create a single module. Due to the high interdependence of components, any change in the system required significant changes to the entire architecture. This had made such systems obsolete in the modern financial industry, where individual and adaptive technological solutions had become increasingly important. The integration of microservices had solved these problems, providing a significant impact on the business results of banks. It had allowed for: increasing employee motivation by engaging them in innovative projects; increasing the productivity of business processes through flexibility and automation; accelerating the launch of new products on the market by reducing development and implementation time; reducing the number of defects in products and services by improving their quality and reliability. Thus, microservices have become a key element for modernising banking platforms and increasing their competitiveness (Dovhan & Halitseiska, 2021).

Based on the research results, the main types of existing modern financial technologies that can be used in the banking activities of Ukraine had been systematised (Table 9).

***Table 9.*** *Key types of financial technologies for the development of banking activities in Ukraine*

| Category | Types |
|---|---|
| Payment technologies (aimed at automating and accelerating payment processes) | 1. Mobile payments and electronic wallets: Apple Pay, Google Pay, PayPal.<br>2. Cryptocurrencies and blockchain payments: enabling fast, intermediary-free transactions.<br>3. Biometric payment authentication: using fingerprints, facial or voice recognition for payments.<br>4. Instant interbank transfers: using API technologies for fast and secure operations |
| Credit technologies (innovations that facilitate the loan acquisition process) | 1. Digital lending platforms: automated services that assess customer creditworthiness based on algorithms and artificial intelligence.<br>2. Peer-to-peer lending (P2P): allowing individuals or small businesses to obtain loans directly from investors through online platforms.<br>3. Data analysis for scoring: using Big Data for rapid risk assessment |
| Investment and analytical technologies (helping customers manage their finances effectively) | 1. Robo-advisors: automated platforms that offer investment advice based on algorithms.<br>2. Intelligent capital management systems: automating financial planning and portfolio analysis.<br>3. Market forecasting technologies: based on artificial intelligence and machine learning for analysing market trends |
| Data protection and cybersecurity technologies (for safeguarding financial transactions) | 1. Blockchain for data storage: a decentralised system that ensures transaction security.<br>2. AI in fraud prevention: real-time detection of suspicious transactions.<br>3. Multi-factor authentication: enhancing security through multiple verification methods |
| Personalisation and customer service technologies (aimed at improving customer experience) | 1. Chatbots and virtual assistants: AI-powered automated support systems.<br>2. Omnichannel platforms: integrating various communication channels for seamless customer service.<br>3. Personalised offers: recommendations for financial products based on customer behaviour analysis |

*Table 9, Continued*

| Category | Types |
|---|---|
| Asset management innovations (solutions that simplify asset management for banks and customers) | 1. Smart contracts technology: automatic execution of agreement terms via blockchain.<br>2. Integrated financial management platforms: centralised management of accounts, expenses, and investments.<br>3. Risk forecasting tools: used to mitigate asset management risks |
| Open banking (allows customers to use financial services through third-party apps via APIs) | 1. Account aggregation: access to accounts from various banks through a single app.<br>2. Financial analysis platforms: real-time monitoring of expenses and income.<br>3. Fintech integration technologies: enabling cooperation between banks and financial start-ups |

***Source:*** *based on R. Bezpalyi (2021), Yu.S. Khudolii & M.O. Khalievina (2021), N. Kondratska & V. Duma (2023)*

The significance of financial technologies for the development of banking activities had only intensified over time. Financial technologies have played a key role in transforming banking operations, providing innovative approaches to service delivery, risk management, and operational improvement. In this context, the need arose for an in-depth analysis of the significance of financial technologies in the development of the banking sector. Based on the results of the research, the main aspects and advantages that confirmed the important role of financial technologies in the development of banking activities were formulated (Table 10).

***Table 10.*** *Advantages of financial technologies for the development of banking activities*

| Indicator | Characteristics |
|---|---|
| Increased efficiency of banking operations | Financial technologies allow banks to automate a range of routine processes, such as payment processing, loan management, and account opening. This significantly reduces the time and costs of performing these operations. For example, the use of robotic process automation (RPA) allows for faster processing of documents, while cloud technologies contribute to scaling banking services |
| Improved customer experience | Fintech technologies contribute to the creation of personalised and convenient financial products. Online banking and mobile applications allow customers to access their accounts, make transfers, or pay for services at any time and from any location. The integration of artificial intelligence allows for analysing customer behaviour and offering products that best meet their needs |
| Expanded access to financial services | Thanks to fintech, banks can serve customers even in remote regions where there are no physical branches. For example, digital banks, or neobanks, such as Monzo or Revolut, operate entirely online, providing a wide range of services through mobile platforms. This promotes financial inclusion and provides access to banking services for a wider audience |
| Optimisation of risk management | Fintech helps banks manage risks more effectively through the use of Big Data and analytics. For example, AI and ML allow for predicting customer creditworthiness and determining the probability of default. Fraud detection systems analyse transactions in real time, quickly identifying suspicious operations |
| Improvement of regulatory compliance | Fintech also contributes to banks' compliance with regulatory norms through RegTech technologies. These solutions automate the processes of monitoring compliance with legal requirements, for example, in the field of anti-money laundering (AML) or combating the financing of terrorism (CFT). This reduces the risk of fines and improves the reputation of banks |
| Cost reduction and increased competitiveness | Innovative financial solutions allow banks to reduce the costs of customer service, infrastructure development, and regulatory compliance. For example, the use of blockchain technologies reduces the cost of transactions and speeds up their processing. Thanks to this, banks can reduce the cost of their services and remain competitive in the market |
| Development of new business models | Financial technologies stimulate banks to introduce new business models, such as open banking. It allows third-party fintech companies to use bank APIs to create new products that expand the range of financial services for customers |
| Integration with other industries | Thanks to fintech, banks are becoming important players in other areas, such as e-commerce or insurance. For example, banking applications now integrate services for purchasing insurance policies or booking travel, which provides additional sources of income |

***Source:*** *based on Yu.S. Khudolii & M.O. Khalievina (2021), N. Kondratska & V. Duma (2023), T. Staverska et al. (2023)*

Scientists N. Kondratska & V. Duma (2023) identified several key factors that contributed to the development of financial technologies in global banking. These include: a decline in trust in the traditional banking sector, caused by the consequences of the global financial crisis; the widespread adoption of mobile internet and the growing popularity of social networks; the successful activities of technology companies in other sectors of the economy; rising consumer expectations regarding the quality of financial services and the desire to implement innovative solutions. In general, as the scientists noted, financial technologies have created new opportunities for innovation, increased competition, and improved financial services. They have become a key driver of the digital transformation of the banking sector, contributing to the development of convenience, efficiency, and personalisation of customer service. M. Ihnatenko *et al.* (2022) noted that cryptocurrencies, their market, circulation, and mechanisms of use are an independent segment of the financial system, which was capable of accelerating business processes in many areas.

Yu.S. Khudolii & M.O. Khalievina (2021) and O. Nakonechna & O. Mykhaylyk (2022) emphasised that in modern banking, the use of financial technologies has become not a competitive advantage, but a mandatory condition. This encompassed the implementation of online banking, multifunctional payment cards, innovative methods of distributing banking services, virtual currencies, fast transfer systems, as well as daily banking services. Particular attention was paid to remote banking and multi-channel forms of service, which functioned as ecosystems for interacting with customers. The adaptive architecture of channels and the usability of such services have become priorities for the active population aged 18-50. The modern pace of life and high demands on the information environment require the widespread use of digital and network technologies, including CRM systems. Such technologies can provide a high level of automation and self-service, integrating multifunctional solutions that will contribute to increasing the efficiency and accessibility of banking services.

An analysis of contemporary trends in financial technologies and the banking sector has demonstrated a continuous process of improvement and modernisation of the industry based on advanced innovations. Banking institutions have actively implemented technologies such as AI, blockchain, and data analytics to optimise operations and ensure a high level of customer service. An important aspect of fintech development has been the collaboration of banks with fintech companies. This partnership has contributed to the creation and implementation of new products and services that meet the needs of the modern market. In addition, increasing the level of personalisation of banking services has significant potential. The use of advanced data analytics has allowed for the formation of individual offers for each customer, which has positively impacted their experience of interacting with the bank, increased satisfaction, and loyalty of the customer base.

Many other researchers have continued to explore the impact of financial technologies on banking and the improvement of financial services. However, there was a lack of separate comprehensive studies on the systematisation of existing modern financial technologies that can be used by banks and a detailed justification of the benefits of their use in the banking sector, as a key segment of the Ukrainian financial market. A comprehensive approach to this problem will allow for the adjustment of future actions of financial institutions' management for further development.

## Conclusions

Financial technologies have fundamentally changed traditional banking, making it more transparent, faster, and accessible. Previously, banks focused primarily on physical branches, but in 2024, thanks to fintech, customers have the opportunity to perform virtually all financial transactions online. This ensured steady growth in a competitive environment and allows banks to remain relevant in the face of rapid technological changes. The development of the banking industry and the improvement of the quality of financial services largely depend on this technical progress. However, when implementing them, it was extremely important to ensure compliance with the highest security standards, in particular regarding the protection of customers' personal data.

It was the modern types of financial technologies that have been implemented in the banking sector that have contributed to increasing the security of operations and services. They have made banking systems less vulnerable both internally and externally, ensuring higher reliability, data processing speed, and the possibility of long-term, stable information storage. The main advantage of such innovations as blockchain, open banking, and microservices has been the use of innovative algorithms and approaches to database organisation. These solutions have provided a significantly higher level of reliability compared to traditional technologies, which has significantly strengthened the economic security of banking institutions and contributed to their sustainable development.

In summary, this study has outlined the fundamentals of financial technologies and their contribution to the growth of banking operations in the Ukrainian financial sector. The analysis of various types of financial technologies in the financial market, with an emphasis on banking, which is its largest segment, was crucial for the research. An overview of the Ukrainian fintech market in the context of the banking system has made it possible to determine their significance and benefits for the development of banking activities. In addition, the research has substantiated the main directions of financial technology development in the banking sector as a key component of the Ukrainian financial market. All of this has made it possible to provide effective recommendations regarding the implementation of the latest financial technologies in the banking sector, as an important segment of the Ukrainian financial market, which will contribute to increasing operational efficiency, reducing costs, expanding financial accessibility, and strengthening customer confidence in financial institutions. Promising areas within this issue may include further research on the relationship between the level of use of modern financial technologies and the increase in the efficiency of financial market entities, in particular regarding their investment attractiveness in the global market.

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## Conflict of Interest

None.

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## Фінансові технології у розвитку банківської діяльності на фінансовому ринку України

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**Анотація.** Проблема дослідження використання фінансових технологій у банківській діяльності є актуальною, оскільки фінансові технології виступають основним драйвером змін у банківському секторі, сприяючи розробці нових продуктів, оптимізації операцій та розширенню доступу до фінансових послуг. Метою статті було дослідження значення фінансових технологій у розвитку банківської діяльності та виявлення напрямків її розвитку завдяки застосуванню сучасних фінансових технологій. При проведені дослідження застосовувалися методи: аналізу, синтезу, систематизації, метод порівняння для розгляду теоретичних засад використання фінансових технологій. Групування, табличний та графічний методи допомогли проаналізувати сучасний стан використання фінансових технологій банківським сектором; також, були використані методи абстрагування та узагальнення. У цифрову епоху банки вимушені впроваджувати інновації для збереження конкурентоспроможності. Проведений аналіз використання фінансових технологій дозволив виявити сучасні тенденції та можливі напрями їх застосування в українському банківському секторі, а також адаптувати прийняття рішень щодо їх використання до українських реалій, забезпечуючи клієнтам більш гнучкі фінансові послуги. Виявлено, що зростання популярності цифрових платформ супроводжувалося підвищенням кіберризиків, тому дослідження фінтеху також допомогло гарантувати кібербезпеку та довіру клієнтів, а розробка ефективних стратегій захисту даних стало ключовим фактором стабільності банківської системи. Також, у роботі було розглянуто наукові дослідження, які підтвердили актуальність фінансових технологій у банківській діяльності, проаналізовано сутність фінтеху, його видів і ролі в банківському секторі та оцінено стан українського фінтех-ринку. У дослідженні було розроблено рекомендації щодо розвитку фінтех-ринку. Практична реалізація наданих у дослідженні рекомендацій щодо впровадження таких сучасних фінансових технологій, як блокчейн, штучний інтелект, Big Data та відкриті інтерфейси, сприятиме підвищенню прозорості, кібербезпеки та адаптації як банківського сектору, так й фінансового ринку України в цілому до сучасних викликів

**Ключові слова:** банківська система; ринок фінансових послуг; інноваційні технології; напрями розвитку банків; поліпшення діяльності банку

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# Interrelation of operational, financial, and investment activities of an enterprise during and after the war period

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**Abstract.** Investigation of the analysis of the interaction of indicators of operating, financial, and investment activities of an enterprise, which characterise its financial condition during the period of external instability caused by Russia's military aggression against Ukraine, is significant for the formation of forecasts of their transformation, with a purpose of ensuring the sustainability of the development of enterprises. The purpose of the study was to analyse external factors and internal measures of enterprises that influence the formation of a high-quality recovery strategy in the post-war period. Since February 2022, Ukrainian business has demonstrated unique models of adaptation to crisis conditions, integration of various activities to achieve a shared goal and preparation for future recovery. This was facilitated by the study and implementation of foreign practices, which enabled Ukrainian enterprises to effectively integrate operational, financial, and investment activities to stabilise their operations during the war and lay the foundations for rapid economic stabilisation after its end. This will help to increase the competitiveness of Ukrainian enterprises in the global economy. The study proved not only the necessity of researching foreign practices in rebuilding the country's economy, but also of analysing Ukraine's geographical features. Understanding its landscape, economic model, mentality of the population, and level of education was necessary to create an effective national recovery model. If such a model was in line with current capabilities, it will be capable of ensuring sustainable development for the country and its business entities in the post-war period in a relatively short time. Military conflicts substantially change the landscape of the economy. The study revealed that a military situation can become a catalyst for the development of innovative technologies and the attraction of international support for recovery and modernisation. Considering this, it was vital to consider investment, operational, and financial activities as interrelated elements that create synergies for economic recovery. A systematic approach to their analysis can provide the basis for a successful post-war recovery, namely, to improve the management of operational processes to increase productivity and create a stable financial environment to attract internal and external investors

**Keywords:** systemic approach; competitiveness; optimisation; technological innovation; strategic planning; recovery strategies; post-war recovery

## Introduction

Military conflicts have always had an impact on the economies of countries, as they substantially change their landscape and lead to major economic changes. This forced states and businesses to adapt their strategies for survival and prolongation of production activities in challenging conditions, minimising losses. During this period, investment, operating, and financial activities gained particular significance, not only as interrelated elements, but also as a single system that provided a mechanism for adapting and transforming an enterprise to external conditions. Investigating, how these components interact with each other in wartime is fundamental

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to formulating a post-war recovery strategy. The practices gained during the conflict can be a valuable foundation for future economic development and stability.

The study of how military operations affect the activities and condition of enterprises not only through a decrease in business activity due to economic instability, i.e., at the macro level, which complicated the management of the activities of business entities and implementation of their financial plans, has been approached in the scientific literature from various perspectives. According to L. Khomych & N. Khrushch (2024), military actions affect operations by reducing demand for goods and services, disrupting supply chains, and restricting access to raw materials. Many businesses face forced production stoppages and capacity reversals, which leads to a decrease in production and an increase in production costs. Operating in such conditions required flexibility and adaptability, which was crucial for business survival. The issue of financial stability was one of the key aspects of enterprise management in wartime. Ya. Belinska & O. Kolyada (2023) noted that military conflicts substantially reduced the liquidity of enterprises, complicated access to external financing, and increase the level of debt burden. Furthermore, many businesses faced a loss of creditworthiness and a decrease in investor confidence. In such circumstances, it was vital to implement anti-crisis financial strategies aimed at preserving cash flows and minimising financial risks. The researchers also noted that in the context of a military conflict, investment activity was greatly reduced due to the high level of risks and uncertainty. In the context of armed conflicts, investors tend to adopt conservative strategies, limiting their investment to a minimum or switching to protected assets. According to T. Gutsan & O. Melnykova (2024), the post-war period will see a tendency towards a gradual recovery in investment activity, especially in such sectors as infrastructure, construction, and renewable technologies. Furthermore, it was emphasised that in wartime, the interconnectedness between operational, financial, and investment activities was increasing. Changes in one segment of the company's activities (e.g., reduction of operating expenses) can lead to major transformations in the financial and investment areas. Effective management in such conditions should be comprehensive, accounting for not only individual indicators, but also their effects on each other. It was significant to investigate the specific features of the post-war economy. After the end of hostilities, enterprises face further challenges related to the resumption of operations, the search for new markets and sources of financing. V. Heyets *et al.* (2022) noted that in such a period, it was vital to develop a long-term strategy that combined the prompt restoration of operations with the intensification of investment and stabilisation of the financial condition. A. Nechyporenko & S. Stabias (2022) focused on the choice of financial planning areas, specifically strategic, tactical, and operational, reinforcing the need for the enterprise to understand its policy for the functionality of its application.

In the foreign scientific literature, various researchers have explored the relationship between the operational, financial, and investment activities of enterprises during the war and post-war period. H. Puhr & A. Kupfer (2023) examined the role of media in identifying geopolitical risks. The researchers employed new data sources, such as GDELT and GoogleTrends, to analyse the influence of war, specifically Russia's invasion of Ukraine in 2022, on business operations in various regions. M.A. De Villa (2020) proposed a multi-level approach to assessing geopolitical risks for top managers of international companies, considering macroeconomic factors as well as specific risks for particular industries and enterprises. M.J. Mol *et al.* (2023) analysed, how Danish MNCs (multinational companies) adapt to geopolitical changes in wartime and develop a framework that factors in the operational and reputational business considerations. The researchers noted the significant role of political stability in restoring the investment attractiveness of the regions after the war. H. Hollanders (2020) presented a comparative analysis of the innovation systems of the EU countries, which can be useful for studying ways to adapt international practices for Ukraine.

Thus, modern research has covered a wide range of issues: from the analysis of geopolitical risks to strategies for economic and business recovery after conflicts in local conditions, based on the real experience of certain countries. Overall, the analysed studies revealed that successful enterprise management in the wartime and post-war period depended on the ability of management to effectively coordinate operational, financial, and investment processes at large, made adaptive decisions under conditions of high uncertainty, and promptly responded to changes in the external environment. The purpose of this study was to analyse the internal measures of enterprises under the influence of external factors and reflect them in the relevant items of investment, operating, and financial activities to formulate a recovery strategy in the post-war period.

## Materials and Methods

The study employed a systematic approach and various research methods. System analysis was applied to consider the interconnection of investment, operational, and financial activities. Comparative analysis was used to compare foreign and Ukrainian practices in the selection of measures for economic recovery and development of enterprises in the post-war period. The method of statistical analysis was employed to investigate the quantitative indicators of foreign direct investment that affect and characterise the indicators of operational, financial, and innovation activities in Ukraine. Information on the attraction of foreign direct investment during martial law, the volume of foreign direct investment by direction and sector of the economy were collected,

processed, and analysed. The information and indicators for the study were obtained from official sources, specifically, the indicators of capital investments of enterprises by types of economic activity and indicators of enterprises' activities grouped by special aggregations for 2021-2023 according to the State Statistics Service of Ukraine (2024), investment activity in Ukraine for the 1st quater of 2024, according to the Ministry of Finance of Ukraine, and the grounds and channels of foreign direct investment (FDI) inflow and outflow in Ukraine according to the systematisation of the Ministry of Finance of Ukraine on economic development, budgets, investment volumes (Processing companies..., 2024; Foreign direct investment (FDI) in Ukraine, 2025). Furthermore, the study analysed the indicators on the state of Ukraine's economy from the OpenDataUA (2024) information source, which contained open information on research and major public registers for citizens and businesses. The study monitored investment legislation, reviewed the provisions of the Law of Ukraine No. 1116-IX (2024), on financial regulation regulated by the Law of Ukraine No. 3480-IV (2024), which underlie the legal regulation in the field of investment and financial activities in Ukraine, as well as government grant programmes, such as the State Grants Programme. Expert assessments of sectoral priorities and financial risks and reports by international think tanks helped to determine the nature and impact of the war on investment and operations of large, medium, and small businesses in Ukraine. The grouping method was employed to organise the primary statistical material, to separate it into homogeneous groups based on essential features, and to conduct a comprehensive in-depth analysis to draw conclusions. Using the method of substantiation, the economic effect was determined, and the reliability of recovery strategies was assessed. Economic and mathematical modelling using stochastic formulas helped to predict the effectiveness of ensuring a sustainable development scenario, considering uncertainty factors, and to assess their impact. To assess the sustainable development of enterprises in the post-war period, a stochastic model was applied, which accounted for random factors and uncertainty of the economic environment, which was an objective factor. This differential formula was as follows:

$$d V(t) = \mu V(t)dt + \sigma V(t)d Wt, \quad (1)$$

where V(t) – value or level of development of the enterprise over time; V(0) – value of the enterprise at the initial stage (initial time); t – certain specified time; d – random component (described by Brownian motion or Winner's motion); W – Winner's motion as a random process (used as a mathematical modelling of the behaviour of unpredictable systems over time); μ – the average growth rate (rate of expectations, e.g., return on investment); σ – the degree of risk (volatility).

The following model helped to assess the impact of various risk factors and the effectiveness of management decisions in the face of external instability. To assess economic security risks in the post-war period for enterprises, a formula was modelled that factors in both the uncertainty of the external environment and fluctuations in key financial or economic indicators. The formula was as follows:

$$d E(t) = \alpha E(t)dt + \beta R(t)E(t)d Wt, \quad (2)$$

where E(t) – level of economic security of the enterprise over time; t – certain time; R – a random risk factor depending on macroeconomic conditions; dW(t) – Wiener motion as a random process (used as a mathematical modelling of the behaviour of unpredictable systems over time); α – average rate of recovery of the economic situation of the enterprise; β – degree of sensitivity of economic security to risk.

The practical use of the formulas for a concrete task was that this model helped to assess risks from external political factors, simulate scenarios (e.g., increased instability), and make management decisions to reduce the influence of political risks, particularly through insurance, business diversification, or lobbying for a transparent political environment. To formulate the conclusions, the study employed the method of generalisation, which recorded the general features and characteristics of problematic issues of operational, financial, and investment activities. The problematic issues of operational, investment, and financial activities, and their effects on the financial planning of enterprises in the post-war period were systematised. Using logical analysis and factual conclusions, the positive aspects of operational, investment, and financial activities were summarised, and ways to overcome crisis and problematic issues were proposed.

## Results and Discussion

To assess and choose strategies for recovery and stabilisation in the post-war period, enterprises should consider a comprehensive approach to their activities for 2022-2024. This involved not only analysing the indicators of operating, investment, and financial activities, but also identifying their sources, their interconnection, the ability to predict the functional impact and economic benefits of innovations on the activities of enterprises and assessing stabilisation and risk factors for business in the current economic environment.

Sources for investment activities included states that increase defence spending in times of war, which may include investments in technology, infrastructure, and training, as well as private investment. Overall, private investment was divided into external and internal:

1) internal investments consisted of own assets, funds of enterprises that were used to change their strategies to meet the needs of war (e.g., production of

military equipment, medical production) or in their own technological development (capital investments);

2) external investments were foreign direct investments (FDI) that enterprised receive from their international partners, which were targeted and directed to fulfil their long-term interest in partnership with the recipient in a liquid product or a promising segment of the economy.

Figure 1 showed a quarterly chart of FDI inflows into Ukraine's economy since 2014 and 1st half of 2024, according to the Ministry of Finance of Ukraine.

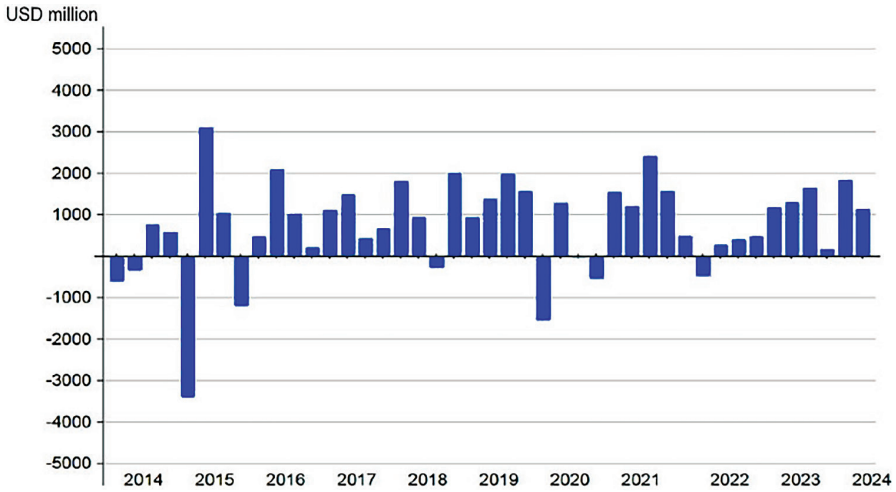


***Figure 1.*** *Quarterly chart of foreign direct investment inflows into Ukraine's economy in 2014-2024*
***Source:*** *developed by the author based on Official website of Ministry of Finance of Ukraine (2024)*

The impact of the war on the amount of investment attracted did not have a substantial negative resonance. Summarising the information, and based on the estimates of independent researchers and official sources, the situation in the investment sector as of 2024 was as follows: the state offered investors the following deal – "... in the defence industry, the government sees opportunities for investment in more than 10 large projects worth UAH 43 billion. In metallurgy and steel processing, there are more than 20 potential projects for investment worth UAH 26 billion. In the agricultural sector, according to government officials, there are opportunities to invest UAH 34 billion in over 300 projects. In the energy sector, there are more than 50 projects worth UAH 177 billion of investment potential. UAH 19 billion can be invested in more than 30 pharmaceutical projects. The state proposes to invest UAH 5.6 billion in the development of natural resources in more than 10 projects. In logistics and infrastructure development, UAH 123 billion can be invested in more than 30 projects. The furniture and woodworking industry is awaiting investments of UAH 5 billion in more than 40 projects. Over 2000 innovative tech startups require investment of about UAH 11 billion. More than 20 industrial production projects require investments of UAH 16 billion" (Investments during wartime: Who, where, and..., 2024). Businesses were actively raising funds in the military technology sector, agro-processing, mechanical engineering, woodworking, and IT outsourcing. According to Capital Times, in the military sector, "... in 2024-2025, there may be 10 million deals in the sector, including investments from leading foreign defence companies" (Investments during wartime: Who, where, and..., 2024). Foreign investors were creating investment funds for the development of Ukraine and consider defence companies as targets for ESG (Environmental, Social, and Governance) investments. The Ministry of Economy of Ukraine published data according to which, as of 31 March 2024, the most significant amounts of direct investment (balances) were directed towards industrial enterprises (38.9%), institutions and organisations engaged in wholesale and retail trade, repair of motor vehicles and motorcycles (17.0%). The primary investor countries included Cyprus – 31.6% of total FDI, the Netherlands – 20.8%, Switzerland – 4.2%, the United Kingdom of Great Britain and Northern Ireland – 4.8%, Germany – 4.3%, Austria – 3.5%, Luxembourg – 2.7%, and France – 2.6% (Investment activity in Ukraine for the 1st quarter of 2024, 2024).

While in wartime, investments were aimed at supporting enterprises, attracting the latest technologies, and the military industry, in the post-war period, investments will be directed not so much to cover costs as to create new production facilities on a new technological basis, and to address environmental and social issues. Business leaders should consider this. Recognising that the financial sustainability of enterprises shapes the economic sustainability of the country, a new view was being formed on the role of financial instruments in the accumulation and distribution of funds. These indicators were among the most crucial in attracting investment. Foreign investors were increasingly paying attention to social and environmental factors when choosing the type of investment and the object for investment. There will not be just one or a few investment models, the area,

where enterprises or resources were located, social groups and their needs, and the investor's business area will all have an impact. For example, for impact investing, it was essential to solve a particular problem in society. One of the most common investment instruments was bonds, which were divided into three groups: social, green, and sustainability. Attracting investments in this way will require companies to follow clear and unambiguous requirements for their use, understanding of hedging instruments, solving a social problem through social bonds, infrastructure or construction tasks, through sustainability bonds, etc. ESG investors were focused on regionally attractive investment targets. These investment and other development programmes were implemented by the company's operating activities.

Operating activities, as the main activity, were obliged to ensure the implementation of production and commercial activities, to manage finances, i.e., to create a permanent mechanism for choosing ways to coordinate work, selecting opportunities from the external environment, analysing strengths and weaknesses, forecasting new factors or changes, selecting and implementing innovative technologies that will ensure the company's sustainable development. An efficient system of resource supply and distribution was becoming critically important. Companies must respond quickly to changing needs by organising the supply of materials and products. Wartime required a special approach to operational activities, specifically to such components as logistics and risk management (Table 1).

***Table 1.*** *Needs of the components of the operating activities of enterprises during martial law*

| Area | Needs | Component | Method of provision | Characteristics |
|---|---|---|---|---|
| Logistics | Speed of response | Supply | Optimisation | Businesses should develop flexible logistics systems that enable them to respond promptly to changes in the military situation, ensure the use of inventory management technologies such as warehouse management systems (WMS) |
| | | Needs | Coordination with government agencies | Cooperation with military structures to ensure prompt delivery of necessary resources |
| Risk management | Prompt and effective response | Security and availability of resources | Monitoring and analysis | Continuous monitoring of risks related to the security and availability of resources is required |
| | | Risks | Continuous assessment of security risks and their impact on the business | This may include the development of contingency plans |
| | | Production processes | Flexibility | Businesses can implement adaptive production processes to quickly respond to changes in demand or provide alternative approaches to a particular event |

***Source:*** *developed by the author*

The post-war period will be critical for the recovery of enterprises, bringing its own adjustments and challenges. Therefore, the research on operational, financial, and investment activities covered several key requirements. For operational activities, these were several key requirements for recovery, namely:

- adaptation of supply chains: new logistics due to infrastructure damage;
- modernisation of production facilities: rebuilding or relocating plants to safe regions;
- implementation of innovations: innovative technologies to improve production efficiency and reduce costs;
- optimisation of human resources: formation of teams at new locations, training of employees, development of new communication skills, introduction of remote technologies.

Challenges to operating activities in the post-war period will be associated with ensuring efficient operation through skilful, high-quality management of production assets and sources of their formation in the context of limited resources and, partly, changes in the areas of activity. In such conditions, operating activities have another function, which was to ensure participation in expanded reproduction of activities. This will help ensure the company's sustainability and attract additional funding. Financial activities in wartime should ensure such tasks as proper financing of military needs, raising funds through bonds, loans, and other financial instruments, implementing effective anti-crisis measures, and rational cash flow management in an unstable period, which involved setting priorities for the allocation of funds to avoid resource shortages in key areas. Financing in wartime has its specific features, which were related to the sources of funds and financial stability issues. States can use bonds, international loans, and other financial instruments to finance military expenditures. For this, bonds can be issued, or reconstruction loans can be attracted, which can be provided by international financial institutions. In addition, measures should be developed to encourage private investors to invest in projects related to the recovery process. As for the maintenance of financial stability, it was crucial to preserve control over cash flows during martial law to avoid financial crises.

This was ensured by monitoring financial flows to avoid budget deficits and creating appropriate reserves to act to stabilise in crisis situations.

Despite the war, large industrial enterprises continue to invest in the restoration and modernisation of production facilities. For instance, Ostchem Holding resumed operations of its main enterprise, Rivne Azot, providing a full cycle of mineral fertiliser production, and grant programmes have become a popular way to support small businesses: over 7000 business projects were implemented through international and government initiatives in 2022-2023 (OpenDataUA, 2024). This was considered as a focus on the long-term development of enterprises. This was in line with the findings of R.J. Moore (2021), who noted that the post-war environment was different from that of active war and established peace, and structures that encourage socially responsible investment with a long-term market perspective may be more successful in this context. It was believed that such forward-looking operational management and rational use of finances by enterprises enabled Ukraine to rank 55$^{th}$ out of 120 countries in the 2023 performance results. According to the source GII 2023 results. The GII unveils the world's innovation leaders, gauging the innovation performance of 132 economies (2024), approximately 88% of the data in the GII 2023 ranking covered the period of 2020-2023, most of which, namely data for 2021 (34%) and 2022 (35%), were during the COVID-19 pandemic and the armed conflict in Ukraine. All this had a multifaceted impact on the corresponding fluctuations in the country's gross internal product (GDP) and affected the scaling factor for the number of data variables. Ukraine managed to maintain such a high level in the international ranking due to the skilful management of financial instruments, which contributed to its competitiveness in the international market environment.

In the post-war period, the role of financial instruments in the country's financial system will increase. Especially against the background of unformed market mechanisms and ambiguity of regulatory requirements. Selecting and implementing the necessary actions for operational, financial, and investment activities in the post-war period will require careful analysis and a balanced approach. As of the end of 2024, when martial law was still in effect and had its influence on the economy of enterprises, it was only possible to predict certain actions as functional and economically interesting in the post-war period. It was worth considering, how this may affect the financial planning mechanism, and what issues will be relevant in the next post-war period. In the context of external changes, the information economy, the financial planning mechanism ceases to be a technical support for the implementation of the financial plan and turns into a financial instrument of the enterprise. As for the risks of continued instability in the present and future, the post-war period posed major challenges to the operational, financial, and investment activities of enterprises (Table 2).

***Table 2.*** *Problematic issues of the post-war period in the operational, financial, and investment activities of enterprises*

| Type | Problematics | Characteristics |
|---|---|---|
| Operational activity | Restoration of destroyed infrastructure | Damaged production facilities, logistics chains, and communication networks, complicating the supply of raw materials and delivery of products |
| | Staffing issues | Lack of skilled staff due to migration, loss, or mobilisation of employees, need to train new staff |
| | Redistribution of resources | Limited financial, material, and energy resources, forcing companies to optimise their use |
| | Planning under high uncertainty | Unpredictable political changes, market fluctuations, risks of recurring conflicts and macroeconomic instability |
| Financial activity | Access to capital | Due to the high risks, banks and investors may be less inclined to lend or invest in the affected regions |
| | Increased insurance costs | Increased risk of recurring conflicts increases the cost of insuring assets and operations |
| | Inflation risks | Exchange rate volatility and inflationary pressures complicate cash flow management |
| | Insolvency of counterparties | Many companies may be on the verge of bankruptcy, which affects the promptness of payments and creditworthiness |
| | Tax burden | Economic recovery requires a review of tax policy, which may lead to an increase in the tax burden on businesses |
| Investment activity | High level of risks | Political, economic, and social instability make investment projects risky. This reduces the attractiveness of investments in the affected regions |
| | Payback uncertainty | Investments in recovery may have a long payback period due to low demand, infrastructure damage, and supply constraints |
| | Limited access to finance | Investors and banks often demand additional guarantees or higher interest rates to compensate for the increased risks |
| | Lack of financial instruments | Disrupted stock markets and limited access to instruments such as stocks and bonds |

*Table 2, Continued*

| Type | Problematics | Characteristics |
|---|---|---|
| Investment activity | Government regulation | Possible changes in legislation and regulatory restrictions may affect the stability of the investment environment |
| | Formation of new priorities | Investments will be directed mainly to infrastructure, construction, and security, which reduces interest in other sectors |

***Source:*** *developed by the author*

The challenges of the wartime period force businesses to implement more adaptive planning, considering crisis scenarios and risks, to maintain financial stability. Businesses must ensure that they have an in-depth understanding of financial processes to reduce the risks of inefficient use of funds and prevent reactive responses to current problems caused by reduced revenues due to lower purchasing power of the population, currency fluctuations, underinvestment, increased logistics costs, and restoration of production facilities at their own expense. In the post-war period, these problems will not disappear, but will be prolonged in time. Furthermore, the post-war period will prompt further changes in the market and social environment, such as reorientation of economic sectors, changes in investment priorities, and retraining of personnel for new industries (Vyhovska *et al.*, 2024). All this should be considered by enterprises as early as 2025, especially if they want to ensure business continuity and sustainable development by accumulating adequate financial reserves. As for financial planning and the implementation of its mechanism in the post-war environment, the post-war period will pose a series of challenges for enterprises in financial planning, for which they should be prepared in advance (Table 3).

***Table 3.*** *Influence of problematic issues of the post-war period on financial planning of enterprises*

| No. | Problematics | Manifestation and its characteristics |
|---|---|---|
| 1 | High uncertainty and volatility | The economic environment is unpredictable, which complicates revenue and expense forecasting and risk assessment |
| 2 | Liquidity issues | Loss of access to working capital, restrictions on bank lending, liquidity shortages |
| 3 | Debt restructuring | Necessity of reviewing loan repayment terms and restructuring financial liabilities to maintain solvency |
| 4 | Attraction of new investments | Businesses require additional resources for recovery, but have limited access to capital due to high risks |
| 5 | Financial support and benefits | Dependence on government subsidies and support programmes to restore operations and financial performance |
| 6 | Increasingly complex legal requirements | Implementation of EU regulations in internal financial and corporate reporting and accounting |

***Source:*** *developed by the author*

At this level, there will be an understanding that without a clear plan and a clear definition of the successive stages of organisational support, the market mechanism of self-regulation will not adjust the enterprise's activities according to its purpose and management of operational activities. Such planning should reflect the level of efficiency of the use of human resources and production capacities at the enterprise, whether the necessary resources for sustainable development were available, the use of modern forecasting models and the provision of analytical conclusions. At this stage of implementation of the financial planning mechanism, new models are introduced, such as strategising in a changing environment, focusing on the human factor, both internal in terms of professional staff and external, customer-oriented. Expanding access to key staff competencies will determine the company's market advantages, as well as create a system of training costs, and develop managerial and other functional skills of the staff. The results of the effectiveness of the measures taken or imperfections will be manifested by the relevant indicators in the reporting of P(S)A 3 "Statement of Financial Performance", P(S)A 4 "Statement of Cash Flows" (Order of the Ministry of Finance of Ukraine No. 73, 2013).

To ensure financial stability in the post-war period, it was necessary to introduce effective and transparent liquidity and debt management. Companies should develop strategies for efficient cash flow management aimed at reducing their debt burden. Access to credit was a key aspect: businesses required cheap loans, debt restructuring, and government guarantees to stimulate economic activity. It was also essential to provide financial support to small and medium-sized enterprises through grants, subsidies, transparent eligibility requirements, and tax breaks. The most attractive and cost-effective strategies should be used to stimulate the growth of investment inflows. The principal areas included investment in infrastructure, including the rehabilitation of roads, bridges, and communications critical for business and society; priority investment in sectors such as agriculture, energy, construction, and manufacturing, considering their significance to the economy; and

attracting foreign capital by creating safe and favourable conditions, such as special economic zones, for international investors once the economic situation was stable.

How will this affect the financial planning mechanism, and what issues will be relevant in the post-war period? At this level, the problem of financial resource management will arise. There was an interdependence between financial resources and the sources of their formation. One of these sources was the constancy of profits. Considering the complexity of the situation in the country, the speed of changes and the dynamics of the market economy, one should consider their rapid impact on the qualitative characteristic of profit. Its purchasing power will be affected by legislative requirements, inflationary processes, and changing market interests. Therefore, by the time profit was actually recognised as a financial source of an enterprise, its purchasing power at the time of its factual use, the direction of its allocation, the economic benefits of such acquisition or investment, etc., should already be calculated. All this was based on a qualitatively new analysis and assessment of the financial condition of the company. Under such conditions, enterprises were using financial methods as a component of financial planning to master not only the quality management method, but also the speed management method, and the situational method was actively developing. Innovations such as financial planning based on behavioural economics and large databases were being applied.

To create a high-quality state support programme, a series of key measures must be implemented. Firstly, regulatory changes should be made to align Ukraine's legal framework with EU legislation to ensure integration into the European market. Secondly, preferential taxation should be introduced: reducing the tax burden, exemptions from income and property taxes for businesses affected by the war, under clearly defined conditions and terms. Grants and government programmes, including funding for innovative projects and support for the restoration of critical infrastructure, were an essential component. Ensuring effective protection of property rights should include guarantees of investment rights, legal support, and business support, especially in the context of post-war reintegration. Such a comprehensive programme will contribute to economic stability, recovery, and sustainable development of the country.

In this regard, the Cabinet of Ministers of Ukraine approved the Order of the Cabinet of Ministers of Ukraine No. 821-r (2024). Figure 2 showed, what the analytical activities of enterprises should include for effective measures to restore infrastructure in the post-war period.

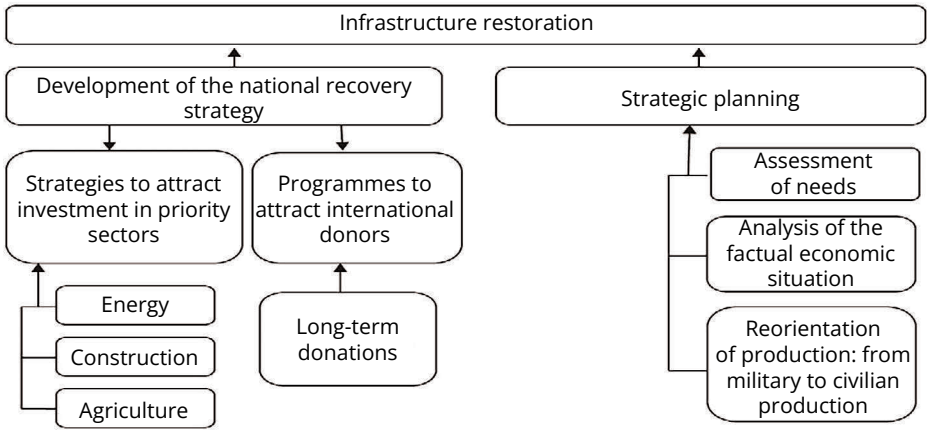


***Figure 2.*** *Characteristics of infrastructure restoration efficiency*

***Source:*** *developed by the author*

Strategic planning will be implemented through the development of strategies that will enable a rapid return to peaceful life by attracting investment in new sectors of the economy, creating jobs and enabling social programmes to be implemented as a priority (Misiuk & Zakhodym, 2023). All this will ensure economic recovery and transition to a peaceful economy by reorienting business models and investments in new sectors of activity, including the national economy, culture, education, and funding for the scientific sector.

At this level, there will be a problem with changing the priorities of production sectors, the need to repay investments or loans that were provided for a certain period or on certain conditions, and the growing influence of social and psychological factors on the economy overall. These were quite specific issues that substantially affect the choice of a product segment or type of service in the market and the definition of the target audience. All this should be reflected in operational activities, financial planning, and the mechanism of its implementation with the most effective return for a particular enterprise.

The general problematic aspects of the financial planning mechanism were as follows:

1) the lack of an effective regulatory framework, which may affect the company with unpredictable penalties, depending on changes in the political course;

2) low level of funding for planning and forecasting at enterprises due to their working capital savings;

3) short-term certainty in the Ukrainian market with risks of changing the "playing field" in 2022-2025, for which almost most enterprises do not have formed funds to cover such risks.

All this prompts the use of novel approaches, particularly those that form a view of economic entities as open market systems. At this stage, innovations such as alternative scenario planning are being introduced; new methods of calculation and forecasting, such as the supply chain (SCOR system), SWOT analysis, UML life cycle model, balanced performance indicators were being applied.

A prerequisite was a systematic approach to analysing investment, operational, and financial activities during the war and in the post-war period. The combined and systematic approach allowed for an assessment of interrelationships, i.e., an understanding of how investments affect the operational efficiency and financial stability of enterprises specifically and the economy overall. They also provided an opportunity to develop recovery strategies, namely, to identify priority areas for investment based on an analysis of recovery needs and to provide enterprises with a tax and financial microclimate in the country that will ensure their interest in participating in recovery programmes.

The assessment of interrelationships involved the integration of strategies. It was the joint analysis of investment, operational, and financial activities that helped to identify, which measures would bring the greatest return and profitability. It also provided an understanding of the interaction between sectors, including, how changes in one sector affect others, and what consequences can be predicted. The development of recovery strategies was aimed at setting priorities, determining which sectors required immediate funding, regulation, and ensuring conditions for sustainable economic development in the face of emerging challenges in an environment that has undergone real changes. It was a systematic approach to their analysis that provided the basis for the country's successful recovery in the post-war period, enabling a faster return to stable development and economic security.

To assess the sustainable development of enterprises in the post-war period in greater detail, the study employed a stochastic model (1) that accounts for random factors and uncertainty of the economic environment, which was an objective factor. To test this formula, the task was to estimate the effects of market volatility and external risks on the value of any enterprise engaged in infrastructure rehabilitation in Ukraine. Initial data: initial value of the enterprise V(0) = UAH 100 million; average growth rate μ = 0.05 (5% expected growth per year); volatility (risk) σ = 0.2σ (20% return on value caused by market fluctuations); time horizon t = 1 year; Brownian motion dWt was modelled as a random component with mean zero and standard deviation Δt.

As a result of applying the formula, the following results of the stochastic differential equation were obtained: $V(t) = V(0)[(\mu - \frac{\sigma^2}{2})t + \sigma Wt]$. When modelled for t = 1 (positive value): $\mu - \frac{\sigma^2}{2} = 0.05 - \frac{0.2^2}{2} = 0.03$. Assuming that Wt ≈ N (0,t) and for one realisation Wt = 0.1 (positive market shock), then: $V(1) = 100 \cdot [0.03 \cdot 1 + 0.2 \cdot 0.1] + 100 =$ ≈ UAH 105 million.

To analyse the risks of economic security of enterprises in the post-war period, the study developed formula (2), which factors in both the uncertainty of the external environment and fluctuations in key financial and economic indicators. This model was employed to assess the effects of external risks, such as political instability and financial crisis, on the stability of the enterprise's economic activity. It worth to suppose there were the following data: initial level of stability of the enterprise E(0) = 100; basic stability α = 0.03 (growth of 3% per year); sensitivity to political risks β = 0.4; intensity of political instability P(t) = 0.5 (average impact on a scale from 0 to 1); Winner process Wt = 0.2 (random shock). The calculation steps for one year (t = 1) were as follows: basic stability contribution: $\alpha E(t)\, dt = 0.03 \cdot 100 \cdot 1 = 3$. Random effect due to political instability: $\beta P(t)\, E(t)\, dWt = 0.4 \cdot 0.5 \cdot 100 \cdot 0.2 = 4$. Total change in stability over the year: $dE(t) = 3 + 4 = 7$. The level of stability after a year: $E(1) = E(0) + dE(t) = 100 + 7 = 107$. Interpretation of the results helped to draw unambiguous conclusions that characterised the effects of political instability on the stability curve of an enterprise. Firstly, political instability was considered to contribute considerably to changes in the firm's stability if it affected 4 out of the total 7 units; secondly, if R(t) increased (e.g., to 1, which means a crisis disease), the impact of instability would increase substantially.

Thus, in Ukraine, political instability substantially affected the variables that characterise enterprise stability, namely:

- financial stability was affected by reduced access to capital, increased risks of insolvency, and currency fluctuations;
- the level of investment attractiveness was affected by a decline in foreign and internal investment in almost all sectors except for the military and energy sectors;
- operating activities were characterised by interruptions in the supply of resources and disruption of logistics chains;
- profitability and margins suffered from a decrease in sales volumes due to changes in demand or loss of markets;
- the human resource potential demonstrated an increase in labour migration, a reduction in skilled workers caused by mobilisation or economic emigration;
- the level of risks has experienced a substantial increase in the unpredictability of the external environment and the complexity of forecasting.

These factors combined to create major challenges for businesses, forcing them to adapt to the unstable

environment and look for new anti-crisis approaches. The stabilisation measures taken by Ukrainian enterprises took a year and a half, as evidenced by the State Statistics Service of Ukraine (2024). Ukraine's economy experienced negative external influences related to the imposition of martial law as a result of external aggression, which also adversely affected the state of enterprises. The period of early 2022 provoked stagnation in all areas and spheres of Ukraine's economy and life. However, even under such conditions, thanks to the accumulated assets, the ability to manage them, the developed consciousness of citizens, mental stability, business experience, etc., as well as prompt benefits and financing introduced by the state and investments raised from foreign partners, Ukrainian enterprises managed to quickly adapt to the existing crisis conditions, resume their operations, expand or preserve their production assets, and a series of Ukrainian companies expanded into the EU markets.

The above information demonstrated the mutual influence of the components of any enterprise. Research by experts in this area showed that the operational, financial, and investment activities of enterprises were interdependent. Operational efficiency formed the basis for financial stability, while the integration of financial and investment decisions allowed enterprises to adapt to changing conditions. An enterprise's investment activities can be aimed at developing new businesses or changing product production, which required investment in various projects and programmes. S. Ruda (2022) noted that the crisis state of the economy required the enterprise to improve the efficiency of its operating activities based on the implementation of technological advancement, the most efficient forms of management and production planning. This was directly related to the production and sale of products (works, services), and was a source of enterprise value creation. In other words, all operational decisions have a financial aspect.

Researchers Z. Kononenko *et al.* (2021) pointed out that the enterprise management strategy based on the use of long-term financial investments was a specific mechanism for increasing the value of non-current assets, confirming its integration with operating activities to ensure the efficiency of the enterprise. O. Panchenko (2018) updated the data that the effective development of enterprises in all sectors of the economy in the long term was achieved only through the introduction of innovations that provide them with strategic competitive advantages.

Special attention was paid to the studies of researchers analysing the experience of foreign countries. M. Bil (2023) investigated and described the recovery experience of Germany, South Korea, the Balkan countries, Israel, and Georgia. One of Bil's messages was that the type of recovery should be chosen based on the specific features of the Ukrainian business culture, mentality, and principles of independence. M. Azhazha *et al.* (2022) found that creating economic opportunities for growth through sound macroeconomic policies, smart investments, and structural reforms was a priority, increasing jobs across the EU and this experience can be used in Ukraine, as the problem of jobs was immediate. Yu. Tochylina (2022) noted that foreign practices in managing human capital development must be factored in only based on the adaptation to the reality of Ukraine's socio-economic development. T. Melnyk & E. Zavgorodnya (2022), studying the sectors of the Ukrainian IT market and analysing the contribution of IT companies to the country's economic stability during the military crisis, noted that the key factors of stability of the Ukrainian IT sector were effective crisis management of IT companies, experience of remote work, and a positive reputation in the global IT market. The researchers concluded that for the post-war recovery of the Ukrainian IT sector, it was advisable to use tax breaks and subsidies, venture capital investment (grant assistance), mechanisms to intensify cooperation between Ukrainian IT companies and foreign partners, and the establishment of foreign representative offices, promote the Ukrainian IT sector abroad, which was typical for any company. O. Bovkun (2022) supported the conclusions of previous researchers. The author argued that in modern Ukraine, the list of industries included the high-tech sector, agricultural engineering, IT, energy, oil, and gas industries. The development and effective implementation of a transparent strategy for attracting foreign investment in these sectors will facilitate the further recovery of other sectors, thereby contributing to Ukraine's post-war recovery. However, one should not ignore the problems and challenges that may be associated with the use of innovative financial instruments and technologies, as described in detail by O. Kondrat (2024).

Comparative analysis of the practices of other countries that have faced analogous challenges (e.g., the Balkan countries or Israel) will help to adapt successful strategies for Ukraine. It was also possible to create universal management methodologies that ensure that operational, financial, and investment decisions were preserved in an unstable environment. During martial law, the focus was on ensuring the continuity of operations, minimising losses, and adapting to crisis conditions. Financing activities were aimed at liquidity, while investment activities were focused on critical expenditures, such as asset protection and support of basic needs. Risks were extremely high, particularly due to physical threats to assets, market volatility, and political uncertainty. Management was focused on minimising costs and funding sources were limited. Focus on flexibility, cost reduction, and adaptation to rapid changes in supply chains.

In the post-war period, the priority was to restore and modernise production facilities and expand markets. Financing activities were aimed at raising capital for development, while investment activities were focused on long-term projects such as infrastructure or

innovation. Risks persist, but the focus was shifting to long-term stability. There was a need to assess economic and political prospects, including integration into international markets. Opportunities were opening to attract investment, international aid, and low-cost loans for recovery and development, and there was a growing opportunity to invest in rehabilitation, modernisation, innovation, and infrastructure projects, with operational activities focusing on efficiency, productivity, and the integration of the latest technologies.

To ensure that problematic issues were overcome at the enterprise level, companies have a clear goal and vision of their contribution to the development of the country's economy, and address certain social or environmental issues, among other things. However, this issue cannot be resolved at the business level alone without government involvement. Unambiguous regulatory requirements, equal access to funding sources, increased competitiveness of innovative enterprises, anti-corruption policy – all this provided an environment, within which enterprises can show their potential and effectively use the potential of the area: resource, human, and scientific.

## Conclusions

The study showed that the level of foreign investment has not declined critically and was on the rise. The sources of raising funds through international partnerships have expanded. Agriculture was the most effective sector in terms of the number of projects, with more than 300 projects. The energy sector has emerged as a potential industry with UAH 177 billion of investment potential. The investment of enterprises' own resources in modern information and communication technologies increased to UAH 13690.6 million in 2023, the highest figure for 2019-2024. The period of 2022-2023 was characterised by the growth of international cooperation, which made it possible to implement over 7000 business projects. All this positively influenced the financial performance of enterprises, encouraging them to develop sustainably, study international practices in economic recovery, and introduce the latest technologies and modern approaches to management, business, and financing.

Enterprises demonstrated high adaptation to a new economic reality, which enabled them to stay competitive. Technologies and digitalisation of financial planning were actively implemented, which ensured efficient management. Considerable emphasis was placed on risk management, ensuring the stability of operations in an uncertain environment. Furthermore, the integration of sustainable development principles enabled businesses to gain environmental and social benefits, which improves their reputation. Flexible budgeting allowed for a quicker response to changes in the economic environment, while access to expanded databases and the introduction of analytical procedures facilitated informed management decisions. The voluntary introduction of EU reporting standards was also significant, opening access to an international base of potential investors and facilitating capital raising.

The differences in the interconnection of operational, financial, and investment activities of an enterprise in the wartime and post-war periods were distinguished by the fact that in the first case it was focused on survival and minimisation of losses, while in the other case it was aimed at restoration, development, and long-term stability of the enterprise's activities and financial condition.

Prospects for further research include the development of anti-crisis management strategies for enterprises, modelling recovery scenarios considering the effects of external factors, integration of sustainable development principles, and the use of innovative technologies. Thus, the study of this topic will help to increase the resilience of enterprises to future challenges by developing the ability to calculate the effects of external instability and promptly adapt to it. As a result, this will help to increase their investment attractiveness, which will affect the overall economic recovery of the country.

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## Conflict of Interest

None.

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## Взаємозв'язок операційної, фінансової та інвестиційної діяльності підприємства у військовий період та після нього

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**Анотація.** Вивчення аналізу взаємодії показників операційної, фінансової та інвестиційної діяльності підприємства, що характеризують його фінансовий стан у період зовнішньої нестабільності, викликаної військовою агресією росії проти України, є важливим для формування прогностики їх трансформації, з метою забезпечення сталості розвитку діяльності підприємств. Метою статті був аналіз зовнішніх факторів та внутрішніх заходів підприємств, які впливають на формування якісної стратегії відновлення в післявоєнний період. З лютого 2022 року український бізнес продемонстрував унікальні моделі адаптації до кризових умов, інтеграції різних видів діяльності для досягнення спільної мети та підготовки до майбутнього відновлення. Допомогою цьому слугувало вивчення і впровадження зарубіжного досвіду, що дозволило українським підприємствам ефективно інтегрувати операційну, фінансову та інвестиційну діяльність для стабілізації роботи під час війни та закласти основи для швидкої економічної стабілізації після її завершення. Це сприятиме підвищенню конкурентоспроможності українських підприємств у глобальній економіці. Доведено не лише необхідність вивчення іноземного досвіду відбудови економіки країни, а й аналіз географічних особливостей України. Розуміння її ландшафту, економічної моделі, менталітету населення, рівня освіти необхідні для створення ефективної національної моделі відновлення. Якщо така модель буде відповідати сучасним можливостям, то вона зможе забезпечити сталість розвитку для країни та її суб'єктів підприємництва в післявоєнний період за швидкі терміни. Військові конфлікти суттєво змінюють ландшафт економіки. Дослідження довело, що військова ситуація може стати каталізатором для розвитку нових технологій, залучення міжнародної підтримки для відновлення та модернізації. З огляду на це, важливо розглядати інвестиційну, операційну та фінансову діяльність як взаємопов'язані елементи, що створюють синергію для економічного відновлення. Системний підхід до їх аналізу може забезпечити основи для успішного відновлення країни в післявоєнний період, а саме, сприяти поліпшенню управління операційними процесами для підвищення продуктивності та формуванню стабільного фінансового середовища для залучення внутрішніх і зовнішніх інвесторів

**Ключові слова:** системний підхід; конкурентоспроможність; оптимізація; технологічні інновації; стратегічне планування; стратегії відновлення; післявоєнне відновлення

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# Exchange rate volatility, stock prices and returns in BRICS: The moderating effect of inflation with wavelength analysis

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**Abstract.** This study aimed to evaluate the conditional effect of exchange rate volatility on stock prices and returns in the emerging markets of BRICS nations. Using daily data from 1 January 2000 to 30 December 2023, wavelet and quantile analysis were conducted. The Markov-regime model was estimated for robustness check. The wavelet scale W1 exhibited a variance of 574.7375 and a relative percentage of 20.95% in explaining stock price variability, whereas wavelet scale W3 had a variance of 288.5577 and a relative proportion of 15.54%, and wavelet scale W2 had a variance of 159.5644 and a relative proportion of 8.59%. The implication was that BRICS stock markets react significantly to cumulative economic trends over the short term and sudden movements in exchange rates. The variance contribution for returns was found to increase with short-term scales, ranging from 0.0156 for W1 to 0.0643 for W3. This increase indicated that stock returns in BRICS countries were moderately reactive to abrupt exchange rate fluctuations, immediate shifts in inflation, and money supply variations. The short-term scales capture the market's rapid responses to economic news and updates. Such sensitivity to transient economic changes aligns with the results of earlier studies. Stock prices rose in response to an increase in the inflation rate across the quantiles, while stock returns were inversely and considerably influenced by the inflation rate. Also, highly significant negative responses of stock returns to variations in the exchange rate were found under both floating and fixed exchange rate regimes. Overall, when internal inflation exerts a strong moderating influence in an economic environment marked by severe volatility, market performance becomes highly responsive to fluctuations in currency values. The findings of this research will aid in the planning and development of policies by all governments, as well as the financial industry

**Keywords:** variation in money supply; cumulative variance; variance spectrum distribution; quantile regression; Markov-switching regression

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## Introduction

BRICS refers to Brazil, Russia, India, China, and South Africa, the five largest emerging economies. As a result, over the past several decades, these nations have seen a continuous increase in international commerce, strengthening their economic and commercial ties. Exchange rate volatility has become increasingly important in commerce as a topic for scholars, investors, and decisionmakers due to these global developments. This is because exchange rates affect a wide range of indicators, organisations, and economic entities, including financial markets at both macro and local levels. Additionally, exchange rates are essential to every economy because they directly influence capital flows, exports, and imports. This is particularly true concerning financial exchanges and international trade between a country and the rest of the world. Accordingly, variations in the value of a national currency relative to other currencies are now considered to have an immediate impact on the cost and price levels of imported and exported goods and services, which can affect the overall competitiveness of the economy.

Numerous studies have examined the link between exchange rates and stock market dynamics in the empirical literature. For instance, during the period 2005-2021, C.A.G. Da Silva (2023) investigated the dynamic interaction between exchange rate fluctuations and stock market returns in Brazil, Argentina, Mexico, and India using the Markov Switching Vector Autoregressive model with regime shifts. The study's findings indicated that, in every emerging economy under consideration, the impact of exchange rate fluctuations on stock returns was not statistically significant. This suggests that, both during calm and tumultuous times, changes in the value of the US dollar had no bearing on the trajectory of stock market returns.

M. Atif *et al*. (2022) investigated the relationship between oil price fluctuations and stock returns in countries that import and export oil. Their study used a panel vector autoregression model, and the results confirmed a growing correlation between changes in stock prices and oil prices, particularly during the period when oil prices fell sharply due to the devastating effects of the COVID19 pandemic. The impulse response and error variance decomposition produced results similar to Granger causality. There were no differences in how volatile market prices affected countries that imported and exported oil. W. Boukraine (2020) used quarterly data from 2011 to 2019 to study the behaviour of the Tunisian currency about inflation. The study used a smooth transition autoregressive model, a nonlinear approach. The results provided evidence of a substantial short-term impact of increases in foreign debt, the real effective exchange rate, and inflation on economic growth. The results of the non-linearity tests supported the logistic smooth transition autoregressive specification, which offered a more accurate account of exchange rate pass-through to inflation in Tunisia over a decade.

Scholars, however, disagree about whether exchange rate volatility and stock prices are related. Hence, empirical research has led to two prominent schools of thought: those who maintain that there is no correlation between exchange rates and the stock market (Sokhanvar *et al*., 2024) and those who argue that there is (Chancharat & Suwannapak, 2024). These differing viewpoints clearly indicate that there is still debate regarding the question of whether stock prices and currency exchange rates are related. There are no definitive answers to the question of how exchange rates impact stock prices in economic theory or empirical data. Considerable debate surrounds the relationship between stock prices and currency exchange rates. Despite extensive research, the conclusions of the empirical literature on the link between real exchange rates and stock prices remain inconclusive. This gap in the literature underscores the relevance of the present study, which aimed to contribute to the ongoing discussion on stock prices and exchange rate dynamics. The primary aim of this article was to investigate, how exchange rate volatility affects stock prices and returns in BRICS.

## Literature Review

It is important to review theories and empirical studies on the effects of exchange rate instability on stock prices and returns. According to F. Gale *et al*. (2019) and the International Monetary Fund (2023), China's economy exceeded Japan's in 2010 to take second place, while Brazil overtook the UK in 2013 to take sixth place. Collectively, the BRICS countries make up 25% of the world's landmass, 40% of its population, 30% of global economic growth, and an estimated 8.7 trillion USD in GDP (Glauben & Duric, 2024). The recent economic crisis has affected final demand in major economies (the US, Europe, and Japan, or the G3), but consumption has been expanding faster in the BRICS. The BRICS nations are increasingly dominating the control of world trade. The WTO (World Trade Organization) and UNCTAD (United Nations Conference on Trade and Development) reported that export growth was 25% in China, 38% in Brazil, and 28% in India (Global trade..., 2024). By 2024, their total exports amounted to 3.2 trillion USD (UN Comtrade, n.d.). The BRICS facilitated up to 60% of trade among low-income countries (Blanga-Gubbay & Rubínová, 2023; Global trade..., 2024). Moreover, those who trade in the stock markets and international travellers are similarly impacted by changes in exchange rates. For decades, researchers have attempted to comprehend the connection between exchange rates and stock prices. Many theoretical and empirical studies have been conducted to ascertain the causal relationship between these two financial variables. For example, the conventional perspective, as exemplified by

floworiented models, proposes that exchange rates influence stock prices. This viewpoint asserts that fluctuations in exchange rates impact a company's competitive position. Consequently, this affects the firm's earnings, overall financial health, and, in turn, the general trend in stock prices, as noted by D. Carter *et al*. (2022). However, in both theory and practice, the direction of causality has remained unclear. Despite several empirical studies identifying some correlations and causal links, no definitive causal relationship has been established. Additionally, it is also observed that the direction of causation has been observed to vary across different economies.

Many theoretical models attempt to explain the connection between stock-oriented prices and exchange rate volatility. These theories include stock and flow-oriented models. According to the flow-oriented model proposed by R. Dornbusch & S. Fischer (1980), exchange rate fluctuations affect international trade, which subsequently influences the real income and production of enterprises. Given that the key factor influencing a company's stock price is its expected future cash flows and discounted present value, changes in the exchange rate will affect the company's balance sheet and, consequently, its stock price. As a result, the flow-oriented model proposes that stock prices and exchange rates are positively correlated. Conversely, the portfolio balance model asserts that there is a negative correlation between exchange rates and stock prices (Adekoya, 2020). According to this hypothesis, changes in stock prices impact capital account transactions, which are the key drivers of exchange rates. Under the principle, when the stock market performs well, foreign money flows into the country, boosting the market and, consequently, the value of the currency. The stock-oriented hypothesis does not share the same assumptions as the theories outlined above regarding the relationship between the stock market and the exchange rate market. This theory suggests that a similar element, such as interest rates, is what drives movements in both markets (Karimo, 2020; Atenga & Mougoue, 2021; Salachas *et al*., 2024). The flow model illustrated, how changes in exchange rates impact a company's trade balance position as well as its capacity to compete globally.

I. Ogunsanya & T.W. Adamson (2024) discovered empirical evidence supporting the portfolio adjustment theory's assertion regarding the correlation between exchange rate fluctuations and stock returns. By directly affecting aggregate demand through wealth and liquidity effects, changes in stock prices have an indirect effect on exchange rate movements. For instance, a drop in stock prices lowers local investors' wealth of local investors and reduces liquidity. A decline in liquidity leads to a further drop in interest rates, which in turn encourages capital flight and depreciates the value of the currency. According to this theory, supply and demand for financial assets like stocks and bonds are balanced by the exchange rate. As a result, expectations regarding relative currency fluctuations have a significant impact on the price variations of financially held assets. Thus, changes in exchange rates trigger changes in stock prices. If the value of the Nigerian Naira drops concerning the US dollar, the returns on dollar-denominated assets increase. This encourages investors to move their funds from domestic financial assets to dollar-denominated investments, thereby lowering the cost of local stocks.

## Materials and Methods

To explore the impact of exchange rate volatility, inflation, and money supply variation on stock returns and prices within BRICS countries, and given the nature of the data and the potential for nonlinear interactions and time-frequency variations in financial time series, the research incorporated wavelet transformations to handle these complexities. Suppose $z = (z_1, ..., z_T)'$ is the series collected on exchange rate volatility, inflation, and money supply variation affecting stock returns. The long-memory wavelet model for $Z$ is defined as:

$$Z = X\beta + W^{\dagger} w + e, \tag{1}$$

where $X = (x_1, ..., x_T)'$ – the design matrix; $\beta$ – the corresponding regression coefficient vector; and $W'$ – the inverse wavelet transform matrix. For each time series, stock returns, and prices, the mean structure is described by $X\beta$, while the dependence structure is characterised by the variance of $w$. In particular, the parameters governing the variance behaviour are described by the following equation:

$$Var(z) = W^{\dagger} M \begin{pmatrix} \sigma_{-1}^2 I \\ \sigma_{-1}^2 I \\ \sigma_{-c}^2 \Gamma_c \end{pmatrix} W + \sigma_e^2 I. \tag{2}$$

Accordingly, $w$ satisfies the variance structures in (3) and (4), and $e = (e_1, ..., e_T)'$ is regression errors with , which are independent of $w$:

$$r_t = \begin{cases} \omega_j^2, j = -1, \ldots, -l \\ \omega_0^2 (2^{1-2d} - 1) 2^{2dj}, j = -(l+1), \ldots, -j. \\ \omega_0^2 2^{2dj}, j = f \end{cases} \tag{3}$$

For a given $L (0 \le l \le l - 1)$, the correlation matrix $(n_f = T2^{-J})$ satisfies $\Phi_f$, where:

$$\Phi_f = \begin{pmatrix} 1 \beta \beta^2 \ldots \\ \beta 1 \beta \ldots \\ \beta^2 \ldots\ldots \beta^2 \\ \ldots\ldots\ldots \beta \\ \ldots\ldots \beta^2 \beta 1 \end{pmatrix}. \tag{4}$$

Thus, the wavelet model specification became:

$$srtn_{W_t} = \beta_0 + \beta_1 W[(exrvol)] + \beta_2 W[inflr] + \beta_3 W[mssvt] + e_{W1_t}; \tag{5}$$

$$sprc_{W_t} = \delta_0 + \delta_1 W[(exrvol)] + \delta_2 W[inflr] + \delta_3 W[mssvt] + e_{W2_t}, \tag{6}$$

where $\delta$'s and $\beta$'s – the wavelet coefficients of stock returns, exchange rate volatility, inflation, and GDP,

respectively. Here, $e_t$ – the error term, and $W[\cdot]$ denotes the wavelet transform applied to each variable, converting them from the time domain into the time-frequency domain. The wavelet coefficients for stock returns, exchange rate volatility, inflation, and GDP were then estimated using a wavelet-based regression technique. This method involves decomposing each series (exchange rate volatility, inflation rate, and money supply variation) into a set of wavelet coefficients using a discrete wavelet transform (DWT). With the transformed data, a regression analysis was performed at each level of decomposition to estimate the effect of variations in each variable on stock returns and prices at various frequencies, capturing both short-term and long-term effects. The Mallat algorithm was implemented for the maximum likelihood estimation of the discrete wavelet coefficients. The asymptotic variance of the MLE for ($\theta$, $\beta$) is the inverse of the information matrix satisfying:

$$I = \begin{pmatrix} I_{\beta\beta} & 0 \\ 0 & I_{\delta\delta} \end{pmatrix} = \begin{pmatrix} 0.5tr[(\varphi\sum)\sum -1(\varphi\sum/\varphi\theta_j)] & 0 \\ 0 & Z\sum -1\,Z \end{pmatrix}. \quad (7)$$

The research also estimated the conditional covariance of the exchange rate as a measure of its volatility across BRICS countries. The study employs the variation in money supply and inflation rate as control variables, while exchange rate volatility is the foremost predictor whose impact on stock returns and prices was assessed. The daily returns are calculated using the equation:

$$r_t = ln[p_t/p_{t-1}], \quad (8)$$

where $r_t$ – the daily return at time $t$, $p_t$, and $p_{t-1}$ – the closing price at time t and the previous adjusted closing price. A decomposition of stock returns yields:

$$r_t = E[r_t/I_{t-1}] + e_t. \quad (9)$$

By definition, $E\,[r_t\,/\,I_{t-1}]$ – the conditional mean that follows an autoregressive process capturing the expected return at time $t$, given all previously available information $I_{t-1}$. On the other hand, $e_t$ is defined by the equation as follows:

$$e_t = z_t\sigma_t, \quad (10)$$

where $\sigma_t$ – the conditional standard deviation of $e_t$, while the sequence of $z_t$ – identically distributed with a zero mean and unit variance (Kumar *et al*., 2019). Based on the conditional variance model, that is, the autoregressive conditional heteroskedasticity (ARCH) model proposed by R.F. Engle (1982), equation (3) was estimated accordingly. In the ARCH model, the variance of the error term depends on previous variances of the error term, as shown in equation (11):

$$\sigma_t^2 = \delta_0 + \sum_{i=1}^{q}\delta_i e_{t\text{-i}}^2. \quad (11)$$

T. Bollerslev *et al*. (2006) expanded the ARCH model by adding a moving average component to develop the generalised autoregressive conditional heteroskedasticity (GARCH) model. The GARCH ($p$, $q$) model was specified as:

$$\sigma_t^2 = \delta_0 + \sum_{i=1}^{q}\delta_i e_{t\text{-}}^2 + \sum_{j=1}^{p}\beta_j\sigma_{t\text{-}j}^2. \quad (12)$$

The process is stationary if $\delta + \beta < 1$. The fulfilment of the stationarity condition leads to the convergence of the conditional variance towards the unconditional variance. The $\delta_i$ coefficients explain the speed at which market participants in BRICS react to market news, while $\beta_j$ captures volatility persistence over time. The study estimated the quantile regression model, which allows for greater flexibility in modelling the relationship between variables. The quantile model specification is given as:

$$Q_{\emptyset}(y\,|\,X) = Q_{\emptyset}(\alpha_0 + \alpha_x X_{it} + \alpha_z H_{it} + \gamma_i + \sigma), \quad (13)$$

where $Q_{\emptyset}(y\,|\,X)$ – the conditional quantile function of the response variable (exchange rate) given the vector of predictors $X$, $\alpha(\emptyset)$ – a vector of parameters that depend on the $\emptyset^{th}$ quantile. The quantile regression estimator for quantile $\emptyset$ minimises the loss function:

$$(\alpha_{\emptyset}) = \sum_{i:y\geq X_i'\alpha}^{N}\emptyset\,|y_i - X_i'\alpha_{\emptyset}| + \sum_{i:y\geq X_i'\alpha}^{N}(1-\emptyset)|y_i - X_i'\alpha_{\emptyset}. \quad (14)$$

Quantile regression estimates the median effect by minimising the sum of absolute deviation errors, as specified in equation (14). Such quantile estimation produced the coefficients $\alpha_{1\emptyset}$, $\alpha_{2\emptyset}$, $\alpha_{3\emptyset}$, and $\alpha_{k\emptyset}$ at the $\emptyset^{th}$ quantile, given the values of $X_i$. Thus, the estimation of coefficients for different quantiles ($\emptyset$) provides a measure of how the impact of each variable varies across different levels of stock returns and stock prices in each country covered by the research. The rationale for estimating quantile regression is that it enables the estimation of various quantiles of stock returns and prices, even in the presence of non-normal data distributions. The estimation process involves the minimisation of weighted absolute deviations through optimisation algorithms. Quantiles in the tables were calculated for $p = 0.25$ using the Rankit (Cleveland) method. A unit root test, the Pedroni cointegration test, and Markov-switching regression were used in the calculations. The unit root tests were conducted at both the level and first difference for the variables stock price (SPRC), exchange rate volatility (EXRVL), inflation (INFLR), money supply volatility (MSSVL) and stock return (SRTN). When comparing the alternative hypothesis – that a unit root does not exist – to the null hypothesis, which states that the series is non-stationary and has a unit root, the authors accepted the alternative hypothesis, suggesting the presence of a unit root. The purpose of the Pedroni cointegration test conducted in this research was to determine whether the variables exhibited signs of cointegration. Eviews 13 was also used for data processing. An asymmetric GARCH (AGARCH) model was used to describe the conditional standard deviation of stock prices. To conduct a comprehensive study on this topic, the analysis covered the period from 2019 to 2023. Daily data from 1 January 2000 to 30 December 2023 were sourced from the World Bank and the International Monetary Fund

databanks. In particular, the International Monetary Fund (2023) was a primary source.

## Results and Discussion

Table 1 presented the descriptive statistics of the variables in the study. The mean values of the stock price (SPRC) are 22.61692, 4.797323, 355.5192, 156.487, and 40.00897 for Brazil, Russia, India, China, and South Africa, respectively. As shown in Table 1, India had the highest stock price during the period of the analysis. The standard deviation values from the mean values are 1341.48, 123.5870, 109.390, 10.2370, and 302.497 for the aforementioned countries, respectively. Kurtosis, a measure of the peakedness of a distribution, indicates that all values are greater than 3.0. The distribution is leptokurtic, meaning it is sharply peaked and heavy-tailed, as all other variables have kurtosis values exceeding 3. To determine the asymptotic properties of the test, the probability values for the distribution are compared to the results of the Jarque-Bera normality test. It can be inferred from the table that all variables exhibit low probability values, and since the means and medians are almost equal, it may be concluded that the residuals of the distribution follow a normal distribution.

***Table 1.*** *Description statistics of the stock prices for BRICS*

| Country | Mean | Max | Min | Quantiles | *SD* | Kurtosis |
|---|---|---|---|---|---|---|
| Brazil | 22.61692 | 1,421.498 | 51.42061 | 1.13E+12 | 1,341.48 | 7.707 |
| Russia | 4.797323 | 8.488170 | 6.782594 | 3.47E+11 | 123.5870 | 15.938 |
| India | 355.5192 | 42,000.00 | 2,947.733 | 1.80E+13 | 109.390 | 59.949 |
| China | 156.487 | 1,899.589 | -1.401473 | 1.308E+12 | 10.2370 | 22.962 |
| South Africa | 40.00897 | 6,133.375 | 262.0754 | 2.55E+12 | 302.497 | 6.814 |
| All | 480,215.3 | 1.13E+10 | 20,605,052 | 1.95E+27 | 1.155E+123 | 9.509 |

***Source:*** *calculated by the authors*

Table 2 contained the descriptive statistics for stock returns in BRICS. According to the table, the mean return values for Brazil, Russia, India, China, and South Africa were 120, 162.21, 170.92, 1,726.24, and 3,027.18, respectively. The standard deviation of returns was lowest for Brazil, with a value of 11.32, while that of South Africa was the highest, at 134.6. Table 3 contained the descriptive statistics for exchange rate volatility in BRICS. According to the table, the mean volatility rate for the currencies was 1.2932 for the Brazilian real, 2.3271 for the Russian ruble, 3.0918 for the Indian rupee, 0.27345 for the Chinese yuan, and 2.03862 for the South African rand concerning the US dollar. The highest standard deviation of currency rates, 3.2309, was reported for the South African rand. The kurtosis coefficients for the volatility of these currencies show that the rand was leptokurtic, implying that the rand/dollar exchange rate exhibits significant deviations from the mean exchange rate.

***Table 2.*** *Description statistics of the stock returns for BRICS*

| Country | Mean | Max | Min | Quantiles | *SD* | Kurtosis |
|---|---|---|---|---|---|---|
| Brazil | 120.89 | 1,672.298 | 120.379 | 1.10E+19 | 11.320 | 2.305 |
| Russia | 162.21 | 1,755.209 | 100.3297 | 2.17E+10 | 13.298 | 1.294 |
| India | 170.92 | 2,930.437 | 1,200.379 | 1.20E+14 | 181.237 | 9.282 |
| China | 1,726.24 | 29,387.100 | 1,345.301 | 1.89E+15 | 101.90 | 4.279 |
| South Africa | 3,027.18 | 3,875.279 | 142.3874 | 2.67E+14 | 134.548 | 19.287 |
| All | 3,259.389 | 1.14E+15 | 2,389.387 | 1.52E+20 | 1.121E+10 | 10.393 |

***Source:*** *calculated by the authors*

***Table 3.*** *Description statistics of the exchange rate volatility for BRICS*

| Country | Mean | Max | Min | Quantiles | *SD* | Kurtosis |
|---|---|---|---|---|---|---|
| Brazil | 1.2932 | 2.3208 | 0.00287 | 1.21E+12 | 0.29189 | 1.2039 |
| Russia | 2.3271 | 1.2389 | 1.02892 | 1.57E+10 | 2.38930 | 2.2087 |
| India | 3.0918 | 4.28102 | 0.19537 | 1.0E+12 | 1.02738 | 2.0314 |
| China | 0.27345 | 1.207400 | 0.01928 | 0.1262+10 | 0.13257 | 1.20328 |
| South Africa | 2.03862 | 5.38189 | 1.20383 | 1.56E+13 | 3.2309 | 3.10287 |
| All | 12.37947 | 2.393190 | 1.20893 | 1.05E+26 | 20.33618 | 1.3289 |

***Source:*** *calculated by the authors*

Table 4 contained the descriptive statistics for stock returns in BRICS. According to the table, the mean inflation rate was highest in Russia at 190.4%, followed by China and South Africa at 176.4% and 109.4%, respectively. India had the highest standard deviation in inflation, followed by China and Russia. The kurtosis coefficients for the inflation rate in Russia and South Africa are 7.3893 and 12.349, respectively. This indicated that

the distribution of inflation rates in those two countries is leptokurtic, meaning it has fat tails, which suggested a higher frequency of extreme deviations from the average price level in those countries.

***Table 4.*** *Description statistics of the inflation rate for BRICS*

| Country | Mean | Max | Min | Quantiles | *SD* | Kurtosis |
|---|---|---|---|---|---|---|
| Brazil | 10.3487 | 20.387 | 12.3837 | 1.13E+10 | 23.478 | 1.29832 |
| Russia | 190.387 | 35.5957 | 19.3562 | 5.40E+11 | 29.490 | 7.3893 |
| India | 27.3467 | 28.3834 | 10.289 | 1.20E+00 | 160.487 | 16.383 |
| China | 176.3874 | 25.487 | 19.2386 | 1.00E+05 | 60.336 | 3.2381 |
| South Africa | 109.386 | 27.1558 | 19.4253 | 1.56E+16 | 12.494 | 12.349 |
| All | 189.384 | 123.4310 | 20.3487 | 1.23E+47 | 1.10E+13 | 7.2194 |

***Source:*** *calculated by the authors*

Table 5 belowed reports the summary statistics for variations in broad money supply in BRICS. The highest variation in money supply was recorded in South Africa, with a mean value of 12620.3%, while China, with a mean value of 1,435.3%, ranked second. Meanwhile, China and Russia, with values of 147.3% and 145.9%, respectively, exhibited the highest volatility in broad money supply. South Africa had the highest kurtosis coefficient, 20.395, while Russia ranked second with 19.289. This indicated that the distribution of money supply in these two countries is leptokurtic, with a tendency towards extreme outliers in money supply values. In other words, money supply changes in these countries have a high tendency to deviate significantly from the average.

***Table 5.*** *Description statistics of the money supply variation for BRICS*

| Country | Mean | Max | Min | Quantiles | *SD* | Kurtosis |
|---|---|---|---|---|---|---|
| Brazil | 120.93 | 126,093.03 | 190.34879 | 1.22E+15 | 110.298 | 12.389 |
| Russia | 190.329 | 14,639.39 | 234.5658 | 4.567E+12 | 145.862 | 19.289 |
| India | 203.4855 | 3,562.186 | 187.5860 | 1.21E+14 | 123.4794 | 5.279 |
| China | 1,435.28 | 34,257.289 | 1,003.494 | 1.66E+23 | 147.300 | 16.081 |
| South Africa | 12,620.30 | 1,783.332 | 18,309.271 | 1.23E+10 | 111.289 | 20.395 |
| All | 24,755.358 | 4,566.6720 | 35,729.287 | 1.05E+23 | 1.03E+10 | 11.379 |

***Source:*** *calculated by the authors*

Table 6 reported the unit root test results for BRICS. The results presented in Table 6 showed that the time series for stock returns and inflation rate indexes were both stationary at their levels.

However, the exchange rate and gross domestic product were non-stationary at their initial level but became stationary at the first difference, with a significance level of 5%.

***Table 6.*** *Unit root test results for BRICS*

| Variables | ADF | | PP | | Order of integration |
|---|---|---|---|---|---|
| | Level | 1st Diff | Level | 1st Diff | |
| SPRC (probability) | 3.2910 (0.1567) | 33.2497 (0.0027) | 1.639 (0.1205) | 49.5218 (0.0000) | 1(1) |
| EXRVL (probability) | 1.0968 (0.1613) | 79.9526 (0.0000) | 1.7042 (0.2723) | 107.105 (0.0000) | 1(1) |
| INFLR (probability) | 0.4492 (0.3467) | 60.3245 (0.0000) | 2.5673 (0.458) | 46.4431 (0.0001) | 1(1) |
| SRTN (probability) | 1.0987 (0.2465) | 6.0987 (0.0000) | 1.3721 (0.2861) | 9.4431 (0.0001) | 1(1) |
| MSSVT (probability) | 2.43900 (0.9997) | 82.3035 (0.0000) | 1.91888 (0.9999) | 135.056 (0.0000) | 1(1) |

***Source:*** calculated by the authors

The results of the co-integration test were reported in Table 7. As shown in Table 7, the majority of tests yielded a probability of less than 0.05, which supported the acceptance of the hypothesis that co-integration exists.

***Table 7.*** *Pedroni co-integration test results for BRICS*

| Measure | Statistic | Probability |
|---|---|---|
| Panel v-statistic | 3.812475 | 0.0001 |
| Panel rho-statistic | -4.171151 | 0.0000 |

*Table 2, Continued*

| Measure | Statistic | Probability |
|---|---|---|
| Panel PP-statistic | -4.905688 | 0.0000 |
| Panel ADF-statistic | -2.103017 | 0.0177 |
| Group rho-statistic | -1.728237 | 0.0420 |
| Group PP-statistic | -4.454848 | 0.0000 |
| Group ADF-statistic | -2.583454 | 0.0049 |

***Source:*** *calculated by the authors*

Figure 1 illustrated the estimated relationship between the inflation rate, GDP, exchange rates, and stock returns. Table 4 reported the computed AGARCH (1.1) parameters. The results indicated a positive and dynamic relationship between the explanatory factors and stock returns, as evidenced by the positive correlations. This suggested that in BRICS, market turnover or trading volume responds positively to stock returns. Figure 2 showed the conditional variances of stock market returns for all BRICS countries.

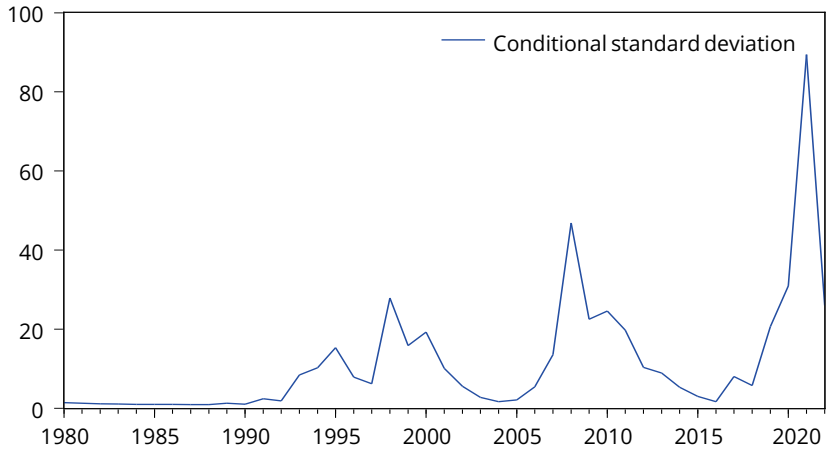


***Figure 1.*** *Conditional standard deviation for stock prices*

***Source:*** *calculated by the authors*

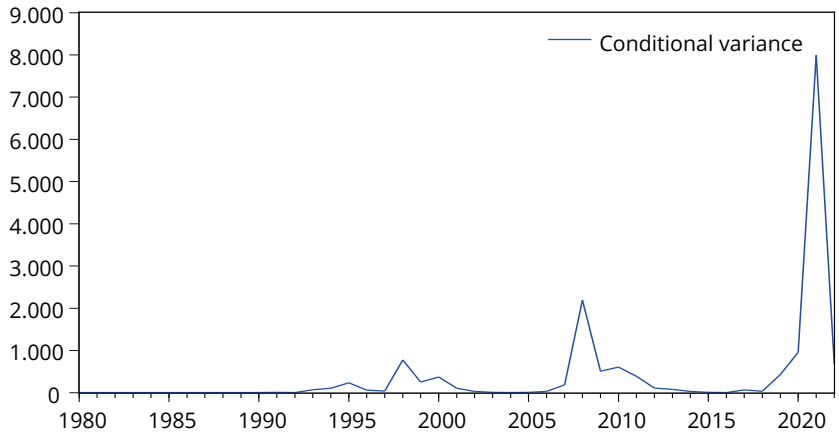


***Figure 2.*** *Conditional variance for stock returns*

***Source:*** *calculated by the authors*

Table 8 reported the wavelet results for BRICS stock returns. The wavelet analysis illustrated, how the variance of stock returns is influenced by exchange rates, inflation, and money supply fluctuations. The variance was distributed across different time scales for BRICS countries. This analysis employed a DWT using a Haar filter, which was well suited for detecting abrupt changes in financial time series data and extends over eight scales (W1 to W8). Short-term scales (W1 to W3) show an increasing variance contribution, rising from 0.0156 for W1 to 0.0643 for W3. This trend indicated that BRICS stock returns were moderately sensitive to short-term

fluctuations in exchange rates, inflation, and money supply. Short-term scales reflect the market's rapid responses to news and economic updates. This heightened sensitivity to short-term economic fluctuations aligns with the findings of H.R. Tejesh (2024). Conversely, K. Coretha *et al*. (2024) reported a short-term effect of exchange rate fluctuations on stock returns. Similarly, the GARCH (1.1) model estimation by D. ElDiftar (2023) revealed a significant positive long-term relationship between exchange rates and stock market returns in emerging markets (E7). Medium-term scales (W4 to W6) exhibit a sharp increase in variance, with W4 and W5 peaking at W6, where the variance reaches its highest relative contribution of 0.1628. These scales likely reflected the rapid adjustment processes in stock markets as they absorb the impacts of medium-term economic trends and policies. Long-term scales (W7 and W8) indicated that the relative proportion of variance remained significant, suggesting that long-term economic fundamentals and policy shifts continue to shape stock returns. W7 and W8 collectively account for over 48% of the total variance, highlighting the critical role of stable, long-term economic conditions in market valuations. This finding was supported by D. El-Diftar (2023), who concluded that positive long-term changes in capital markets can result from fluctuations in exchange rates.

***Table 8.*** *Wavelet analysis of variance for stock returns of BRICS countries*

| Scale | Variance | Relative proportion | Cumulative proportion |
|---|---|---|---|
| W1 | 398.2728 | 0.0156 | 0.0156 |
| W2 | 1268.214 | 0.0496 | 0.0652 |
| W3 | 1643.941 | 0.0643 | 0.1295 |
| W4 | 3098.092 | 0.1212 | 0.2508 |
| W5 | 2826.667 | 0.1106 | 0.3614 |
| W6 | 4160.729 | 0.1628 | 0.5242 |
| W7 | 3890.241 | 0.1522 | 0.6764 |
| W8 | 8268.978 | 0.3236 | 1.0000 |

***Source:*** *calculated by the authors*

The bar graph in Figure 3 illustrated the wavelet variance spectrum for BRICS stock returns. This graph was particularly useful for analysing how stock return volatility, influenced by factors such as exchange rate fluctuations, inflation volatility, and money supply variations, evolves across different frequency scales. Each bar represented the variance at a specific scale, demonstrating, how much of the total variability in stock returns can be attributed to fluctuations within that particular frequency band. The shorter bars on the left side of the graph indicated relatively lower variance contributions from high-frequency fluctuations, suggesting that in BRICS countries, immediate shortterm changes in exchange rates, inflation, and money supply variations contribute less to overall stock return volatility. By implication, when markets adjust quickly to transient changes, short-term economic shocks have minimal impact on stock markets. This finding aligned with the conclusions of S. Damiano (2020), who found that emerging markets can strengthen their resilience to global financial shocks through macroprudential regulation.

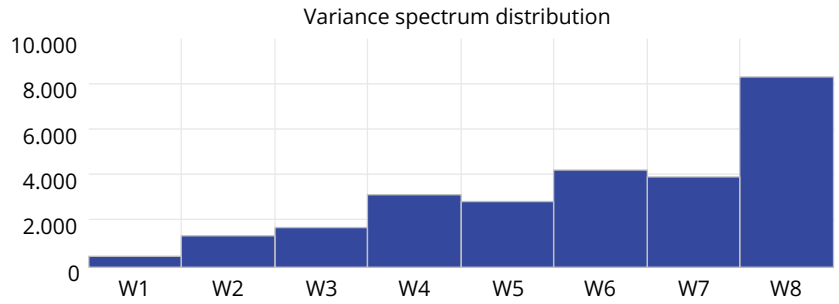


***Figure 3.*** *Wavelet variance spectrum for stock returns of BRICS countries*
***Source:*** *calculated by the authors*

Medium-term scales (middle bars) increased in height towards the centre of the graph, indicating a greater variance contribution from medium-term economic fluctuations. This increased variance at medium suggests the stock markets' reaction to more sustained economic trends and policies, which may take months to fully materialise in stock returns. According to the International Monetary Fund (2024), medium-term effects were significant because they reflect the market's adjustment period to new economic policies or changes in economic fundamentals. Long-term scales (rightmost bars) indicated that the largest share of variance in stock

returns stems from long-term factors. This highlighted the influence of long-term economic instability on stock markets. Such variances likely reflect deeper, structural economic changes occurring over several years, such as long-term trends in money growth, persistent inflationary conditions, and volatile exchange rate regimes. C. O'Sullivan & V.G. Papavassiliou (2021) emphasised that long-term economic trends exert a profound and lasting impact on stock market performance, particularly in emerging economies like those of the BRICS. This supported the argument that the greatest net volatility transmitters, according to the authors, were the longer-term benchmark stocks of core nations. Y.K. Qing & S. Kusairi (2019) also found that stock returns were significantly affected by changes in money growth, currency fluctuations, and interest rates in Malaysia.

Figure 4 represented the cumulative variance distribution of stock returns influenced by exchange rate volatility, inflation volatility, and variations in the money supply across various time scales, using wavelet analysis for BRICS countries. The cumulative variance, as shown in the graph, increases progressively, indicating a stronger influence of longer time-scale fluctuations on stock return variance. The initial segment of the curve (early rise) suggested that short-term fluctuations in exchange rate volatility, inflation volatility, and money supply variations begin to impact stock returns, but their cumulative effect was initially modest. This part of the curve represented rapid market reactions to new information and immediate economic changes, which can trigger significant but short-lived volatility in stock markets, particularly in response to exchange rate fluctuations. This aligned with the findings of C. O'Sullivan & V.G. Papavassiliou (2021), who observed that the only net receivers of return spillovers were the short-end and the long-end segments of the yield curve periphery in core countries.

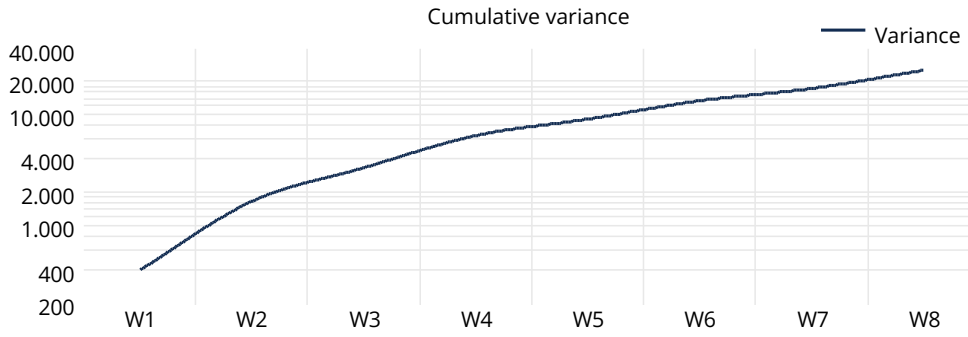


***Figure 4.*** *Cumulative variance spectrum for stock returns of BRICS countries*
***Source:*** *calculated by the authors*

The middle segment of the curve (steady ascent) rises more steadily; this suggested that mediumterm economic indicators begin to play a more significant role. This segment captures adjustments in stock returns to underlying economic trends such as sustained inflationary pressures or changes in money supply. The increasing cumulative variance in this section aligned with findings by R.K. Verma & R. Bansal (2021), who argued that in emerging markets, stock returns were particularly sensitive to macroeconomic variables such as GDP, FDI, and global institutional investment over the medium term. The later segment of the curve (plateauing trend) showed that towards the end of the curve, the rate of increase in cumulative variance slows and begins to plateau, indicating that the additional variance explained by the longest time scales is less pronounced. This plateau suggested that while long-term economic fundamentals, such as stable and consistent exchange rate policies, do influence stock returns, their incremental contribution to total variance was smaller than that of short- and medium-term factors.

Table 9 presented a wavelet analysis of BRICS stock prices. The wavelet analysis breaks down the variance of the time series using the DWT. According to the given equations, variables such as changes in the money supply, inflation volatility, and exchange rate fluctuations impact stock prices. Wavelet scale W1 had a relative percentage of 20.95% and a variance of 574.7375. Regarding stock price responses to short-term fluctuations in money supply, inflation, and exchange rates, this scale captured the highest frequency of fluctuations. The significant variation at this scale indicated that the stock prices of the BRICS nations were highly susceptible to market sentiment and short-term economic indicators. In particular, sharp fluctuations in exchange rates may cause stock market volatility immediately. When analysing the distinct effects of economic variables such as exchange rates, inflation, and money growth trends on stock market volatility over different time horizons, empirical research supported the wavelet analysis of BRICS stock prices, which examined the BRICS countries, broken down by variance across multiple scales. Studies by U.-F. Atipaga *et al*. (2024) and G.V.S. Chiranjivi & R. Sensarma (2023) have demonstrated that wavelet approaches are particularly useful in capturing the dynamic correlations between stock prices and exchange rates over a range of time scales. The continuous wavelet analysis reported by

U.-F. Atipaga *et al*. (2024) revealed negative co-movements within the short-term frequency, implying that African market asset investors preferred the short-term horizon during times of crisis. The results of G.V.S. Chiranjivi & R. Sensarma (2023) remained robust across variations in forecast timeframes, window sizes, data observation frequencies, and volatility analysis methods. These findings supported the high variance observed at W1, which reflected sharp market reactions to transient economic fluctuations.

***Table 9.*** *Wavelet analysis of variance for stock prices of BRICS countries*

| Scale | Variance | Relative proportion | Cumulative proportion |
|---|---|---|---|
| W1 | 574.7375 | 0.2095 | 0.2095 |
| W2 | 159.5644 | 0.0859 | 0.2954 |
| W3 | 288.5577 | 0.1554 | 0.4508 |
| W4 | 793.2613 | 0.2272 | 0.6780 |
| W5 | 35.82648 | 0.0193 | 0.6973 |
| W6 | 20.879 | 0.0027 | 0.7000 |
| W7 | 10.013 | 0.2501 | 0.9501 |
| W8 | 6.2051 | 0.0499 | 1.0000 |

***Source:*** *calculated by the authors*

According to the results, wavelet scales W2 and W3 have a variance of 159.5644 with an 8.59% relative proportion and a variance of 288.5577 with a 15.54% relative proportion. These scales represent medium-frequency components that capture the economic responses over a medium-term horizon. Scales W2 and W3 together account for adjustments in stock prices that correlate with more gradual economic developments, such as persistent inflation trends or steady GDP growth and decline. These components suggested that stock markets in BRICS countries exhibit significant responses not only to abrupt exchange rate fluctuations but also to the cumulative impact of economic trends over several months. Moreover, the medium-term adjustments (W2 and W3) found support in the research of M. Batondo & J. Uwilingiye (2022), who applied wavelet decomposition to stock return series to determine the multi-horizon pattern of joint movement as well as the dynamics of market integration. In terms of market episodes related to integration, short- and long-term interactions reinforced and extended the co-movement among stock markets. By extension, mediumfrequency components in financial time series often reflect the adjustment periods during which markets absorb and react to new economic data and policies over several months. Wavelet scale W4 had a variance of 793.2613 with a 22.72% relative proportion, representing lower frequency fluctuations. This scale indicated long-term trends in stock prices, potentially capturing underlying economic stability or significant economic shifts over multiple years, such as long-term GDP growth trends or prolonged inflationary pressures. The substantial variance explained by this component suggests that in BRICS countries, long-term economic fundamentals have a profound impact on stock prices, which may be influenced by persistent exchange rate policies or structural economic reforms.

The significant variance captured at lower frequencies (W4) aligned with research by F. Liu *et al*. (2022), T.C. Silva *et al*. (2023), and D.K. Khatri (2024), which suggested that lowerfrequency components indicate long-term economic trends and global pandemic-related shifts that gradually influence stock markets. This highlighted the profound impact of sustained economic developments on stock prices in BRICS countries over multiple years. Wavelet scale W5 had a variance of 35.82648 with a 1.93% relative proportion, while W6 had a variance of 4.922907 with a 0.27% relative proportion. These scales captured the lowest frequency variations, indicating very longterm trends in the economic data that have minimal impact on the variance of stock prices. These components represent generational shifts or extremely slow-moving economic processes whose impact on current stock prices is negligible compared to more immediate and medium-term economic factors. The negligible variance at the lowest scales (W5, W6, W7, and W8) is consistent with the findings of J.I. Samuels (2024), who noted that the longest-term trends of inflation, GDP growth, interest rates, foreign trade policies, cross-border capital flows, and market events often have minimal direct impact on current financial market dynamics. This is because these effects are so gradual that they become nearly indiscernible in the context of more immediate and medium-term economic processes.

In this wavelet variance spectrum, as shown in Figure 5, each bar represented the variance of stock returns at different scales, with the height of the bar indicating the magnitude of variance associated with that particular scale. From left to right, the scales transition from shorter to longer timeframes. Short time scales (leftmost bars), which were shorter in height, suggested that the immediate impact of exchange rate fluctuations, inflation, and variations in money supply on stock prices was relatively moderate. This aligned with studies such as M.I. Tabash *et al*. (2024), which found that stock markets in emerging economies often absorb short-term economic and financial shocks with moderate volatility, differing from the response of developed markets to financial shocks. This suggested that investors might

price in such fluctuations fairly quickly, leading to lower variance at these scales. Medium time scales (middle bars), which were the taller bars in the middle of the spectrum, indicate a higher variance, suggesting that stock prices were more sensitive to medium-term economic trends. This may indicate, how monetary policies and economic developments over several months to a year influence market perceptions and valuations. Studies such as M. Jibril *et al.* (2023) and K.K. Kumar *et al.* (2024) have discussed how long-term and medium-term economic indicators, such as inflation rates and GDP growth, significantly impact the financial markets of developing countries. This leads to higher volatility in stock returns as markets react to economic forecasts and policy shifts. Long-time scales (rightmost bars), which were the relatively shorter bars at the far right, suggested that the very long-term impacts of exchange rate volatility, inflation volatility, and money supply variations on stock prices exhibit lower variance, indicating stability. This may reflect the fact that long-term economic fundamentals tend to be more predictable or that long-term investors have already factored such elements into stock prices. According to T. Chun *et al*. (2022), long-term global financial market trends in emerging markets often showed resilience to short-term economic shocks, emphasising the role of fundamental economic health over extended periods. However, the wavelet variance spectrum indicated that stock returns in MENA countries were more influenced by mediumterm economic variables, with less emphasis on immediate and very long-term changes.

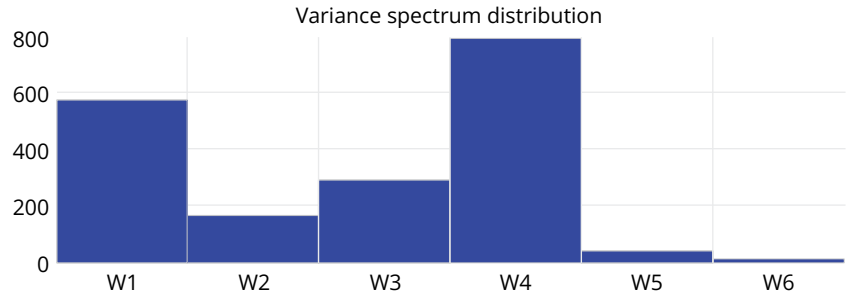


***Figure 5.*** *Wavelet variance spectrum for stock prices of BRICS countries*
***Source:*** *calculated by the authors*

The graph in Figure 6 depicted the cumulative variance of stock prices analysed over varying time scales using a wavelet transformation, focusing on the influence of exchange rate volatility, inflation volatility, and money supply variations on stock prices in BRICS countries. The curve illustrated a continuous increase in cumulative variance as the scale expands, stabilising at the longer time scales. Initial increase (left side of the curve): the steep ascent in the early part of the curve suggested that short-to-medium-term fluctuations in exchange rate volatility, inflation volatility, and money supply variations significantly contribute to stock price fluctuations. This indicated that stock prices were highly sensitive to immediate and medium-term economic changes. Empirical studies such as those by G. Korhan *et al*. (2021) on emerging markets demonstrated that stock market returns were notably impacted by exchange rate fluctuations in the short and medium term due to market conditions, whether bullish or bearish.

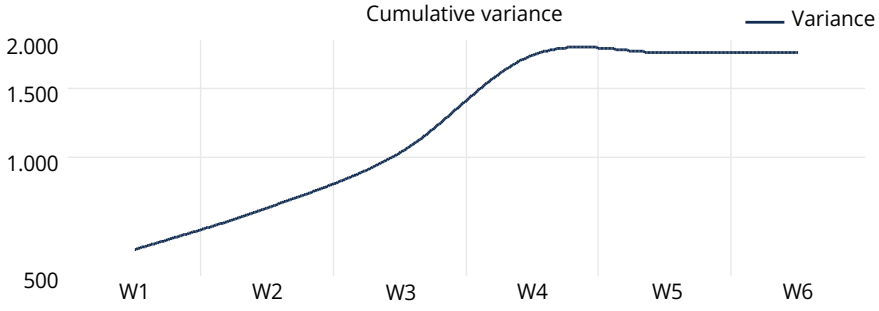


***Figure 6.*** *Cumulative variance spectrum for stock prices of BRICS countries*
***Source:*** *calculated by the authors*

Gradual plateau (middle to right side of the curve): as the curve extends towards the right and begins to plateau, this suggested that adding longer-term economic changes contributes incrementally less to the total vari-

ance. This plateauing effect implied that, while long-term economic trends (such as sustained exchange rate volatility or prolonged inflation instability) influence stock returns, their incremental impact was smaller compared to short- and medium-term volatility. This aligned with findings by M. Mroua & L. Trabelsi (2020), H. Qian *et al*. (2021), and R.K. Singh *et al*. (2024). Using the Lagrange multiplier principle, H. Qian *et al*. (2021) reported significant stock market effects arising from exchange rate changes in BRICS, examining the mechanisms underlying exchange rate shocks. M. Mroua & L. Trabelsi (2020) investigated the dynamic links between exchange rates and stock returns in BRICS countries using the panel GMM and ARDL methods as analytical frameworks. They found that these relationships were positive in the short, medium, and long term, suggesting that in Brazil and Russia, exchange drives lead stock returns, while in India, they were negative. In contrast, China exhibits bidirectional causality.

R.K. Singh *et al*. (2024) analysed the transmission of risk, return, and volatility in the BRICS stock markets between 2008 and 2023 using both linear and non-linear GARCH models. The results demonstrated that there was a significant unilateral and reversible spillover effect in BRICS market performance. The research findings also corroborate those obtained by S. Kumar (2019), U.A. Sheikh *et al*. (2020), and R.K. Suri *et al*. (2024). R.K. Suri *et al*. (2024) identified a complex interaction between stock markets and exchange rates in G20 countries, highlighting a strong positive long-run relationship and negative nexus between these variables. For instance, S. Kumar (2019) and U.A. Sheikh *et al*. (2020) argued that there was an asymmetrical correlation between stock prices and currency exchange rates. S. Mahapatra & S.N. Bhaduri (2019) used a two-factor arbitrage pricing model to study the spillover effects of exchange rate and stock return volatility in Indian financial markets. The findings showed that fluctuations in exchange rates affect stock returns. Some authors also suggested that there was a nonlinear relationship between stock prices and exchange rates.

Furthermore, the far-right side of the cumulative variance curve at longer scales indicated a saturation point, where additional economic information does not significantly alter the understanding of stock return variability. This reflected the market's efficiency in integrating long-term economic expectations into stock prices, a phenomenon discussed by W. Breuer & S. Ruiz de Vargas (2021) in their analysis of key issues in international financial investment management. According to the results of the conditional mean equation shown in Table 10, exchange rate volatility had a positive effect on equities in BRICS. The results of the conditional variance equation demonstrated the presence of statistically significant bidirectional shock transmissions among the study's key variables. However, bond rates influence market returns due to high volatility and shock transmissions. Furthermore, evidence suggested the presence of shock spillovers between returns and currency exchange rate fluctuations. The findings implied that shocks and volatility had a substantial impact on stock prices. While stock prices responded positively to exchange rate volatility, returns exhibited a negative response to volatility in exchange rates and inflation rates.

***Table 10.*** *GARCH results for BRICS*

| **GARCH results for stock prices** | | | |
|---|---|---|---|
| Mean equation | | | |
| Variable | Coefficients | *z* statistic | Prob. |
| SPRC(-1) | 1.01732 | 120.0036 | 0.0000 |
| EXRVL | 1.33513 | 500.4028 | 0.0000 |
| INFLR | 0.11499 | 40.7893 | 0.0000 |
| MSSV | 0.03811 | 70.6146 | 0.0000 |
| C | 0.20745 | 110.1038 | 0.0000 |
| Variance equation | | | |
| C | 0.301204 | 10.00941 | 0.0000 |
| Arch | 0.154353 | 60.36250 | 0.0000 |
| Tarch/Leverage | 0.04306 | 111.52538 | 0.0000 |
| GARCH | 0.51360 | 924.8814 | 0.0000 |
| Persistence | 0.728052 | 118.06938 | 0.0000 |
| Adjusted $R^2$ = 0.674978 | Durbin-Watson | 2.034225 | 0.0000 |

*Table 10, Continued*

| **GARCH results for stock returns** | | | |
|---|---|---|---|
| Mean equation | | | |
| Variable | Coefficients | *z* statistic | Prob. |
| SRTN(-1) | 0.97455 | 160.393 | 0.0000 |
| EXRVL | -1.09346 | -120.48094 | 0.0000 |
| INFLR | -1.23490 | -176.3983 | 0.0000 |
| MSSV | 1.70586 | 400.58632 | 0.0000 |
| C | 0.19209 | 100.38634 | 0.0000 |
| **GARCH results for stock prices** | | | |
| Variance equation | | | |
| C | 0.032864 | 140.58975 | 0.0000 |
| Arch | -0.548190 | 133.48794 | 0.0000 |
| Tarch/Leverage | 0.035870 | 114.5125 | 0.0000 |
| GARCH | 0.621093 | 50.409187 | 0.0000 |
| Persistence | 0.982610 | 1,635.089 | 0.0000 |
| Adjusted $R^2$ = 0.745900 | Durbin-Watson | 2.10004 | 0.0000 |

***Source:*** *calculated by the authors*

Exchange rate volatility had a significant impact on stock prices, while it had a negative impact on stock returns. Investors in the BRICS stock markets must exercise caution due to the ongoing volatility of currency exchange rates. Such persistent volatility in the stock market reflects ongoing uncertainty. The conditional variance equation also demonstrated the presence of volatility transmissions between the foreign exchange and stock markets of the BRICS nations, suggesting that exchange rate shocks have a long-lasting effect on the stock market. Overall, there was a substantial positive spillover from shocks and volatility, providing empirical support for the theory that shocks and fluctuations in currency exchange rates affect stock market prices and returns.

These findings aligned with those of B. Subburayan & A. Aruldoss (2020) and R. Aydin *et al*. (2023). Using an AGARCH model, they examined the volatility spillovers between exchange rates and stock prices in South Africa and other BRICS and Association of Southeast Asian Nations (ASEAN) financial markets. Their research supported the existence of bidirectional spillovers in South Africa's financial markets. Furthermore, the findings were consistent with those reported by W.M.A. Ahmed (2019) and T. Lakshmanasamy (2021). According to T. Lakshmanasamy (2021), exchange rates had a significant positive impact on stock returns in India. The robustness of these results was consistent with those earlier reported by W.M.A. Ahmed (2019). Using the non-linear autoregressive distributed lag method, the researcher reported the presence of asymmetry in the effect of exchange rates on stock returns.

I. Anyikwa & A. Phiri (2023) employed the Quantile-VAR technique to establish the interconnectedness of returns between African stock markets and global commodity and financial asset markets. Using the EGARCH model, K. Agyarko *et al*. (2023) researched on the correlation between volatility in the Ghanaian stock market and exchange rate volatility, advising market investors to rely on the generalised error distribution as the most suitable model, when making decisions regarding the volatility of the Ghanaian stock market. Additionally, Y. Kassouri & H. Altıntaş (2020) studied the dynamic co-movements between Turkish market stock prices, interest rates, money supply, and currency exchange rates from January 2003 to December 2018. Using the threshold autoregressive model, they discovered that a decline in Turkish stock prices corresponds to an increase in the value of the Turkish lira relative to the US dollar.

Stock returns were both positively and negatively influenced by changes in the money supply, with significant coefficients of 1.70586 and -1.23490, respectively. This finding supported the conclusion of S.E. Effiong *et al*. (2023), who demonstrated econometrically that a positive money supply shock significantly increased stock returns, regardless of the exchange rate policy regime in place. The authors also found that devaluation policies in emerging economies resulted in declining returns. Conversely, the rate of inflation and fluctuations in the money supply, with significant coefficients of 0.11499 and 0.03811, respectively, had a positive effect on stock prices. These findings were consistent with those of S. Hirota (2023), who observed that as the money supply grows, the demand for equities rises, which in turn positively affects their pricing. Furthermore, the findings aligned with those reported by C.C. Anyanwu & D.U. Ohurogu (2024), empirically determined that variations in money supply enhance stock market liquidity.

The results of this research also supported those of L. Liu *et al*. (2024). The GMM results reported by L. Liu *et al*. (2024) indicated a positive relationship between bank stock returns and changes in the money stock, as well as between stock prices of deposit money banks and

money supply variability. These findings suggested that investors may choose equities markets if substantial returns outweigh the significant currency rate risks. Across all of the countries under study, there were significant spillovers of market volatility. Exchange rate volatility generated ripple effects that transmitted from the foreign exchange market to the BRICS stock markets. The main hypothesis asserted that financial markets in emerging economies are usually more volatile, meaning that exchange rate changes occur more frequently and have an immediate impact on stock prices. Table 11 presented the quantile results for stock prices across different quantiles: Q0.1, Q0.2, Q0.3, Q0.4, Q0.5, Q0.6, Q0.7, Q0.8, and Q0.9.

***Table 11.*** *Quantile regression results for BRICS stock prices*

| Variable | OLS | Q0.1 | Q0.2 | Q0.3 | Q0.4 | Q0.5 | Q0.6 | Q0.7 | Q0.8 | Q0.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| EXRVL | 0.3884 | 0.551 | 0.1536 | -0.0193 | 0.489 | 0.1328 | 0.1342 | 0.1921 | 0.6312 | 0.2510 |
| | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| INFLR | 0.5480 | 0.713 | 0.5546 | 0.4880 | 0.394 | 0.3486 | 0.3296 | 0.4139 | 0.4357 | 0.4739 |
| | 0.002 | 0.001 | 0.013 | 0.001 | 0.012 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 |
| C | 0.0320 | -0.313 | -0.0797 | -0.0479 | -0.029 | 0.0263 | 0.0462 | 0.0692 | 0.0820 | 0.3427 |
| | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| MSSVL | 0.0320 | -0.124 | 0.011 | 0.0129 | 0.035 | 0.136 | 0.114 | 0.183 | 0.651 | 0.051 |
| | 0.00 | 0.00 | 0.020 | 0.01 | 0.01 | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 |
| Quantile slope equality 39 tests | | Wald test: 63.45(.00) | | Stability test Ramsey reset test: QLR lambda stat: 0.0068(.93) | | | | | | |

***Source:*** *calculated by the authors*

Exchange rate variation negatively affected stock prices only at the Q0.3 quantile, with a 0.0193 effect. The coefficients for exchange rate volatility in the stock price equation were positive and highly significant across the quantiles, except for the third quantile. These coefficients for the 10$^{th}$, 20$^{th}$, 40$^{th}$, 50$^{th}$, 60$^{th}$, 70$^{th}$, 80$^{th}$, and 90$^{th}$ quantiles were 0.551, 0.1536, 0.489, 0.1328, 0.1342, 0.1921, 0.6312, and 0.2510. The positive coefficients indicated that volatility in the exchange rate stimulates stock prices. The rate of inflation also had a significant positive influence on stock prices. Specifically, a 1% increase in exchange rate volatility led to a 0.551%, 0.1536%, 0.489%, 0.1328%, 0.1342%, 0.1921%, 0.6312%, and 0.2510% increase in stock prices at the 10$^{th}$, 20$^{th}$, 40$^{th}$, 50$^{th}$, 60$^{th}$, 70$^{th}$, 80$^{th}$, and 90$^{th}$ quantiles for BRICS markets.

The coefficients for inflation also demonstrated a positive relationship betwe en stock prices and the inflation rate in BRICS economies. These coefficients were 0.7153, 0.5546, 0.4880, 0.3948, 0.3486, 0.3296, 0.4139, 0.4357, and 0.4739 for the 10$^{th}$, 20$^{th}$, 30$^{th}$, 40$^{th}$, 50$^{th}$, 60$^{th}$, 70$^{th}$, 80$^{th}$, and 90$^{th}$ quantiles, respectively. Consequently, stock prices rose following an increase in the inflation rate throughout the period of analysis. The estimated effects across different quantiles of the regression model were largely consistent for all the BRICS countries: negative for exchange rate volatility and inflation in terms of their impact on stock returns, but positive regarding their impact on stock prices. However, the magnitudes of these effects vary considerably. The coefficients for money supply variation were significant but negative at the 10$^{th}$ quantile and continue to be negative through the 20$^{th}$ quantile; beyond this, however, money supply variation positively impacted stock prices. Table 12 presented the quantile results for stock returns across different quantiles, namely Q0.1, Q0.2, Q0.3, Q0.4, Q0.5, Q0.6, Q0.7, Q0.8, and Q0.9.

***Table 12.*** *Quantile regression results for BRICS stock returns*

| Variable | OLS | Q0.1 | Q0.2 | Q0.3 | Q0.4 | Q0.5 | Q0.6 | Q0.7 | Q0.8 | Q0.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| EXRVL | -0.0269 | -0.0235 | -0.0254 | 0.0231 | -0.0208 | -0.0211 | -0.0226 | -0.0246 | -0.0291 | -0.0319 |
| | 0.02 | 0.544 | 0.001 | 0.02 | 0.361 | 0.005 | 0.001 | 0.001 | 0.002 | 0.002 |
| INFLR | -0.016 | -0.013 | -0.020 | -0.0135 | -0.0254 | -0.0144 | -0.0190 | -0.0381 | -0.0525 | -0.0646 |
| | 0.09 | 0.02 | 0.05 | 0.02 | 0.05 | 0.04 | 0.05 | 0.06 | 0.09 | 0.02 |
| C | 0.0212 | -0.0297 | -0.0242 | -0.0213 | -0.0201 | 0.0203 | 0.0211 | 0.0228 | 0.0265 | 0.0327 |
| | 0.02 | 0.02 | 0.02 | 0.02 | 0.08 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| MSSVL | 0.090 | 1.032 | 1.0387 | 1.0289 | 0.002 | 0.1928 | 0.0981 | 0.1286 | 1.001 | 1.0837 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Quantile slope equality tests | | Wald test: 56.82(.00) | | Stability test Ramsey reset test: QLR Lambda stat: 1.5899(.20) | | | | | | |

***Source:*** *calculated by the authors*

As shown in Table 13, the coefficients for exchange rate volatility and stock returns were -0.0269, -0.0235, -0.0254, 0.0231, -0.0208, -0.0211, -0.0226, -0.0246, 0.0291, and -0.0319. Based on *p*-values, stock returns were found to be significantly affected by exchange rate volatility at the 20th, 30th, 50th, 60th, 70th, 80th, and 90th quantiles. In contrast, stock returns at the 10th and 40th quantiles were found to be insignificantly affected by exchange rate volatility. The findings suggested that stock returns responded to exchange rate volatility by increasing by 0.0231 percentage points for every 1% rise in exchange rate volatility at the third quantile. Quantile regression estimations showed that the inflation rate was negatively correlated with stock returns, with *p*-values below 0.05 across all quantiles for BRICS. Specifically, stock returns were inversely and considerably affected by the inflation rate, with coefficients of -0.013, -0.020, -0.0135, -0.0254, -0.0144, -0.0190, -0.0381, -0.0525, and -0.0646 for the 10th, 20th, 30th, 40th, 50th, 60th, 70th, 80th, and 90th quantiles, respectively. A 1% increase in the variation of the money supply resulted in stock returns rising by 0.090%, 1.032%, 1.0387%, 1.0289%, 0.002%, 0.1928%, 0.0981%, 0.1286%, 1.001%, and 1.0837%, in each quantile, i.e., Q0.1, Q0.2, Q0.3, Q0.4, Q0.5, Q0.6, Q0.7, Q0.8, and Q0.9, with *p*-values of each being less than 5%. The outputs of the Markov-switching regression for BRICS, as illustrated in Table 13 below, revealed the joint effects across different regimes during the study period for both stock prices and stock returns, respectively. The equation specification comprised two regimes, namely, Regime 1 and Regime 2 with switching mean regressors of exchange rate volatility, inflation rate, and variations in money supply, and four AR terms identified as non-switching.

***Table 13.*** *Markov-switching regression results for BRICS stock prices and returns*

| Regimes | Stock prices | | | Stock returns | | | | |
|---|---|---|---|---|---|---|---|---|
| | EXRVL | INFLR | C | MSSVL | EXRVL | INFLR | C | MSSVL |
| Regime 1 (floating) | 0.517** (0.0956) | 0.519* (0.079) | 0.025 (0.029) | 1.013** (0.002) | -1.350** (0.0970) | -2.318* (0.086) | 0.302* (0.000) | 1.921* (0.000) |
| Regime 2 (fixed) | 0.2916 (0.000) | 0.5360** (0.0005) | 0.427** (0.304) | 0.113* (0.000) | -0.015** (0.026) | -0.063** (0.078) | 0.021** (0.022) | 0.216* (0.000) |
| AR(1) | -0.0549 (0.8007) | | | 0.1387 | 0.329*(0.0000) | | | 0.002 |
| AR(2) | 0.2331**(0.0020) | | | 0.0029 | 0.015**(0.0010) | | | 0.016* |
| AR(3) | 0.0421*(0.0008) | | | 0.0073 | 0.5132*(0.0054) | | | 0.019* |
| AR(4) | 0.0169**(0.0016) | | | 0.059 | 0.1125**(0.0020) | | | 0.002* |
| LOG(SIGMA) | -2.677** | 3.0200* | 0.289 | 2.389** | -4.964* | 1.000 | 1.0200 | 6.000* |
| Transition parameters | | | | | | | | |
| P11-C | 0.0315**(0.0005) | | | 0.1208*(0.0000) | | | | |
| P21-C | 0.0058**(0.0000) | | | 0.0453**(0.0005) | | | | |
| S.E. of regression | 0.00059 | | | 0.00040 | | | | |
| Durbin-Watson stat | 2.7631 | | | 2.7550 | | | | |

***Source:*** *calculated by the authors*

The results for BRICS showed that fluctuations in the currency exchange rates positively and significantly impacted stock prices in both regimes of floating and fixed exchange rates, with coefficients of 0.517 and 0.2916, respectively. A percentage rise in currency fluctuations induced a 0.517% and 0.2916% increase in stock prices under the floating and fixed exchange rate regimes, respectively. Within the same model and economic setting, a rise in the variation of the money supply resulted in a 1.013% increase in stock prices under the floating exchange rate regime, whereas, under the fixed exchange rate regime, a rise in money supply variation resulted in a 0.113% increase in stock prices. The impact of money supply variation on stock prices was greater under the floating exchange rate system. This suggested that in an economic environment characterised by extreme volatility, stock price fluctuations become more sensitive to variations in currency values and money circulation. The Markov-switching results showed that fluctuations in currency exchange rates and inflation rates both impacted stock returns negatively in both the floating and fixed exchange rate regimes. A percentage rise in exchange rate volatility led to a 1.350% and 0.015% decline in stock returns under the floating and fixed exchange rate regimes, respectively.

These results were also consistent in line with the findings of P.O. Junior & G. Tweneboah (2020), where the link between exchange rates and the stock markets of Morocco and Tunisia was researched through the application of quantile-in-quantile regression techniques on daily data. Accordingly, the research reinforced the findings of W.M.A. Ahmed (2019), who used a nonlinear ARDL (NARDL) model to ascertain significant negative variations in the Egyptian exchange rate's impact on stock returns. Specifically, the conditional volatility of currency exchange rates positively impacts stock prices, while negatively impacting stock returns. During the same period, the researcher focused on the returns of the Egyptian stock market and employed a NARDL to identify both short- and long-term asymmetries, as well as the impact of exchange rate fluctuations on stock returns across two regimes. They found that fluctuations

in the value of the Egyptian pound negatively affected stock returns significantly. They also found that an increase in the value of the home currency positively affects stock prices, but this influence is less pronounced than that of currency depreciation, which significantly affects stock returns.

The findings of A.A. Salisu & X.V. Vo (2021) and A.A. Salisu *et al*. (2021) also corroborated the asymmetric nature and regime effects of the present research findings. A.A. Salisu *et al*. (2021) used historical monthly data that included exchange rates and stock returns of the BRICS countries in question to analyse the relationship between exchange rates and stock returns within the BRICS countries. The research developed a forecasting model that connected changes in exchange rates to the difference in stock returns between the US and overseas markets. According to the data, three BRICS countries – Brazil, India, and South Africa – had positive correlations between stock return differentials and exchange rate returns. However, after accounting for the asymmetry impact, contradictory findings for China and Russia emerged. Both in-sample and out-of-sample forecasts demonstrated how useful and reliable stock returns are in predicting changes in exchange rates within the BRICS framework. Additionally, taking observable asymmetry and common (global) variables into consideration improves forecast accuracy even further.

The results of this study have significant implications for portfolio diversification techniques and foreign exchange management. A.A. Salisu & X.V. Vo (2021) used a dataset covering a period of 513 weeks, from 2011 to 2020, to investigate the relationship between exchange rates and stock returns in fast-growing emerging economies with high interest rates, such as Brazil, China, Colombia, India, and Indonesia, and advanced industrialised countries with low interest rates, such as Canada, Denmark, Israel, Japan, South Korea, Poland, Sweden, and the UK. For its analysis, the study used a panel data approach. The results indicated differences in the interactions between the two environments: economies with a low interest rates regime have positive interactions over the long term, whereas economies with a high interest rates regime have negative associations in the short term.

The role of money supply variation was consistent across both models. Hence, an increase in money supply variation stimulated a 1.921% rise in stock returns under the floating exchange rate, whereas, under the fixed exchange rate, it led to a 0.216% increase in stock returns. However, it was sufficient to report that the impact of money supply variation on stock returns was greater under the floating exchange rate system than under the fixed exchange rate regime. The plot of the AR/MA polynomial inverse roots was shown in Figure 7. These plots confirmed that all root locations for both the stock price and stock return equations are contained within the circle, as shown in Figures 7 and 8 below, implying that all AR coefficients were relatively stable. Furthermore, the validity of both models was confirmed by the significance of the transition probabilities.

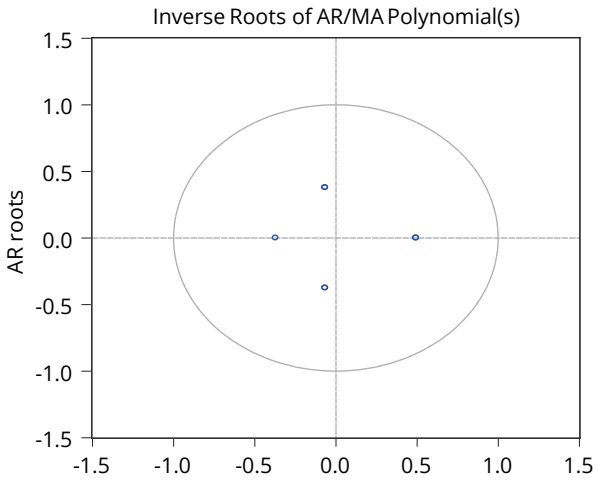


***Figure 7.*** *Inverse root plot for stock returns*
***Source:*** *calculated by the authors*

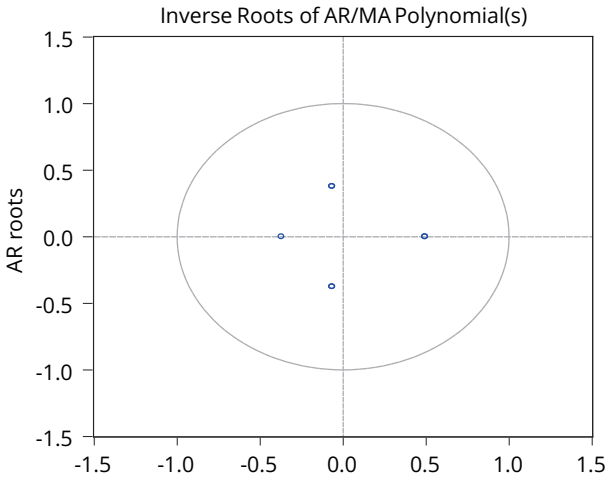


***Figure 8.*** *Inverse root plot for stock pricese*
***Source:*** *calculated by the authors*

Apart from the AR(1) autoregressive term, all other autoregressive terms – namely, AR(2), AR(3), and AR(4) – were significant at the 1% and 5% levels in the stock price model. This validated that previous stock prices have a substantial influence on current stock prices. For the stock returns model, all the autoregressive coefficients – 0.329 for AR(1), 0.015 for AR(2), 0.5132 for AR(3), and 0.1125 for AR(4) – were significant at the 1% level. This also provided the required validation that previous stock returns have a significant impact on current stock returns. Given the non-switching behaviour of the autoregressive terms, the Markov-switching estimations clearly indicated that only stock prices from the previous two, three, and four days significantly and positively predict current stock prices.

The non-switching behaviour of the autoregressive terms also indicated that past stock returns largely and positively predict current stock returns. The coefficient of the transition parameter for stock prices was larger in Regime 1 than in Regime 2, whereas, in the stock returns model, the transition probability was significant only for Regime 1. Taken together, these findings suggested that under the floating exchange rate regime, volatility in exchange rates, money supply variation, and inflation were more likely to occur and persist for a longer period than under the fixed exchange rate regime. Moreover, the floating exchange rate regime was the most likely to endure. The Durbin-Watson statistics for both stock price and stock return regressions deviate from 2. Thus, autocorrelated errors were detected in the estimated models for both stock prices and stock returns. This was likely due to the significance of the autoregressive terms.

## Conclusions

The study's findings demonstrated a clear correlation between stock market activities and exchange rate volatility. The study also found heightened variance at medium scales, implying that stock markets in BRICS react to more sustained economic trends and policies, which may take months to yield earnings. The influence of long-term economic instability on the stock markets reflects deeper, structural economic changes induced by long-term money growth trends, sustained inflationary pressures, and unstable exchange rate regimes. It was found that stock prices in BRICS were highly sensitive to short-term economic indicators and market sentiment, where immediate volatility in stock markets was triggered by rapid changes in exchange rates. More specifically, the findings aligned with empirical research that highlights the differentiated impact of economic variables such as exchange rates, inflation, and changes in money growth trends on stock price volatility over varying time horizons. Long-term economic fundamentals have a profound impact on stock prices, which may be influenced by persistent exchange rate policies or structural economic reforms.

The results indicated that stock prices were highly sensitive to immediate and medium-term economic changes. The estimated impacts of different quantiles of the regression line were largely the same – negative for exchange rate volatility and inflation in terms of their effect on returns, and positive in terms of their effect on stock prices. However, the magnitudes of these impacts vary significantly. Volatility spillovers in the foreign exchange market were considerable in all the studied nations. Exchange rate volatility spread from the foreign exchange market to stock markets. According to the results, volatility in the exchange rate stimulates stock prices. Inflation also had a significant positive influence on stock prices. Quantile regression estimations showed that the inflation rate was negatively correlated with stock returns. The Markov-switching regression results indicated that variations in currency exchange rates positively and significantly impact stock prices in both floating and fixed exchange rate regimes.

Variations in currency exchange rates and inflation rates both impact stock returns negatively in floating and fixed exchange rate regimes. Businesses need to implement more effective hedging strategies in stock markets to mitigate negative impacts. Additionally, policymakers must deepen capital markets and create a resilient stock market that can endure over time. To enhance future research, scholars could utilise daily-to-annual panel datasets for other regions, such as the ASEAN nations, while also accounting for the effects of interest rate variations on stock markets in each country. Examining the asymmetric effects of exchange rate fluctuations could also yield further insightful research findings.

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## Conflict of Interest

None.

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## Коливання обмінного курсу, цін акцій та прибутковості у країнах BRICS: модераторний вплив інфляції за допомогою аналізу хвильових довжин

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**Анотація.** Метою цього дослідження було оцінити умовний вплив волатильності обмінного курсу на ціни акцій і прибутковість у країнах, що розвиваються, з групи BRICS. Використовуючи щоденні дані за період з 1 січня 2000 року по 30 грудня 2023 року, було проведено хвильовий та квантильний аналіз. Для перевірки надійності результатів було оцінено модель Маркова. Хвильова шкала W1 виявила дисперсію 574,7375 і відносну частку 20,95 % у поясненні мінливості цін на акції, тоді як хвильова шкала W3 мала дисперсію 288,5577 і відносну частку 15,54 %, а хвильова шкала W2 – дисперсію 159,5644 і частку 8,59 %. Це свідчило про те, що фондові ринки країн BRICS суттєво реагують на сукупні економічні тренди у короткостроковій перспективі та на раптові коливання обмінного курсу. Внесок дисперсії для прибутковості зростав на короткострокових шкалах, коливаючись від 0,0156 для W1 до 0,0643 для W3. Це вказало на те, що прибутковість акцій у країнах BRICS є помірно чутливою до раптових коливань обмінного курсу, миттєвих змін інфляції та варіацій грошової маси. Короткострокові шкали фіксували швидкі ринкові реакції на економічні новини та оновлення, що відповідало результатам попередніх досліджень. Ціни акцій зростали у відповідь на збільшення рівня інфляції на всіх квантилях, тоді як прибутковість акцій демонструвала значну обернену залежність від рівня інфляції. Крім того, було виявлено значний негативний вплив волатильності обмінного курсу на прибутковість акцій як у режимі плаваючого, так і у фіксованого валютного курсу. Загалом, коли внутрішня інфляція чинить значний модераторний вплив у середовищі з високою волатильністю, ринкова ефективність стає дуже чутливою до коливань валютного курсу. Результати цього дослідження сприятимуть розробці політик як урядами, так і фінансовим сектором

**Ключові слова:** варіація грошової маси; сукупна дисперсія; спектральний розподіл дисперсії; квантильна регресія; регресія з перемиканням режимів Маркова

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# Economic risks of agricultural enterprises in Ukraine: Analysis of threats and mitigation strategies to ensure financial security

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**Abstract.** The study aimed to identify economic risks, in particular the impact of currency fluctuations, inflation and changes in tax policy on the financial security of Ukrainian agricultural enterprises. The data of such companies as Myronivsky Hliboproduct, Kernel and Slobozhansky Agrocombine were studied. Comparative analysis methods were used to assess the impact of macroeconomic factors on the agricultural sector. For this purpose, the situation in Ukraine and Germany, which is an example of a stable economy in the European Union, was compared. The study identified key economic threats to agricultural enterprises, including currency fluctuations, inflation and high lending rates. The study determined that in 2022, the hryvnia exchange rate experienced significant fluctuations, which made it difficult to import agricultural inputs and increased production costs. The stabilisation of the exchange rate in 2023 was analysed, but in 2024, amid rising inflation of 12%, currency instability again created difficulties for farmers, in financing imports. In general, in 2025, new tax initiatives were also introduced, including a reduction in the value-added tax for small and medium-sized businesses from 20% to 10%, which helped ease the financial burden on farmers. However, large enterprises remained subject to the high corporate tax rate of 18%, which increased their costs and reduced their competitiveness. The study also revealed the effectiveness of government and international financial initiatives, such as the "Affordable loans 5-7-9%" programme, the United States Agency for International Development Agro, the European Innovation Council Accelerator, as well as projects of the European Union and the World Bank aimed at supporting the agricultural sector during economic instability. These initiatives provided agricultural enterprises with access to finance, reducing the risks associated with high interest rates and currency fluctuations. The practical significance of the study is to develop strategies to minimise economic risks for Ukrainian agricultural enterprises, which contributes to their financial security and increases the sector's resilience through business diversification and the introduction of digital technologies

**Keywords:** investments; monitoring; anti-crisis mechanisms; diversification; lending

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## Introduction

The modern economic difficulties affecting Ukraine's agricultural sector require a thorough risk analysis and effective methods to minimise them. Agricultural enterprises face greater threats to their financial security as a result of global economic instability, macroeconomic changes, logistical constraints and currency fluctuations. In addition, access to credit, insurance coverage and foreign investment has become more difficult due to the war in Ukraine. New, adapted risk management methods are therefore required. Additional volatility in sales markets, rising production costs and changes in legislation to support the agricultural sector are also hindering the stable operation of enterprises. Thus, to ensure the sustainability of agribusiness and its competitiveness, research into financial security and effective methods of minimising economic threats is essential.

The risks faced by agricultural enterprises due to economic instability, climate change and social challenges are a significant problem. R. Grigorian (2023) analysed the main risks, such as currency fluctuations, climate change and man-made impacts, that complicate the operations of agricultural enterprises. The author also proposed a classification of these risks and methods to minimise them through modern management tools. Gaps that require further study included the integration of the latest risk management technologies and the creation of comprehensive models for forecasting the impact of climate change on the agricultural sector.

The financial and economic efficiency of agricultural enterprises was critical in an unstable market. V. Boiko *et al.* (2024) investigated this problem by developing a methodology for assessing financial efficiency based on profitability, asset turnover, and stability. The authors determined that the main threats were military action, reduced liquidity, rising costs, and limited credit. The study lacked an analysis of long-term business adaptation and the effectiveness of anti-crisis measures.

The military conflict has a significant impact on the economic activity of agricultural enterprises, creating risks that threaten their stability. O. Hryvkivska & Ye. Heizha (2024) studied this problem and systematised the main risks, such as reduced production, deteriorating storage and transportation conditions, reduced demand for products, and changes in the market situation. The authors developed an algorithm for neutralising risks, including identification, assessment, development, implementation and monitoring of minimisation strategies. Long-term financial instruments for risk management and evaluation of the effectiveness of the implemented strategies in the post-war period were not sufficiently addressed.

The economic security of agricultural enterprises depends on the seasonality of production, limited resources and market infrastructure. A. Mashevska & M. Kolomiets (2022) identified the main components: human, financial, market, environmental, technical and technological, focusing on the need for comprehensive monitoring of threats. Insufficient analysis of the impact of digital technologies and the effectiveness of crisis adaptation strategies was a research problem. Risks in agriculture have a significant impact on its efficiency. L. Chornobay & I. Mushenyk (2023) investigated military, climate, and price threats that lead to a decrease in acreage, exports, and infrastructure destruction. They suggested crop diversification, crop insurance, modern technologies, and increased storage capacity, but the study was't analyse the long-term effectiveness of the measures.

The economic security of agricultural enterprises is a key factor in their stability and development. V.I. Tkachuk & M.I. Yaremova (2019) investigated this issue by analysing the impact of seasonality of production, limited land resources, insufficient infrastructure and natural and climatic risks. The authors identified the main components of economic security: human resources, energy, market, financial, environmental, and technical and technological, emphasising the importance of comprehensive threat monitoring. A gap in the study was the insufficient analysis of long-term mechanisms for enterprises to adapt to crisis conditions and the effectiveness of preventive measures.

The financial mechanism of risk management is a key factor in the sustainable development of the agricultural sector. Ye. Hryb (2024) investigated this issue by analysing the effectiveness of financial risk management instruments in agricultural production. The study determined that risk hedging, financial stability and investment sustainability were critical to maintaining the continuity of agricultural enterprises. The author also considered the possibilities of minimising risks using modern financial management methods. However, the study wasn't sufficiently address the impact of macroeconomic changes on the effectiveness of risk management and their interaction with government support mechanisms for the agricultural sector.

Growing risks associated with climate change, economic difficulties and geopolitical conflicts pose threats to the sustainable development of the agricultural sector. B. Khakhula *et al.* (2024) studied innovative management of risks of agricultural enterprises' production activities in the institutional environment. Researchers emphasised that the use of technological innovations, digital financial instruments and contract farming significantly increases financial stability and risk management efficiency. The study showed that the integration of modern risk management tools into the agricultural sector helped to reduce production risks and increase economic security. However, the study does not sufficiently consider the long-term impact of institutional reforms on the development of agricultural enterprises and does not assess the risks associated with international trade agreements.

The study aimed to identify the main economic risks of agricultural enterprises in Ukraine and to develop effective strategies to minimise them to ensure the financial security of the industry. The objectives of the study were to identify the key economic risks affecting the financial security of agricultural enterprises and analyse their impact on the sustainability of the industry; to assess the effectiveness of existing approaches to risk management; and to develop comprehensive strategies to minimise threats to the financial stability of the agricultural sector.

## Materials and Methods

The study was conducted in the period from 2022 to 2024, which assessed the impact of the economic situation on the agricultural sector. This made it possible to examine in detail the changes that take place in the context of economic instability, in the face of rising inflation and currency fluctuations, which had a major impact on the financial stability of agricultural enterprises.

The main material for the study was official statistical data on inflation (Inflation estimate..., n.d.; NBU 2023 Inflation..., 2024; NBU 2024 Inflation..., 2025). Data on exchange rates from sources such as the NBU dollar exchange rate on February 26, 2025 (2025) and EUR (Euro) exchange rate dynamics in January 2025 (2025) were used to study exchange rate fluctuations and their impact on financial stability. The analysis of market prices for agricultural products and production costs was used to assess the impact of inflation on the agricultural sector (Inflation overview: Consumer price changes, n.d.). The study of data on Earnings before Interest, Taxes, Depreciation and Amortisation (EBITDA) for the main crops allowed for assessing economic trends in agriculture and changes in the land market (Gusarova, 2024; Land market analytics..., 2024). The methods of comparative analysis and trend analysis were used to assess the impact of economic risks on the financial security of agricultural enterprises. The method of comparative analysis helped to identify the relationship between inflationary processes, exchange rate fluctuations, and the availability of financing for farmers. The trend analysis was used to assess changes in the financial performance of agricultural enterprises in different periods, during the economic instability of 2022 and 2023, when there were significant fluctuations in inflation and exchange rates.

The study compared the currency stability and economic risks of Ukraine with those of Germany. Germany was chosen for comparison due to its stable economy, developed infrastructure and influence on the economic situation in the European Union (EU), which reflected the contrast between a country with a high level of economic stability and a country facing economic challenges. A key component of the study was to examine the effectiveness of government financial support programmes for farmers, such as the "Affordable loans 5-7-9%" programme, as well as other initiatives that affect the financing of the agricultural sector (Funding and support..., 2025). Among such initiatives are projects, in particular, the United States Agency for International Development, Order of the Cabinet of Ministers of Ukraine No. 684-r (2024), as well as the EIC Accelerator, the United Nations (Food and Agriculture Organization) (UN (FAO)) (USAID AGRO programme..., n.d.; A new round..., 2023). For this purpose, it was analysed these programmes and their role in reducing financial risks for agricultural enterprises, in the context of economic instability and inflationary processes.

The study also analysed tax rates for farmers and their changes in 2025, which assessed the impact of new tax initiatives on the economic situation in the agricultural sector (Smakota, 2023; From independence to..., 2025). This compared, how changes in tax policy affect the overall financial stability of enterprises, and what measures can be taken to reduce the tax burden on farmers. Digital technologies, including the use of satellite field monitoring, geographic information systems for yield forecasting and the use of big data to assess market risks, had become indispensable tools in assessing economic risks and developing strategies to minimise them. The study also addressed the use of modern financial instruments such as risk hedging and investment portfolios to reduce volatility in the agricultural sector.

This comprehensive approach assessed the effectiveness of the strategies applied and proposed the best ways to minimise economic risks for agricultural enterprises, which was an important step in ensuring their financial security.

## Results

### Economic risks of agricultural enterprises: impact factors and mitigation strategies

Agriculture is one of the most vulnerable sectors of the economy as it depends on many factors, including natural, economic, political and technological conditions. Given the unstable macroeconomic environment, geopolitical risks and climate challenges, Ukrainian agricultural enterprises face numerous threats that affect their financial stability and operational efficiency. An analysis of the economic risks of agricultural enterprises is necessary to develop effective strategies to minimise the negative impact and ensure their competitiveness.

Economic risks in the agricultural sector can be classified into several main groups: financial, investment, operational (production), market, legal and political, as well as agricultural environmental and social risks. Financial risks were the main factors that determine the stability of agricultural enterprises, as they directly affect the ability of an enterprise to meet its financial obligations, maintain a balanced budget and attract investments. Credit, inflation, currency, and financial equilibrium risks were the most important financial risks. In case of difficulties in attracting and repaying credit liabilities, credit risks arise. Rising prices for inputs, such as fuel,

seeds, fertilisers and equipment, lead to inflation, which increased the cost of agricultural production and may lead to lower profitability. Currency risks were associated with fluctuations in the hryvnia exchange rate, which affected the cost of imported inputs and the profitability of exported goods (Mazur, 2014). A. Zharykova (2023) emphasised that, since many Ukrainian agricultural companies, such as Kernel, Louis Dreyfus Company, and Cargill, actively export grain, currency fluctuations can significantly affect their revenues. The risk of financial distress was associated with the inability of companies to meet their financial obligations due to reduced profitability, unstable cash flows, or insufficient reserve funds.

Opportunities for the development and modernisation of agricultural enterprises were determined by significant investment risks, but investments can also lead to financial losses. Unpredictable economic changes, such as rising production costs, commodity price fluctuations and reduced demand, increase the risk of lower investment returns. Portfolio risk arose, when investments were not properly allocated between different parts of the agricultural business. This can led to a loss of capital due to unfavourable changes in a particular sector, such as crop or livestock production (Titenko, 2022).

Operational (production) risks were among the most difficult to predict and manage, as they depend on natural conditions and the company's technological level. Climate and technology threats were the main operational risks. Climate hazards were associated with sudden changes in weather, such as droughts, floods, frosts and other natural disasters, which can cause significant yield reductions and product losses. Technological threats included the use of outdated or low-quality technologies, and low levels of mechanisation and automation, which may affect production efficiency and product quality. Market risks were an important component of instability in the agricultural sector, as they determine the level of profitability of a company and its ability to produce. Fluctuations in commodity prices and competitive threats were the main market risks. Changes in global demand, trade restrictions or oversupply can cause price fluctuations, which directly affected companies' revenues. Competitive risks included the penetration of foreign producers into the internal market and the emergence of new players in the industry, which required companies to change their business plans (Shah *et al.*, 2021).

Legal and political risks were also significant factors that may affect the functioning of the agricultural sector. The key legal risks included imperfect legislation and frequent changes in the regulatory framework, which created an additional burden on the agricultural business. Political instability can affect the access of enterprises to state support, investment, and international trade, which significantly complicated the strategic planning of enterprises (Komarek *et al.* 2020). Agricultural environmental and social risks were critical for the sustainable development of the agricultural sector. As noted by A. Burliai *et al.* (2021), the environmental impacts of agricultural activities included soil degradation, water pollution and biodiversity loss. Social risks were associated with changing demographics, labour migration, socio-economic conditions in rural areas, and a shortage of skilled workers.

Economic risks in agriculture depend on the industry and type of production, whether the enterprise was engaged in livestock or crop production. They can be the result of internal factors, such as strategic decisions by management, and external factors, such as policy changes or natural disasters. Managing these risks required a comprehensive strategy to assess their impact and mitigate the consequences to ensure the sustainability of the industry. All of these types of risks significantly impact the performance of Ukrainian agricultural enterprises and require timely identification and implementation of effective management mechanisms to ensure the industry's competitiveness in the modern world.

The impact of these risks on agricultural enterprises can vary significantly depending on the type of enterprise. This was due to the careful consideration of financial, investment, operational, market, legal, political, agricultural, environmental and social risks. For example, small farms face more operational risks, such as climate change and the availability of finance, than large agricultural corporations that were engaged in exports. For them, currency risks and market fluctuations may be more important. Enterprises that were actively investing in modernisation and development were heavily exposed to investment and financial risks, while small enterprises with limited resources were exposed to social and legal risks associated with legislative instability and labour migration. Therefore, comprehensive management of these risks should consider the specifics of each agricultural business to ensure its sustainable development and competitiveness.

**Financial access to credit and its impact on the development of the agricultural sector in the context of economic instability**

Affordability of credit is a key factor for the stable development of the agricultural sector, as most enterprises depend on borrowed funds to ensure seasonal production, purchase inputs and modernise technology. High inflation, currency fluctuations, and macroeconomic instability have a significant impact on the ability of agricultural enterprises to obtain loans and repay debts. During 2022-2024, inflationary processes in Ukraine significantly changed the lending conditions for agricultural businesses, creating new challenges and risks that had to be compensated for by government programmes and external financial support.

The inflation rate in 2022 reached 26.6%, which was one of the highest in the period from 2012 to 2024. Military operations in Ukraine, destruction of infrastructure, disruption of logistics chains, and rapidly rising

production costs were the main causes of inflation (Inflation estimate..., n.d.). The agricultural sector has been significantly affected by inflation as the cost of fertilisers, fuel, machinery and other inputs has increased. Due to the rising cost of debt financing and reduced solvency of enterprises, banks significantly restricted the issuance of new loans by raising interest rates, increasing collateral requirements, and reducing lending to high-risk sectors of the economy (Rusan & Zhurakovska, 2024). One of the most important consequences was the change in the National Bank of Ukraine's discount rate, which increased sharply, leading to a significant increase in the cost of commercial loans for companies. However, the government created support programmes for farmers, such as "Affordable Loans 5-7-9%", which allowed companies to obtain loans at preferential rates (Zharykova, 2023; Funding and support..., 2025). In addition, the distribution of subsidies and the restoration of liquidity in the financial system were supported by international financial assistance from organisations such as the World Bank, the International Monetary Fund and the EU.

Along with credit problems, Ukraine's agricultural sector faced a significant increase in production costs in 2022, which further complicated the availability of financing. The war caused a sharp rise in prices for electricity, fuel and other inputs, which significantly increased production costs. In addition, the land market has also changed: the average value of one hectare of agricultural land in 2022 increased to UAH 35000, which was higher than the pre-war level of UAH 30000 per hectare (Matvieiev, 2023). At the same time, the profitability of agricultural production declined significantly, falling to 14.1%, compared to 37.8% in 2021. This dynamic was driven by high production costs and difficulties in selling products due to logistics disruptions. In addition, investment activity in the sector declined significantly: capital investments in agriculture decreased by 26.1% compared to 2021, amounting to about UAH 51 billion (Rusan & Zhurakovska, 2024). Reduced investment flows combined with high lending rates further increased financial pressure on farmers, limiting their ability to modernise and expand production.

In 2023, the lending situation improved as inflation slowed to 5.8%. This allowed the banking sector to ease lending conditions and agricultural enterprises to gradually adapt to new realities (NBU 2023 Inflation..., 2024). However, production costs remained high, with expected farm expenditures in 2023 at UAH/ha 27 thousand, which was 7.6% higher than the pre-war level. In addition, land prices continued to rise to UAH/ha 37 thousand by the end of the year, which also affected the availability of collateralised lending. Material costs remained significant: mineral fertilisers cost UAH/ha 7 thousand (26.4% of costs), fuel and lubricants UAH/ha 3 thousand (12%), and plant protection products and seeds UAH/ha 2 thousand (7.7%) (Farmers' expenses per..., 2023). At the same time, production profitability improved: EBITDA of main crops doubled compared to 2022 and reached USD/ha 94, which improved the solvency of enterprises and their ability to service debts (Gusarova, 2024). The state programme "Affordable loans" continued to operate, making it easier for farmers to attract financing.

In 2024, inflation started to rise again, reaching 12%, and in December, the monthly price increase was 1.4%. The main reasons for the acceleration of inflation were higher energy costs, the weakening of the hryvnia exchange rate, and rising production costs (NBU 2024 Inflation..., 2025). Food prices in the consumer market grew by 1.8% in December, with butter going up by 5.2% and sunflower oil by 5% (Inflation in Ukraine..., 2025). Farm costs continued to increase, which affected the need for additional lending. In addition, the land market continued to change in 2024, when legal entities were granted the right to purchase agricultural land, which significantly affected pricing. As a result, the weighted average price of 1 hectare of land increased to UAH 45.4 thousand, and in the Ivano-Frankivsk, region reached UAH 101 thousand (Land market analytics..., 2024). In response to inflationary risks, the National Bank of Ukraine continued to adjust interest rates, which affected the overall cost of lending. Government programmes to support lending to farmers, such as the "Affordable loans" programme, remained a key tool for minimising risks for businesses. In addition, economic stabilisation and international financial support mitigated the effects of high inflation on the banking sector and businesses. Figure 1 showed the dynamics of inflation over 2022-2024.

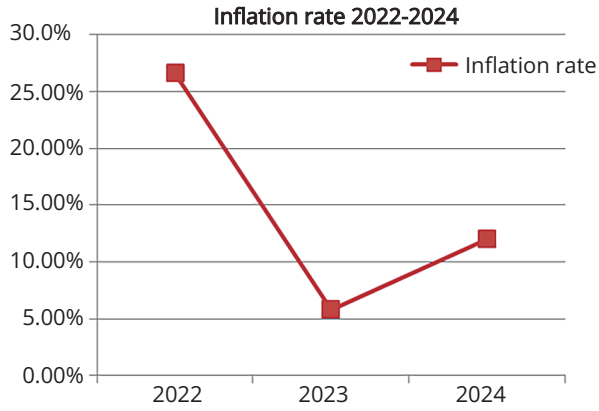


***Figure 1.*** *Inflation rate 2022-2024*
***Source****: based on Inflation estimate. August 2022. (n.d.), NBU 2023 Inflation Update (2024), NBU 2024 Inflation Update (2025)*

A comparative analysis of the inflation rate for the period 2022-2024 showed that inflation had a significant impact on the ability to attract loans, the cost of debt financing, and the profitability of agricultural enterprises. In 2022, farmers faced a critical increase in the cost of borrowing due to a rapid rise in interest rates, which

made it more difficult to raise funds and created risks of insolvency. In 2023, lower inflation and a stabilising economy helped to improve lending conditions, while government support programmes enabled businesses to adapt to new challenges. In 2024, a renewed rise in inflation to 12% again increased credit risks, but government support and international financial assistance allowed farmers to maintain access to borrowed funds.

Exchange rate fluctuations were a key factor affecting the financial stability of Ukraine's agricultural sector. The devaluation of the hryvnia affected the cost of imported inputs, such as machinery, fertilisers and fuel, which increased the costs of agricultural enterprises. In 2022, a sharp depreciation of the hryvnia due to the outbreak of Russia's war against Ukraine led to a rapid rise in the US dollar from UAH/USD 28 to over UAH/USD 40, which caused a significant increase in the price of all imported goods (NBU dollar exchange..., 2025). Similarly, the euro exchange rate rose from UAH/EUR 30 to UAH/EUR 45, making it more difficult to purchase European agricultural machinery and inputs (EUR (Euro) exchange..., n.d.).

In 2023, the hryvnia exchange rate remained volatile, but stabilised at UAH/USD 39-41 and UAH/EUR 39-41, indicating that the market was gradually adapting to the new conditions. This partially facilitated cost planning for agricultural companies, although the cost of imported inputs remained high. In 2024, the hryvnia continued to appreciate, reaching UAH/USD 42-43 and UAH/EUR 43.45, which again increased pressure on the agricultural business due to higher import costs. Table 1 illustrated the changes in the exchange rate during 2022-2024.

***Table 1.*** *Changes in the exchange rate during 2022-2024*

| Year | UAH/USD exchange rate | UAH/EUR exchange rate |
|---|---|---|
| 2022 | 28 → 40 → 36 | 30 → 45 → 38 |
| 2023 | 39 → 41 | 39 → 41 |
| 2024 | 42 → 43 | 43 → 43.45 |

***Source:*** *based on NBU dollar exchange rate February 26, 2025 (2025), EUR (Euro) exchange rate dynamics in January 2025 (2025)*

Also, Table 1 demonstrated the general trend of the hryvnia devaluation, which affected the economic conditions of the agricultural sector, in particular production costs and the availability of imported inputs.

**Analysis of currency stability and credit policy**

The analysis of currency stability and economic risks included a comparison of Ukraine with countries with more developed financial systems. Germany was an example of this, as it was part of the eurozone and benefits from a stable euro exchange rate. The current monetary policy of the European Central Bank guarantees stability for businesses, a predictable economic environment and low inflation. The euro exchange rate had remained stable, which had facilitated long-term financial planning for agricultural enterprises, unlike in Ukraine, where the hryvnia exchange rate had experienced significant fluctuations from 2022 to 2024. Germany uses a wide range of financial instruments to hedge currency risks, including currency swaps, options and forward contracts. Hedging opportunities in Ukraine were very limited due to the volatile economic environment and lower availability of financial instruments. Governmental currency regulations and hryvnia stabilisation programmes continue to be the primary means of protection.

In addition, due to low interest rates in the Eurozone, German agricultural entrepreneurs can access cheap credit. In contrast, loan interest rates remain significantly high in Ukraine due to high inflation and macroeconomic risks. This limits the ability of companies to finance investment programmes and expand production. In addition, Germany had an effective system of state support for agricultural enterprises through subsidies and compensation mechanisms. This also contributed to the financial sustainability of the agricultural sector (Neumann, 2019).

Due to the stability of the euro and developed financial infrastructure, Germany demonstrated a more efficient model of currency risk management and credit policy. Volatile exchange rates, difficulties in obtaining financial instruments and high costs of imported inputs have forced Ukrainian farmers to operate under high economic risks. To improve the situation, further improvement of currency regulation mechanisms, development of the risk hedging market and intensification of government support programmes for the agricultural sector are needed.

Ukraine should incorporate German experience with currency swaps, options and forward contracts in the agricultural market to adopt the currency risk management instruments used in Germany. German agricultural enterprises actively used these instruments to reduce currency risk and effectively plan their international relations. Ukraine should create a market for such financial instruments so that agricultural enterprises can reduce the risks associated with exchange rate fluctuations, as they were more accessible and flexible. In addition, the introduction of state support programmes such as subsidies and compensation mechanisms similar to those in Germany – CAP Strategic Plan (n.d.), e.g., the Common Agricultural Policy (CAP), could be a crucial factor in stabilising the financial

position of agricultural enterprises in Ukraine. This would create a more stable economic basis for the development of the agricultural sector, especially in the face of high credit and currency risk.

The agricultural taxation system in Ukraine included several components and variants of taxation depending on the type of farm and its activities. The main tax regimes for agricultural enterprises were the general and simplified taxation systems. The general system included a corporate income tax for legal entities at 18%, a unified social contribution (USC) of 22%, a minimum contribution in 2025 of approximately UAH 1760 per month, and a military duty of 1.5%. The simplified system was used for small businesses and provided for the payment of a single tax, which varies depending on the group: for the first group about UAH 268 plus the SSC, for the second group about UAH 1340 plus the SSC, for the third group a percentage tax on income (3% for VAT (value added tax) payers and preferential rates apply under martial law) (Smakota, 2023).

An important component of the tax policy in the agricultural sector was the minimum tax liability (MTL) for land. It established a mandatory tax amount for agricultural land of at least UAH 700 per hectare, and if the share of arable land exceeds 50%, the tax can reach UAH 1400 per hectare (From independence to the present..., 2025). In addition, in 2024, there were certain tax exemptions for agricultural enterprises in the war zones or temporarily occupied territories, which helped to minimise the financial burden on businesses in wartime. The structure of the main elements of the tax system for the agricultural sector was presented in Table 2.

***Table 2.*** *The main elements of the taxation system in the agricultural sector of Ukraine*

| Taxation system | Description | Advantages |
|---|---|---|
| General system | Income tax 18%, unified social contribution 22%, military duty 1.5% | Ability to account for expenses |
| Simplified system | Fixed taxes depending on the group of companies | Easy to calculate and pay |
| Minimum tax liabilities | Fixed payments per hectare | Stability of financial liabilities |

***Source:*** *based on Ya. Smakota (2023), From independence to the present: 33 years of changes in the land taxation system of Ukraine (2025)*

Changes to the agricultural taxation system are aimed at increasing budget revenues and combating shadow land use. Starting in 2025, a new procedure for calculating the minimum tax rate will be introduced, which may become a financial challenge for small farms. Another important factor was the increase in the military tax, which had increased from 1.5% to 5% since December 2024, further increasing the overall tax burden on the agricultural sector (Minimum Tax Obligation..., 2025). The government also announced a reform of the simplified taxation system, which envisaged its abolition of legal entities and an increase in rates for individual entrepreneurs as part of the National Revenue Strategy 2030 (Makovey, 2024). This change may have a controversial impact, as small agricultural businesses have traditionally used the simplified system to reduce their tax burden. The impact of these changes on the agricultural sector was presented in Table 3.

***Table 1.*** *Distribution of cotton gene pool samples according to the duration of the growing season, days (2012-2016)*

| Changes | Description | Influence |
|---|---|---|
| MTL | New procedure for calculation of MTL for land | Increased financial burden for small businesses |
| Military duty | Rate increased from 1.5% to 5% | The additional tax burden on farmers |
| Simplified system | Planned to be cancelled for legal entities | Possible negative impact on small businesses |
| Accelerated depreciation | Can be used to write off equipment costs faster | Promotes the modernisation of the agricultural sector |

***Source:*** *based on Yu. Makovey (2024), Minimum Tax Obligation (MTO) 2025: New rules for Ukrainian farmers (2025)*

The introduction of new rules for calculating the minimum tax liability and the increase in the rates of certain taxes may increase financial pressure on the agricultural sector, especially for small and medium-sized farms. At the same time, the possibility of accelerated depreciation and state support may help mitigate these changes for agricultural enterprises.

Ukraine's state policy to support agricultural business and ensure food security included comprehensive measures aimed at increasing the resilience of the agro-industrial complex (AIC) and minimising risks for farmers. During the period of economic instability caused by the war, the main mechanisms of state support were financial incentives, loan programmes, grants, compensation for land demining and the implementation of strategic initiatives to ensure food security.

One of the key instruments to support the agricultural sector is the budget subsidy per unit of cultivated land, which allows farmers to receive financial assistance depending on the area of land under cultivation. In 2022, this subsidy was UAH 3100 per hectare, but the total amount did not exceed UAH 372 thousand. In 2024, the amount of payments increased to UAH 4000 per hectare for certain categories of farmers (Kryzhny, 2024).

Particular attention was devoted to support for enterprises in frontline areas, which can receive assistance in the amount of UAH 1000-2000 per hectare depending on the risk level of the territory. Applications for this support were submitted through the State Agrarian Register (Prysyazhna, 2024).

O. Ozerova (2024) noted that loan programmes remain another important mechanism of state aid. The "Affordable Loans" programme allowed farmers to receive financing at reduced interest rates (5-7-9%), which was a significant advantage in the context of macroeconomic instability and high interest rates in the market. In addition, restoration of access to agricultural land after the hostilities has been a particular focus. The government has introduced compensation for humanitarian demining, which allowed businesses to resume operations in areas contaminated by explosive ordnance.

In addition to government programmes, Ukraine's agricultural sector receives significant international financial support. The USAID AGRO programme aimed to develop the processing industry, expand production capacity and stimulate the production of value-added products. Among the participants in this programme were Ukrainian companies such as Agrico Ukraine (Kyiv), which received funding to develop post-harvest potato processing and packaging, including the purchase of potato packaging equipment and laboratory equipment on a 50-50 co-financing basis. Volia (Cherkasy region) and Central Plains Group Ukraine (Lviv region) also participated in the project to finance equipment for post-harvest potato processing. The Adelaide enterprise (Kherson region) received funding for irrigation systems under USAID projects (Rodak *et al.*, 2025).

Under this initiative, enterprises can receive grants of up to UAH 367 million. Other international projects, such as the EIC Accelerator, provide funding of up to UAH 2.5 million for the development and implementation of the latest technologies in agriculture (USAID AGRO programme..., n.d.). The Food and Agriculture Organisation of the United Nations had also launched a grant programme to support Ukrainian farmers in the western regions of the country, providing funding of up to UAH 925 thousand per enterprise (A new round..., 2023).

At the strategic level, the state has developed the Order of the Cabinet of Ministers of Ukraine No. 684-r (2024), which defined the main priorities for the development of the agricultural sector. One of the key tasks is to ensure the country's self-sufficiency in the production of key agricultural products, develop the internal market and increase exports. The operational action plan of this strategy included support for production, development of logistics infrastructure and improvement of state regulation of the sector. Ukraine had also initiated a humanitarian programme, "Grain from Ukraine", aimed at combating the global food crisis. As part of this initiative, Ukrainian grain was exported to countries that were most in need of food aid (Ukraine sent flour..., 2024).

Ensuring the safety of agricultural land is important during the war in Ukraine. The government had launched a large-scale programme to clear agricultural land of explosive ordnance due to the significant contamination of the area. As a result of these measures, farmers can return to work and prevent a reduction in crop areas in the future. Thus, stable production, increased food security and stimulating the modernisation of the industry were the goals of government policy and international support for Ukraine's agricultural sector. Through targeted programmes and strategic initiatives, farmers can access financial and technological resources to help them minimise risks and remain competitive in a challenging economic environment.

**Development of strategies to minimise risks and improve the financial security of agricultural enterprises**

For Ukrainian agricultural enterprises, ensuring financial stability is a key aspect of stable operations, maintaining competitiveness and expanding investment potential. The agricultural sector faces many threats that can lead to financial losses or even bankruptcy, especially in the context of economic instability, inflationary risks, currency fluctuations, political instability and changes in the taxation system. To mitigate the negative consequences, it was necessary to develop comprehensive risk management strategies that included diversification of activities, implementation of anti-crisis measures, digitalisation of management processes and study of the impact of tax policy on the investment attractiveness of agricultural business.

One of the most effective ways to minimise risks in agriculture was to diversify activities. Reducing dependence on individual risk factors involved expanding the range of production processes and sales routes. Expanding the range of products was one of the main areas of diversification. Agricultural enterprises can grow different crops at the same time or combine crop and livestock production. For example, enterprises that also grow vegetables or organic products were less vulnerable to fluctuations in world prices than enterprises that grow only grain crops.

Geographical diversification was also substantial. Adverse weather conditions, changes in local legislation, and distance from logistics centres were not problems for businesses operating in different locations. Innovative approaches to product sales should also be considered. The use of electronic trading platforms and the conclusion of contracts with international companies can increase financial stability and reduce dependence on local market risks. Diversification also involved engaging in non-agricultural activities, such as agritourism or processing industries. Farmers, for example, can set up their processing plants to produce flour, butter, and dairy products, reducing their dependence on seasonal fluctuations in raw material prices. Myronivsky

Hliboproduct (MHP), for example, was actively pursuing international expansion, expanding its business in Europe and the Middle East. This allowed the company to diversify its export markets and reduce its dependence on the volatility of certain regional markets. MHP was developing its production facilities in the EU and expanding its network of partners in the Middle East, which ensured a steady demand for the company's products.

Expanding business to new markets not only increases exports, but also enhances financial stability, as the company gains access to new sales channels and reduces the risks associated with dependence on one market. It also opened new opportunities for investment and strategic development in the context of global economic changes (Information about MHP, 2025). Exports of meat products in 2019 increased by 11%, from USD 479 million to USD 531 million compared to 2018. Exports were also positively impacted by an increase in the value and volume of poultry supplies, where the value of exports increased by 15% from USD 381 million to USD 439 million in January-September 2019, and export volumes increased from 244 thousand tonnes to 303 thousand tonnes. This indicated an increase in the company's profitability and financial stability due to the diversification of sales markets and the expansion of export geography (Saudi Arabia has..., 2019). Thus, business diversification improves the company's financial condition, as it allowed it to effectively distribute risks associated with market fluctuations, climate change and foreign economic circumstances. Anti-crisis financial stability mechanisms included measures to maintain business continuity and reduce the impact of external risks. One of the main mechanisms was the formation of a reserve fund, which allowed companies to cover expenses in the event of a crisis. It was recommended that the reserve capital should be twenty to 30% of the company's annual turnover.

Crop and property insurance against military threats, weather changes and droughts were important components of a strategy to minimise financial losses. Optimising the loan portfolio was another anti-crisis tool. Businesses should use government support programmes, such as the "Affordable loans 5-7-9%" programme, to balance short-term and long-term liabilities. In terms of risk insurance, Kernel actively used comprehensive insurance programmes to ensure a stable income. As part of its strategy, the company insured the entire winter crops against freezing, which helped to reduce the risks associated with adverse weather conditions. In addition, Kernel insured its production assets against business interruption, which provided coverage in case of interruptions in production, as well as against actions of third parties that may cause losses. The company also insured against political risks, which helped protect its investments from changes in the political situation, particularly in the markets where it operates. This comprehensive insurance helped to reduce financial losses and maintain the stability of the company's operations in the face of high economic and political risks (How a business model..., 2019).

In addition, the use of flexible financial strategies is important. For instance, during a crisis, it would be important to rethink the production process and switch to products with higher margins. Thus, anti-crisis mechanisms help agricultural enterprises reduced the risks of financial losses and adapt to changes in market conditions. Predictive models and digital technologies were becoming increasingly important in managing the financial risks of agricultural enterprises. Big data, artificial intelligence (AI) and geographic information systems improve the processes of planning, monitoring and responding to potential threats. A satellite field monitoring system was substantial for analysing soil conditions and forecasting yields in real-time.

Automation of financial accounting is also a promising area. More efficient cost and revenue planning, forecasting of financial flows and prevention of cash gaps can be achieved using customer relationship management (CRM) systems and enterprise resource planning (ERP) platforms. Predictive economic models can be used to study, how macroeconomic elements, such as inflation, currency fluctuations and changes in tax policy, affect the operations of agricultural enterprises. Slobozhansky Agrocombine was actively implementing automation of accounting and taxation to optimise its financial processes. The use of modern ERP systems allowed the company to effectively plan expenses and income, forecast financial flows and prevent cash gaps. By automating accounting, an agricultural enterprise can quickly and accurately make calculations, improve the accuracy of financial reports, and reduce the probability of human error (Automation of accounting..., n.d.).

Digital technologies also improve logistics and resource management. The use of blockchain technologies in agricultural trade reduced the risk of fraud and increases transparency of transactions. Thus, companies can improve their financial security, optimise costs and respond effectively to market changes using digital technologies and predictive models. The development of strategies to minimise risks and enhance the financial security of agricultural enterprises was an important step in ensuring the sustainable development of Ukraine's agricultural sector. Enterprises can reduce their dependence on factors such as market fluctuations, climate change and foreign economic risks by diversifying their activities. The use of anti-crisis financial mechanisms, such as reserve capital, risk insurance and loan portfolio optimisation, reduced the impact of adverse economic factors. The use of predictive models and the digitalisation of management processes significantly improved planning efficiency, optimised costs and can be used to quickly adapt to changing market conditions. Innovative financial instruments, such as blockchain technology and satellite field monitoring,

increase transparency of operations and facilitate resource allocation.

Taken together, these measures form a comprehensive approach to financial risk management, increase the investment attractiveness of enterprises and create conditions for the long-term sustainable development of the agricultural sector. The use of these strategies will allow agricultural companies to ensure financial stability, improve profitability, and minimise potential risks in the face of macroeconomic instability.

## Discussion

The agrarian sector remained one of the most vulnerable to economic risks, which were formed under the influence of macroeconomic factors, global instability and structural changes in the financial system. Managing financial risks was a critical task for ensuring the stability of agricultural enterprises, which led researchers to analyse effective strategies for minimising them. Research in this area covered a wide range of approaches, including diversification of activities, introduction of digital technologies, use of predictive models, government support and insurance mechanisms.

This study and the article by L. Kostyrko *et al.* (2024) shared common aspects in the study of economic risks in the agricultural sector and approaches to minimising them, but differ in the detail of risk management mechanisms and proposed financial security strategies. Both studies analysed the risks of the agricultural sector and ways to minimise them. They considered the impact of macroeconomic factors, including currency fluctuations, credit availability, and government support. Both emphasised the need to develop financial security strategies for agricultural enterprises. This study analysed internal financial mechanisms, digital technologies, and predictive models for risk management, while the study by L. Kostyrko *et al.* (2024) addressed international factors, government support programmes, and insurance mechanisms.

O. Kukhar (2024) investigated the financial risks of agricultural enterprises in the face of economic uncertainty, focusing on state support, mechanisms for compensating losses, and the role of tax policy in shaping the sector's investment attractiveness. This study, on the other hand, emphasised strategies to minimise risks through diversification of activities, the use of predictive models and digital technologies. Both studies agreed on the importance of managing macroeconomic factors, such as currency fluctuations and inflation, but differed in their approaches to compensating for them. O. Kukhar (2024) analysed government regulation, while the current study addressed the internal financial mechanisms of enterprises.

The conducted study and the study by Yu. Kucherenko (2018) emphasised the importance of financial security as a key element of the economic stability of agricultural enterprises. They considered risks arising from macroeconomic factors such as inflation, credit availability, exchange rate fluctuations, and general financial threats. Both studies also recognised that effective financial risk management was a key mechanism for maintaining enterprise stability, especially in times of crisis. However, the study by Yu. Kucherenko (2018) payed more attention to general approaches to financial security that were relevant to the entire agricultural sector. The author analysed receivables and payables, their impact on the financial position of enterprises, and the role of government regulation in ensuring economic security. In addition, the study contained a significant amount of data on macroeconomic conditions affecting the agricultural sector and emphasised that instability in the financial system threatens enterprises due to limited access to financial resources. Instead, this study focused on practical risk mitigation strategies, including diversification of activities, digital technologies for risk management, and mechanisms to maintain financial stability. It also examined modern financial protection instruments, such as government subsidy programmes, grants and risk insurance. Particular, attention was paid to the analysis of the effects of tax policy on the investment attractiveness of the sector and government support mechanisms.

Researchers V. Touch *et al.* (2024) examined the economic security of the agricultural sector, focusing on the risks associated with financial instability, climate change and global market trends. This study also highlighted these factors, but puts more emphasis on government mechanisms for regulating and supporting agricultural enterprises. Both studies analysed methods of risk diversification and financial stability. V. Touch *et al.* (2024) analysed digital technologies and innovative financial instruments, while this study focused on tax policy and credit support. The author examined the impact of global investment mechanisms, while this paper focused on internal government initiatives and the ability of Ukrainian enterprises to adapt to modern challenges.

R.L. Manogna & N. Kulkarni (2024) analysed economic risks in agriculture and their impact on the financial security of agricultural enterprises, which had common aspects with this study. Both papers analysed market volatility, which affects the availability of financial resources and the strategic decisions of farmers. The emphasis on risk management was also common, but this study emphasised the introduction of digital technologies and predictive models, while R.L. Manogna & N. Kulkarni (2024) focused on the impact of the financialisation of agricultural markets on global food systems. This study considered them in the context of Ukraine's macroeconomic policy, while the authors analysed structural changes in global agricultural trade.

The authors E. Szafraniec-Siluta *et al.* (2024) analysed the financial security of farms in the EU, identifying key factors of stability such as income, subsidies, investment and credit. Both studies analysed financial risks

and the role of external finance, applying factor analysis. E. Szafraniec-Siluta *et al.* (2024) examined farms in a stable economy, while this study focused on Ukrainian agricultural enterprises facing economic uncertainty, inflation and credit constraints. Ukrainian agricultural enterprises had to adapt their financial strategies to an uncertain environment, while in the EU subsidies and access to credit were more predictable. This highlighted the need to develop flexible financial risk management mechanisms in Ukraine.

A.C. Sánchez *et al.* (2022) analysed the financial profitability of diversified farming systems through a global meta-analysis. The authors estimated the cost-benefit ratio, finding that such systems often outperform simplified systems, especially in developing countries. Profitability varies by region, crop and technology. In contrast, the study focused on threats to the financial security of agricultural enterprises, such as inflation, credit and market risks. Whereas A.C. Sánchez *et al.* (2022) analysed the long-term profitability of strategies, this study focused on short-term challenges and mechanisms to minimise them.

Scientists A.R. de Araujo Zanella *et al.* (2020) and this study shared similarities and differences in their approaches to analysing the financial security of agricultural businesses. Both highlighted the impact of external factors such as inflation, currency fluctuations, and environmental risks, as well as the need for strategic planning and digital technologies to minimise threats. However, A.R. de Araujo Zanella *et al.* (2020) emphasised institutional aspects, such as government support and regulation, while this study analysed practical methods, such as diversification and crisis management. Researchers used a comparative analysis, comparing financial instruments across countries, while this study assessed risks through econometric models.

J. Prashanth *et al.* (2024) analysed risk management strategies in agricultural enterprises, focusing on diversification, agricultural insurance, financial planning and digital technologies. This study had a broader focus on financial risks, including credit, inflation, and external economic factors. While both studies emphasised the importance of government support, this focused more on the impact of tax policy and regulation on the sector's investment attractiveness.

Researcher A.S.S.F. da Costa (2024) and this study discussed financial risks in the agricultural sector, focusing on price fluctuations, access to credit, climate change, and regulatory challenges. Both supported the use of diversification, hedging, insurance and digital technologies to minimise risks. Scientist analysed market fluctuations, innovative financial instruments and climate impacts in more detail, while this study focused on government support, tax policy and macroeconomic threats. Both confirmed the need for a comprehensive approach, but look at it from different perspectives, enterprises and government regulation.

G.C. Gray & T. Nguyen-Tien (2024) analysed the interconnections between food security, and human, animal and environmental health, highlighting the need for an integrated One Health approach to address the threats posed by pandemics, antibiotic resistance and climate change. The authors analysed, how global trade, and international movements contribute to the spread of food security threats and called for interdisciplinary research and increased collaboration between government and academic institutions. In contrast, this study focused more on the financial security of agricultural enterprises and mechanisms to minimise economic risks. While both studies acknowledge the importance of diversification to manage risks, G.C. Gray & T. Nguyen-Tien (2024) analysed it in the context of global crises and adaptation strategies in the food sector, while this study focused on its economic aspects.

The author S. Barral (2023) analysed the role of the EU's Common Agricultural Policy (CAP) in creating risk management instruments, emphasising the use of private insurance, digital technologies and financial markets to reduce economic and environmental threats. At the same time, the study addressed the economic risks of agricultural enterprises, including credit, inflation and macroeconomic factors that affect their financial stability. Both studies shared the analysis of risks and strategies for their minimisation and emphasised the need for diversification and the use of financial instruments to protect the agricultural sector. S. Barral (2023) addressed structural changes in the CAP, while this study analysed practical approaches to ensuring the financial security of agricultural enterprises. The main difference was that this scientist examined the impact of financial markets and big data on risk management in EU agriculture, while this study focused on local economic threats and adaptation mechanisms of agricultural businesses.

S. Volyk *et al.* (2023) and this study were similar in their analysis of the economic security of agricultural enterprises as a key factor in their competitiveness. They recognised the importance of financial stability, risk management and innovation to increase the resilience of agricultural enterprises in an unstable economic environment. Both papers emphasised that threats to economic security stem from both internal and external factors, including macroeconomic instability, political risks, agricultural price fluctuations and limited access to finance. S. Volyk *et al.* (2023) addressed the strategic aspect of managing the economic security of agricultural enterprises, emphasising methods of state support and regulation. The authors also considered in detail the role of competitive advantages and the impact of institutional factors on the financial security of enterprises. In contrast, this study emphasised the analysis of short-term financial risks, mechanisms for diversifying activities, and the use of digital technologies to predict threats.

Researchers S. Kalogiannidis *et al.* (2023) analysed the role of institutional factors, EU policies and global market changes in shaping the economic security of agricultural enterprises. The study addressed specific risk management strategies, financial security and internal risk management mechanisms. A common feature was the recognition of the importance of diversifying business models and using digital technologies to increase the efficiency of agricultural production. At the same time, the authors analysed macroeconomic conditions and the impact of government policies more closely, while this study considered the direct impact of financial risks on individual enterprises.

T. Voronko-Nevidnycha *et al.* (2022) analysed the technological management of agricultural and food enterprises, emphasising the importance of managing technological risks and their impact on business security. The study identified the need to implement strategic measures to improve the competitiveness of enterprises, through technological upgrades, the development of innovative approaches and the introduction of mechanisms for monitoring external threats. Both studies recognised the importance of a systematic approach to risk management and emphasised the need to develop strategic plans to ensure the sustainability of agricultural businesses. The difference was that T. Voronko-Nevidnycha *et al.* (2022) focused mainly on technological aspects and structural changes within enterprises, while this study analysed financial sustainability through the prism of economic mechanisms and government regulation.

Scientists A. Kulkarni *et al.* (2024) analysed cybersecurity in the agricultural sector analyses cyber incidents that occurred in 2011-2023 and considered methods of protection against attacks. At the same time, this study addressed macroeconomic risks, financial threats and strategies to minimise economic losses of agricultural enterprises. A common feature of both studies was the recognition of the significant impact of digitalisation on agricultural development, which required an integrated approach to risk management.

T. Zhai *et al.* (2023) addressed risk assessment for investments in small and medium-sized agricultural enterprises (SMEs) using a decision-support model. The use of Pythagorean fuzzy sets (PFSs) and multi-criteria analysis was used to assess the main risks in supply chains. This study, on the other hand, addressed threats to the financial stability of agricultural enterprises and proposed strategies to minimise risks to ensure economic security. The main points of contact between the two papers were the recognition of the complexity of agricultural supply chains, the need for risk diversification, and the importance of government policy in creating a favourable environment for agricultural business. At the same time, the scientists study analysed investment risks by assessing the factors that influence decision-making in small and medium-sized enterprises, while this study addressed macroeconomic risks that determine the financial stability of the agricultural sector.

The results of the comparison of scientific studies confirmed that economic risks remain a key challenge for agricultural businesses, regardless of the region or scale of operations. Common to most studies was an understanding of the need to develop comprehensive financial security mechanisms, including government support, the use of insurance and credit instruments, the introduction of digital technologies, and the diversification of activities. At the same time, the emphasis in different studies differed: some focus on macroeconomic factors and policy impact, while others analysed the internal financial mechanisms of enterprises. The use of modern forecasting models, big data analytics and digital platforms opened new opportunities for effective risk management.

## Conclusions

The findings of this study confirmed that agricultural enterprises in Ukraine face many economic risks that significantly affect their financial security. An analysis of the main factors, such as inflation, currency fluctuations, the impact of financing projects, and the introduction of innovative technologies, demonstrated the importance of a comprehensive approach to risk management to ensure the sustainability of the agricultural sector.

Inflation was one of the main threats to the agricultural sector as it directly affected production costs. In 2022, inflation in Ukraine reached a record high of 26.6%, which significantly complicated the situation for farmers. High inflation had led to higher prices for key inputs for agricultural production, including fertilisers, fuel and machinery. This significantly increased the cost of agricultural production and reduced the profitability of agricultural enterprises. In 2023, inflation slowed to 5.8%, but still put pressure on the financial results of companies. The projected inflation rate of 12% in 2024 again poses a threat to farmers, especially due to rising energy costs and the depreciation of the national currency. In this environment, agricultural companies were forced to constantly review their financial strategies and adapt to changes.

Exchange rate fluctuations were another important risk factor for agricultural enterprises, as a significant portion of input costs, such as imported fertilisers and machinery, were denominated in foreign currencies. Changes in the hryvnia exchange rate, in particular the depreciation of the national currency, led to higher prices for these inputs, which increased the overall cost of production and reduces the profitability of enterprises. In 2023, there was some stabilisation of the exchange rate, but in 2024, due to economic factors such as high inflation, currency fluctuations remained a significant risk for farmers.

Financing projects, in particular government support programmes such as “Affordable loans 5-7-9%”,

were substantial in reducing economic risks for agricultural enterprises. These programmes provided farmers with access to cheap loans, allowing them to invest in modernisation, equipment and infrastructure upgrades, as well as working capital for continuous production. In 2022, when inflation reached its highest levels, the government actively supported the agricultural sector through these financial programmes, which helped maintain the level of investment in agricultural enterprises. The "Affordable loans" programme continued to operate in 2023, reducing interest rates and facilitating access to finance in times of economic instability.

Development of strategies to minimise risks and improve the financial security of agricultural enterprises was key to their sustainable development. Diversification of activities, anti-crisis mechanisms, digital technologies and forecasting models help to reduce the impact of economic and external risks. Examples of such companies as MHP, Kernel and Slobozhansky Agrocombine showed the effectiveness of such approaches. The use of the latest financial instruments and automation of accounting increase the financial stability and investment attractiveness of agricultural companies in difficult conditions.

Thus, effective risk management of agricultural enterprises in Ukraine required the use of integrated approaches to financing, digitalisation, and continuous monitoring of external and internal factors. Adequate strategies for minimising economic risks will help to maintain the financial security of the agricultural sector even in the face of economic instability. Prospects for further research include a detailed analysis of the impact of new digital technologies on financial risk management, the development of mechanisms for adapting to climate change, and the improvement of state support models to ensure the stable development of the agricultural sector in times of crisis.

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## Conflict of Interest

None.

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# Економічні ризики аграрних підприємств в Україні: аналіз загроз та стратегій мінімізації для гарантування фінансової безпеки

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**Анотація.** Метою дослідження було визначення економічних ризиків, зокрема впливу валютних коливань, інфляції та змін у податковій політиці на їх фінансову безпеку для аграрних підприємств України. Було досліджено дані таких підприємств, як Миронівський хлібопродукт, Кернел та Агрокомбінат «Слобожанський». У дослідженні було використано методи порівняльного аналізу, які дозволили оцінити вплив макроекономічних факторів на аграрний сектор. Для цього була порівняна ситуація в Україні та Німеччині, яка є прикладом стабільної економіки Європейського Союзу. В результаті проведення дослідження було вивчено ключові економічні загрози для аграрних підприємств, серед яких валютні коливання, інфляція та високі ставки кредитування. Було встановлено, що у 2022 році курс гривні зазнав значних коливань, що ускладнило імпорт сільськогосподарських ресурсів та підвищило витрати на виробництво. Було проаналізовано стабілізацію валютного курсу у 2023 році, проте в 2024 році на фоні підвищення інфляції до 12 % валютна нестабільність знову створила труднощі для аграріїв, зокрема у фінансуванні імпортних постачань. Узагальнено, що у 2025 році також були введені нові податкові ініціативи, зокрема зниження податку на додану вартість для малого та середнього бізнесу з 20 % до 10 %, що допомогло полегшити фінансове навантаження на аграріїв. Проте для великих підприємств залишалися високі ставки податку на прибуток – 18 %, що збільшувало витрати і знижувало їхню конкурентоспроможність. Дослідження також виявило ефективність державних та міжнародних фінансових ініціатив, таких як програма «Доступні кредити 5-7-9 %», United States Agency for International Development Агро, European Innovation Council Accelerator, а також проєкти Європейського Союзу та Світового Банку, спрямовані на підтримку аграрного сектору під час економічної нестабільності. Ці ініціативи допомогли аграрним підприємствам отримати доступ до фінансування, зменшивши ризики, пов'язані з високими процентними ставками та валютними коливаннями. Практичне значення дослідження полягає в розробці стратегій мінімізації економічних ризиків для аграрних підприємств України, що сприяє їхній фінансовій безпеці та підвищує стійкість сектору через диверсифікацію бізнесу та впровадження цифрових технологій

**Ключові слова:** інвестиції; моніторинг; антикризові механізми; диверсифікація; кредитування

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# Methods for assessing the balanced development of entrepreneurship in the field of cultural tourism

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**Abstract.** The aim of this article was to analyse modern approaches to tourist zoning in Ukraine and assess the balanced development of cultural tourism in regions, considering economic, social, and ecological factors. Methods for evaluating the development of cultural tourism were identified, problems hindering were highlighted, recommendations for ensuring the sustainable development of the tourism sector under wartime conditions were formulated. It was defined the main approaches to evaluating the balanced development of cultural tourism, which involved the preservation and popularisation of cultural heritage. Also, it included the restoration of architectural monuments and the organisation of cultural festivals. One of the elements of the studied approaches was the development of tourist routes aimed at improving transportation accessibility to cultural sites and using digital technologies. It was emphasised the importance of adhering to sustainable development through monitoring the ecological impact on cultural and natural sites, using resource-saving technologies, ensuring social responsibility in tourism. The importance of integrating cultural heritage into regional sustainable development initiatives was stressed. Cultural tourism was a significant component of regional sustainable development, contributing to economic growth, the preservation of cultural heritage, and the formation of a positive image of regions. Successful cultural tourism development required a systematic approach that involved interaction among local communities, authorities, tourism companies, and stakeholders. The analysis of regional tourism development indicators pointed to several key problems hindering growth, such as insufficiently developed tourism infrastructure, the low priority of tourism, the absence of comprehensive development programs in most regions, and the underestimation of territorial resources. The number of tourism entities, the quantity and quality of areas with tourism infrastructure, the volume of visitor flows, and the accessibility of natural, recreational, cultural, and historical resources became key indicators for determining the level of tourism development. The results of the study can be useful for management bodies and tourism companies in developing effective strategies for cultural tourism development, aiming for a balance between economic growth, cultural heritage preservation, and meeting local community needs

**Keywords:** hospitality industry; sustainable development; historical-cultural heritage; tourist region; tourism services sector

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## Introduction

Changes in social relations necessitate a rethinking of pressing issues, particularly in the tourism sector, which is a crucial component of socio-economic development. Due to its rich natural and recreational resources, as well as a rich historical and cultural heritage, Ukraine has significant potential for both internal and international tourism. Analysing visitor activity and assessing resources available in different locations is crucial for the successful development of the industry. Global pandemics, which have caused a crisis in the travel and tourism industry, have made this issue even more relevant. A comprehensive assessment of regional opportunities, threats, and resource potential will help shape an effective strategy for the development of both internal and international tourism.

Tourism is one of the most dynamic sectors of the global economy, as evidenced by its rapid growth. From 2014 to 2024, the average annual growth rate of demand for tourist services was around 4.6%, and the total turnover of the industry reached 6 trillion USD. Tourism accounted for 7% of global investments, 11% of global consumer spending, and one in every eight jobs. According to the World Tourism Organization (2024), the number of travelers worldwide was directly proportional to the world's population.

According to the World Economic Forum's tourism competitiveness rankings, the industry leaders are Spain, France, Germany, the USA, and the United Kingdom, while Ukraine did not make the list (Travel & tourism development index 2021..., 2022). Effective management of the tourism sector has allowed many countries, which do not have as rich natural and cultural resources as Ukraine, to accelerate their economic development. Therefore, the quality assessment of tourism potential and its regulation was becoming increasingly important. Analysing the attractiveness of a region has allowed government organisations to find viable locations for tourism development, create competitive tourism products, and market them both domestically and internationally. The issue of regional competitiveness and increasing tourism attractiveness has been studied by both Ukrainian and foreign researchers. A. Okhrimenko & I. Antonenko (2023) analysed modern state, trends, and prospects for the development of the tourism and hotel business in Ukraine, along with the economic and managerial aspects of hospitality enterprises and their potential for post-war recovery. To enhance the competitiveness of the hotel industry, special attention was given to the implementation of innovative technologies, the digitalisation of business processes, and the strategic management of its development. M.Yu. Barna & Y.V. Stetsyk (2023) focused on the importance of organising and researching cultural events for economic development and the preservation of cultural heritage in the context of war. L. Bozhko & V. Kholodok (2022) analysed the experience of countries that successfully restored their tourism sectors after war, which could serve as a foundation for Ukraine's tourism development opportunities. The work by A. Mazaraki *et al.* (2020) was dedicated to analysing trends and challenges in the tourism industry in the context of forming a new paradigm of future economic development Society 5.0. The authors examined tourism as a strategic sphere that can play an important role in implementing the Society 5.0 concept by adapting to global challenges and using new technologies for its development.

According to E. Zabarna (2017), regions were formed primarily based on economic feasibility and united territories with similar economic structures. Regarding the competitiveness of tourist regions, K. Tymoshenko (2020) stated that the competitiveness of an entity operating at a certain level can only be ensured if the competitiveness of entities at higher levels is also present. Thus, the competitiveness of individual tourism enterprises at the micro level depended on the growth of competitiveness in the tourism sector of a destination at the meso level, which was made possible through the competitiveness of the tourism industry at the macro level of Ukraine. As a result, the tourism sector acquired a new systemic characteristic and obtained a synergistic effect. The most crucial factor for the development of tourism destinations became the formation of strategic competitive advantages. The differences inherent in a tourist destination can be both positive and negative from the perspective of tourism organisations.

Authors K. Pompurová & I. Šimočková (2014) studied the key factors affecting the competitiveness of tourist destinations in a country. Their approach combined the analysis of statistical data and sociological surveys conducted among tourists from major markets. This allowed them to conclude that, to increase attractiveness, tourism products need to be adapted according to the expectations of foreign visitors.

The purpose of the article was to analyse the modern state of Ukraine's tourism industry under global and internal challenges, such as the COVID-19 pandemic, war, economic instability, and environmental threats.

## Materials and Methods

The article employed a comprehensive approach to assess the balanced development of entrepreneurship in cultural tourism, taking into account economic, social, and environmental aspects. To ensure the reliability of the results and form well-founded conclusions, various scientific methods were used in the research. In particular, the statistical method allowed for the collection and analysis of real data on the activities of tourism entities based on specific observations and actual indicators. This method provided practical insight into the dynamics of changes in tourism and the interaction between regions. The systematisation method was used to analyse existing scientific approaches, concepts, and

models in the field of balanced cultural tourism development in regions. This helped to identify key trends being applied, formulate new proposals for further research on adapting these concepts within the context of balanced cultural tourism development in Ukraine.

For the statistical analysis of collected data on the economic activities of the tourism sector and the establishment of dependencies between the studied indicators, such as tax revenues from tourism, economic-mathematical methods were applied. Specifically, regression analysis was used to forecast tourist flows based on factors such as the state of cultural heritage, infrastructure levels, advertising expenditures, and seasonality. Additionally, through the analysis method, the tourist was defined as a "unit of account" in the tourism sector, with divisions into groups, focusing on inbound and outbound tourism, which impact the financial flows of both Ukraine and other countries. The primary data for analysis were obtained from statistical sources such as the World Tourism Organization (2024) and the State Statistics Service of Ukraine (2025). These sources provided data on tax revenues from the tourism sector by region for the period 2022-2024, allowing for a graphical interpretation of the dynamics of tax revenues from tourism. Furthermore, data from sources such as Travel and Tourism (2024) and Global and regional tourism performance (2025) were used to analyse global trends in the studied industry. The study also used environmental audits to assess the impact of tourism activities on the condition of cultural objects and the environment, analysing the effect of tourist flows on cultural heritage sites.

## Results and Discussion

Tourist zoning can be understood as the division of territory into separate regions, taking into account natural, cultural-historical, socio-economic, and infrastructural features, which contributed to the effective planning and development of tourism. It helped to identify promising directions for tourism development, considering the uniqueness of the natural and cultural resources of each region. Four main regions were distinguished: the Carpathian, Polissya, Dnieper, and Azov-Black Sea regions. Additionally, scholars had defined seven regions of Ukraine: Carpathian (Western), Volyn-Ternopil (North-Western or Polissya), Zhytomyr-Vinnytsia (Buffer), Kyiv (Central), Kharkiv (North-Eastern), Dnieper-Donetsk (South-Eastern), and Black Sea (Southern) (Pankova, 2003).

Besides these approaches, there was a tendency to merge three coastal regions into a single Crimean-Odesa-Azov tourist region, while the Carpathian region remained separate. In general, a tourist region encompassed the territory, where tourist attractions were concentrated and necessary tourism services were provided. It may include individual cities, resorts, regions, and districts, as well as larger territorial formations such as regions, countries, or groups of countries that attract tourists. In this sense, the term "region" referred to a part of the country's territory, which borders administrative-territorial units and has certain natural, geographical, economic, and ecological features. A tourist region was understood as a territory with certain appeal to tourists, having a developed tourism infrastructure and organisational system. Its appeal was determined by various factors, including natural, historical, cultural, social, and economic aspects. The foundation for the formation of the region was tourist resources, which determined the region's specialisation. For example, cultural and historical monuments have become the foundation for forming popular modern tourist destinations (Pankova, 2003).

The principles of sustainable cultural tourism development, which included the preservation and economical use of historical-cultural resources, the implementation of environmentally conscious practices, assistance to local communities, and support for the financial stability of the tourism sector, should serve as the foundation for the growth of tourist destinations. The assessment of the balanced development of the cultural tourism industry involved the use of a number of methodologies and approaches, which allowed to determine, how economic, social, and environmental issues influence the growth of the hospitality sector (Table 1).

***Table 1.*** *Approaches to assessing the balanced development of entrepreneurship in the field of cultural tourism*

| Category of approaches | Evaluation methods | Description |
|---|---|---|
| **Economic approaches** | SWOT-analysis | Study of the advantages and disadvantages of enterprises, as well as opportunities and risks in the external environment |
| | Financial analysis | Assessing profitability, liquidity, financial stability, and their impact on the local economy |
| **Social approaches** | Return on investment (ROI) analysis | Evaluating the profitability of investments in building tourist routes or cultural sites |
| | Employment assessment | Analysing the number of jobs created by the cultural tourism sector |
| | Customer satisfaction index | Assessing the level of tourist satisfaction with services, infrastructure, and the condition of cultural objects |
| | Sociological surveys | Studying the opinions of local residents and tourists on the quality of life, cultural heritage, and regional development |
| **Environmental approaches** | Environmental impact analysis | Studying the impact of tourism on ecological balance, natural, and cultural landscapes |

*Table 1, Continued*

| Category of approaches | Evaluation methods | Description |
|---|---|---|
| **Environmental approaches** | Resource use evaluation | Analysing the consumption of water, energy, waste generation, and environmental condition near cultural sites |
| **Integrated approaches** | Multicriteria assessment | Using various factors for a comprehensive analysis of the effectiveness of cultural tourism development |
| | Balanced scorecard (BSC) | Assessing the effectiveness of cultural heritage management based on internal procedures, personnel development, client relations, and finances |
| **Digital approaches** | Big Data analytics | Analysing large datasets about tourist flows, cultural site ratings, and visitation dynamics |
| | GIS technologies | Assessing the location of cultural sites, their accessibility, and tourist interest zones |
| | Scenario development modeling | Predicting future demand for cultural services using artificial intelligence |

***Source:*** *developed by the authors based on Yu. Yukhnovska (2019)*

The mentioned approaches allowed for a thorough assessment of sustainable development, which improved company productivity, protected cultural values, and contributed to regional sustainable economic growth. To achieve sustainable development in cultural tourism, the environmental impact of cultural and natural sites must be considered. Additionally, resource-saving technologies should be actively used, and social responsibility in the tourism sector must be ensured for cultural tourism to develop sustainably. A comprehensive approach to these factors will contribute to improving the quality of life for local populations, reducing the negative environmental impact, and preserving unique heritage (Table 2).

***Table 2.*** *Environmental impact of tourism on cultural and natural sites*

| Aspect | Characteristics | Examples |
|---|---|---|
| **Environmental impact on objects** | 1) degradation of monuments due to tourist flows;<br>2) pollution of natural areas (waste, soil erosion);<br>3) reduction in biodiversity | 1) overcrowding at St. Sophia's Cathedral in Kyiv;<br>2) destruction of the Kakhovka Reservoir;<br>3) damage to the natural landscapes of the Carpathians |
| **Resource-saving technologies** | 1) solar panels, energy-saving lamps;<br>2) water-saving systems (reuse);<br>3) electric transport for tourists | 1) solar panels in hotels in Odesa;<br>2) electric buses in the Carpathians;<br>3) waste sorting in national parks |
| **Social responsibility** | 1) support for local communities (job creation, promoting crafts);<br>2) engaging tourists in ecological culture;<br>3) investment in the restoration and preservation of objects | 1) tourist taxes for the preservation of the Carpathians;<br>2) educational programs for museum visitors;<br>3) restoration of Lviv's historic center |
| **Education and engaging tourists** | 1) informing about respectful treatment of cultural heritage;<br>2) teaching ethical behaviour (no littering, respecting sites) | 1) information stands at Khortytsia Reserve;<br>2) ecological festivals in Ukraine's national parks |
| **Preservation of objects** | 1) monitoring tourist load;<br>2) restoration and support of monuments;<br>3) use of digital technologies to create 3D models of cultural heritage | 1) 3D model of Chersonesus Taurica;<br>2) restoration of the Golden Gates in Kyiv;<br>3) restricting access to popular locations (e.g., Odesa catacombs) |

***Source:*** *developed by the authors*

The development of sustainable tourism requires achieving a balance between social responsibility, the preservation of cultural and natural heritage, and commercial benefits. The use of resource-saving technologies and the promotion of environmental awareness were key conditions for preserving unique sites for future generations. At the modern stage, tourism development was significantly limited by a number of fundamental barriers (Global and regional..., 2025). The COVID-19 pandemic became one of the main issues hindering the growth of the industry, particularly due to strict quarantine restrictions, border closures, reduced visitor numbers, increased sanitary norms, decreased revenue for tourism enterprises, and Russia's war against Ukraine, which included the destruction of tourism infrastructure, historical landmarks, landmine contamination, decreased security, and the outflow of foreign tourists and investors, triggering a series of other crises. These included inflation, rising fuel and transportation costs, and a decrease in population purchasing power, which limited travel opportunities; reduced funding for tourism projects, lack of resources for infrastructure restoration and cultural site restoration; and the lack of convenient air connections.

Due to the conflict, economic instability, and the pandemic, many tourism professionals changed careers or moved abroad, adding another obstacle to industry growth. To overcome these challenges, a comprehen-

sive tourism development strategy was needed, including infrastructure restoration, investment attraction, adaptation to new security conditions, and support for sustainable tourism. Despite the difficulties caused by the conflict, Ukraine's tourism sector had the opportunity to preserve the country's unique cultural heritage, while simultaneously strengthening the local economy. From January to September 2024, about 173 million UAH in tourism taxes were collected for local budgets. The State Agency for Tourism Development (SATD) reported the amount of tourism tax revenue to local budgets for the first three quarters of 2024. For the first nine months of 2024, tourism tax revenues in Ukraine amounted to 172 million UAH (143 million EUR), which was 21% more than in the same period in 2023. Regional tourism taxes for 2021 amounted to 243 million UAH, almost 30% more than in 2024 (Public report of the State Agency for..., 2024). The cities of Kyiv and five regions led in tourism tax payments: Lviv, Ivano-Frankivsk, Kyiv, Zakarpattia, and Dnipropetrovsk regions (Fig. 1).

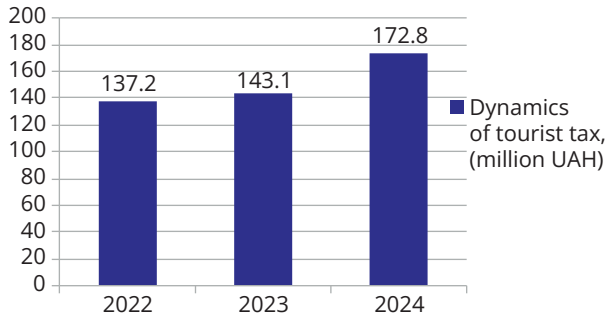


***Figure 1.*** *Dynamics of tourist tax, million UAH*
***Source:*** *Public report of the State Agency for Tourism Development of Ukraine (2024)*

In 2024, Kyiv's budget received the highest amount of tourism tax – 34 million 417 thousand UAH, compared to 21 million 26 thousand UAH in 2023. However, compared to 2021, the capital's tourism tax has decreased by half – to 67 million 995 thousand UAH. The budget of the Lviv region was replenished by 32 million 769 thousand UAH. This amount was 42% higher than in 2021, when the tourism tax to the Lviv region budget was 2 million 308 thousand UAH. Ivano-Frankivsk region received 22 million 7 thousand 452 UAH in tourism tax, which was 120% more than in 2021. The tourism tax in the region was 14 million 69 thousand 900 UAH as of the third quarter of 2023 (Public report of the State Agency for..., 2024).

In 2024, the tourism tax in Zakarpattia region amounted to 15 million 93 thousand UAH. This was almost the same as in 2023 – 14 million 84 thousand UAH. It was also one-third higher than in 2021 – 11 million 749 thousand UAH. Due to the tourism tax, the budget of Kyiv region was replenished by 10 million 731 thousand UAH for the first nine months of 2024. This amount was one-third less than the amount collected in 2021 (15 million 310 thousand UAH). It was also twice as much as in 2023 (6 million 905 thousand UAH) (Public report of the State Agency for..., 2024).

With a revenue budget of 10 million 186 thousand UAH, Dnipropetrovsk region took first place. This amount exceeded the tourism tax in the region in 2023 by 18% (9 million 92 thousand UAH) and was almost the same as the tourism tax in 2021 (10 million 72 thousand UAH). Compared to 2023, the tourism tax in Central Ukraine increased in 2024: in Vinnytsia region (3 million 560 thousand UAH vs. 2 million 521 thousand UAH), Poltava region (4 million 946 thousand UAH vs. 4 million 497 thousand UAH), Kirovohrad region (1 million 252 thousand UAH vs. 1 million 62 thousand UAH). However, from January to September 2024, the tourism tax revenue in Cherkasy region decreased by more than 30% compared to the same period in 2023 (3 million 932 thousand UAH vs. 5 million 481 thousand UAH) (Public report of the State Agency for..., 2024).

In Khmelnytskyi region in 2024, the tourism tax amounted to 5 million 271 thousand UAH compared to 3 million 754 thousand UAH in 2023, in Ternopil region – 984 thousand UAH compared to 1 million 3 thousand 200 UAH, and in Chernivtsi region – 2 million 342 thousand UAH compared to 2 million 935 thousand UAH. Compared to 1 million UAH in 2021, the tourism tax in Bukovina increased by 166%. In 2024, the budget from tourism tax in Volyn region was replenished by 2 million 568 thousand UAH. This amount was 23% higher than the 2023 figures, which were 2 million 8 thousand 700 UAH. In Rivne region, the local budget received 1 million 968 thousand UAH compared to 1 million 778 thousand UAH in 2022. Additionally, in the southern regions of Ukraine, the tourism tax was partially increased, mainly in Odesa and Mykolaiv regions. In Odesa region, the tourism tax increased by 45% compared to 2023 (7 million 727 thousand UAH vs. 5 million 340 thousand UAH) (Public report of the State Agency for..., 2024).

In the third quarter of 2024, Mykolaiv region transferred 1 million 727 thousand UAH in tourism tax to the budget compared to 457 thousand UAH in 2023. In Zaporizhzhia region, the tourism tax remained almost the same as in 2023 (1 million 3 thousand 480 UAH vs. 396 thousand UAH). In the northern regions of Ukraine, tourism tax generally increased. In Zhytomyr region – by 10% (2 million 21 thousand UAH vs. 2 million 3 thousand UAH in 2023); in Sumy region – by 29% (1 million 3 thousand 200 UAH vs. 802 thousand UAH); in Chernihiv region – by 21% (1 million 18 thousand UAH vs. 976 thousand UAH). In the eastern regions – Kharkiv, Donetsk, and Luhansk, as well as in the southern region – Kherson – tourism tax significantly decreased (Public report of the State Agency for..., 2024). The local council decided to set rates up to 0.5% for internal tourism and 5% for inbound tourism for each day of temporary residence. As of 2023, the maximum rates were 30 UAH for internal tourism and 300 UAH for inbound tourism (State

Statistics Service of Ukraine, 2025). Figure 2 graphically depicted the dynamics of tourism tax revenue by regions of Ukraine.

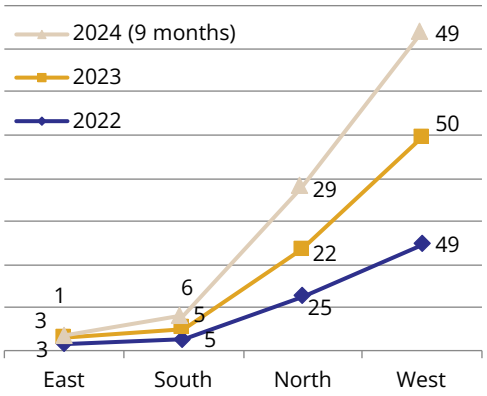


***Figure 2.*** *Dynamics of tourist tax revenue by region (%)*
***Source:*** *Public report of the State Agency for Tourism Development of Ukraine (2024)*

The main accounting unit in the tourism sector is the traveler, or any person, who travels between countries, regardless of the purpose of the trip or the type of transport. This group included both tourists and other individuals, who travel. Travelers were divided into two groups: those, who stay overnight and those, who make day trips. Thus, tourists were defined as those, who travel for various purposes and spend at least one night in accommodation (hotels, campsites, resorts). The term "outbound tourism" referred to international travel by Ukrainian citizens, and money spent abroad was economically considered an import. This led to the issue of a reduction in internal financial flows. Additionally, outbound tourism contributed to cultural exchange, which improved understanding of other countries and their ways of life. On the other hand, inbound tourism was considered an export, as it brought foreign income. The quality of services and the development of tourist infrastructure played a significant role in its growth. The underdevelopment of tourist infrastructure in Ukraine had caused an imbalance between outbound and inbound tourism, leading to capital outflow, insufficient use of the country's recreational potential, and limited opportunities to attract foreign tourists. Improving tourist services and modernising infrastructure could significantly increase Ukraine's appeal to international travelers (Travel and tourism, 2024).

The authors O. Berkova & O. Borisyuk (2023) focused on the study of regional tourism markets and economic interactions based on the production, distribution, and consumption of the full tourism product within a specific territory. Scientists O. Chubrei *et al.* (2022) examined the impact of the pandemic on the travel and tourism industry, as well as the latest opportunities for its development as a key structural element of the national economy. The tourism and leisure industry was the most affected by the COVID-19 pandemic, largely due to measures needed to contain it. As of April 20, 2020, 97 tourist destinations had closed their borders or parts of them, and about 65 countries and territories, including 39 countries, had closed their borders to certain groups of tourists arriving from COVID-19 hotspots, while the remaining 7% of regions implemented preventive measures such as 14-day quarantines for tourists from other countries. Researchers I. Zhurba *et al.* (2022) analysed the modern state and prospects for the development of the tourism industry in Ukraine and worldwide. Russia's military aggression caused significant economic, financial, and social losses for Ukraine. Additionally, the economic development of Eastern Europe and the world worsened due to the high degree of globalisation of the world economy and the close ties between national economic systems.

N. Pankiv & V. Byk (2023) analysed the issues and trends related to the ecological sustainability of tourist infrastructure both in Ukraine and globally, as well as the opportunities and challenges of greening the hotel and restaurant sector in Ukraine. Scientist V. Kovalyshyn (2024) explored tourism development at the national level and in the Carpathian region. The researcher noted that in 2023, the number of business entities in the Carpathian region increased and surpassed the 2022 figures. The authors S. Melnychenko & N. Zikiy (2019) studied the modern state of tourism enterprises and identified factors that contribute to the decline in the number of participants in the tourism sector.

The authors O. Korkuna *et al.* (2020) focused on gastronomic tourism, which had became a significant contributor to the socio-economic development of local communities today. Global experience had shown that gastronomic tourism can stimulate the improvement of living standards in places with varying levels of economic potential. The main advantages of gastronomic tourism were its inherent connection to satisfying fundamental human needs and its ability to develop independently of the availability of attractive historical, cultural, or natural landmarks in the area. I. Nestorishen *et al.* (2023) explored trends in the international tourism services market from 2021 to 2023, specifically analysing the dynamics of the "international tourist arrivals" indicator.

Researchers T. Zubekhina *et al.* (2024) demonstrated the effectiveness of using museum virtualisation for training tourism professionals. The authors emphasised, how the philosophy and practice of e-learning were shaped by the development of modern information technologies. Researchers analysed several meanings of the term "virtual museum", as well as various types of virtual museums, classification criteria, reasons for their attractiveness, and their historical development. Virtual museums played a crucial role in the development of cultural tourism and stood out for their structural and functional diversity.

O. Nosyriev *et al.* (2022) addressed the issue of coordinating activities among key participants in the tourism

and hospitality sector and justified the development of the industry in the context of post-war recovery. Scientists highlighted the need to optimise potential measures for improving the strategic direction of the industry's development in the context of armed conflict and post-war recovery. The authors also outlined the characteristics of Ukrainian tourism during and after the war, systematised the negative consequences of the armed conflict for the travel and hospitality sector, and identified key barriers to inbound tourism growth in the current conditions. The tourism and hospitality sector was expected to become a driving force for Ukraine's post-war economic recovery. Researchers emphasised the necessity of significantly updating Ukraine's tourism branding, which should be based on ensuring the safety and security of tourists, as well as shaping a positive and secure image of the country. N. Pohuda *et al.* (2023) examined the use of information and communication technologies in tourism businesses. The authors found that, unlike other economic sectors, tourism enterprises actively used these technologies.

D. Krešić & D. Prebezac (2011) analysed various parameters, including natural and cultural resources, infrastructure quality, safety levels, and service availability. The assumption that geographical regions had became an integral part of the population, economy, and natural environment often served as the basis for scientific views on the regionalisation of countries. Thus, by applying the concept of a panoramic perspective of the entire region, scientists viewed the region as an integrated system, whose components interact with each other. Ukraine's planned territorial division was determined by the influence of natural and socio-economic factors, which required the development of the hospitality industry.

Thus, the analysis of modern research indicated the need for structural adjustments, adaptation to new challenges, and the implementation of creative strategies to revive and develop Ukraine's tourism sector in line with global trends.

## Conclusions

The modern development of tourism faces numerous challenges, including the COVID-19 pandemic, Russia's war against Ukraine, economic instability, environmental threats, and infrastructure issues. These factors had significantly impacted the tourism sector, reducing tourist flows, damaging cultural and natural sites, decreasing investments, and changing traveler preferences. To ensure the sustainable development of cultural tourism, it was essential to implement environmentally responsible practices, use resource-saving technologies, support local communities, and develop safe tourist routes. Digital tools, big data analytics, artificial intelligence, and innovative approaches to heritage preservation have played an important role in this process.

Despite the difficult circumstances caused by war and economic instability, Ukraine's tourism industry had shown positive growth dynamics. Statistical data confirmed a gradual recovery of the tourism sector: tourism tax revenues increased by 21% in 2024 compared to 2023, indicating the activation of internal tourism and a rising demand for cultural and historical sites. However, the analysis of tax revenue dynamics revealed significant regional differences: in some areas, particularly Kyiv, there was a decrease in tourism tax revenues compared to 2021, while western and central regions demonstrated steady growth. This indicated a redistribution of tourist flows to safer regions of Ukraine. Meanwhile, southern and eastern regions, most affected by the fighting, experienced a significant decline in tourism.

The development of inbound tourism remained limited due to security risks, but its potential can be realised by improving tourist infrastructure and enhancing service quality. Outbound tourism, which became a significant factor in capital outflow from the country, required a strategy of containment through the active development of internal tourist routes and the promotion of recreational areas.

To further grow the tourism sector, state programs supporting tourism initiatives, infrastructure modernisation, stimulation of private investments, and the implementation of modern marketing strategies are needed. Only a comprehensive approach will allow tourism to become one of the key factors in Ukraine's economic recovery. The restoration of tourist infrastructure, development of internal tourism, promotion of international cooperation, and integration of sustainable development principles had became the main components of a comprehensive plan to overcome modern challenges and adapt to new realities. This will not only restore the tourism sector, but also make it more resilient, safe, and responsible. Future research prospects include assessing the modern state and future directions of cultural tourism development in various regions of Ukraine.

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None.

## Conflict of Interest

None.

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# Методи оцінювання збалансованого розвитку підприємництва у сфері культурного туризму

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**Анотація.** Метою статті був аналіз сучасних підходів до туристського районування України та оцінка збалансованого розвитку культурного туризму в регіонах з урахуванням економічних, соціальних та екологічних факторів. Було визначено ключові методи оцінювання розвитку культурного туризму, ідентифіковано проблеми його зростання, сформульовано рекомендації щодо забезпечення сталого розвитку туристичної галузі в умовах війни. Визначено підходи до оцінювання збалансованого розвитку культурного туризму, які передбачали збереження та популяризацію культурної спадщини, що включала реставрацію пам'яток архітектури, організацію культурних фестивалів. Одним з елементів досліджуваних підходів була розробка туристських маршрутів, що передбачали поліпшення транспортної доступності до культурних об'єктів, використання цифрових технологій. Також було вказано про дотримання сталого розвитку, шляхом моніторингу екологічного впливу на культурні та природні об'єкти, використання ресурсозберігаючих технологій, забезпечення соціальної відповідальності туризму. Підкреслено важливість включення культурної спадщини в регіональні ініціативи сталого розвитку. Культурний туризм є важливою складовою стійкого розвитку регіонів, він сприяє економічному зростанню, збереженню культурної спадщини та формуванню позитивного іміджу територій. Успішний розвиток культурного туризму вимагає системного підходу, що включає взаємодію між місцевими громадами, органами влади, туристичними компаніями та стейкхолдерами. Аналіз регіональних показників розвитку туризму вказав на низку ключових проблем, що стримують його зростання, зокрема на недостатньо розвинену туристичну інфраструктуру, низький пріоритет туризму, відсутність комплексних програм його розвитку в більшості регіонів, недооцінка потенційних ресурсів територій. Кількість суб'єктів туристичної діяльності, кількість та якість територій з туристичною інфраструктурою, обсяг потоків відвідувачів, доступність природних, рекреаційних, культурних та історичних ресурсів стали ключовими показниками для визначення рівня розвитку туристичної галузі. Результати дослідження можуть бути корисними для органів управління, туристичних компаній у розробці ефективних стратегій розвитку культурного туризму, спрямованих на досягнення збалансованості між економічним зростанням, збереженням культурної спадщини та задоволенням потреб місцевих громад

**Ключові слова:** індустрія гостинності; сталий розвиток; історико-культурна спадщина; туристичний регіон; галузь туристичних послуг

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# Customs policy as a tool to stimulate exports under martial law

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**Abstract.** The purpose of the article was to study the specifics of the functioning of Ukraine's customs policy under martial law, with a special emphasis on the mechanisms for stimulating export activities and ensuring the efficiency of the state's foreign economic processes. The methods of analysis, synthesis, comparison, generalisation of data and logical conclusion of the analysis were used for the study. An integrated approach allowed for a systematic study of the multifaceted nature of customs policy, which included interrelated components. The use of the abstract and logical method contributed to the formulation of the key areas of modernisation of Ukraine's customs policy in the context of martial law and European integration. The paper examined the peculiarities of Ukraine's customs policy under martial law, analysed the indicators of foreign trade at the beginning of the war and the activities of the State Customs Service. The key objectives of the customs policy were identified: export development, protection of the internal market and support for the competitiveness of Ukrainian goods. For this purpose, customs tariffs with protective and incentive functions were applied in accordance with economic needs and international obligations. Exports declined, particularly in 2022, but stabilised in 2024. The index of physical exports increased, indicating that production processes improved. The agricultural sector suffered the largest losses. At the same time, the EU and Canada's decision to temporarily exempt Ukrainian goods from duties contributed to trade liberalisation. Military actions and the blockade of ports changed logistics: rail transport replaced sea transportation, which complicated

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the work of customs due to the increase in the volume of goods flows. It was proposed simplified approaches to export procedures that can stimulate foreign economic activity. The economic effect of the proposed changes was estimated as a basis for new strategic objectives in the field of foreign trade. The practical value of the work is to provide adaptive solutions to the conditions of uncertainty and chaos arising from the martial law in Ukraine, as well as to improve the procedures and processes of foreign economic activity

**Keywords:** state economic policy; customs; export activity; foreign economic activity; martial rule

## Introduction

The hostilities had caused large-scale destructive processes that had complicated foreign trade operations, disrupted traditional logistics chains, limited access to strategically important markets, and significantly reduced the competitiveness of Ukrainian products on the international market. As a result, there had been a significant decline in exports, increased economic losses and risks for the operation of Ukrainian enterprises, which required the development of effective mechanisms for adapting customs policy and foreign trade regulation under martial law. Many sectors of the Ukrainian economy had undergone significant changes as a result of the military conflict. Given the existing external threats that call into question the stability of foreign economic activity and the financial system as a whole, there was a need to develop and implement new approaches to the functioning of the national customs policy, which will contribute to its effective implementation. Customs policy had become one of the most important tools for implementing the protectionist strategy, as it was an important component of state regulation of foreign economic activity. As a country that aspired to EU membership, Ukraine formed its customs policy in accordance with the requirements of international economic institutions and international trade regulations. Important areas in this process included strengthening international cooperation, implementing the best international practices of customs administration, and strategically using the competitive and comparative advantages of the national economy in certain sectors. Ukraine's European integration course was significantly transforming the system of foreign trade regulation, highlighting the need to improve tax and customs mechanisms as key instruments of state policy in the field of international trade. The essence of the state customs policy was the development and implementation of a system of principles and directions of state activity aimed at protecting customs interests, ensuring customs security of Ukraine, regulating foreign trade, protecting the internal market, as well as stimulating the development of the national economy and Ukraine's integration into the world economy.

The analysis of scientific publications showed that researchers paid considerable attention to the functioning of Ukraine's customs policy. The author A. Babiuk (2022) examined in detail the essence of the concepts of "customs" and "customs policy" in the context of regulating foreign economic activity. The study of K. Blishchuk (2023) organised the mechanisms for improving customs policy in Ukraine within the framework of the European course. T. Borodenko & K. Levchenko (2023) emphasised the effectiveness of customs, which directly affected the implementation of customs policy. The study of the customs policy of Ukraine in the context of uncertainty and martial law was carried out by O. Bondarenko & M. Utkina (2024), who emphasised that martial law and smuggling of goods require an optimal model of legal liability. The presented works analyse the activities of customs authorities in crisis conditions, outline key challenges and suggest areas for improving their performance. The issues of international relations and economic activity in the formation of export policy were covered in the works of K. Dumanska & L. Fedoryshyna (2023). The researchers examined the role of foreign economic relations in ensuring the competitiveness of Ukrainian exports in international markets. D. Kulish (2022) stu died the peculiarities of foreign economic activity of the European Union enterprises, in particular, the author analysed the main trends, regulatory mechanisms and factors affecting international trade and investment activity within the EU single market. The topic of international customs regulation and innovations to stimulate exports was studied by A. Mavrommati *et al.* (2024). The researchers carried out an econometric analysis of the competitiveness of olive oil exports in the leading producing countries, considered the key factors affecting export potential, and assessed the effectiveness of industry development strategies. N. Reznik & T. Borovyk (2022) studied the peculiarities of customs and customs policy of the state, analysed its role in regulating foreign economic activity, and outlined areas for improving customs administration. The papers presented were devoted to the introduction of digital technologies, modernisation of customs procedures and creative methods of improving the efficiency of customs administration. Customs policy had become a key instrument of state regulation of foreign economic activity, defining the principles, mechanisms and tools for its implementation. Through the application of scientifically based economic and legal measures, the state regulated export operations, contributing to the optimisation of trade flows, balancing foreign trade turnover and ensuring the protection of national economic interests in the global trade environment.

The purpose of the study was to assess the effectiveness of customs policy in stimulating exports under martial law, its impact on Ukraine's foreign economic activity, and to develop recommendations to minimise negative consequences and strengthen export potential.

## Materials and Methods

The information base of the study was based on scientific publications by leading Ukrainian scholars, as well as on the regulatory and legal framework of Ukraine. In particular, the study used the data from Resolution of the Cabinet of Ministers of Ukraine No. 1424 (2021) and Resolution of the Cabinet of Ministers of Ukraine No. 1402 (2023) to conduct a comparative analysis of goods, whose exports were subject to licensing. The data from the Official website of State Statistics Service of Ukraine (2025) were used to calculate the index of physical volume and dynamics of exports of goods in the period 2021-2024.

The study applied a set of scientific methods that provided a systematic analysis of customs policy as a tool for stimulating exports under martial law. The method of analysis was used to study the dynamics of Ukrainian exports in 2021-2024, which made it possible to identify the main trends and assess changes in the country's foreign trade activities. This method was also used to comprehensively analyse the nature and role of customs policy in stimulating foreign economic activity, identify key stages of its evolution, and determine the main mechanisms and instruments of tariff and non-tariff regulation. The synthesis method made it possible to summarise the results of the analysis, outline the key challenges and prospects for the development of the export sector in the context of external and internal threats. Also, the current problems of Ukraine's customs policy were systematised and strategic directions for its improvement were substantiated, taking into account long-term trends in European integration processes and their impact on foreign economic activity. The comparison method was used to identify differences between the legal acts adopted in 2021-2023 regulating customs policy and export operations. The conclusions on the study and evaluation of the effectiveness of customs policy as a tool for controlling foreign economic activity under martial law were made using the method of scientific generalisation.

An integrated approach to analysing the peculiarities of the functioning of Ukraine's customs policy in the context of modern challenges provided an opportunity for a systematic study of its multicomponent structure. The customs policy was considered as a complex system that encompassed numerous interrelated elements that were studied within a single conceptual approach. The application of the abstract and logical method ensured generalisation of the results obtained and identification of strategic directions for modernisation of Ukraine's customs policy in the context of martial law and European integration transformations, taking into account current legal, economic and geopolitical factors. The integrated use of these methods allowed to form indicators of export operations, which contributed to the identification of the main challenges in the field of customs regulation.

## Results and Discussion

Russia's full-scale military aggression against Ukraine, which began in February 2022, has had a significant impact on all aspects of the economy, including foreign trade. Ukrainian exporters had faced many large-scale challenges that have significantly complicated their operations and caused a decline in exports, resulting in significant losses for the country's economy and threatening the stable functioning of many businesses. Despite the large-scale destruction of export infrastructure, logistical difficulties, trade restrictions, and the impact of international sanctions, which significantly reduced Ukraine's foreign trade, the country continued to maintain its presence in international markets. An important factor that complicated export activities was the location of a significant part of production facilities in the areas of active hostilities or in the temporarily occupied territories, which caused additional risks and complications in the production, transportation and sale of products. However, Ukrainian business had demonstrated a high level of adaptability to the new business environment.

In modern environment of economic instability, driven by both internal and external factors, rapid changes in global financial markets and a complex system of international economic relations, managing the country's financial sector had become increasingly challenging. In these conditions of growing number of economic offenses, the integration of customs authorities into the export process had become an important element of the system of combating offenses. Due to their expertise in customs and foreign economic activity, as well as cooperation with customs administrations of other countries and international organisations, the customs authorities played an important role in combating customs fraud and smuggling. Customs security was an important component of the economic security of the state, directly affecting its financial component. Researchers N. Tyurina *et al.* (2023), in their analysis of customs policy and customs authorities' activities, identified the fiscal function as one of the main components of the tasks of customs authorities. The fiscal function of the customs authorities had become the main component of the customs system of each state, and its implementation had been identified as the main reason for the creation of customs authorities. A comparative analysis of public administration of customs showed that tasks related to fiscal policy have become one of the most important for customs administrations.

In Ukraine, the implementation of customs policy was carried out by the State Customs Service of Ukraine,

which performed the functions of the customs administration. M. Utkina *et al.* (2023) noted that the main tasks of the customs authorities were to implement the state policy in the field of combating offenses related to tax and customs legislation, control over the receipt of customs and other payments to state budgets, as well as supervision over the production and circulation of alcohol, alcoholic beverages and tobacco products. The customs authorities of Ukraine were vested with the necessary powers to perform tasks aimed at the effective implementation of the fiscal function. Customs taxes have a direct impact on the financial aspect of economic security, given the broad definition of its components. The stability of the monetary, currency and budgetary systems of the state largely depends on the revenues of customs payments to the state budget. Customs taxes were closely related to the international economic security of the state. Due to the differentiation of customs tariff rates, the customs taxation system performed two key functions: on the one hand, it provided barriers to smuggling and irrational import and export patterns, and on the other hand, it stimulated the free movement of goods, labour and capital, which contributed to the integration of the national economy into the global economic system. The formation of state budget revenues depended on tax and customs revenues derived from internal and foreign economic activity. The financial stability of the state, which created the conditions for its economic growth, was based on the customs and taxation spheres. The volume and quality of economic activity, which created the preconditions for future economic growth, directly affected the amount of state budget revenues. M. Brookbanks & G.C. Parry (2024) noted that customs policy provided significant budget revenues, protected the internal market by setting customs rates and fees, and stimulated the growth of local production, and was an important component of the state's financial stability. In addition, customs policy guarantees the stable functioning of global trade and promotes the growth of international economic relations. Military aggression, the blockade of the Black Sea, and the seizure of ports in Skadovsk, Kherson, Berdiansk, and Mariupol have led to a significant reduction in Ukraine's export opportunities, causing significant disruptions in the supply of Ukrainian products to world markets (Yakovets & Kovalchuk, 2023). An analysis of the dynamics of Ukrainian exports in 2021-2024, in particular for the period January-October 2024, made it possible to identify the main obstacles and outline opportunities for its further growth in the face of both internal and external threats (Fig. 1).

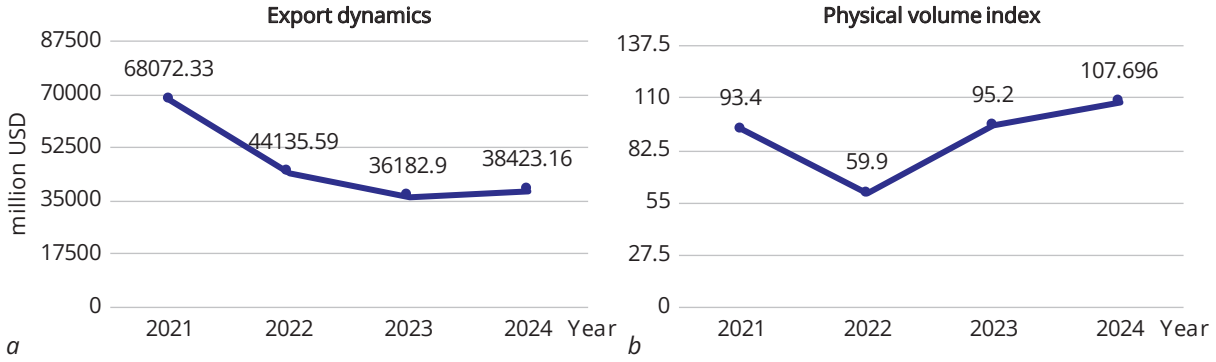


***Figure 1.*** *Physical volume index and dynamics of exports of goods for the period 2021-2024*
***Note:*** *a – dynamics of exports of goods; b – index of physical volume of goods*
***Source:*** *based on data from the Official website of State Statistics Service of Ukraine (2025)*

The analysis of Figure 1 showed a gradual decline in exports due to the military conflict. The largest decline in exports was recorded in 2022, where the absolute deviation amounted to -23936.7 USD million. At the same time, during the first three quarters of 2024, there was a stabilisation compared to 2023, when the absolute deviation decreased to -1580.9 USD million. According to the physical volume index, there was a significant increase in exports of goods, indicating an improvement in the efficiency of production processes, the restoration of export opportunities, or the adaptation of enterprises to new market conditions.

The problem of exports has had an acute impact on the agricultural sector, as Ukraine was one of the world's leading exporters of grain crops and vegetable oils. It was noted that in the period from 2021 to 2024, the volume of exports of plant products decreased by 13%, but since 2023 there had been a resumption of positive growth dynamics. Cereals were ranked second in terms of exports, and fats and oils of animal or vegetable origin were ranked third (Fig. 2). The aggregate share of the main categories in Ukraine's total exports in 2024 exceeded 65%, which emphasised their key role in Ukraine's foreign economic activity.

As shown in Figure 2, there was a decline in exports in all product groups in 2023. During the period from 2021 to 2024, there was a tendency for a gradual decrease in exports. The situation with oil exports was important, as they did not show positive dynamics and continued to decline, although the rate of decline gradually

decreased. The largest decline in exports was recorded in 2022 (15.47%), which was due to military aggression, the destruction of logistics chains, and the blocking of major export routes.

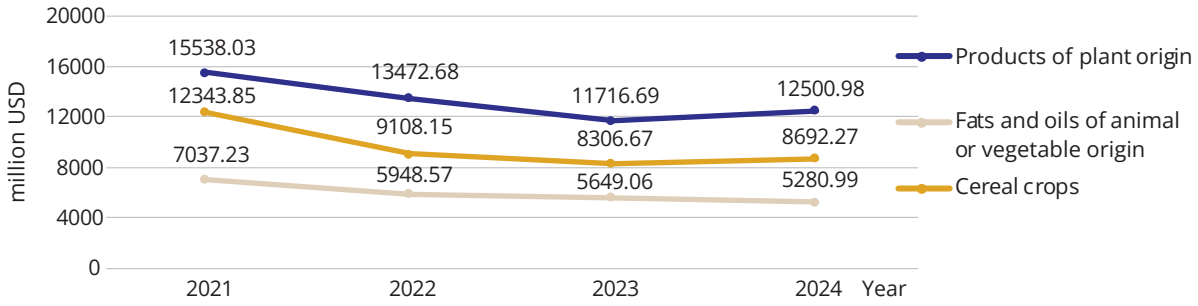


***Figure 2.*** *Dynamics of export volumes of the main groups of goods of key importance for foreign trade in 2021-2024*
***Source:*** *based on data from the Official website of State Statistics Service of Ukraine (2025)*

Russia's full-scale invasion of Ukraine in 2022 caused significant changes in trade flows. In the context of military aggression, Ukraine was forced to adjust its customs policy, taking into account the situation at the front and transformations in foreign trade. In particular, in the event of an enemy blockade of the territories, where enterprises with high exports were located, the state changed customs rates for imports of similar goods, which reduced dependence on supplies from the respective territories (Mavrommati *et al.*, 2024). Given the conditions of martial law, Ukraine needs to focus on improving customs procedures and developing partnerships with the international community. Strengthening Ukraine's position as a dynamic player in the global economy, capable not only of supplying raw materials, but also of producing high-quality products with significant added value, was also crucial. D. Kulish (2022) noted that in this context, protection and support of Ukrainian businesses and producers were key to ensuring the smooth operation of enterprises and maintaining their competitiveness in international markets, even in times of war. Simplification of customs procedures for imports will also help to optimise the satisfaction of the needs of the population and ensure the defense needs of the state.

In the first half of 2022, export operations were significantly affected by the expansion of the list of goods subject to licensing. It included chicken, beef, and chicken eggs, as well as strategically important products for Ukraine, such as millet, sugar, and oats. At the same time, the government abolished export quotas for rye, buckwheat, and salt, effectively limiting the export of these goods. For customs clearance of goods whose exports required licensing, it was necessary to submit a permit document – a license issued by the Ministry of Economy. Under martial law, the procedure for issuing licenses was simplified by reducing the list of documents required to obtain an export license. In 2024, significant changes took place, as a result of which about ten items of goods were switched to a zero-volume quota (Table 1).

***Table 1.*** *Comparative analysis of goods subject to licensing for 2022 and 2024*

| Product name | 2022 | 2024 | Notes |
|---|---|---|---|
| Meat of domestic chickens | No quota set | Quota set (0 tons) | Transition to a zero-volume quota |
| Eggs of domestic chickens | No quota set | Quota set (0 tons) | |
| Cattle, live | No quota set | Quota set (0 tons) | |
| Meat of cattle, frozen | No quota set | Quota set (0 tons) | |
| Meat and edible offal, salted or in brine, dried or smoked | No quota set | Quota set (0 tons) | |
| Millet | No quota set | Quota set (0 tons) | |
| Sugar | No quota set | Quota set (0 tons) | |
| Oats | No quota set | Quota set (0 tons) | |
| Rye | Zero quota (0 tons) | Zero quota (0 tons) | No significant changes |
| Buckwheat | Zero quota (0 tons) | Zero quota (0 tons) | |
| Salt suitable for human consumption | Zero quota (0 tons) | Zero quota (0 tons) | |
| Mineral or chemical fertilisers | Zero quota (0 tons) | Zero quota (0 tons) | |
| Liquid fuel (fuel oil) | Zero quota (0 tons) | Zero quota (0 tons) | |
| Coal, anthracite | Zero quota (0 tons) | Zero quota (0 tons) | |
| Natural gas of Ukrainian origin | Zero quota (0 cubic meters) | Zero quota (0 cubic meters) | |

***Source:*** *Resolution of the Cabinet of Ministers of Ukraine No. 1424 (2021), Resolution of the Cabinet of Ministers of Ukraine No. 1402 (2023)*

An analysis of Table 1 showed that prior to the introduction of martial law, legal documents contained various lists of goods with export quotas. This indicated a change in approaches to regulating the export of certain goods, which could indicate the introduction of stricter restrictions to maintain economic stability and strengthen the country's security. At the same time, some goods, such as rye, buckwheat, salt, fertilisers, liquid fuels, coal, and gas, whose export quotas remained unchanged, remained at 0, indicating that the ban on exports of strategically important goods was continued. Basically, the zero quotas were introduced for goods that did not have quotas in 2022, which can be explained by the need for stricter export control during martial law. Customs declarations for export goods were processed according to procedures that have remained unchanged since the pre-war period.

The customs policy of Ukraine was a system of measures and regulations that govern the movement of goods and services across the state border, as well as determined customs tariffs, procedures, standards and norms that created conditions for international trade. As noted by L.V. Kononenko *et al.* (2023), it was a key element of the state's economic strategy, as it affected economic growth, regulation of foreign economic activity, maintaining a balance between imports and exports, and protecting the national market from excessive external influence.

The main objectives of Ukraine's customs policy were to stimulate exports, protect the internal market from uncontrolled imports, and increase the competitiveness of national products. To achieve these objectives, customs tariffs were introduced, which performed both protective and stimulating functions, depending on the current needs of the national economy and Ukraine's obligations under international agreements. As part of this, on June 4, 2022, Regulation (EU) 2022/870 of the European Parliament (2022) on the introduction of temporary trade liberalisation measures aimed at expanding Ukraine's export opportunities within the framework of the implementation of the Association Agreement between Ukraine and the European Union came into force. M. Glukh *et al.* (2022) pointed out that this decision provided for the temporary suspension of a number of tariffs established by the Agreement. In particular, this concerned duties on industrial products, the system of input prices for fruits and vegetables, tariff quotas for agricultural products, anti-dumping duties on goods of Ukrainian origin, and global safeguards that restricted the access of Ukrainian goods to EU markets (Dumanska & Fedoryshyna, 2023). Also, on June 9, 2022, the Canadian government decided to exempt goods of Ukrainian origin from customs duties for a period of up to one year, as reported on the Official website of the Ministry of Economy of Ukraine (2025). Despite the fact that the vast majority of Ukrainian products already enjoyed duty-free treatment under the Canada-Ukraine Free Trade Agreement, certain categories of goods remained subject to customs regulation. The new decision eliminates these restrictions, creating additional conditions for further liberalisation of trade between Ukraine and Canada (Free Trade Agreement between Ukraine and Canada No. 124_001-23, 2024).

Military operations on the territory of Ukraine and the blockade of seaports have caused significant changes in the structure of logistics supply chains. Before the introduction of martial law, more than 55% of freight transportation in Ukraine was carried out by sea, while rail transport accounted for 33% of transportation and road transport for 12%. Under these conditions, the main share of cargo transportation was accounted for by rail (56%) and road (26%), which indicated a significant redistribution of the functional load between different modes of transport in the country's logistics system (Official website of State Customs Service of Ukraine, 2023). Changes in foreign economic logistics have led to the emergence of new leading regions in the field of exports and imports, which had necessitated the use of modes of transport that were atypical for certain categories of goods. N. Trushkina & T. Serbina (2022) noted that cross-border transportation of significant volumes of grain by road or rail, which were previously considered uncommon, had become commonplace. Such transformations have significantly complicated the functioning of customs authorities, as the capacity of customs offices had proved insufficient to handle new volumes of trade flows. On the one hand, it created additional challenges for customs services, and on the other hand, it negatively affected the quality of control and verification measures. As noted by A. Dziubynskyi *et al.* (2024), optimisation of logistics processes in the context of martial law required an integrated methodological approach that involved strategic planning, operational route adjustment, and effective management of material resource flows, taking into account security challenges. The key task was to predict potential risks and adapt logistics schemes to dynamic changes in the geopolitical environment.

Particular, attention should be paid to regulating inventory management, identifying priority supply routes with a focus on the use of land transport corridors, building critical reserves of strategically important resources, and objectively assessing the volume of products that can be sold in an unstable market environment. Implementation of these measures will help to increase the sustainability of logistics systems, ensure the smooth functioning of supply chains and maintain macroeconomic stability even in crisis situations.

As noted by A. Kashperska & O. Yatsiuk (2024), the main factors that will contribute to the effective development of Ukraine's international trade were:

- increasing quotas for duty-free supply of goods to EU markets and removing technical obstacles that limit exports to the EU;

- applying effective methods of representing Ukraine's international interests in the global arena;
- providing information support to exporters to raise awareness of entrepreneurs about available financial opportunities;
- improving the quality of transport infrastructure and reducing the customs value of goods.

T. Borodenko & K. Levchenko (2023) pointed out that the basis for accounting for import-export operations was contracts, accompanying documents, licenses, customs, insurance, payment and claim documents. V. Panasyuk *et al.* (2023) noted that an important future trend determining the work of customs authorities was the growth of e-commerce in international trade. Optimisation of the document flow of enterprises involved in foreign economic activity involved the implementation of a number of strategic measures: a) introduction of a system of registers and journals that accumulate information resources on the organisation's foreign economic activity, with their structuring by main categories; b) disclosure of financial information confirming the completion of business transactions, as well as non-financial data that serve as the basis for financial reporting; c) disclosure of data in internal documents kept in the Thus, customs policy functions as an important tool for export promotion.

Improving customs policy should become one of the main areas of post-war reconstruction after the war and during the economic recovery process. This process will contribute to reforming the country's economic system, increasing its sustainability and ensuring national security. The authors N.I. Vlasyuk & Y.I. Momryk (2024) noted that optimisation of customs clearance procedures by harmonising customs procedures in accordance with the standards of the European Union will help to reduce bureaucratic barriers and reduce the time required to cross the border. These measures will help increase the efficiency of foreign economic activity and reduce transaction costs for business entities. The introduction of modern technologies in the customs sphere through the use of innovative technical means and digital solutions will help to improve customs control and increase its efficiency. The digitalisation of customs procedures, the introduction of electronic declaration and automated risk analysis systems will not only reduce the time for checking goods, but also reduce corruption risks. Scholar A. Babiuk (2022) argued that the development of customs infrastructure was important due to the changing geography of logistics directions of foreign economic activity, which required the opening of new checkpoints across the state border. Equipping these checkpoints with modern equipment, attracting qualified personnel, and resolving the issue of providing housing for customs officers will help to increase the efficiency and security of customs control. The opening of additional checkpoints will optimise the flow of goods and reduce the burden on existing infrastructure. According to L. Dermanska (2022), the introduction of transparent and predictable customs regulations through the harmonisation of customs legislation with the EU norms and ensuring the transparency of customs clearance procedures will create favourable conditions for the development of export-oriented business and increase the country's investment attractiveness. A. Kashperska & O. Yatsiuk (2024) argued that ensuring effective tax regulation of foreign economic activity through the development and implementation of effective mechanisms for monitoring and controlling prices for imported goods, especially those imported under preferential conditions, will avoid abuse and increase the economic efficiency of preferential customs regimes. Thus, improving customs policy in the postwar period is an important component of ensuring sustainable economic development of Ukraine, creating conditions for expanding foreign economic relations and integrating the country into the European economic space.

## Conclusions

The customs policy of Ukraine was a set of legal and regulatory measures and regulations that determined the procedure for the movement of goods and services across the state border, defining customs tariffs, procedures, standards and norms that created conditions for international trade. Because it had a direct impact on economic growth, international economic activity control, maintaining an ideal balance between imports and exports, and shielding the internal market from undue external influence, customs policy was essential to the nation's economic strategy. The main directions of Ukraine's customs policy were to stimulate exports, minimise the risks associated with uncontrolled imports and ensure the competitiveness of national products in international markets. The analysis of regulatory acts demonstrated systematic work aimed at improving customs regulation, taking into account the economic conditions and challenges of the global market of Ukraine. Prior to the introduction of martial law, there was a significant diversity in the list of goods for which export quotas were set. Mostly, zero-volume quotas were introduced for goods that did not have quotas in 2022, which can be explained by the need for enhanced export control during martial law. The process of issuing customs declarations for goods subject to the export regime continues to be carried out in accordance with the procedures established before the outbreak of war. As a result of the hostilities and the blockade of seaports in Ukraine, the structure of supply chains had changed significantly. Since February 2022, the majority of cargo transportation had been carried out by rail and road, which had indicated a significant transformation in the structure of the functional load between different modes of transport in the national logistics system. The most significant decline in exports was recorded in 2022, but in the first three quarters of 2024, there was a stabilisation

compared to 2023. This problem had had a significant impact on the agricultural sector, as Ukraine was one of the world's key exporters of grains and vegetable oils. An analysis of the dynamics of exports of plant products during the period of martial law showed a decline. Since 2023, there had been a positive trend of gradual recovery and growth in exports. Changes in foreign economic logistics had led to the formation of new leaders among the regions in the export of goods, which had necessitated the use of non-traditional modes of transport for certain groups of goods. The study determined the elements that will help Ukraine's international trade grow successfully. After the end of the military conflict and in the process of economic recovery, the improvement of customs policy should become one of the priorities of post-war reconstruction. Further scientific research should include an analysis of the reform of the country's economic system in order to strengthen its sustainability, strengthen national security and identify strategic directions for modernising customs policy in the context of post-war recovery and integration into the European economic space.

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## Conflict of Interest

None.

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# Митна політика як інструмент стимулювання експорту в умовах воєнного стану

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**Анотація.** Метою статті було дослідження специфіки функціонування митної політики України в умовах воєнного стану з особливим акцентом на механізми стимулювання експортної діяльності та забезпечення ефективності зовнішньоекономічних процесів держави. Для дослідження використовувались методи аналізу, синтезу, порівняння, узагальнення даних та логічне виведення аналізу. Комплексний підхід дозволив системно дослідити багатогранність митної політики, що включало взаємопов'язані компоненти. Використання абстрактно-логічного методу сприяло формулюванню ключових напрямів модернізації митної політики України в умовах воєнного стану та євроінтеграції. В роботі розглянуто особливості митної політики України в умовах воєнного стану, проаналізовано показники зовнішньої торгівлі на початку війни та діяльність Державної митної служби. Визначено ключові завдання митної політики: розвиток експорту, захист внутрішнього ринку та підтримка конкурентоспроможності українських товарів. Для цього застосовувалися митні тарифи з захисними й стимулюючими функціями відповідно до економічних потреб та міжнародних зобов'язань. Спостерігалося скорочення експорту, зокрема у 2022 році, проте у 2024 році відзначено його стабілізацію. Індекс фізичного обсягу експорту зріс, що свідчило про покращення виробничих процесів. Найбільших втрат зазнав агропромисловий комплекс. Водночас, рішення ЄС і Канади щодо тимчасового звільнення українських товарів від мит сприяло лібералізації торгівлі. Військові дії та блокада портів змінили логістику: залізничний транспорт замінив морські перевезення, що ускладнило роботу митниць через збільшення обсягів товаропотоків. Запропоновано спрощені підходи до експортних процедур, що можуть стимулювати зовнішньоекономічну активність. Оцінено економічний ефект запропонованих змін як основу для нових стратегічних завдань у сфері зовнішньої торгівлі. Практична цінність роботи полягає в наданні адаптаційних рішень до умов невизначеності та хаотичності, що виникають через воєнний стан в Україні, а також у вдосконаленні процедур та процесів зовнішньоекономічної діяльності

**Ключові слова:** державна економічна політика; митна справа; експортна діяльність; зовнішньоекономічна діяльність; воєнний режим

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# Linking working capital efficiency to profit maximisation: A conceptual analysis

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**Abstract.** The survival of a company is highly dependent on the management of its working capital. Effective working capital management can lead to greater profitability. Insufficient working capital or liquidity shortages can severely hinder profitability and operational sustainability. The primary objective of this research was to examine the relationship between efficient working capital management and profitability. To explore this connection, inventory, the cash conversion cycle, accounts receivable, and accounts payable were used as key indicators of working capital management. Profitability was evaluated using return on equity and return on assets, supported by a conceptual framework based on secondary data. The findings revealed a strong correlation between efficient working capital management and enhanced profitability. Effective management of cash inflows and outflows reduced financing costs and enhanced liquidity, leading to higher returns on equity and assets for companies with shorter cash conversion cycles. Companies with efficient accounts receivable processes significantly reduced their day's sales outstanding, improving cash flow and operational flexibility. Maintaining optimal inventory levels enabled companies to increase turnover rates, improve profit margins, and lower inventory holding costs. Moreover, efficient accounts payable management, particularly through negotiated credit terms with suppliers, optimised payment schedules without damaging supplier relationships, further enhancing profitability. The results highlighted that businesses can achieve long-term profitability by aligning their working capital components with operational goals. Companies that actively manage their cash conversion cycle are better equipped to meet financial obligations without excessive debt, enabling them to invest in expansion opportunities. From a practical perspective, this study underscored the strategic importance of working capital management in driving profitability. Businesses can improve financial stability and strengthen their competitive position by adopting data-driven approaches to optimise cash flow, inventory, and credit management. These insights offer valuable guidance for managers aiming to enhance their company's operational resilience and financial performance

**Keywords:** firm performance; inventory management; liquidity management; profitability; working capital management

## Introduction

Effective business administration is essential for maximising profitability, which is a fundamental objective for all organisations. According to I.M. Islam *et al.* (2022), effective management of working capital (WC) played a critical role in determining profitability, significantly impacting a business's financial health and operational success. Within the context of business operations, profitability referred to the financial state of an organisation that consistently generates profits. This metric reflected a company's ability to optimally utilise its resources to generate financial returns. Profitability measures a company's operational efficiency and its capacity to create value. A business achieves profitability, when it was able to generate profit through the effective allocation and utilisation of resources. Improving resource utilisation had been demonstrated to enhance productivity

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and profitability across various industries (Sharma *et al.*, 2021). Therefore, M.G. Abebe (2022) emphasised that asset-liability management must receive adequate attention to ensure optimal performance.

The author D. Kušter (2022) noted that WC was an essential concept in financial management, representing the disparity between a company's current assets and current obligations. Current assets were those that can be readily converted into cash within a short period, whereas current liabilities referred to financial obligations that were due for settlement in the near future. Ensuring sufficient WC was crucial for the continued profitability of a business. The efficient administration of WC affected both short-term profitability and the long-term growth of shareholder value. WC fluctuated daily based on the operating needs of the enterprise. A firm must fulfil its daily financial commitments and sustain seamless operations. Working capital management (WCM) referred to the approach through, which a corporation maintained equilibrium between its current assets and current liabilities. The principal objective of WCM was to ensure that the enterprise had adequate cash to meet its short-term liabilities, while maintaining operational efficiency.

According to O.M.A. Enad & S.M.A. Gerinda (2022), performance was a significant objective for any firm, as it demonstrated the firm's ability to efficiently manage and allocate resources. Thus, effective administration of WC was essential, as both excessive and insufficient WC can negatively impact a company's financial performance. Efficient WCM prevented excessive investment in current assets, thereby enhancing financial stability and operational efficiency.

The cash conversion cycle (CCC) was a widely used metric for assessing WCM. T. Ishikawa *et al.* (2025) measured that the CCC quantified the duration required for a corporation to transform its investments in accounts receivable into cash, while simultaneously considering the time needed to settle accounts payable obligations. The CCC provided critical insights into the efficiency of a company's WCM by measuring the time required to convert assets into cash and discharge liabilities. A reduced CCC indicated a faster cash turnover, typically viewed as an indicator of effective WCM. Researchers D. Sastararuji *et al.* (2022) emphasised that effective WCM was vital not only for sustaining liquidity, but also for enhancing a business's competitiveness and financial prosperity. R.P. Boisjoly *et al.* (2020) asserted that effective WCM can foster a competitive edge by optimising cash flow, reducing reliance on external finance, and increasing profitability. WCM involved managing a company's short-term capital, including current assets and liabilities that were essential for daily operations.

Effective management of assets and liabilities was essential for a firm to meet its short-term financial commitments, while preserving long-term growth prospects. A crucial element of proficient WCM was the meticulous examination of key factors, such as liquidity, credit management, inventory control, and debt management. Each of these aspects significantly influenced the overall effectiveness of a company's WCM strategies. For instance, maintaining sufficient liquidity ensured that a corporation can meet its immediate financial commitments, whereas proficient credit management reduced the risk of bad debts. Inventory management helped ensure that a corporation maintains an adequate stock level, preventing both stockouts and surplus inventory that might tie up operating capital.

Scientists I.A. Umar *et al.* (2023) argued that effective WCM directly affected a company's profitability by maximising resource utilisation, enhancing cash flow, and minimising reliance on external finance. Similarly, A.M. Habib (2022) a positive and significant correlation between WCM and entrepreneurial profitability. Effective management of WCM ensured that a business retained adequate liquidity to meet its operational requirements while preventing overinvestment in nonproductive assets. By balancing liquidity and profitability, organisations can improve their financial performance and secure long-term sustainability.

Nonetheless, managing WCM poses certain challenges. A primary issue for firms was the possibility of insufficient WCM or excessive investment in WCM. Insufficient WCM can cause liquidity issues, hindering a company's ability to meet its short-term obligations and potentially resulting in operational disruptions. Conversely, excessive investment in WCM can diminish profitability by tying up resources that could be more effectively deployed elsewhere in the organisation. Consequently, organisations must achieve an appropriate balance between these two extremes to ensure both liquidity and profitability. I. Makarchuk *et al.* (2022) noted that, when compared to average market liquidity levels, opportunities for asset liquidity management emerged, such as increasing it by offering price discounts or reducing markups.

The purpose of this study was to investigate the relationship between effective WCM and corporate profitability, emphasising how optimising key metrics such as the CCC, accounts payable, inventory and accounts receivable can enhance cash flow, reduce borrowing costs, and improve profitability, providing practical insights for managers to achieve better financial performance and long-term sustainability.

The methodology of this review paper involved collecting and analysing existing studies on the relationship between profitability and effective WCM. First, clear research goals were set, and relevant sources were identified using keywords such as profitability, WCM, liquidity, CCC, return on assets, return on equity, and accounts receivable. Next, the collected studies were assessed for quality and relevance, and their findings were categorised by themes or trends. Finally, the results were summarised to draw conclusions and suggest areas for future research.

## Discussion on profitability and its representatives

A company's overall financial position can be broadly determined by evaluating its economic growth over a particular period. According to M.M. Mohammad & M. Elaheh (2014), this approach can be used to compare industries or sectors in general or to assess similar companies within the same industry. Analysing financial performance provides information about the company's financial situation, the level of industry competitiveness, and a thorough understanding of the organisation's cost structure and profit areas.

The fundamental objective of a company was its profit-generating capacity, which required implementing strategic policies and operations to attain specific goals (Olaoye *et al.*, 2019). The primary objective of any firm was to achieve maximum profitability (Ojha, 2019). The concept of financial performance was crucial in the study of financial management, as it reflected the effectiveness of management in utilising resources to generate profits.

Assessing profitability was essential for determining the effectiveness and performance of assets and ensuring the organisation's survival (Chong, 2016). Profitability was crucial for enterprises since it determined their survival. If a firm failed to generate profit, it will eventually collapse. However, if resources were utilised correctly, it will result in profitability (Chemis, 2015). According to L.C. Uguru *et al.* (2018), a company's profitability was a measure of its capacity to generate profit and depend on effective WCM. According to F.O. Olaoye *et al.* (2019), profitability measures, how effectively and efficiently assets such as machinery, plants, and current assets were converted into profit. Figure 1 illustrated the analytical framework. K.B. Prempeh & G. Peprah-Amankona (2020) defined profitability as a corporation's ability to generate profit. Profit referred to the surplus of revenue over expenses. They also stated that profitability evaluates a company's efficiency and ability to generate profits. According to N. Ponsian *et al.* (2014) and H. Shahid & A. Saad (2016), profitability was a measure of return on investment, a view supported by R. Khalid *et al.* (2018).

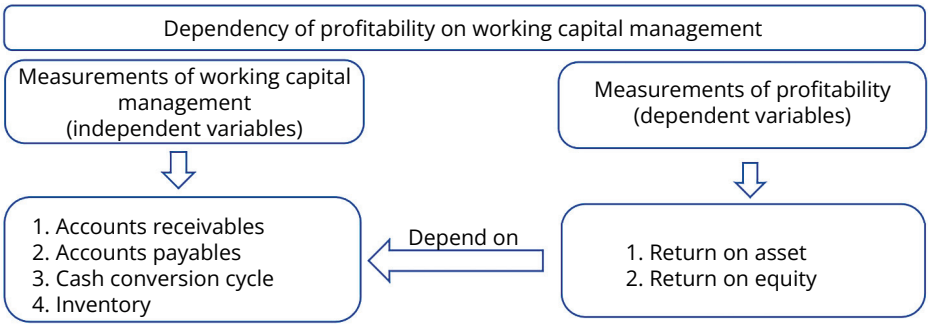


***Figure 1.*** *Dependency of profitability on working capital management*
***Source:*** *developed by the author*

The relationship between WCM and profitability had been widely studied, with researchers employing various profitability metrics to analyse this connection. Financial managers often assessed changes in retained earnings, reserves, and surplus to evaluate improvements in profitability. L.C. Uguru *et al.* (2018) emphasised that effective WCM significantly affected a company's profitability. Similarly, J.M. Kurawa & A. Abubakar (2014) and N.R. Ojeani (2014) highlighted that the efficient utilisation of WC components contributed to enhanced profitability, with increased efficiency correlating with higher profit margins. They further argued that profitability was best measured using metrics such as return on assets (ROA), return on equity (ROE), and return on capital employed (ROCE).

I.M. Pandey (2015) posited that the profitability of an organisation can be evaluated through the rate of return on the wealth contributed by its owners, with ROE serving as a key indicator, of how efficiently this capital was utilised. ROE was determined by dividing net profit, calculated after deducting interest and taxes, by total equity. N.A. Alsulayhim (2019) underscored the significance of ROE as a crucial metric for analysing the relationship between profitability and WCM. This assertion was supported by F. Şamiloğlu & A.I. Akgün (2016), alongside the articles of M. Siraj *et al.* (2019) and I.M. Islam *et al.* (2022), who employed ROE in their respective studies. Consequently, ROE was an indispensable financial measure for assessing the effectiveness, of how organisations utilise the resources provided by their shareholders.

This ratio was a critical measure of a business's profitability, reflecting how effectively financial assets were utilised to generate returns. ROA assesses management's efficiency in using a company's assets to generate profits, calculated by dividing net revenue before taxes by total financial assets. Numerous studies had employed ROA as a methodological tool – for instance, B. Shah *et al.* (2018) and I. Abdeljawad & L. Dwaikat (2021), who applied ROA to measure profitability. Therefore, ROA was a key indicator of a company's profitability and operational efficiency. A higher ROA indicated better asset utilisation and management efficiency.

## Working capital management and its components

WC was a crucial asset required by a corporation to support its ongoing operations (Akindele & Odusina, 2015). According to O. Aregbeyen (2013), it was essential for the smooth functioning of daily business activities. H. Kusuma & A.D. Bachtiar (2018) defined WC as the total amount of funds a business allocated to its current assets during the accounting period. E.S. Agbi & I. Yusuf (2017) further clarified that WC represented the difference between current liabilities and current assets, a distinction that A.A. Almazari (2014) highlighted as fundamental to effective financial management.

When implemented effectively, WCM served as a strategic tool that enabled businesses to mitigate financial challenges, while improving profitability and competitiveness (Gill, 2011). It involved managing current liabilities – financial obligations due within a year – and current assets, which consisted of resources convertible into cash within the same accounting period. This framework examined the relationship between these two components to ensure a business can cover its operational expenses and short-term commitments (Ukaegbu, 2014). WCM encompassed all decisions that affect current assets and liabilities, directly influencing a firm's liquidity (Sensini, 2020). The objective was to optimise the management of these elements to maintain each at an optimal level. According to O. Aregbeyen (2013), this process included managing cash, inventories, accounts receivable, and accounts payable. Its fundamental goal was to maintain adequate cash flow to sustain operations, while reducing the risk of defaulting on short-term obligations.

The effective management of accounts receivable (AR) was a crucial aspect of WCM in any organisation (Jindal *et al.*, 2017). It was primarily influenced by a company's credit policy and collection procedures, which determined the efficiency of receivables recovery (Ikechukwu & Nwakaego, 2015). The primary objective of AR management was to reduce the time lag between transaction completion and payment receipt from customers (Hardiansyah & Trisnaningsih, 2025). Businesses can enhance their value by extending payment periods, as this approach helped cultivate long-term relationships with clients. However, prolonging the accounts payable term poses a risk of losing key suppliers, making it essential for companies to maintain strong relationships with them to achieve effective WCM (Pandey, 2015). N. Ponsian *et al.* (2014) similarly underscored the significance of supplier relationships in this context. The management of accounts payable involved optimising cash flow by extending payment obligations, while simultaneously maintaining a favourable credit rating.

The CCC was a key metric used to assess the duration required for a business to complete its WC cycle. According to M. Singhania & P. Mehta (2017), the CCC represented the time lag between cash inflows from the sale of finished goods and cash outflows for the procurement of raw materials. Firms with shorter CCC periods were able to generate sufficient internal cash flow to sustain daily operations, thereby reducing reliance on external financing and ultimately enhancing profitability (Fatimatuzzahra & Kusumastuti, 2016). The CCC measured the period between cash disbursement and subsequent cash recovery, which was determined by calculating the difference between the conversion period of inventory and receivables, subtracting the payable conversion period (Mathuva, 2010). H. Tran *et al.* (2017) highlighted that the CCC quantified the time taken for firms to convert cash outflows into cash inflows, while K.B. Prempeh & G. Peprah-Amankona (2020) defined it as the sum of the days required to collect AR and hold inventory (INV), minus the days taken to settle accounts payable (AP). Companies often procure goods on credit, leading to accounts payable, while simultaneously engaging in credit sales, which results in AR. Consequently, cash transactions occur only when the firm collects receivables and settles its financial obligations.

One of the main challenges for the financial manager was to maintain inventory at an optimal level. The primary objective of inventory management was to reduce inventory-related costs, while maintaining production efficiency (Ponsian *et al.*, 2014). Given its substantial share of current assets, manufacturing firms allocate significant financial resources to inventory (Mittal *et al.*, 2014). Effective WCM, facilitated by timely and strategic inventory control, ensured an optimal balance between profitability and liquidity, both of which were essential for business success and growth. O.H.D. Isaksson & R.W. Seifert (2014) argued that efficient inventory management provided a competitive advantage and improved financial performance. Similarly, P.J. García-Teruel & P. Martínez-Solano (2010) suggested that maintaining lower inventory levels can enhance profitability, as capital that would otherwise be tied up in stock could instead be invested or deposited to generate interest. Ultimately, the goal of inventory management was to maintain adequate stock levels to support production, meet sales demands, and minimise both operating expenses and financing costs.

## Dependency of working capital management components on profitability

The CCC had a significant impact on profitability. According to N. Ponsian *et al.* (2014), a company's profitability can increase significantly with a longer CCC. The CCC was calculated by adding the inventory conversion period and the accounts receivable period and then subtracting the accounts payable period. Several studies had examined the relationship between the CCC and profitability, including those by R. Khalid *et al.* (2018) and K. Fijabi *et al.* (2023). Their data indicated a considerable negative correlation between the CCC and profitability. However, N. Ponsian *et al.* (2014) reported a strong positive

relationship between the CCC and profitability, a conclusion that was also supported by P.K.Y. Nastiti *et al.* (2019).

Inventory management (IM) was a crucial element of current assets and played a significant role in the efficient management of WC (Sitienei & Memba, 2015). Inventory was integral to WCM and had a substantial impact on a company's financial performance. According to V. Tauringana & G. Afrifa (2013), corporations that maintain optimal inventory levels often experience enhanced profitability, as increased investment in inventory helped to prevent stockouts. To maximise WC and operational performance, firms must strike a balance between keeping enough inventory to meet sales demands and reducing excess stock.

Effective inventory management aims to reduce inventory costs, while ensuring production efficiency. In an ideal scenario, organisations may not need to maintain inventory (Mathuva, 2010). However, firms must keep inventories at a precautionary level. To calculate the inventory conversion period, inventory was divided by the cost of sales and multiplied by 365 days. Studies by H. Shahid & A. Saad (2016) and K. Fijabi *et al.* (2023) identified a negative correlation between stock levels and operational efficiency. Managers can enhance shareholder value by reducing the AR period, as this directly impacts profitability. A.K. Sharma & S. Kumar (2011) established a positive correlation between the duration of AR and a company's financial success, suggesting that the faster a company collects payments from its clients, the higher its profitability was likely to be. D.M. Mathuva (2010) found a significant negative correlation between a company's productivity and the time taken to recover outstanding payments from clients.

The accounts receivable processes (ARP) were calculated by dividing AR by sales and multiplying the result by 365 days. Studies by H. Shahid & A. Saad (2016) and K. Fijabi *et al.* (2023) identified an inverse relationship between AR and profitability, indicating that a longer receivables recovery period was associated with reduced profitability. However, this finding contrasted with the conclusions of P.K.Y. Nastiti *et al.* (2019), who discovered a substantial positive relationship between AR and profitability. These differing results highlight that, while reducing the AR period generally enhances profitability, the correlation may vary depending on industry standards, corporate strategies, and market conditions. The AP referred to unpaid bills for supplies or services that had been delivered but not yet paid for. As the use of debt financing increases, a company's efficiency tends to decrease. A.A. Almazari (2014) found a strong positive correlation between profitability and the average payment term, noting that extending payment periods benefits the organisation, while shortening them restricts cash availability for other profitable opportunities.

Organisations must carefully assess the potential risks associated with delaying payments, particularly the risk of damaging long-term supplier relationships. The accounts payable period (APP) was determined by dividing accounts payable by the cost of sales and multiplying the result by 365 days. According to M. Sharma *et al.* (2021), the time required for a business to settle its accounts had a negative correlation with its profitability. In contrast, D.M. Mathuva (2010) suggested that longer delays in paying corporate bills were associated with higher profitability.

A study by K. Fijabi *et al.* (2023) found an unfavourable correlation between profitability and AP. However, research by A.A. Almazari (2014) yielded differing results. P.K.Y. Nastiti *et al.* (2019) demonstrated a positive correlation between AP and profitability, suggesting that extended payment terms may have a beneficial impact on cost-effectiveness. M. Blatter & A. Fuster's (2022) research on the Swiss banking sector indicated that efficiency and profitability increase with bank size, and that there was a possible causal relationship between size and efficiency/profitability based on an instrumental variables approach for a set of geographically limited institutions. The study also found that high levels of efficiency and profitability were consistent with sound capitalisation.

T. Hossain (2020) used ordinary least squares (OLS) regression and Pearson's correlation analysis to examine the impact of WCM on profitability in 52 randomly chosen manufacturing companies listed on the Dhaka Stock Exchange between 2012 and 2017. The study revealed a significant negative relationship between ROA and the CCC, as well as between ROE and CCC. However, the inventory conversion period (ICP) exhibited a positive correlation with ROA and ROE. Using OLS and fixed effects models, A.H. Nguyen *et al.* (2020) investigated the influence of WCM on profitability using a sample of 119 companies traded on the Vietnam Stock Exchange (VNX) between 2010 and 2018. Their findings indicated a significant negative effect of the CCC, accounts receivable turnover, inventory turnover (IT), and AP on both ROA and Tobin's Q. Using a sample of 20 businesses from 2010 to 2019, K.X. Pham *et al.* (2020) investigated the impact of WCM on the profitability of steel companies listed on the Vietnam Stock Exchange (VNX). Days payable outstanding, days inventory outstanding, current ratio, days sales outstanding, company size, and growth rate were the six working capital factors that the study found to have a positive impact on profitability. In contrast, the CCC and financial leverage had a negative effect on profitability.

The author J.B. Nzitunga (2019) examined the influence of WCM practices on the profitability of Namibian state-owned enterprises (SOEs), analysing 23 institutions and 125 employees using partial least squares regression analysis. The results indicated that effective management of cash, receivables, payables, and inventory significantly contributed to improved profitability. However, other WCM factors such as the CCC, average inventory days, and average receivables days, did not have a significant effect on profitability. From 2005 to 2013,

A.Y. Salman *et al.* (2014) investigated the relationship between WCM and profitability in Nigeria. Data were collected from 20 companies listed on the Nigerian Stock Exchange. According to the study, WCM significantly reduced ROA and ROE. N. Ponsian *et al.* (2014) analysed the relationship between WCM and profitability in three manufacturing firms traded on the Dar es Salaam Stock Exchange from 2002 to 2011 using OLS regression. The study found that the CCC positively impacted profitability. In contrast, liquidity, the average collection period, and inventory turnover had a negative effect. Additionally, the average payment period was positively associated with profitability. A.A. Almazari (2014) examined the link between WCM and profitability in eight Saudi Arabian cement firms from 2008 to 2012 using linear regression and Pearson correlation analysis. The study found that gross operating profit was negatively correlated with the payables deferral period, CCC, inventory conversion period, financial debt ratio, and receivables collection period. However, it was positively correlated with firm size, fixed financial asset ratio, and the current ratio, which was identified as the most significant liquidity factor influencing profitability. T. Dinku (2013) assessed the impact of WCM on the performance of Ethiopian micro and small enterprises in the Bahir Dar municipal administration, using a sample of 67 firms from 2003 onwards. The study revealed a significant positive correlation between the length of accounts payable and profitability (ROA), while the duration of accounts receivable, inventory, and CCC negatively affected ROA. L. Rey-Ares *et al.* (2021) examined the impact of WCM on the profitability of Spanish companies and concluded that effective WCM positively affected corporate profitability. G. Eshetu (2020) noted that WCM played a crucial role in influencing the efficiency of commercial banks.

The relationship between WCM and profitability was complex, with several factors – including inventory control, accounts payable, accounts receivable, and the CCC – playing a role. Some studies argued that effective WCM, including faster receivables collection and proactive payables management, enhanced financial performance, while others suggested that a longer CCC and higher inventory levels may increase profitability. Maintaining liquidity, reducing expenses, and improving operational efficiency (all of which contribute to greater profitability) required effective WCM. To achieve optimal financial outcomes and long-term sustainability, companies must adapt their WCM strategies to suit their specific operational and industrial contexts.

## Conclusions

Proficient management of WC is essential for maximising profitability and ensuring the long-term sustainability of enterprises. This study had elucidated the essential elements of WCM, encompassing the CCC, AR, AP, and IM. The results indicated that these factors played a crucial role in influencing a company's financial performance. Effective management of these factors can substantially improve profitability, as evidenced by key financial metrics such as ROA and ROE. Nevertheless, the study revealed that the correlation between WCM and profitability was not necessarily linear or straightforward. The impact of each WCM component on profitability may vary depending on external conditions and the management strategies employed.

The findings highlighted that, while optimising the CCC and maintaining appropriate levels of AR, AP, and inventory can enhance profitability, the relationship was shaped by several internal and external factors. Therefore, businesses must adopt a strategic approach to WCM, carefully balancing liquid assets and profitability to avoid potential pitfalls such as excessive inventory or delayed receivables. Furthermore, while ROA and ROE were widely used to measure profitability, the study suggested that incorporating additional profitability metrics would provide a more comprehensive view of a company's financial health and performance.

Future research should explore these additional profitability indicators and examine the broader implications of WCM across different industries and business sizes. By doing so, businesses can develop more tailored strategies that not only enhance short-term profitability, but also foster longterm financial stability. Ultimately, effective WCM is a critical factor in enhancing operational efficiency, lowering financing costs, and ensuring the overall competitiveness of a business in the market.

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## Conflict of Interest

None.

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# Зв'язок ефективності управління оборотним капіталом із максимізацією прибутку: концептуальний аналіз

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**Анотація.** Виживання компанії значною мірою залежить від управління її оборотним капіталом. Ефективне управління оборотним капіталом може призвести до підвищення прибутковості. Недостатній обсяг оборотного капіталу або дефіцит ліквідності можуть суттєво перешкоджати прибутковості та операційній стійкості. Основною метою цього дослідження було вивчення зв'язку між ефективним управлінням оборотним капіталом і прибутковістю. Для аналізу цього зв'язку використано такі ключові показники управління оборотним капіталом, як запаси, цикл конверсії грошових коштів, дебіторська та кредиторська заборгованість. Оцінка прибутковості здійснювалася на основі рентабельності власного капіталу та активів, що підтримувалося концептуальною моделлю, заснованою на вторинних даних. Результати дослідження підтвердили наявність сильного зв'язку між ефективним управлінням оборотним капіталом і зростанням прибутковості. Раціональне управління грошовими потоками сприяло зменшенню фінансових витрат і підвищенню ліквідності, що призводило до зростання рентабельності власного капіталу та активів для компаній з коротшим циклом конверсії грошових коштів. Компанії з ефективними процесами управління дебіторською заборгованістю значно скоротили середній термін оплати рахунків, що покращило грошовий потік та операційну гнучкість. Оптимізація рівня запасів дозволила компаніям підвищити швидкість обігу, збільшити маржу прибутку та зменшити витрати на зберігання товарів. Крім того, ефективне управління кредиторською заборгованістю, зокрема через узгоджені умови оплати з постачальниками, сприяло оптимізації графіків платежів без погіршення відносин із постачальниками, що додатково підвищувало прибутковість. Результати дослідження підкреслили, що компанії можуть досягти довгострокової прибутковості, якщо узгодять свої компоненти оборотного капіталу з операційними цілями. Компанії, які активно керують своїм циклом конверсії грошових коштів, краще здатні виконувати фінансові зобов'язання без надмірного боргового навантаження, що дає їм можливість інвестувати у розширення бізнесу. З практичної точки зору це дослідження наголосило на стратегічній важливості управління оборотним капіталом для підвищення прибутковості. Використання підходів, орієнтованих на аналіз даних, дозволяє компаніям оптимізувати грошові потоки, управління запасами та кредитування, що сприяє зміцненню фінансової стабільності та конкурентних позицій

**Ключові слова:** ефективність компанії; управління запасами; управління ліквідністю; прибутковість; управління оборотним капіталом

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# Features of marketing in international pharmaceutical market in the context of digital transformation

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**Abstract.** The pharmaceutical market performs a key function of providing the population with medicines, where marketing is the driving force behind meeting the needs for quality healthcare and requires innovative approaches. The research relevance is determined by technological innovations, alongside the severe epidemiological situation in the world and the war in Ukraine, which have changed the requirements for the marketing complex in the pharmaceutical and healthcare markets. The study aimed to deepen the theoretical provisions and develop scientific and practical recommendations for the implementation of marketing innovations in the international pharmaceutical market to increase efficiency and improve and accelerate public access to innovative medicines. The methodological basis was comparative and quantitative methods, tabular analysis and synthesis. The study defined the role of marketing methods and management mechanisms in the international pharmaceutical market. The study analysed the challenges faced by international pharmaceutical market participants related to globalisation and identified the key aspects of international marketing that affect the success of pharmaceutical market management. The study discussed the need to adapt marketing strategies to different cultures and economic conditions inherent in different countries. The study analysed effective methods of promotion in international pharmaceutical markets and examined important aspects of branding and communication to ensure the success of management in the pharmaceutical sector. The study examined modern trends in international marketing in the pharmaceutical sector and identified strategies for adapting to changes in the global economic environment. The role of effective marketing management in creating competitive advantages in international markets was defined, prioritising improvement of the quality of customer service. The study proposed a structural and logical model for the formation of a marketing strategy for the development of business entities in the pharmaceutical market in the global economic space, emphasising their development in the international economic space. The challenges faced by pharmaceutical companies were studied, and the key aspects of international marketing aimed at effective positioning in the global market were identified. The practical significance of the study is determined by the development of a structural and logical model for the formation of a marketing strategy for business entities in the pharmaceutical market, which will contribute to their successful positioning in international markets and increase the efficiency of public access to innovative medicines

**Keywords:** digital technologies; innovative approaches; competitiveness; communication tools; promotion strategy; customer focus; adaptation of business models

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## Introduction

The modern stage of global economic development is characterised by rapid technological changes that significantly affect all aspects of business, including marketing. The pharmaceutical industry, as one of the most innovative and regulated industries, is undergoing a profound transformation due to the introduction of digital technologies in the processes of production, distribution and communication with consumers. L. Olmstead (2023) noted that global digitalisation was stimulating the development of new marketing strategies aimed at improving the efficiency of interaction between manufacturers, distributors and end users of pharmaceutical products.

The peculiarities of the international pharmaceutical market, such as high competition, strict regulation by governments and international organisations, as well as the specifics of consumer demand, render the relevance of adaptation of marketing approaches to the conditions of digital transformation. As noted by N. Voytovych & O. Tereshchuk (2021), digital platforms provided pharmaceutical companies with greater access to consumer information, quick response to changes in demand, and optimisation of marketing campaign costs.

Digital technologies create new opportunities for expanding markets, personalising offers and optimising costs, while also posing challenges related to data security, ethical compliance and maintaining consumer trust. O. Penkova *et al.* (2022) determined that in these conditions, effective marketing in the international pharmaceutical market required not only the use of modern tools such as Big Data, artificial intelligence, the Internet of Things or blockchain, but also a deep understanding of regional characteristics, cultural differences and regulatory requirements in different countries.

L. Kudyrko (2024) also highlighted the priorities of marketing activities of international pharmaceutical companies, noting that digital transformation was a key factor in market development. The researcher emphasised the importance of implementing integrated strategies in view of the current challenges of globalisation. In addition, N. Stezhko & O. Shevchuk (2023) studied global trends in e-commerce and its role in transforming consumer behaviour. Their findings confirmed the need to use modern digital solutions to maintain the competitiveness of pharmaceutical companies.

Of particular interest was the study of the impact of digital transformation on international marketing strategies, on communication tools, customer interaction models and processes of forming competitive advantages. M.H. Reza (2020) noted that the analysis of these aspects outlined new approaches to the management of marketing activities in the international pharmaceutical market and determined the prospects for further development of the industry in the context of digitalisation.

Given the rapid pace of digital development, the international pharmaceutical market faced the need to adapt traditional business models to new conditions, which required a rethinking of approaches to marketing activities. In particular, the development of integrated marketing strategies has become an important element of success for companies seeking to maintain and strengthen their positions in the global competition.

The authors J. He *et al.* (2019) emphasised that the introduction of artificial intelligence technologies in the field of medicine, including the pharmaceutical industry, contributes to improving the efficiency of management processes, prompt response to changes in consumer preferences, as well as the formation of new communication formats based on transparency and trust between companies and patients. T. Minero & L. Kuger (2024) noted that the development of digital distribution channels and e-commerce were key in the transformation of pharmaceutical marketing. These changes restructured international supply chains, providing better access to wide consumer segments. The authors emphasised the importance of integrating artificial intelligence, data analytics and machine learning to improve the accuracy of demand forecasting, inventory management and personalisation of marketing strategies. The digitalisation environment was creating new expectations among consumers focused on speed, convenience and individual approaches from pharmaceutical companies.

Notably, in the context of digital transformation, competition in the international pharmaceutical market was not only intensifying, but also the role of ethics and social responsibility was growing. Companies were forced to incorporate the protection of personal data, transparency of information about products and services, and promote the availability of quality medicines to the general population. In this context, there was a need to develop new marketing standards that considered global digitalisation trends and the specifics of the pharmaceutical industry. In addition, the COVID-19 pandemic has revealed the shortcomings of traditional communication technologies, shifting the focus of pharmaceutical marketing to innovative digital channels, the effectiveness of which required further research. Studying innovative approaches to marketing in the international pharmaceutical market and developing recommendations for their implementation was a necessary task.

## Materials and Methods

The methodological basis of the study was system analysis, comparative analysis, strategic analysis, logical and structural modelling, formalisation and statistical analysis. The theoretical method ensured the study of the theories of digitalisation of marketing processes in the pharmaceutical sector, in particular, the concepts of the strategy for promoting innovative medicines developed based on the works of I.O. Sovershenna & A.O. Kubrak (2019), who analysed the use of digital technologies to improve the effectiveness of marketing strategies through the integration of online platforms,

social networks and analytical tools to more accurately identify the target audience. At the same time, N. Voytovych & O. Tereshchuk (2021) proposed the adaptation of marketing strategies to the conditions of digital transformation, emphasising the importance of using digital platforms to collect and analyse consumer data, which ensured quick response to changes in demand and optimise the cost of marketing campaigns. Additionally, the concepts of drug promotion in the pharmaceutical industry were supported by the strategic marketing methodology developed by Ya. Larina *et al.* (2023), proposed the integration of innovative technologies for effective market analysis, consumer needs and the competitive environment. It was studied the models of development of the international pharmaceutical market presented in the World Economic Forum reports (2018-2023) and the results of the analysis conducted by O. Penkova *et al.* (2022). This formulated new hypotheses on the integration of innovative approaches into the marketing activities of the pharmaceutical industry.

The statistical method was used to collect and analyse data on the volume of exports and imports of medicines, the dynamics of marketing costs in different countries and the results of the implementation of innovative strategies. In particular, the data obtained from the PharmXplorer (2023) analytical system assessed the structure of the Ukrainian pharmaceutical market and its development trends. In addition, the statistical information provided by the State Statistics Service of Ukraine (2025) contributed to the analysis of changes in the consumption of medicines and the impact of marketing strategies on their demand. Moreover, one of the sources of analysis of the pharmaceutical market of Ukraine was the Resolution of the Cabinet of Ministers of Ukraine No. 542 (2022), which addressed changes in the regulatory policy of the pharmaceutical sector under martial law.

The analytical method was used to identify the main problems, including the insufficient use of digital communication channels in the promotion of medicines, delays in adapting international innovations to the local market, and the high cost of marketing promotion. These problems were specified based on the IMD World Digital Competitiveness Ranking (2017-2024) reports, which highlighted the state of competitiveness of the pharmaceutical industry. Logical and structural modelling developed a system for forming a marketing strategy that incorporated global digitalisation trends and the specifics of the Ukrainian pharmaceutical market. In the process, an algorithm for the implementation of digital marketing tools was created, based on the models proposed in the analysed reports.

The analysis of the data created a profile of the international pharmaceutical market, determined the dynamics of key indicators of its development, such as marketing costs, the level of digitalisation and investment, and modelled a system for forming a marketing strategy for the development of business entities in the global economic space. This became the basis for the development of scientific and practical recommendations aimed at integrating innovative approaches to marketing, which ensure increased efficiency and improved access to innovative medicines for the population.

## Results and Discussion

The pharmaceutical industry in Ukraine in 2025 has become one of the most profitable and dynamic sectors, and the Ukrainian pharmaceutical market was key in ensuring access to medical services and products for the population. This industry is an important part of both the domestic and international markets, which includes the production of medical devices and medicines, wholesale and retail trade, logistics networks and storage and distribution systems, which largely determine the national security of each country. Therefore, the pharmaceutical sector is a large knowledge-intensive industry with developed cooperation. At the same time, dynamic changes in patient flow and dominant pathologies require doctors to quickly master new therapies and drugs, and pharmaceutical companies to urgently provide the public and hospitals with drugs and information on the effective and safe use of these drugs. Given that this sector is key in the market and significantly affects the national and defence security of the country, it is an important component.

During 2022-2025, Ukraine suffered from a full-scale russian invasion, but despite the temporary occupation of the territories, the loss of a significant number of people due to migration abroad and those, who remained in the temporarily occupied territories, the destruction of infrastructure and enterprises, the country's economy was developing faster than expected in early 2023. I.A. Popova & A.V. Serdyuk (2023) noted that the war in Ukraine caused large-scale disruptions in logistics, raw material supply, and the functioning of pharmaceutical production. The destruction of infrastructure, migration of the population, reduced purchasing power, and export restrictions have significantly hampered the industry. At the same time, as the authors emphasised, pharmaceutical companies were forced to adapt quickly, introducing new distribution models and digital tools to maintain public access to medicines.

The war in Ukraine has demonstrated the vulnerability of the traditional marketing mix in a situation, where there was a mass migration of the population, a threat to the lives and health of doctors and patients in entire regions, and in other regions, the patient flow of hospitals and pharmacies has increased so much that the impact of traditional communication channels was impossible. Ukrainian and international institutions have repeatedly improved their forecasts for the development of the Ukrainian economy in 2023. Ukrainian real GDP growth in 2023 was 5.3% after a significant drop of 28.8% in 2022 (IMD World Digital Competitiveness Ranking 2022, 2022). According to the World Bank's

forecasts, GDP growth was expected to reach 3.2% in 2024 and 6.5% in 2025, which was the highest among the countries of the Europe and Central Asia region (IMD World Digital Competitiveness Ranking 2024, 2024).

In this context, the study by L. Kudyrko (2025) on the role of innovative companies in ensuring competitiveness in the international pharmaceutical market was noteworthy. The impact of digital technologies on business management in crisis conditions was emphasised. The study by I. Byshovets (2024) on modern digital communication channels in the pharmaceutical industry was noteworthy. The author emphasised that the use of email, mobile applications and social media significantly improves the efficiency of companies' interaction with end consumers. It was also worth mentioning the study by A.B. Olkhovska & V.V. Malyi (2018), in which the authors theoretically substantiated the directions of development of marketing communications in the pharmaceutical market in the context of social and ethical promotion. This was especially relevant in wartime, when the issues of brand trust and transparency become even more important.

The pharmaceutical market of Ukraine was substantial in ensuring access to medical services and products for the population. Based on data from the PharmXplorer (2023) market research analytical system, in 2021 the value of the pharmaceuticals and medical devices market reached approximately 116.6 billion UAH, an increase of 10.7% compared to 2020. Therefore, the pharmaceutical sector remained one of the largest and fastest-growing segments of the Ukrainian economy. In 2023, total retail sales of all pharmacy basket goods amounted to 164 billion UAH, which was 29% more than in 2022. Compared to pre-war 2021, the growth was 20%. In physical terms, pharmacy sales totalled 1.3bn packs, up 3% compared to 2022, but down 27% compared to 2021. In USD, the growth rate in 2023 was 13% compared to 2022, and decreased by 10% compared to 2021, which was due to a significant appreciation of the exchange rate after the Russian full-scale invasion of Ukraine.

Ukrainian pharmaceutical sector continued to steadily grow in a challenging economic environment. According to the PharmXplorer (2023) analytical system, the value of the pharmaceuticals and medical devices market in 2021 increased by 10.7% compared to 2020. This was the result of both stable demand for medicines and significant development of other categories of pharmaceutical products. Table 1 provided data on retail sales of various categories of the pharmaceutical sector in 2021-2024.

***Table 1.*** *Retail sales of various categories of the pharmaceutical sector in 2021-2024*

| Year | The market as a whole | | Medicine | | | Cosmetics | | | Dietary supplements | | | Medical devices | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | million UAH | Δ, % | million UAH | Δ, % | share | million UAH | Δ, % | share | million UAH | Δ, % | share | million UAH | Δ, % | share |
| 2021 | 1,36794.8 | 20 | 1,10558.6 | 19.2 | 80.8 | 4583 | 18 | 3.4 | 1,1549.4 | 43.8 | 8.4 | 1,0103 | 8 | 7 |
| 2022 | 1,26975.4 | -7.2 | 1,03849.5 | -6.1 | 81.8 | 4367 | -5 | 3.4 | 1,0441.2 | -9.6 | 8.2 | 8317 | 17 | 6 |
| 2023 | 1,63996.4 | 29.2 | 1,29958.2 | 25.1 | 79.2 | 6512 | 49 | 4 | 1,7078.6 | 63.6 | 10.4 | 1,0447 | 26 | 6 |
| 2024 | 1,92000.0 | 17.0 | 1,52000.0 | 17.0 | 79.2 | 7500 | 15.2 | 3.9 | 2,1800.0 | 27.7 | 11.4 | 1,0700 | 2.4 | 5.5 |

***Source:*** *IMD World Digital Competitiveness Ranking (2017-2024), Pharmacy sales in the first half of 2024 (2024), Pharmacy sale (2025)*

An analysis of retail sales of different categories over the reporting period showed an increase in sales, which was typical for all product categories, with the "dietary supplements" segment growing at a much higher rate than other categories (The farm market ends the..., 2023). The main factors of market growth include:

- demographic and epidemiological factors, including population ageing and the spread of chronic diseases, which affect the demand for medicines and medical devices;
- development of the medical infrastructure, namely an increase in the number of hospitals, clinics and pharmacies, which helps to improve the availability of medical services and goods to the population;
- innovations and technological progress, which is associated with the introduction of the latest technologies in the production of medicines and increases their effectiveness and reduce side effects.

Furthermore, in analysis of the growth factors of the pharmaceutical market, it was necessary to account for the active stockpiling of supplies due to russian armed aggression against Ukraine, including not only water and food, but also medicines, especially those needed for patients with chronic diseases, which has significantly increased sales of medicines.

In the context of digital transformation, the pharmaceutical market was actively interacting with new technologies, which improved the competitiveness of the companies and ensure further growth in the context of rapid change. One of the key factors of development was the level of mobile connectivity and Internet access, which directly affected the effectiveness of digital strategies. According to the Mobile Connectivity Index (2022), countries with high levels of mobile connectivity have significant advantages in implementing digital solutions that can be used to adapt to market needs faster and provide a high level of customer service.

Concerning the innovative development of the pharmaceutical sector in Ukraine, innovative marketing as a significant element of the global value chain was a

valuable source of competitive advantage for pharmaceutical companies in the international pharmaceutical market. At the same time, amid globalisation, the potential accession of Ukraine to the EU and the historically high development of pharmaceutical production in Ukraine, it was reasonable to explore potential competitive advantages for Ukrainian manufacturers to enter international markets. In 2024, local companies accounted for half of the top 10 pharmaceutical manufacturers in Ukraine, and the top 2 leaders of Ukrainian production, Farmak and Darnitsa, were at the top of this ranking (Pharmaceutical sales in the first half of 2024, 2024; Pharmaceutical sales, 2025). The largest representatives of Ukrainian pharmaceuticals in the top 10 have already entered international markets, but the share of exports is still small. At the same time, Ukraine has lost about a quarter of its internal consumers due to the war and migration, but has retained its production potential, including several pharmaceutical production facilities that have suffered, but they were not among the largest producers. This process created a significant export potential that can be realised. The post-war recovery of the country will involve focusing on the most promising sectors, and pharmaceutical production has every reason to be among them. Table 2 showed the distribution of market shares among the major players in the pharmaceutical sector. In 2023, all companies in the Top 20 demonstrated growth in sales, with Farmak, Darnytsia and Teva becoming the leaders in sales of medicines and dietary supplements.

***Table 2.*** *Positions of the main participants of the Ukrainian pharmaceutical market in 2019-2024, %*

| Market Org | year | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| Total | | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Farmak JSCo (Kyiv, Ukraine) | | 5.39 | 5.10 | 5.30 | 4.86 | 5.30 | 5.40 |
| Darnytsia PrJSC (Kyiv, Ukraine) | | 3.10 | 3.26 | 2.93 | 3.98 | 4.45 | 4.50 |
| Arterium Corporation OJSC (Kyiv, Ukraine) | | 3.60 | 3.60 | 2.81 | 2.86 | 2.89 | 3.00 |
| Yuria-Pharm LLC (Kyiv, Ukraine) | | 3.16 | 3.37 | 3.21 | 2.79 | 2.58 | 2.60 |
| Sanofi (France) | | 3.21 | 3.01 | 2.80 | 2.90 | 2.24 | 2.20 |
| Teva (Israel) | | 2.86 | 2.87 | 2.54 | 2.85 | 2.74 | 2.80 |
| Acino (Switzerland) | | 2.53 | 2.47 | 2.48 | 2.97 | 2.69 | 2.70 |
| Kyiv vitamin factory JSCo (Kyiv, Ukraine) | | 2.12 | 2.19 | 2.04 | 2.52 | 2.66 | 2.65 |
| Berlin-Chemie/Menarini Group (Germany) | | 2.33 | 2.29 | 2.18 | 2.43 | 2.31 | 2.35 |
| KRKA (Slovenia) | | 2.18 | 2.21 | 2.14 | 2.55 | 2.38 | 2.40 |
| Delta Medical LLC (Vyshneve, Ukraine) | | 2.21 | 2.03 | 1.98 | 2.17 | 2.37 | 2.40 |
| Zdoroviye LLC (Kharkiv, Ukraine) | | 2.53 | 2.53 | 2.02 | 1.79 | 1.50 | 1.60 |
| Kusum Pharm LLC (Kyiv, Ukraine) | | 1.95 | 1.93 | 1.83 | 2.11 | 2.10 | 2.15 |
| Sandoz (Switzerland) | | 2.25 | 2.05 | 1.61 | 1.58 | 1.41 | 1.45 |
| Servier (France) | | 1.27 | 1.26 | 1.26 | 1.62 | 1.51 | 1.55 |
| Pfizer Inc. (USA) | | 0.61 | 1.01 | 3.59 | 0.60 | 0.61 | 0.65 |
| Reckitt Benckiser Healthcare International (Great Britain) | | 1.30 | 1.20 | 1.17 | 1.34 | 1.28 | 1.30 |
| Bayer Pharmaceuticals (Germany) | | 1.10 | 1.21 | 1.42 | 1.32 | 1.07 | 1.10 |
| Abbott Products GmbH (Germany) | | 1.02 | 1.07 | 1.10 | 1.28 | 1.25 | 1.30 |
| Borschagovsky ChPhP PJSC (Kyiv, Ukraine) | | 1.20 | 1.19 | 1.02 | 1.03 | 0.95 | 0.90 |
| Other | | 54.09 | 54.14 | 54.59 | 54.44 | 55.72 | 54.60 |

***Source:*** *IMD World Digital Competitiveness Ranking (2017-2024), Pharmacy sales in the first half of 2024 (2024), Pharmacy sale (2025)*

In 2024, in the modern economic situation, the achievement of high results in the company's activities cannot be ensured solely by the quality of goods, including pharmaceuticals, and the conditions of their sale. The pharmacy market was characterised by a significant number of competitors, which required a detailed approach to developing a strategy for operating and behaving in the market. To succeed, each pharmacy must focus on the specifics of promoting pharmaceuticals, using all available tools in this process. Technological innovations, together with global changes in the epidemiological situation, have significantly changed the requirements for promotion formats in the pharmaceutical industry, as well as the speed and formats of research required by pharmaceutical companies and other healthcare sector players (Table 3).

***Table 3.*** *Sales structure of prescription and over-the-counter drugs in 2019-2024*

| Year | Prescription, million UAH | Over-the-counter, million UAH | Share of prescription drugs in the total volume, % | Share of over-the-counter in the total volume, % | Rx, EI | OTC, EI | Rx, GR, % | OTC, GR, % |
|---|---|---|---|---|---|---|---|---|
| 2019 | 63,348.74 | 33,350.52 | 65.5 | 34.5 | 102 | 96 | 16.09 | 9.00 |
| 2020 | 72,111.88 | 35,398.10 | 67.1 | 32.9 | 102 | 95 | 13.83 | 6.14 |

*Table 3, Continued*

| Year | Prescription, million UAH | Over-the-counter, million UAH | Share of prescription drugs in the total volume, % | Share of over-the-counter in the total volume, % | Rx, EI | OTC, EI | Rx, GR, % | OTC, GR, % |
|---|---|---|---|---|---|---|---|---|
| 2021 | 93,701.20 | 41,089.50 | 69.5 | 30.5 | 104 | 93 | 29.94 | 16.08 |
| 2022 | 77,040.88 | 39,992.24 | 65.8 | 34.2 | 95 | 112 | -17.78 | -2.67 |
| 2023 | 96,470.07 | 49,281.26 | 66.2 | 33.8 | 101 | 99 | 25.22 | 23.23 |
| 2024 | 104,500.00 | 52,000.00 | 66.5 | 33.5 | 100 | 98 | 20 | 18.00 |

***Source:*** *IMD World Digital Competitiveness Ranking (2017-2024), Pharmacy sales in the first half of 2024 (2024), Pharmacy sale (2025)*

The potential ban on TV advertising until 2024 has prompted pharmaceutical companies to reconsider the structure of their marketing mix in favour of trade marketing, and remote and digital communications. Global requirements for the pharmaceutical industry in terms of social responsibility and customer focus have prompted pharmaceutical companies to introduce "patient centricity" as a key factor in competitiveness. Consequently, patient support programmes with a focus on quality service and communication with patients are very popular. Remote communications, which the agency specialises in, were becoming an increasingly important part of the marketing mix of pharmaceutical companies, while the uncertainty of the situation encourages companies to research the market, seek new ideas, test content, and strengthen interaction with pharmacy retailers.

Thus, in the modern conditions of development, the efficiency of the Ukrainian farmers' market depended on the quality of marketing. Ensuring the quality of marketing depended on the performance of the following functions: analytical research of the market, target audience, competitors, and products; production organisation, introduction of new technologies, product quality and competitiveness; sales channel organisation, logistics, product and pricing policy, market promotion; management strategic and tactical planning, control, information support.

The key factors that ensured the quality of marketing were suppliers, consumers, service, social and business activities of the company and reputation. In the process of creating marketing standards, the following groups of standards and areas of their application should be identified (Quality management toolkit for..., 2024):

- organisational standards: trade mark standard; equipment standard; premises design standard; employee appearance standard; sanitary and hygiene standard;
- qualification standards: the standard of employees' education; the standard of employees' experience for performing a certain type of work; the standard of regular professional development;
- production and service standards: standard for accepting orders; standard for working hours (work schedule); standard for employee behaviour; standard for production or service provision (with production standards, deadlines and quality criteria); standard for payment;
- security standards.

Marketing quality standards should be reflected in all areas of the company's activities procedures and regulations. The developed marketing quality standards must be reflected in the organisational structure, budget structure, and personnel requirements (Quality management toolkit for..., 2024). However, to streamline and improve these processes and manage the risks associated with them, quality criteria need to be defined. Further, it was necessary to collect statistics on deviations from the established quality standards. By analysing deviations from the standards, it was possible to determine their causes and take corrective action, as well as develop a programme of preventive actions (as part of the risk management system), including making appropriate adjustments to the project support procedure.

The first step on the way to quality management should be a quality policy, which will contain the following sections: distribution of areas of responsibility for quality: management responsibility and employee responsibility; a list of requirements for the quality of the main production processes; requirements for the qualification of specialists; process audit: regularity, procedure, results, consequences, responsibility for the implementation of audit findings; personnel certification (Tokmenko, 2024).

The requirements for the quality of production processes in pharmaceutical facilities are partially described in the standard operating procedure for project support in the respective companies (Quality management toolkit for..., 2024). The timing of the processes is specified, and the project lead time was one of the important requirements of clients. Furthermore, based on the definition of quality as "compliance with customer requirements", the documented recording of customer requirements in a brief, which has already been formalised, and the implementation of the project following the terms of the brief should guarantee 100% project quality and customer satisfaction. There are two areas of quality management: internal and external, so executing projects following the terms of the brief and the standards set within the company does not mean client

satisfaction. As a marketing and research agency that operated in the service sector, external quality management requires constant improvement, as services were assessed subjectively.

To objectify the evaluation of services, it was necessary to clarify and record in writing the project goals and indicators by which they will be measured at the start of the project. At the same time, in the development of a creative, there were no quantitative criteria for achieving the goal, but it was necessary to define quality criteria. Such criteria may include the number of creative options provided to the client for consideration, mandatory visualisation of each option, and presentation of the creative only at the meeting (to receive direct feedback from the client).

A risk management system should be an important component of the quality management system. Pharmaceutical companies have already developed and implemented a risk management policy. It was based on the DSTU standard IEC/ISO 31010:2013 (2014) and defined risk categories, risk owners, the risk management process, and the classification and form of the risk register. However, for this policy to be implemented, it was necessary to complete all the stages specified in the risk management process, namely: risk identification and description; risk assessment; development and implementation of risk management actions; risk monitoring; reporting (Quality management toolkit for..., 2024). It was worth noting that the list of these risks included those that can significantly affect the quality of services provided by the company, therefore Table 4 considered these hazards, described them more specifically and suggested possible measures and recommendations for their avoidance or reduction.

***Table 4.*** *Preventive actions to reduce the risks of hazards for pharmaceutical companies*

| Danger | Proactive actions to reduce the risk of hazards |
|---|---|
| Dependence on key employees (including their expertise): most relevant for sales managers, analysts and trade marketing executives | Create a knowledge management system.<br>Create and maintain a talent pool.<br>Manage employee loyalty (measure loyalty and job satisfaction, motivate employees, development plans) |
| Lack of an established internal control system: normative indicators are measured, but deviations need to be monitored | Develop and implement a quality management policy that includes both standards (including resource consumption rates) and a process for dealing with deviations from standards, internal audits and corrective action procedures |
| Inefficient use of enterprise resources | The pharmaceutical company has a project support system that describes the norms of working time spent on key processes.<br>In addition, a quality management policy should be developed and implemented |
| Lack of competencies and lack of innovative ideas necessary for enterprise development – competitiveness risks | Annually plan visits to educational and innovation events to find new ideas and record new ideas as a result of learning.<br>The creation of a knowledge management system, in particular, involves the creation of an "idea bank".<br>Approval and implementation of the annual development plan is an integral part of the ongoing work of the management |
| Dependence on suppliers, no alternative | Develop and implement a tender procedure that includes tenders with at least three participating suppliers and at least two contracts with suppliers (primary and secondary) |
| Poor quality of services from suppliers and/or partners | Develop and implement a tender procedure that includes a detailed check of the contractor for compliance with quality requirements, deadlines, and compliance with standards |
| Risks of technical failures of hardware, software and data transmission channels | Develop and implement an IT security policy that includes: the distribution of access to information in the company's information system (access rights policy); audit and proper updating of the IT infrastructure, provision of backup capacities and information transmission channels; backup regulations for the entire company's information system; backup is performed and the IT infrastructure is updated, but reactively (due to problems), not planned, without anticipating possible system limitations that arise |
| Loss of backup copies of infrastructure, data storage and/or information within the processes and operations to be protected | |

***Source:*** *developed by the authors*

Thus, the analysis of the risks of hazards of enterprises in the pharmaceutical sector has proved that research in the field of pharmaceutical marketing in Ukraine has played a key role in shaping the development strategies of the national pharmaceutical industry in the global economic space. At this stage, there was a need to modernise the system of marketing strategy development to ensure its flexibility, dynamism and efficiency. Management of the pharmaceutical industry in Ukraine requires coherence of market opportunities and innovative development of the industry. This means that the main management processes should be aimed at attracting the latest marketing approaches that will ensure effective use of the opportunities in the international market.

In the context of the global economic situation, the company's success cannot be achieved solely through the quality of its products, including pharmaceuticals, and the terms of its sale. The pharmacy market has a significant number of competitors, which required a careful

approach to the development of a strategy and market behaviour. To succeed, each pharmacy must account for the specifics of promoting pharmaceutical products using all available tools. Technological innovations, together with changes in the epidemiological situation around the world, have significantly changed the requirements for promotion methods in the pharmaceutical industry, as well as the speed and type of research required by pharmaceutical companies and other healthcare industry players (Fig. 1).

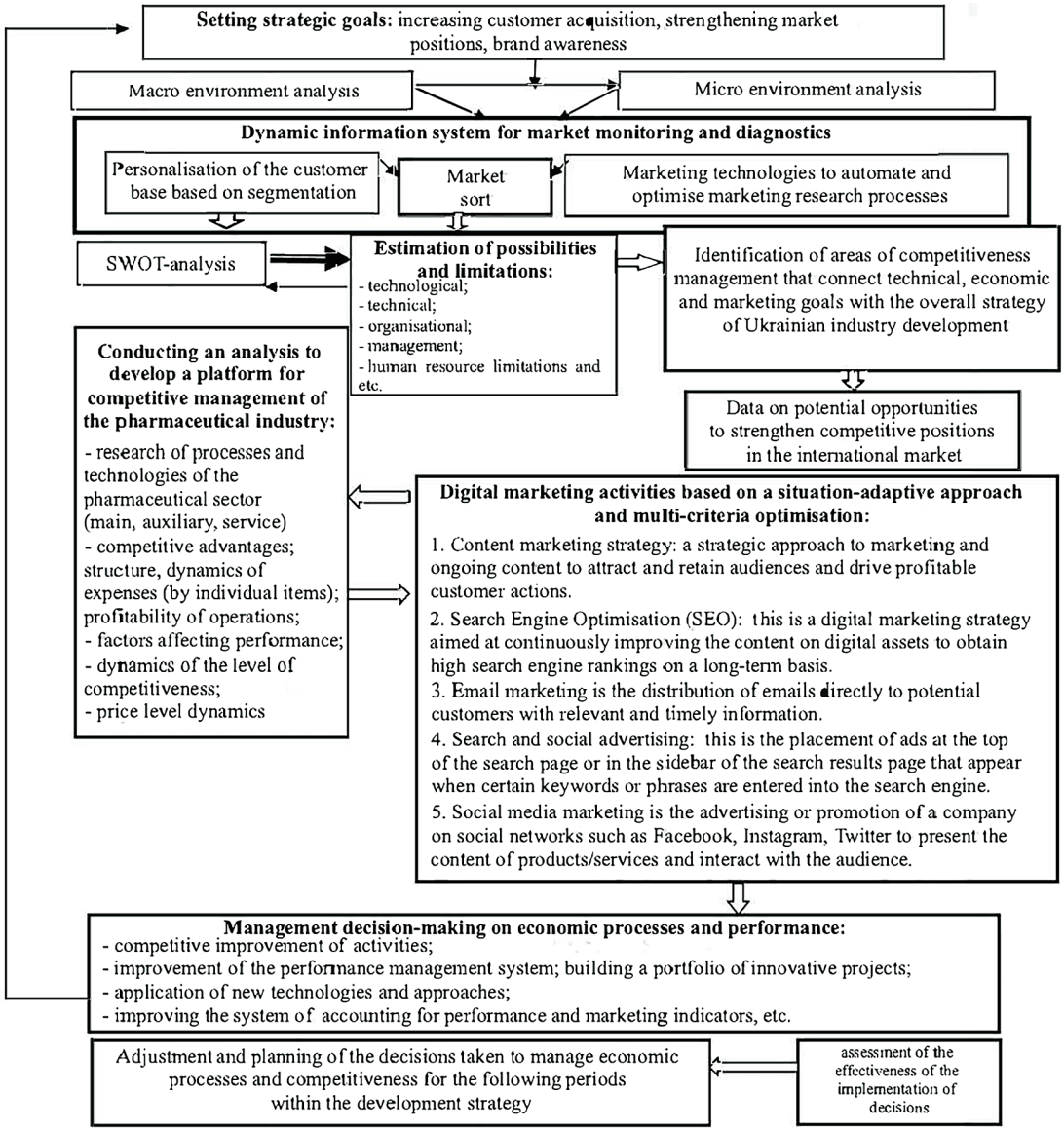


***Figure 1.*** *A model for forming a marketing strategy for the development of the pharmaceutical industry using digital marketing tools in the global economic space*

***Source:*** *compiled by the authors*

The analysis of the structure of promotions in the pharmaceutical sector in 2019-2024 demonstrated significant changes in the preferences for using different channels. Table 5 showed that online advertising and information showed a steady increase in popularity, which became noticeable in 2020. In 2023, the share of this channel among pharmacists reached 6.86%, which was 8 times higher than in 2019, when this indicator was not included in the structure at all. In 2024, the share increased to 7.00%. Visits by medical representatives, although still the main promotional tool, gradually decreased from 43.70% in 2019 to 31.00% in 2024, which indicated that companies were adapting to new conditions, including the digitalisation of processes. Remote communication ranked second among the channels and showed a steady growth trend, increasing from 14.31% in 2019 to 22.00% in 2024. TV and video advertising also gradually gained popularity, increasing from 6.89% in 2019 to 9.50% in 2024, which could be due to the growing interest in visual content among pharmacists. Other

types of promotions, such as POS materials and advertising in the specialised press, have lost their relevance, which was reflected in the gradual decline in their share in the total volume of promotions.

***Table 5.*** *Promotions in the pharmaceutical sector by channel in 2019-2024 (pharmacists), %*

| Type of promotion | Period | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| Total | | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 01. Visits of the medical representatives | | 43.70 | 32.17 | 30.51 | 31.82 | 32.06 | 31.00 |
| 02. Remote communication | | 14.31 | 21.58 | 21.09 | 21.92 | 20.23 | 22.00 |
| 03. Advertising in specialised press | | 12.92 | 14.79 | 12.57 | 7.23 | 8.82 | 8.50 |
| 04. TV advertising/Video | | 6.89 | 7.93 | 8.54 | 9.16 | 9.20 | 9.50 |
| 05. POS materials | | 7.53 | 7.27 | 6.44 | 6.40 | 5.38 | 5.10 |
| 06. Shares | | 4.58 | 6.03 | 6.03 | 6.36 | 6.63 | 6.80 |
| 07. Events/Conferences | | 6.28 | 3.65 | 2.91 | 1.90 | 3.66 | 3.80 |
| 08. Advertising/Information on the Internet | | - | 0.83 | 4.58 | 5.37 | 6.86 | 7.00 |
| 09. Promotions through medical representative calls | | 1.19 | 2.38 | 3.51 | 6.67 | 3.72 | 3.50 |
| 10. Email newsletter | | 1.23 | 2.25 | 2.25 | 1.59 | 1.78 | 1.60 |
| Other | | 1.38 | 1.10 | 1.56 | 1.56 | 1.66 | 1.80 |

***Source:*** *IMD World Digital Competitiveness Ranking (2017-2024), Pharmacy sales in the first half of 2024 (2024), Pharmacy sale (2025)*

It was worth highlighting events and conferences, which reached 3.80% in 2024. This growth may be a result of the gradual resumption of traditional interaction formats after the COVID-19 pandemic, when a significant number of events were moved online. This resumption of activity in holding conferences and events may also indicate new approaches to the development of professional relationships in the pharmaceutical industry, which facilitated the integration of more participants in the physical format. This process was also accompanied by the growing influence of digital channels in the promotion of medicines and healthcare services. Digital technologies and online platforms have become an integral part of pharmaceutical companies' marketing campaigns, providing opportunities for more effective interaction with end users, healthcare professionals and other stakeholders (Larina *et al.*, 2023).

In the context of the growing role of digital technologies in business, an analysis of The Digital Economy and Society Index (DESI) (2022) was essential. According to this source, the level of integration of digital solutions into business activities differs significantly between EU countries. For instance, in Denmark, 62% of companies use cloud technologies, while the EU average was only 34%, indicating a high level of digital maturity in the business environment. In contrast, in Poland, the figure was only 19% and the use of Big Data technologies was 8%, indicating a slower adoption of digital tools. These differences demonstrated the extent to which the introduction of digital platforms, automated management systems and analytical technologies can improve the efficiency of pharmaceutical companies in different countries, as well as influence their competitiveness in the international environment.

The trend towards digitalisation was relevant as the importance of digital channels for pharmacists and doctors was growing. These changes were confirmed by the data in Table 5, which demonstrated how the resumption of traditional event formats coexisted with a significant increase in the influence of digital channels. These trends also have their characteristics in the context of interaction with doctors, as shown in Table 6.

***Table 6.*** *Promotions in the pharmaceutical sector by channel in 2019-2023 (pharmacists), %*

| Type of promotion | Year | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| Total | | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 01. Visits of the medical representatives | | 53.74 | 37.01 | 40.62 | 39.58 | 39.23 | 37.00 |
| 02. Remote communication | | 9.80 | 17.85 | 16.15 | 18.78 | 17.75 | 19.00 |
| 03. Events/Conferences | | 14.00 | 15.42 | 14.66 | 11.05 | 12.95 | 12.50 |
| 04. Advertising in specialised press | | 9.38 | 9.60 | 8.66 | 7.33 | 7.39 | 7.20 |
| 05. Promotions through medical representative calls | | 1.25 | 4.96 | 4.41 | 8.93 | 6.71 | 6.50 |
| 06. Email newsletter | | 2.94 | 6.32 | 5.65 | 4.43 | 5.03 | 5.50 |
| 07. TV advertising/Video | | 4.97 | 4.69 | 4.78 | 3.82 | 4.35 | 4.60 |
| 08. Advertising/Information on the Internet | | 1.67 | 2.12 | 3.43 | 4.90 | 5.24 | 6.00 |
| 09. Newsletter campaigns | | 2.25 | 2.03 | 1.28 | 0.36 | 0.33 | 0.30 |
| 10. Advertising on the radio | | - | - | 0.36 | 0.82 | 1.02 | 1.20 |

***Source:*** *IMD World Digital Competitiveness Ranking (2017-2024), Pharmacy sales in the first half of 2024 (2024), Pharmacy sale (2025)*

Digital marketing was one of the key tools that provide flexibility and high dynamics in the management of the pharmaceutical industry. This tool included the use of digital technologies, social networks, search platforms and other online resources to advertise and promote products on the market. The implementation of digital marketing ensured the effectiveness of the monitoring information system and the adaptability of management processes in this area (Fig. 1). The model of forming a marketing strategy for the development of business entities in the pharmaceutical market presented in the study illustrated the relationship between the formation of a marketing strategy for the development of the pharmaceutical industry in Ukraine and key management processes. This relationship demonstrated how the introduction of digital marketing has contributed to increased efficiency and flexibility in solving strategic tasks.

The use of digital marketing in the pharmaceutical industry in Ukraine created significant opportunities for promoting medicines, attracting new customers and increasing sales. This has provided a competitive advantage to companies in the market environment and stimulated the innovative development of the sector. The use of digital technologies in marketing strategies not only contributed to the effective promotion of products, but also helped to establish strong relationships with customers, increase their loyalty and provide comprehensive information about the drugs and their use. Thus, the introduction of digital marketing is an important strategic development area that strengthens the competitiveness of the Ukrainian pharmaceutical industry at the international level.

The prospects for marketing pharmaceutical products to international markets and expanding services abroad are quite favourable. Ukrainian pharmaceutical companies can provide high-quality and fast service at an affordable price, which distinguishes them from their expensive foreign counterparts, which often have longer delivery times. In particular, the popularisation of pharmaceutical services abroad can be achieved not only through an active advertising campaign but also through the introduction of referral programmes.

Many Ukrainians who are familiar with Ukrainian pharmaceutical brands are abroad and can recommend Ukrainian products to the local population. This will be effective if customers are offered bonuses or discounts for such activity. Thus, the use of digital marketing stimulates the development of the pharmaceutical sector in the context of globalisation and the active spread of digital technologies. According to V. Pashkov & Ye. Gnedyk (2022), the importance of this industry was manifested in a large number of research and innovation activities focused on developments, technologies and equipment that took place in the sector (about 48% of pharmaceutical companies were engaged in innovative activities in the field of research and development).

Scientists I.F. Prokopenko *et al.* (2021) emphasised that effective marketing management in the pharmaceutical sector contributed to increasing competitiveness in the international market using innovative strategies. The authors noted that the key success factors were adaptation to changes in the global environment and integration of digital tools into marketing activities. I. Petrova & Ye. Loiko (2022) noted that the "big players" in the market actively used marketing strategies to achieve their goals in the competition. The researchers emphasised the importance of developing strategies that incorporate the peculiarities of international markets and were aimed at maintaining leadership positions in the long term.

I.A. Popova *et al.* (2023) studied the adaptation of marketing approaches in the pharmaceutical sector to the current conditions of digital transformation. The researchers emphasised that the COVID-19 pandemic has become a catalyst for changes in the system of communication and promotion of pharmaceutical products, through an emphasis on remote and digital channels of interaction with customers. M.H. Reza (2020) analysed the role of innovative technologies in global marketing, emphasising that the use of digital tools in the pharmaceutical sector not only increases efficiency, but also reduces the costs associated with product promotion, which was critical in a competitive environment.

Researchers T. Tsygankova *et al.* (2022) considered the challenges of globalisation for the international pharmaceutical market, in particular the need to adapt marketing strategies to different cultural and economic conditions. The author emphasised the importance of using localised approaches to achieve effective communication with the target audience. O.O. Shmalko (2022) stated that the pharmaceutical market of Ukraine played a key role in ensuring access to medical services and products for the population. In 2021, the market volume of pharmaceuticals and medical devices reached approximately 116.6 billion UAH, which was 10.7% more than in 2020. This meant that the pharmaceutical sector remained one of the largest segments of the Ukrainian economy.

P. Shevchuk & B. Derhaliuk (2022) and I. Lylyk (2024) highlighted the division of the market by segments, in particular, patented drugs, which covered the production and sale of medicines of well-known global brands such as Pfizer, Novartis, Sanofi, GlaxoSmithKline. In 2021, the value of patented drugs was approximately 56 billion UAH. These drugs were usually more expensive, but they were known for their effectiveness and safety; generic drugs. Generic drugs were more affordable analogues of patented drugs. In 2021, their value was about 60 billion UAH. These medicines have reduced treatment costs and made treatment more affordable for most of the population; imported medicines Ukraine imports a significant amount of medicines from other countries. In 2021, the value of imported medicines was approximately 40 billion UAH. These drugs were known

for their high quality and effectiveness, making them popular among doctors and patients.

## Conclusions

The study determined that the modern pharmaceutical market of Ukraine was characterised by significant development potential due to the active digitalisation of business processes and the introduction of innovative marketing approaches. Competition in the pharmaceutical market was growing, which required companies to improve their marketing strategies.

Digital marketing, as one of the key tools of modern business, has demonstrated significant opportunities for the development of the pharmaceutical industry. The introduction of digital technologies expanded the sales market, attracted new customers and increased customer loyalty, which has ensured the competitiveness of Ukrainian pharmaceutical companies in both internal and international markets.

The results of the analysis demonstrated that one of the main challenges for the pharmaceutical business was to adapt to new market conditions, in particular through the integration of digital marketing tools. The successful implementation of digital strategies optimised costs, increased market share and improved brand awareness. At the same time, the development of the pharmaceutical market was largely dependent on external factors, such as economic stability, international support and demographic changes.

The presented model of forming a marketing strategy for the development of business entities in the pharmaceutical market was essential for the formation of strategic approaches to improving the competitiveness of pharmaceutical companies in the modern environment, in particular in the context of active implementation of digital technologies and optimisation of marketing processes. It combined analysis of the macroeconomic environment, use of dynamic information systems for market monitoring and assessment of competitive advantages, which ensured quick response to changes in the external environment and adapt their strategies to ensure sustainable development. The model was used as the basis for building effective digital marketing strategies, including the creation of relevant content, search engine optimisation, and the active use of social media to attract customers. Thanks to integrated data obtained from market monitoring and screening systems, companies were able to quickly assess limitations and opportunities related to technological, organisational and managerial factors. This approach not only adapted business strategies promptly, but also optimised resources, reducing costs and increasing the efficiency of interaction with end users and partners. The model also ensured a continuous assessment of competitive positions based on comparisons with major market players, which is critical in the highly dynamic pharmaceutical industry. As a result, the integration of this model into the management processes of pharmaceutical companies contributed to the achievement of strategic goals increasing competitiveness and ensuring sustainable development at the national and international levels.

Further research could assess the impact of specific digital marketing tools on the performance of pharmaceutical companies, as well as explore opportunities to expand cooperation with international partners. This will determine the industry's development prospects in greater detail and find new ways to adapt to rapid changes in the global business environment.

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## Conflict of Interest

None.

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## Особливості маркетингу на міжнародному фармацевтичному ринку в умовах цифрової трансформації

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**Анотація.** Фармацевтичний ринок виконує ключову функцію забезпечення населення ліками, де маркетинг виступає рушійною силою задоволення потреб у якісному медичному забезпеченні та потребує інноваційних підходів. Актуальність роботи полягала у тому, що технологічні інновації разом із складною епідеміологічною ситуацією в світі та війною в Україні змінили вимоги до комплексу маркетингу на фармацевтичному ринку, сфері охорони здоров'я. Метою дослідження було поглиблення теоретичних положень та розробка науково-практичних рекомендацій щодо впровадження маркетингових інновацій на міжнародному фармацевтичному ринку для підвищення ефективності, покращення і пришвидшення доступу населення до інноваційних медичних препаратів. Методологічною базою стали порівняльний, кількісний методи, табличний аналіз та синтез. В статті визначено роль маркетингового інструментарію та механізму маркетингового управління на міжнародному фармацевтичному ринку. В ході дослідження було проаналізовано виклики, що виникають перед учасниками міжнародного фармацевтичного ринку, пов'язані з глобалізацією, та визначають ключові аспекти міжнародного маркетингу, які впливають на успішність управління фармринком. У статті розглянуто необхідність адаптації маркетингових стратегій до різноманітних культур та економічних умов, що властиві різним країнам. Проаналізовано ефективні методи просування на міжнародних фармацевтичних ринках, вивчено важливі аспекти брендингу та комунікації для забезпечення успіху управління в фармсфері. Було досліджено сучасні тенденції міжнародного маркетингу в фармсфері та визначено стратегії адаптації до змін у глобальному економічному середовищі. Було визначено роль ефективного маркетингового управління у створенні конкурентних переваг на міжнародних ринках, звертаючи увагу на підвищення якості обслуговування клієнтів. В статті запропоновано структурно-логічну модель формування маркетингової стратегії розвитку бізнес-суб'єктів фармацевтичного ринку в глобальному економічному просторі, зосереджуючись на їх розвитку у міжнародному економічному просторі. Було вивчено виклики, з якими стикаються фармацевтичні компанії, визначають ключові аспекти міжнародного маркетингу, спрямовані на ефективне позиціонування на світовому ринку. Практична цінність роботи полягає у розробці структурно-логічної моделі формування маркетингової стратегії для бізнес-суб'єктів фармацевтичного ринку, що сприятиме їх успішному позиціонуванню на міжнародних ринках та підвищенню ефективності доступу населення до інноваційних медичних препаратів

**Ключові слова:** цифрові технології; інноваційні підходи; конкурентоспроможність; комунікаційні інструменти; стратегія просування; клієнтоорієнтованість; адаптація бізнес-моделей

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