SCIENTIA FRUCTUOSA

Scientific journal

Established: 1998

№ 3(155)2024

To October 2000 had been published under the title"Herald of Kyiv State University of Trade and Economics"
To February 2022 had been published under the title"Herald of Kyiv National University of Trade and Economics"
From March 2022 it will be published under the title "Scientia fructuosa"
It is published six times a year

The journal is recognized by the Ministry of Education and Science of Ukraine as the professional edition in economic sciences of Category "B"

Founder, edition,
publisher and manufacturer
State University of Trade and Economics

Director of periodicals – KRYVYTSKA I.

Editors: KYRYCHENKO E., KRYVENKO O.,
DUBKO M., SALAY I., RASSKAZOVA I.
Artistic and Technical Editor
PSHENICHNA T.

Entered into the Register of entities in the field of print media by decision of the National Council of Ukraine on Television and Radio Broadcasting
No. 798 dated August 31, 2023
and assigned the identifier R30-01229

Index of the magazine in Catalogue of publications in Ukraine in 2024 – 21910

Signed 05.06.2024.
Conventional print. pages. 11
Circulation 250. Order 155

Address of the Editorial board,
publisher, manufacturer:
st. Kyoto, 19, Kyiv-156, Ukraine 02156.
Contact us at 531-31-16
visnik@knute.edu.ua
http://journals.knute.edu.ua/scientia-fructuosa/pro_journal

Printed on equipment of SUTE.

Certificate of subject of publishing industry series DK № 7656 of 05.09.2022

Published on the recommendation of the Academic Council of SUTE
(minutes № 10 of 30.05.2024)

The journal is represented in international scientometric databases, repositories and search engines, such as Index Copernicus, Register of Scientific Publications of Ukraine, Vernadsky National Library of Ukraine, Crossref, Dimensions, Research Bible
.

C O N T E N T

ENERGY SECURITY

ENTERPRISE

FINANCE

З М І С Т

ENERGY SECURITY

DOI: 10.31617/1.2024(155)01
UDK: 620.91-049.5=111

MAZARAKI Anatolii,
Doctor of Sciences (Economics),
Professor, Rector
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0003-1817-0510
rector@knute.edu.ua

MELNYK Tetyana,
Doctor of Sciences (Economics),
Professor, Head of the Department of International Management
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0002-3839-6018
t.melnyk@knute.edu.ua

ENERGY SECURITY: NEW CHALLENGES AND GLOBAL TRENDS

In the conditions of a permanent world energy crisis and its strengthening against the background of full-scale aggression of russia in Ukraine, questions regarding risks to national energy security come to the fore in the world. At the same time, the world is undergoing the fourth energy transition, which requires the development of a new concept of energy security by countries that are both suppliers of energy resources and their consumers. The aim of the research is to develop the conceptual principles of energy security, taking into account modern challenges caused by simultaneously growing crises in energy, economy and geopolitics. The creation of such a basis makes it possible to identify a number of solutions for neutralizing new threats that arise, in particular, in the context of the "green" transition. The research was conducted using the methods of scientific abstraction and systematization, analysis and synthesis, generalization, comparison. Conceptual features of energy security management in conditions of radically changed context, strengthening of crisis phenomena and threats of

МАЗАРАКІ Анатолій,
д. е. н., професор, ректор
Державного торговельно-економічного університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0003-1817-0510
rector@knute.edu.ua

МЕЛЬНИК Тетяна,
д. е. н., професор, завідувач кафедри міжнародного менеджменту
Державного національного торговельно-економічного університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0002-3839-6018
t.melnyk@knute.edu.ua

ЕНЕРГЕТИЧНА БЕЗПЕКА: НОВІ ВИКЛИКИ ТА СВІТОВІ ТРЕНДИ

В умовах перманентної світової енергетичної кризи та її посилення на тлі повномасштабної агресії росії в Україні на перший план у світі виходять питання щодо ризиків для національної енергетичної безпеки. Водночас у світі триває четвертий енергетичний перехід, що потребує вибудовування нової концепції енергетичної безпеки країнами, які є як постачальниками енергетичних ресурсів, так і їх споживачами. Метою статті є розроблення концептуальних засад енергетичної безпеки з урахуванням сучасних викликів, зумовлених одночасно наростаючими кризами в енергетиці, економіці та геополітиці. Створення такої основи дає змогу визначити низку рішень для нейтралізації нових загроз, які виникають, зокрема, у контексті "зеленого" переходу. Дослідження проведено з використанням методів наукового абстрагування та систематизації, аналізу та синтезу, узагальнення, порівняння. Представлено концептуальні особливості управління енергетичною безпекою в умовах радикально зміненого контексту, посилення кризових явищ і загроз різного характеру. Підтверджено

various natures are presented. The hypothesis that energy security is a complex category that expresses the ability of the fuel and energy complex of the region to supply the domestic market with the necessary volume and range of energy resources at stable and acceptable prices, to quickly mitigate unexpected fluctuations in demand for fuel and energy resources and to ensure uninterrupted energy supply and energy carrier parameters in real time. Based on the analysis of scientific publications and practical models of energy security, theoretical provisions, methodological principles and energy security management tools that meet modern requirements have been developed. In particular, the key global trends of changes in the energy markets are defined, the types and forms of modern energy threats and risks are outlined. It outlines the impact of the "green" transition that many countries have undertaken and confirmed at the UN Climate Change Conference (COP28), emphasizing further energy security, taking into account both the reduction of dependence on fossil fuels and the new challenges associated with renewable energy sources. The results of the research are of practical interest during the development of energy policy, plans and specific actions aimed at ensuring energy security in a turbulent global environment.

Keywords: energy security, gas, oil, electricity, nuclear energy, renewable energy sources, energy transition, European integration.

гіпотезу, що енергетична безпека є комплексною категорією, яка виражає здатність паливно-енергетичного комплексу регіону постачати на внутрішній ринок необхідний обсяг і номенклатуру енергоресурсів за стабільними та прийнятними цінами, оперативно пом'якшувати несподівані коливання попиту на паливно-енергетичні ресурси та забезпечити безперебійне енергопостачання і параметри енергоносія в режимі реального часу. На основі аналізу наукових публікацій та практичних моделей енергетичної безпеки розроблено теоретичні положення, методологічні засади і засоби управління енергетичною безпекою, що відповідають сучасним вимогам. Зокрема, визначено ключові глобальні тренди змін на енергетичних ринках, окреслено види та форми сучасних енергетичних загроз і ризиків. Встановлено напрями впливу "зеленого" переходу, який багато країн взяли на себе та підтвердили на конференції ООН зі зміни клімату (COP28), наголошуючи на подальшій енергетичній безпеці, враховуючи як зменшення залежності від викопного палива, так і нові виклики, пов'язані з відновлюваними джерелами енергії. Результати дослідження становлять практичний інтерес під час розроблення енергетичної політики, планів і конкретних дій, спрямованих на забезпечення енергетичної безпеки в турбулентному глобальному середовищі.

Ключові слова: енергетична безпека, газ, нафта, електроенергія, атомна енергія, відновлювальні джерела енергії, енергетичний перехід, євроінтеграція.

JEL Classification: F42, H56, L71, L94, L95, Q 41, Q 48.

Introduction

The ongoing energy crisis amid russia's invasion of Ukraine has highlighted countries' longstanding vulnerability to fossil fuel dependence and reignited global concerns about national energy security. As defined by the International Energy Agency (IEA), energy security is the uninterrupted availability of energy sources at an affordable price (IEA, n. d. *a*). Despite the importance of other aspects of energy security, it is urgent to pay attention to the constant availability of energy supply. In such a context, the key factors of energy security – diversification of supply and political risk of suppliers – come to the fore to understand the historical evolution of energy security and differences between countries.

In addition, the fourth energy transition (ET) is underway in various countries around the world, which largely determines the current sectoral and inter-sectoral context. According to the inventor of this term, the Czech-Canadian scientist V. Smil, the fourth ET is a global transformation of the

world's energy supply systems, aimed at achieving carbon neutrality in all spheres of human activity (Smil, 2010). For the first time, environmental goals (rather than economic or technological ones) gain significant importance in energy supply, and deposits of oil, gas and coal are declared "undesirable" and even dangerous due to their harmful effects on the climate and the environment.

The new ET is distinguished by a wide scale of innovative tasks and a relatively short time for their solution (within 30 years). At the same time, the accelerated and widespread introduction of solar, wind and hydrogen energy technologies, which are considered the main energy carriers in the USA and European countries, requires the creation of an appropriate scientific and technical base, the definition of requirements for logistics, the system and the reconfiguration of energy markets (IEA, 2019*a*; Wolf & Zander, 2021). However, excessive attention to renewable energy sources leads to uncontrollable price volatility; the emergence of investment problems (Moriarty & Honnery, 2022) and, as a result, a sharp decrease in the level of energy security of the region. Thus, the destabilization of primary (natural) energy flows can lead to a decrease in the utilization factor of the installed capacity of wind power plants (WEPs) to economically unacceptable values, which calls into question the further operation of the entire complex of WEPs in the territory. Taking into account plans to decommission coal and nuclear power plants, the problem of stability of energy supply, especially in power systems with uneven load, is sharply aggravated.

This leads to a number of new challenges, the study of which is important for the development of appropriate solutions in the field of energy security. And therefore, the main leading motive of ET, the decarbonization of the global energy industry "by all means", needs to be carefully checked, first of all from the standpoint of new threats to energy security.

Ukraine is both a supplier and a consumer of energy, moving in line with European and world trends in the field of energy. Therefore, the state and its energy policy face new and new challenges, which are complicated by the war and the constant destruction of the energy infrastructure.

The results of the analysis of modern scientific research and publications by domestic authors have shown significant attention to the urgent challenges of global energy and the energy sector of Ukraine during the war.

In the research of O. Sukhodolya and co-authors, the methodological principles of the formation of the energy security risk management system were highlighted, and the processes of determining the current level of energy security of Ukraine were formalized with the help of a mathematical model (Sukhodolya et al., 2023). However, the proposed system of indicators does not take into account global trends and reformatting of the global energy system, in the context of which Ukraine has already begun its own energy transition.

Current trends in the development of world energy and energy security of Ukraine are considered in the article by S. Kogut, in which the author, based on the analysis of current trends in the development of world energy and the structural transformation of the global energy market, draws a conclusion about reformatting the national energy policy, which requires the development of new tools for ensuring energy security and search for the optimal configuration of the energy system at the stage of the energy transition (Kogut, 2023).

In the work of A. Ilyenko, threats to the energy security of the state in the pre-war period were outlined and a tendency to their gradual neutralization was revealed by reducing natural gas imports and diversifying supplies (Ilyenko, 2019).

However, despite a significant amount of thorough scientific and scientific-practical domestic research in this field, a number of unresolved issues remain, in particular, regarding the influence of global trends in the energy policy of states and the identification of threats that arise, taking into account both the reduction of dependence on fossil fuels and new challenges, related to renewable energy sources.

The aim of the article is to develop the conceptual principles of energy security, taking into account modern challenges caused by simultaneously growing crises in energy, economy and geopolitics. The creation of such a basis makes it possible to determine a number of solutions for neutralizing new threats that arise, including in the ET context.

The research presented in the article is based on the hypothesis of the need to strengthen the energy security of Ukraine in connection with the emergence of new challenges in this area, associated with the new global energy transition, geopolitical changes in the world and the transformation of climate policy, as well as the integration of Ukraine into the new global the concept of the energy market.

The article is based on a methodology that includes a review of scientific literature, analysis and systematization of existing theoretical ideas about energy security, analytical reports of global structures and institutions (OSCE, International Energy Agency, UN European Energy Commission, International Renewable Energy Agency), as well as international consulting groups Deloitte (London, Great Britain), Accenture (Dublin, Ireland), McKinsey & Company (New York, USA). Methods of scientific abstraction, generalization, and comparison were used.

In practical terms, the results of the research can be used during the development of national energy policy, plans and specific actions to ensure energy security in a turbulent global environment.

The structure of the main part contains three sections, the first of which is devoted to the clarification of terminology and the idea of energy security as a complex interdisciplinary category in which economic, environmental, engineering and management aspects are intertwined, the

second is to the study of trends in global energy security, the third devotes to the identification of risks of "green" transition in Ukraine during the war and post-war period.

1. Energy security content in modern conditions

Energy security is an ambiguous term used in political, economic, environmental, social, technical and other fields (Cherp & Jewell, 2011; Winzer, 2012; Månsson et al., 2014). The interpretation of the term is the subject of a wide and long discussion in the international community, because there is still no unified approach to the definition of energy security. D. Baldwin notes that neither scientists, nor practitioners, nor international institutions have yet managed to develop a comprehensive definition, which obviously indicates the significant interdisciplinary nature of the problem and the impossibility of covering its features from different sides at the same time (Baldwin, 1997). Therefore, each author analyses the issue of energy security either from a position that is considered the most important in a certain professional community, or in connection with a discourse that is currently gaining increased relevance.

Energy security is determined by how diversified and politically secure a country's energy sources are. For our purpose, energy security is defined as security of supply. That is, ceteris paribus, high energy security is observed if there is a diversified portfolio of suppliers (Cohen et al., 2011) with low political risks (Le Coq & Paltseva, 2009).

Energy security can be defined from two polar angles: for economies exporting and importing energy (Willrich, 1976). From the point of view of energy exporters, security of demand is important – guaranteed access to various foreign markets. From the point of view of the economies of energy-importing countries, the reliability of energy supply is of primary importance. In addition to the security of supply and demand dichotomy, energy security is commonly defined by several other dimensions, including sustainability of supply (Blum & Legey, 2012).

According to a study by J. Kim et al. (Kim et al., 2024), security of supply is a dominant topic in the energy security literature. The continuity and availability of energy supply depends on several factors, including the diversity and political risks of supply sources (Le Coq & Paltseva, 2009). The concept of diversity of energy supply, borrowed from portfolio theory in finance, assumes that, other things being equal, there is high energy security if there is a diversified portfolio of suppliers (Gupta, 2008; Cohen et al., 2011; Andre et al., 2014). For fuels such as natural gas, diversification goes beyond the country of origin of supply. The route of transportation, pipeline or sea, is also of great importance. Although there is a more concentrated supply where infrastructure constraints limit pipeline natural gas imports, liquefied

natural gas (LNG) can enhance energy security by expanding sources of supply (Vivoda, 2019). This strategic importance of LNG has reinforced the growing role of LNG in the energy security debate, with LNG supply contracts becoming more flexible and some LNG being sold in spot deals instead of long-term contracts (IEA, 2019*b*).

In the analysis of energy security, renewable energy sources (RES) are gaining more and more importance. RES, replacing energy imports (Gökgöz & Güvercin, 2018), create new challenges for energy security. A number of studies (Ketterer, 2014; Rintamäki et al., 2017) prove that RES can reduce the volatility of electricity prices in some countries, but increase it in others. Since energy security also depends on availability, price volatility is an energy security issue. However, there are examples of how to deal with price volatility in countries with a high share of renewable energy sources. Germany has already taken regulatory and policy measures to reduce the price volatility caused by renewable energy, and they are showing success (Ketterer, 2014). Some studies argue that an electricity system based entirely on renewable energy sources (as opposed to the current energy balance, which is based mainly on oil and natural gas) would significantly improve energy security in Jordan in terms of availability, cost, environment and health and will maintain a constant level of diversity (Abdelrahman et al., 2020).

Energy security and energy independence are closely related, but increasing domestic fossil fuel production to achieve energy independence is delaying the green transition. Therefore, a distinction should be made between energy independence and energy security, as the former focuses only on reducing the share of imported energy in the national energy balance (Cohen et al., 2011). However, increasing energy independence through domestic fossil fuel investment is at odds with the Paris Agreement and efforts to achieve net zero emissions. This means that energy security and sustainable investment can only be achieved jointly through investment in renewable energy capacity (Cevik, 2022).

2. World trends in energy security

Over the past two decades, *coal and oil production has become more concentrated.* Together, the largest coal producers capture an increasing share of the global coal market, with China and, to a lesser extent, Indonesia's share rising from 33% of world production in 2000 to 60% in 2020 (IEA, n. d. *b*). For oil, the last decade has also seen a marked shift towards more concentrated production markets, with the US, Canada and Iraq increasing market share. But, although the combined market share of the 7 leading manufacturers increased, it remained below 60%. In contrast, the global natural gas market has not experienced any significant changes in

concentration over the past two decades, despite some modest changes in the market shares of several natural gas producers (e.g., Qatar, Iran, and China), accompanied by some declines in the share of Russia and Canada. The picture remains practically unchanged in terms of shares of world exports.

Over the past decade, indicators of *political risk and democratic freedom* have worsened in most fossil fuel-producing economies. According to foreign studies, the democracy index compiled by the Economist Intelligence Unit as an intermediate indicator of democratic freedom and two separate indicators of political risks are used to measure political risks: the index of the International Country Risk Guide (ICRG) of the Political Risk Service Group (PRSG) and the ideal point distance measurement (IDP), developed by Bailey et al. (2017). They complement each other by highlighting different aspects of risk. The Democracy Index is based on the electoral process and pluralism, civil liberties, government functioning, political participation and political culture (EIU, 2022). Among the largest components of the ICRG index are government stability, social and economic conditions, and internal and external conflicts (PRS, 2018). The results show that political risks have increased for coal and natural gas, while the picture is mixed for oil producers.

The political distance between producers and consumers of fossil fuels has generally decreased. The IDP indicator is based on voting at the UN General Assembly using a Bayesian logit model with three voting options (yes, abstained, no)[1]. The higher the absolute value of the IDP between a pair of countries, the higher the political risks and potential for energy disruptions if one country depends on the other for energy needs (IMF, 2023). However, due to the limited availability of bilateral fuel trade data, it is constructed only for OECD economies and their imports from fossil fuel suppliers. An interesting fact is that the geopolitical distance between natural gas exporting and importing economies has increased since 2010.

Perhaps this reflects a plateau in globalization after the global financial crisis and the strengthening of trade and financial barriers (Shekhar et al., 2023) since then.

Risks to energy security amid concentrated production and heightened political risks have varied by fuel type in recent years. For example, coal and natural gas production has shifted toward regions with lower rates of democratic freedom, higher risks of internal political instability, and greater geopolitical distance between producing and importing economies. However, the picture for oil is less clear. Production appears to be concentrated in countries with both low and high levels of democratic freedom, as well as in regions with less political risk. The latter largely reflects the increase in the market shares of the United States of America and Canada.

[1] The distance is not estimated, but obtained from a link that provides the most recent version of the distance for all country pairs (Harvard Dataverse, n. d.).

Political risk affects energy security mainly through supply disruptions. In addition to other dimensions of political risk, the concentration of energy production in different governance systems and cultures can also be assessed based on the widely used Freedom House Index (2022). The aim is not to establish a causal relationship between democratic freedom and political risks. To the extent that civil rights and freedom matter for domestic political stability (Aisen & Veiga, 2011), their absence can potentially manifest itself in risks to energy security. The results of the analysis of the share of world production from countries classified as "free", "partially free" and "unfree" showed that coal production, as with other risk indicators, is increasingly concentrated in "unfree" regions. Similar trends are observed for natural gas and oil.

Modern concept of energy security

In their interpretations of energy security, large global consortia emphasize that its main function is to ensure sustainable energy development.

Sustainable development of the electric power industry, for its part, is a condition and consequence of economic growth. It is based on the effective management of all types of risks generated by the uncertainty of the external environment, and is impossible without ensuring sustainable functioning.

Next, we will analyze how energy security is interpreted from the point of view of sustainability in the world.

Experts from the Asia-Pacific Energy Research Center provide the following interpretation: energy security is the ability of the economy to guarantee the availability of supplies of energy resources in a sustainable and timely manner, while the price of energy is at a level that will not have a negative impact on economic indicators (APERC, 2007). The center has developed the 4A model of energy security, which is based on four principles:

- *availability* (availability of energy resources);
- *accessibility* (physical availability of energy for consumers);
- *affordability* (financial availability of energy for consumers);
- *acceptability* (acceptability of consumption conditions). Different scholars use this model as a basic framework from which they develop their own improved approaches (Cox, 2014; Sovacool & Mukherjee, 2011). For example, E. Cox (Cox, 2014) develops the 4A model, emphasizing that energy security must be ensured not only in the short term, but also, most importantly, in the long term, which implies increased attention to the reliability of energy systems, as well as stable economic and ecological indicators of their functioning (*Figure*). At the same time, reliability is a property of energy objects, and energy security characterizes the state of the state, its economy and society.

Energy security is ensured not only by the impact of energy facilities, but also by external factors that reduce risks (Ayoo, 2020).

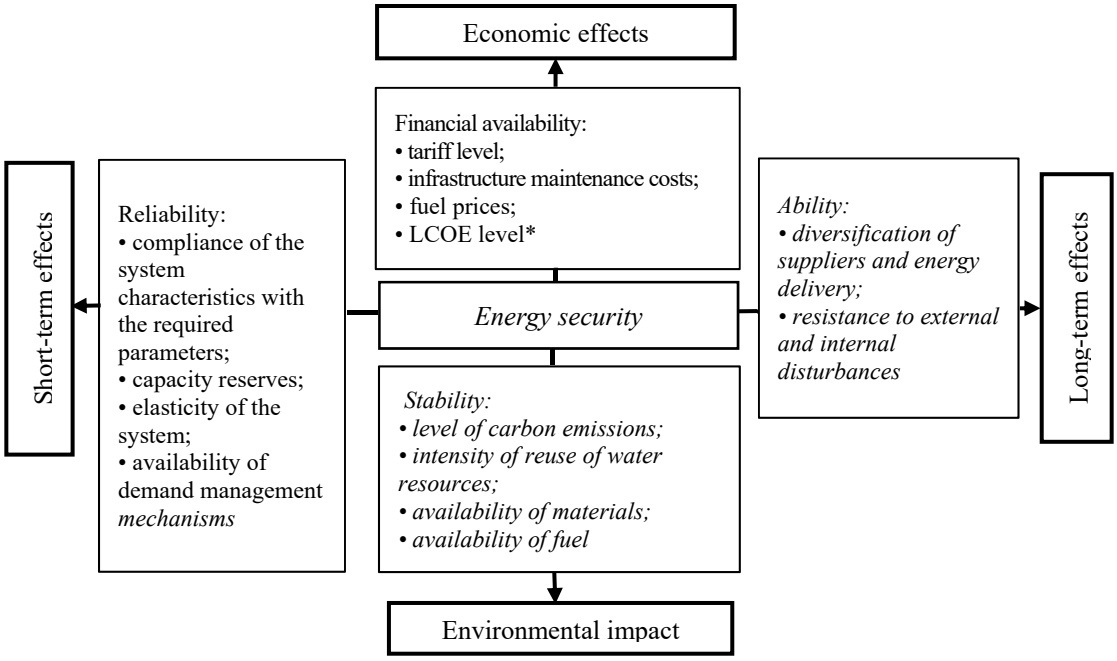


Figure. Conceptual idea of energy security

* Levelized cost of electricity (LCOE) is a measure of the average net present cost of electricity production for a generator over its lifetime. It is used to plan investments and compare different methods of electricity production on a consistent basis.

Source: summarized and constructed by the authors from (Cox, 2014).

Price is one of the leading criteria in this group of definitions, since price as a mandatory functional component of energy security determines the level of energy availability for consumers. But it is quite difficult to objectively substantiate this. According to D. Deese's classic study, energy prices ... are affordable if they do not cause serious disruptions to normal social and economic activity (Deese, 1979). It should be noted that some business entities do not feel the devastating effects of changes in energy prices, while others (especially large energy-intensive consumers, where the cost of electricity is significant in the structure of their production costs) react to such changes extremely sensitively. Thus, the term "affordability" in relation to energy security should always be distinguished and should answer the question "affordable to whom?" (Cherp & Jewell, 2016).

The results of the analysis of interpretations of energy security as a factor (or condition) of energy sustainability indicate that these interpretations give priority to economic and social determinants, while engineering and technical aspects are considered complementary (or indirect). A number of other interpretations are based on the principles of a systems approach, in which technique and technology are no less important than social and economic issues.

From the point of view of a systemic approach, energy should simultaneously increase the level of vitality and reduce the level of

vulnerability. The viability of energy systems is determined by their structural and operational parameters: structure, composition, and technical condition, modes of use of fuel bases, energy sources, energy network infrastructure, and energy reserve capacities. Vulnerability is an indicator that reflects the ratio of the degree of exposure to risks that may arise in various energy systems to their resilience potential. This definition uses specific systems engineering patterns related to ensuring the resilience of complex systems by creating protective structures to prevent system collapse, reduce vulnerability, and increase flexibility (Florin, 2016).

Usually, three interrelated groups of risks affecting the level of energy security are distinguished (Elbassoussy, 2019; Axon & Darton, 2021; Hu et al., 2022).

The first is the violation of state integrity arising as a result of deliberate actions of foreign states.

The second is natural and man-made disasters associated with the lack of fuel and energy resources, aging infrastructure, climate disasters.

The third is the unpredictability of social and economic factors: changes in the preferences of investors and end consumers, structural shifts in the markets of various goods and services, reorientation of export-import flows.

Neutralization of the first group of risks creates the so-called "perspective of sovereignty", which ensures the country's energy independence, the appropriate level of diversification of energy production methods and types of energy carriers in the regional energy balance (energy mix) (Shahzad et al., 2021; Devaraj et al., 2021; Yao, 2014). The goal of neutralization of the second group of risks is the formation of the "strength perspective" of the energy system - its non-destructive ability and physical protection from external influences. The elimination of the third group of risks is aimed at creating a "perspective of stability" of the energy system - first, its ability to function and provide energy needs of the region in conditions of increased uncertainty; secondly, proactive readiness for configuration changes in connection with future challenges and threats. In this case, the concept of "sustainability" takes on a much broader and more complex meaning.

During the study of subjects of energy security, it is customary to distinguish three groups of countries: countries producing energy resources; importing countries; transit countries that receive commercial benefits from the use of their territory for the transit of energy resources. Research on energy security most often focuses on the issue of consumer countries, that is, the second and third groups. They tend to equate energy security with security of energy supply (Winzer, 2012) and energy independence (Hakes, 2015).

In the global transition to carbon neutrality, exporters lose their traditional markets and export revenues, a situation that can be corrected. Exporters also face the need for decarbonization and radical transformation of the energy sector, which requires significant financial resources and technology. Dependence on the import of "green" technologies and services becomes their main threat.

Thus, based on the analysis of theoretical foundations at the current stage of energy market development, the following definition of the country's energy security can be formulated: it is a state of protection of citizens and the economy against the threat of not satisfying reasonable energy needs; ensuring acceptable quality and price under normal conditions and under extraordinary circumstances; ensuring protection against violations of the stability and continuity of fuel and energy supply.

Under normal conditions, the specified state of protection corresponds to the provision of justified (rational) energy needs in full. In emergency situations, this corresponds to the guaranteed supply of the necessary minimum volume of needs.

In this definition, "energy security" is considered as a complex category that expresses the ability of the country's (region's) fuel and energy complex to perform the functions of maintaining stable and economically acceptable prices for energy for all categories of consumers, as well as ensuring: timely and full fulfillment of fuel supply contracts – energy resources for the domestic market in the necessary volume and assortment for the short- and long-term perspective; operational coverage of unplanned fluctuations in demand for PER; continuity of current energy supply and regulatory parameters of energy carriers in real time.

3. Energy transition of Ukraine

Energy transition means the global restructuring of the economy to stop the use of fossil fuels such as coal, oil and gas, which are the main sources of greenhouse gases and cause climate change. This process aims to completely switch to carbon-free technologies and efficient energy consumption. The importance of the energy transition for all countries is to stop climate change, which causes droughts, floods, storms, heat waves and rising sea levels. The basis of this transition is *renewable energy and increased energy efficiency*, contributing to a 90% reduction in greenhouse gas emissions in key sectors, including transport, industry, agriculture, urban development and utilities. These measures are also aimed at solving other critical problems: from ensuring energy security to improving air quality in cities and reducing financial costs of energy.

Analyzing the relevant conditions in the energy sector of Ukraine, three groups of energy transition risks can be identified (Energy Transition, 2023):

I. Technical related to the connection and balancing of "green" capacities. Including:

- *integration of renewable energy sources:* a large share of such renewable energy sources as solar and wind energy can cause problems with the stability of the energy system due to their variability and unpredictability;
- *outdated equipment and infrastructure:* many parts of Ukraine's energy system are outdated, requiring modernization or replacement in order

to effectively integrate new technologies and manage the load from renewable energy sources;

- *energy storage:* insufficient development of energy storage technologies can make it difficult to manage load peaks and variations in energy production from renewable sources;
- *cyber security:* the growing digitalization of the energy infrastructure increases the risks associated with cyber attacks, which can damage control systems and affect the stability of energy supply;
- *dependence on imported technologies:* Ukraine may depend on imported technologies for renewable energy sources, which creates a risk in case of changes in trade policies or global supplies;
- *technical competence:* the need for qualified specialists to manage, maintain and implement the latest technologies in the energy sector, given their complexity and specificity.

II. Economic, related to the lack of predictability in the market, and other factors that affect the economic indicators of the "green" transition, in particular, are:

- *high capital costs:* investments in renewable energy, adaptation of existing infrastructure require significant initial costs. This is an additional financial burden for the state and the private sector, especially in conditions of a limited budget;
- *price volatility in the market:* the transition to renewable energy may lead to changes in the pricing of traditional energy sources, which will potentially affect the country's economy and its dependence on energy imports;
- *instability of subsidies and support:* political and economic uncertainty can lead to changes in government support for renewable energy projects, which creates risks for investors and developers;
- *labor market risk in traditional sectors:* the transition from fossil fuels to renewable energy sources is likely to lead to job losses in sectors dependent on coal, oil and gas;
- *competition in international markets:* integration with the global renewable energy market may face high competition, especially from countries with more advanced technologies and larger scale of production.

III. Legal risks relate mainly to regulatory and legislative aspects that may affect the successful implementation of strategies for the transition to renewable energy and energy efficiency. They include:

- *instability of legislation:* changes in domestic legislation, especially frequent and unpredictable legislative changes, can create uncertainty for investors and companies engaged in projects in the field of renewable energy, which makes it difficult to plan long-term investments;
- *inconsistency of national legislation with international regulations:* in the process of adapting Ukrainian legislation to international standards, legal conflicts may arise;

- *delays in obtaining permits and licenses:* bureaucratic procedures for obtaining the necessary permits and licenses for the implementation of renewable energy projects can complicate doing business and delay the implementation of projects;
- *risks related to land relations,* for example, issues of access to land plots for large-scale renewable energy projects (wind farms or solar plants) can complicate land legislation, property rights and provoke conflicts with local communities;
- *problems regarding the execution of contracts:* the existence of legal and administrative obstacles to the effective execution of contracts, especially in the part of the relationship between the state and private companies, may create risks of shortages, delays in payment or fulfilment of contractual obligations;
- *data and privacy protection:* given the high degree of integration of IT systems in the management of energy resources, the legal aspects of cyber security and data protection acquire great importance, taking into account the vulnerability of systems to possible malicious attacks.

The war in Ukraine further complicated the situation, causing new risks regarding the "green" transition. This created threats not only for existing facilities, but also for projects started earlier. In addition, the accumulation of negative factors may affect the planning of new renewable energy projects in the post-war period.

Therefore, in order to reduce risks and restore the sector, a number of measures need to be implemented using an integrated approach, including improving the legal framework, simplifying administrative procedures and creating transparent and predictable legal conditions for attracting investment and stable work in the renewable energy sector.

In the short term, it is necessary to create conditions for continuing the implementation of projects that were started before the active phase of the war. This concerns the extension of the terms of validity of the technical conditions for connecting these objects to electric networks. In parallel, measures should be developed to minimize economic and legal risks for existing and future projects, which will help ensure market predictability. The overall goal is to prepare for the transition of the electricity market to a competitive state. It is also important to analyze the effectiveness of different mechanisms for both renewable energy and balancing capacities to ensure a balanced development of renewable energy in the power system.

In the medium term, during 2024, in the absence of intensive Russian missile attacks on the energy infrastructure of Ukraine, it is necessary to update the data for modelling the energy system. This will make it possible to develop energy development scenarios, taking into account the updated goals for renewable energy, the conditions for their achievement, in particular through the use of balancing capacities. It is also important to ensure the coordination of all strategic documents with a single target

indicator for the development of "green" electricity. It is necessary to implement measures to create a competitive market, balanced development of renewable energy and achievement of new established goals. All this will contribute to the rapid development of renewable energy projects in the post-war period.

In the long term, starting from 2025, measures aimed at the integration of the electricity markets of Ukraine and the European Union should be implemented. This will provide Ukrainian manufacturers with new opportunities, especially in the context of the growing demand for electricity from renewable sources in connection with the decarbonization policy in EU countries. It is important to synchronize all requirements in accordance with European legislative norms in the energy sector in advance. The establishment of European-style market rules, as well as the expansion of opportunities for the sale of "green" electricity, will significantly increase the investment attractiveness of the renewable energy sector in Ukraine and activate the rapid development of renewable energy projects in the post-war period.

These proposals are aimed at reducing existing risks for renewable energy projects. Under the current conditions associated with the military aggression of the Russian Federation on the territory of Ukraine, it is impossible to completely avoid these risks. However, in cooperation with international partners, Ukraine strives for a "green" recovery in the post-war period. Therefore, it is important to focus on planning and creating appropriate conditions for the harmonious development of "green" electricity in Ukraine.

Conclusions

The problem of energy security is becoming multi-criteria. The level of energy security today is determined not only by the assessment of local technological, ecological, economic, material and technical, managerial, social, political, and legal threats (indicators), but also, which is particularly important, by a new consideration of interdisciplinary connections between them.

In the foreseeable future, the global energy situation will be characterized by: aggressive competition and sharp geopolitical contradictions between the countries that are the largest players in the world energy market; the complication of the supply of the main types of PPE and the increase in its cost; a decrease in the stability of energy supply due to a decrease in dependence on fossil fuels in favor of renewable energy; continued decommissioning of coal-fired thermal power plants and nuclear power plants and, as a result, a sharp increase in the volatility of energy prices.

The principles of ensuring energy security relate to the interpretation of the concept of "energy security", the actualization of climate risks, as well as the main directions of organizational and technical transformations in the power industry. It should be noted that it is inadmissible to isolate the energy

sector from advanced technologies, even if the country is fully equipped with reserves of natural energy resources that make it possible to achieve a sufficient level of energy security in the medium-term future. Advanced technologies include, for example, fossil fuel combustion, nuclear power, renewable energy sources, energy conservation and electrification. Such a policy guarantees the country's energy security in the long term, when the uncertainty of future risks and threats is growing sharply. In addition, it will provide the country with a base for exporting advanced technologies.

In order to get rid of dependence on russian fossil fuels, Ukraine is particularly interested in accelerating the energy ("green") transition, which involves a large-scale reform of the economy to minimize the use of fossil fuels, which are the main source of greenhouse gases and cause climate change. However, this process is accompanied by a number of risks of a technical, economic and legal nature, which were significantly increased by the war.

In a strategic plan, achieving climate neutrality requires changes in the direction of integration of the electricity markets of Ukraine and the European Union, synchronization of requirements in accordance with European legislative norms in the energy sector, as well as expansion of opportunities for the sale of "green" electricity, which will strengthen the investment attractiveness of the renewable energy sector in Ukraine and will ensure the rapid development of renewable energy projects in the post-war period.

REFERENCE	**СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ**
Abdelrahman, Azzuni, Aghahosseini, Ram, Arman, Manish, Bogdanov, Dmitrii, Caldera, Upeksha & Breyer, Christian. (2020). Energy Security Analysis for a 1% Renewable Energy Transition in Jordan by 2050. *Sustainability, 12*(12). https://doi.org/ 10.3390/ su12124921	Abdelrahman, Azzuni, Aghahosseini, Ram, Arman, Manish, Bogdanov, Dmitrii, Caldera, Upeksha & Breyer, Christian. (2020). Energy Security Analysis for a 1% Renewable Energy Transition in Jordan by 2050. *Sustainability, 12*(12). https://doi.org/10.3390/ su12124921
Aisen, Ari, Veiga, & Francisco, Jose. (2011). *How Does Political Instability Affect Economic Growth?* International Monetary Fund. https://www.imf.org/ external/pubs/ft/wp/2011/wp1112.pdf	Aisen, Ari, Veiga, & Francisco, Jose. (2011). *How Does Political Instability Affect Economic Growth?* International Monetary Fund. https://www.imf.org/ external/pubs/ft/wp/2011/wp1112.pdf
Aiyar, Shekhar, Chen, Jiaqian, Ebeke, Christian H., Garcia-Saltos, Roberto, Gudmundsson, Tryggvi, Ilyina, Anna, Kangur, Alvar, Kunaratskul, Tansaya, Rodriguez, Sergio L., & Ruta, Michele. (2023). *Geo-Economic Fragmentation and the Future of Multi-lateralism.* Staff Discussion Notes.	Aiyar, Shekhar, Chen, Jiaqian, Ebeke, Christian H., Garcia-Saltos, Roberto, Gudmundsson, Tryggvi, Ilyina, Anna, Kangur, Alvar, Kunaratskul, Tansaya, Rodriguez, Sergio L., & Ruta, Michele. (2023). *Geo-Economic Fragmentation and the Future of Multi-lateralism.* Staff Discussion Notes.
APERC. (2007). *A Quest for Energy Security in the 21st Century.* Resources and Constraints. https://aperc.or.jp/file/2010/9/26/APERC_2007_A_ Quest_for_Energy_Security.pdf	APERC. (2007). *A Quest for Energy Security in the 21st Century.* Resources and Constraints. https://aperc.or.jp/file/2010/9/26/APERC_2007_A_ Quest_for_Energy_Security.pdf
Axon, C. J. & Darton, R. C. (2021). *Sustainability and risk – A review of energy security.* https://doi.org/ 10.1016/j.spc.2021.01.018	Axon, C. J. & Darton, R. C. (2021). *Sustainability and risk – A review of energy security.* https://doi.org/ 10.1016/j.spc.2021.01.018

Ayoo, C. (2020). Towards Energy Security for the Twenty-First Century. *Energy Policy*. https://www.intechopen.com/chapters/71825

Ayoo, C. (2020). Towards Energy Security for the Twenty-First Century. *Energy Policy*. https://www.intechopen.com/chapters/71825

Bailey, Michael A., Anton, Strezhnev, & Erik, Voeten. (2017). Estimating Dynamic State Preferences from United Nations Voting Data. *Journal of Conflict Resolution*, *61*(2), 430–56. https://doi.org/10.1177/0022002715595700

Bailey, Michael A., Anton, Strezhnev, & Erik, Voeten. (2017). Estimating Dynamic State Preferences from United Nations Voting Data. *Journal of Conflict Resolution*, *61*(2), 430–56. https://doi.org/10.1177/0022002715595700

Baldwin, D. A. (1997). The concept of security. *Rev. Int. Stud. Stud.*, (23), 5–26.

Baldwin, D. A. (1997). The concept of security. *Rev. Int. Stud. Stud.*, (23), 5–26.

Blum, Helcio, & Legey, Lui F. L. (2012). The Challenging Economics of Energy Security: Ensuring Energy enefits in Support to Sustainable Development. *Energy Economics*, *34*(6), 1982–89. https://doi.org/10.1016/j.eneco.2012.08.013

Blum, Helcio, & Legey, Lui F. L. (2012). The Challenging Economics of Energy Security: Ensuring Energy enefits in Support to Sustainable Development. *Energy Economics*, *34*(6), 1982–89. https://doi.org/10.1016/j.eneco.2012.08.013

Cevik, Serhan. (2022). *Climate Change and Energy Security: The Dilemma or Opportunity of the Century?* IMF. https://www.imf.org/ en/Publications/ WP/Issues/2022/09/08/Climate-Change-and-Energy-Security-The-Dilemma-or-Opportunity-of-the-Century-523249

Cevik, Serhan. (2022). *Climate Change and Energy Security: The Dilemma or Opportunity of the Century?* IMF. https://www.imf.org/ en/Publications/ WP/Issues/2022/09/08/Climate-Change-and-Energy-Security-The-Dilemma-or-Opportunity-of-the-Century-523249

Cherp, A., & Jewell, J. (2011). The three perspectives on energy security: Intellectual history, disciplinary roots and the potential for integration. *Curr. Opin. Environ. Sustain*, (3), 202–212.

Cherp, A., & Jewell, J. (2011). The three perspectives on energy security: Intellectual history, disciplinary roots and the potential for integration. *Curr. Opin. Environ. Sustain*, (3), 202–212.

Cherp, A., & Jewell, J. (2016). *The concept of energy security: Beyond the four As.* https://doi.org/10.1016/j.enpol.2014.09.005

Cherp, A., & Jewell, J. (2016). *The concept of energy security: Beyond the four As.* https://doi.org/10.1016/j.enpol.2014.09.005

Cohen, G., Frederick, J., & Prakash, Loungani. (2011). Measuring Energy Security: Trends in the Diversification of Oil and Natural as Supplies. *Energy Policy*, *39*(9), 4860–69. https://doi.org/10.1016/j.enpol.2011.06.034

Cohen, G., Frederick, J., & Prakash, Loungani. (2011). Measuring Energy Security: Trends in the Diversification of Oil and Natural as Supplies. *Energy Policy*, *39*(9), 4860–69. https://doi.org/10.1016/j.enpol.2011.06.034

Cox, E. (2014). Assessing the Future Security of the UK Electricity System in a Low-Carbon Context. In *Proceedings of the BIEE 14th Academic Conference*. Oxford, UK, 17–18 September. https://www.biee.org/wp-content/uploads/Cox-Assessing-the-future-security-of-the-UK-electricity-system.pdf

Cox, E. (2014). Assessing the Future Security of the UK Electricity System in a Low-Carbon Context. In *Proceedings of the BIEE 14th Academic Conference*. Oxford, UK, 17–18 September. https://www.biee.org/wp-content/uploads/Cox-Assessing-the-future-security-of-the-UK-electricity-system.pdf

Deese, D. A. (1979). Energy: Economics, Politics, and Security. *Int. Secur.*, (4), 140–153.

Deese, D. A. (1979). Energy: Economics, Politics, and Security. *Int. Secur.*, (4), 140–153.

Devaraj, D., Syron, E., & Donnellan, P. (2021). Diversification of gas sources to improve security of supply using an integrated Multiple Criteria Decision Making approach. *Clean. Responsible Consum.*

Devaraj, D., Syron, E., & Donnellan, P. (2021). Diversification of gas sources to improve security of supply using an integrated Multiple Criteria Decision Making approach. *Clean. Responsible Consum.*

EIU. (2022). *Democracy Index 2021: The China Challenge.* https://www.eiu. com/n/campaigns/democracy-index-2021

EIU. (2022). *Democracy Index 2021: The China Challenge.* https://www.eiu. com/n/campaigns/democracy-index-2021

Elbassoussy, A. (2019). European energy security dilemma: major challenges and confrontation strategies. *Review of Economics and Political Science*, *4*(4), 321–343. https://doi.org/10.1108/ REPS-02-2019-0019

Elbassoussy, A. (2019). European energy security dilemma: major challenges and confrontation strategies. *Review of Economics and Political Science*, *4*(4), 321–343. https://doi.org/10.1108/ REPS-02-2019-0019

Energy transition. (2023). *The electricity market from RES: what hinders it and how to help it?* https://energytransition.in.ua/rynok-elektroenerhii-z-vde-shcho-zavazhaie-ta-iak-tsomu-zaradyty	Енергетичний перехід. (2023). *Ринок електроенергії з ВДЕ: що заважає та, як цьому зарадити?* https://energytransition.in.ua/rynok-elektroenerhii-z-vde-shcho-zavazhaie-ta-iak-tsomu-zaradyty
Florin, M.-V. (2016). *Resilience to Unexpected Impacts of Emerging Risks in IRGC's Recommendations for Emerging Risk Governance.* https://irgc.org/wp-content/uploads/2018/09/Florin-Resilience-in-IRGCs-Recommendations-for-Risk-Governance-1.pdf	Florin, M.-V. (2016). *Resilience to Unexpected Impacts of Emerging Risks in IRGC's Recommendations for Emerging Risk Governance.* https://irgc.org/wp-content/uploads/2018/09/Florin-Resilience-in-IRGCs-Recommendations-for-Risk-Governance-1.pdf
Freedom House. (2022). *Freedom in the World 2 22 Methodology.* https://freedomhouse.org/sites/default/files/2022-02/FIW_2022_Methodology_For_Web.pdf	Freedom House. (2022). *Freedom in the World 2 22 Methodology.* https://freedomhouse.org/sites/default/files/2022-02/FIW_2022_Methodology_For_Web.pdf
Gökgöz, Fazıl, & Güvercin, Mustafa Taylan. (2018). Energy Security and Renewable Energy Efficiency in EU. *Renewable and Sustainable Energy Reviews*, (96), 226–39. https://doi.org/10.1016/j.rser.2018.07.046	Gökgöz, Fazıl, & Güvercin, Mustafa Taylan. (2018). Energy Security and Renewable Energy Efficiency in EU. *Renewable and Sustainable Energy Reviews*, (96), 226–39. https://doi.org/ 10.1016/j.rser.2018.07.046
Gupta, Eshita. (2008). Oil Vulnerability Index of Oil-Importing Countries. *Energy Policy*, *36*(3), 1195–1211. https://doi.org/10.1016/j.enpol. 2007.11.011	Gupta, Eshita. (2008). Oil Vulnerability Index of Oil-Importing Countries. *Energy Policy*, *36*(3), 1195–1211. https://doi.org/10.1016/j.enpol. 2007.11.011
Hakes, J. (2015). *A Declaration of Energy Independence.* Wiley: Hoboken, NJ, USA.	Hakes, J. (2015). *A Declaration of Energy Independence.* Wiley: Hoboken, NJ, USA.
Harvard Dataverse. (n. d.). https://dataverse.harvard.edu/dataverse/Voeten	Harvard Dataverse. (n. d.). https://dataverse.harvard.edu/dataverse/Voeten
Hu, G., Yang, J., & Li, J. (2022). *The Dynamic Evolution of Global Energy Security and Geopolitical Games: 1995~2019.* https://doi.org/10.3390/ijerph192114584	Hu, G., Yang, J., & Li, J. (2022). *The Dynamic Evolution of Global Energy Security and Geopolitical Games: 1995~2019.* https://doi.org/10.3390/ijerph192114584
IEA. (2019*a*). *The Future of Hydrogen. Seizing Today's Opportunities.* https://iea.blob.core.windows.net/assets/9e3a3493-b9a6-4b7d-b499-7ca48e357561/The_ Future_of_Hydrogen.pdf	IEA. (2019*a*). *The Future of Hydrogen. Seizing Today's Opportunities.* https://iea.blob.core.windows.net/assets/9e3a3493-b9a6-4b7d-b499-7ca48e357561/The_ Future_of_Hydrogen.pdf
IEA. (2019*b*). *Global Gas Security Review 2019.* Paris: International Energy Agency. https://www.iea.org/reports/global-gas-security-review-2019	IEA. (2019*b*). *Global Gas Security Review 2019.* Paris: International Energy Agency. https://www.iea.org/reports/global-gas-security-review-2019
IEA. (n. d. *a*). *Energy Security: Reliable, affordable access to all fuels and energy sources.* https://www.iea.org/topics/energy-security	IEA. (n. d. *a*). *Energy Security: Reliable, affordable access to all fuels and energy sources.* https://www.iea.org/topics/energy-security
IEA. (n. d. *b*). *International Energy Agency, World Energy Balances.* https://www.iea.org/data-and-statistics/data-product/world-energy-balances#energy-balances	IEA. (n. d. *b*). *International Energy Agency, World Energy Balances.* https://www.iea.org/data-and-statistics/data-product/world-energy-balances#energy-balances
Ilyenko, A. S. (2019). *Energy security of Ukraine: essence, threats and mechanisms of regulation.* https://doi.org/10.32838/2663-6468/2019.4/11	Ільєнко, А. С. (2019). *Енергетична безпека України: сутність, загрози та механізми регулювання.* https://doi.org/10.32838/2663-6468/2019.4/11
IMF. (2023). *International Monetary Fund Research. Chapter 4 Geoeconomic Fragmentation and Foreign Direct Investment.* World Economic Outlook, April. A Rocky Recovery. International Monetary Fund. https://www.elibrary.imf.org/display/book/9798400224119/CH004.xml	IMF. (2023). *International Monetary Fund Research. Chapter 4 Geoeconomic Fragmentation and Foreign Direct Investment.* World Economic Outlook, April. A Rocky Recovery. International Monetary Fund. https://www.elibrary.imf.org/display/book/9798400224119/CH004.xml

Ketterer, Janina C. (2014). The Impact of Wind Power generation on the Electricity Price in Germany. *Energy Economics*, (44), 270–80. https://doi.org/10.1016/j.eneco.2014.04.003

Kim, Jaden, Panton, Augustus J., & Schwerhoff, Gregor. (2024). *Energy Security and The Green Transition*. International Monetary Fund.

Kogut, S. (2023). *Modern trends in the development of global energy and energy security of Ukraine.* https://doi.org/10.31891/mdes/2023-10-10

Le Coq, Chloé, & Elena, Paltseva. (2009). Measuring the Security of External Energy Supply in the European Union. *Energy Policy*, *37*(11), 4474–81. https://doi.org/10.1016/j.enpol.2009.05.069

Månsson, A., Johansson, B., & Nilsson, L. J. (2014). Assessing energy security: An overview of commonly used methodologies. *Energy*, 1–14.

Moriarty, P., & Honnery, D. (2022). Renewable Energy and Energy Reductions or Solar Geoengineering for Climate Change Mitigation? *Energies*. https://www.mdpi.com/1996-1073/15/19/7315

PRS Group. (2018). *ICR Methodology.* https://www.prsgroup.com/wp-content/uploads/2014/08/icrgmethodology.pdf

Rintamäki, Tuomas, Siddiqui, Afal S., & Salo, Ahti. (2017). Does Renewable Energy Generation Decrease the Volatility of Electricity Prices? An Analysis of Denmark and Germany. *Energy Economics*, (62), 270–82. https://doi.org/10.1016/j.eneco.2016.12.019

Shahzad, U., Yulan Lv., Buhari, D. B. & Xia, W. (2021). *Unveiling the heterogeneous impacts of export product diversification on renewable energy consumption: New evidence from G-7 and E-7 countries.* https://doi.org/10.1016/j.renene.2020.10.143

Smil, V. (2010). *Energy Transitions: History, Requirements, Prospects.* Praeger: Oxford, UK. https://www.environmentandsociety.org/mml/energy-transitions-history-requirements-prospects

Sovacool, B. K., & Mukherjee, I. (2011). Conceptualizing and measuring energy security: A synthesized approach. *Energy*, (36), 5343–55.

Sukhodolya, O., Kharazishvili, Yu., & Ryabtsev, G. (2023). *Energy security of Ukraine: a perspective model of risk management.* https://doi.org/10.53679/NISS-book.2023.01

Willrich, Mason. (1976). International Energy Issues and Options. *Annual Review of Energy*, *1*(1). 742–743. https://doi.org/10.1146/annurev.eg.01.110176.003523

Winzer, C. (2012). Conceptualizing Energy Security. *Energy Policy*, (46), 36–48.

Ketterer, Janina C. (2014). The Impact of Wind Power generation on the Electricity Price in Germany. *Energy Economics*, (44), 270–80. https://doi.org/10.1016/j.eneco.2014.04.003

Kim, Jaden, Panton, Augustus J., & Schwerhoff, Gregor. (2024). *Energy Security and The Green Transition*. International Monetary Fund.

Когут, С. (2023). *Сучасні тенденції розвитку світової енергетики та енергетичної безпеки України.* https://doi.org/10.31891/mdes/2023-10-10

Le Coq, Chloé, & Elena, Paltseva. (2009). Measuring the Security of External Energy Supply in the European Union. *Energy Policy*, *37*(11), 4474–81. https://doi.org/10.1016/j.enpol.2009.05.069

Månsson, A., Johansson, B., & Nilsson, L. J. (2014). Assessing energy security: An overview of commonly used methodologies. *Energy*, 1–14.

Moriarty, P., & Honnery, D. (2022). Renewable Energy and Energy Reductions or Solar Geoengineering for Climate Change Mitigation? *Energies*. https://www.mdpi.com/1996-1073/15/19/7315

PRS Group. (2018). *ICR Methodology.* https://www.prsgroup.com/wp-content/uploads/2014/08/icrgmethodology.pdf

Rintamäki, Tuomas, Siddiqui, Afal S., & Salo, Ahti. (2017). Does Renewable Energy Generation Decrease the Volatility of Electricity Prices? An Analysis of Denmark and Germany. *Energy Economics*, (62), 270–82. https://doi.org/10.1016/j.eneco.2016.12.019

Shahzad, U., Yulan Lv., Buhari, D. B. & Xia, W. (2021). *Unveiling the heterogeneous impacts of export product diversification on renewable energy consumption: New evidence from G-7 and E-7 countries.* https://doi.org/10.1016/j.renene.2020.10.143

Smil, V. (2010). *Energy Transitions: History, Requirements, Prospects.* Praeger: Oxford, UK. https://www.environmentandsociety.org/mml/energy-transitions-history-requirements-prospects

Sovacool, B. K., & Mukherjee, I. (2011). Conceptualizing and measuring energy security: A synthesized approach. *Energy*, (36), 5343–55.

Суходоля, О., Харазішвілі, Ю., & Рябцев, Г. (2023). *Енергетична безпека України: перспективна модель управління ризиками.* https://doi.org/10.53679/NISS-book.2023.01

Willrich, Mason. (1976). International Energy Issues and Options. *Annual Review of Energy*, *1*(1). 742–743. https://doi.org/10.1146/annurev.eg.01.110176.003523

Winzer, C. (2012). Conceptualizing Energy Security. *Energy Policy*, (46), 36–48.

Winzer, C. (2012). *Conceptualizing Energy Security.* https://doi.org/10.1016/j.enpol.2012.02.067	Winzer, C. (2012). *Conceptualizing Energy Security.* https://doi.org/10.1016/j.enpol.2012.02.067
Wolf, A. & Zander, N. (2021). Green Hydrogen in Europe: Do Strategies Meet Expectations? *Intereconomics*, (56), 316–323.	Wolf, A. & Zander, N. (2021). Green Hydrogen in Europe: Do Strategies Meet Expectations? *Intereconomics,* (56), 316–323.
Yao, L. (2014). *Energy Security in China: The Impact of Domestic Policies and Reforms.* https://www.witpress.com/Secure/elibrary/papers/EQ14/EQ14023FU1.pdf	Yao, L. (2014). *Energy Security in China: The Impact of Domestic Policies and Reforms.* https://www.witpress.com/Secure/elibrary/papers/EQ14/EQ14023FU1.pdf

Conflict of interest. The authors certify that don't they have no financial or non-financial interest in the subject matter or materials discussed in this manuscript; the authors have no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript. Given that the authors are affiliated with the institution that publishes this journal, which may cause potential conflict or suspicion of bias and therefore the final decision to publish this article (including the reviewers and editors) is made by the members of the Editorial Board who are not the employees of this institution.

The authors received no direct funding for this study.

The contribution of the authors is equal

Mazaraki A., Melnyk T. Energy security: new challenges and global trends. *Scientia Fructuosa*. 2024. № 3. P. 4–22. https://doi.org/10.31617/1.2024(155)01

Received by the editorial office 29.04.2024.
Arrived after revision 10.05.2024.
Accepted for printing 15.05.2024.
Published online 11.06.2024.

DOI: 10.31617/1.2024(155)02
UDK: 620.9:338.27=111

LEBEDEVA Larysa,
PhD (Economics), Associate Professor,
Associate Professor of the Department
of Economics and Competition Policy
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0001-8632-5460
l.lebedeva@knute.edu.ua

SHKUROPADSKA Diana,
PhD (Economics),
Senior Lecturer of the Department
of Economics and Competition Policy
State University
of Trade and Economics,
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0002-6883-711X
diana.shkuropadska2016@knute.edu.ua

DETERMINANTS OF ENERGY SYSTEM RESILIENCE

The importance of energy resilience for the EU countries and Ukraine in the context of geopolitical conflicts and challenges caused by Russian aggression is emphasized. The author emphasizes the need to modernize energy networks, continuous monitoring and analysis of the energy situation. The purpose of the study was to identify the factors that influence energy resilience and the state policy of energy system resilience. It is hypothesized that in times of crisis, state regulation, in particular support for diversified energy sources, construction of efficient energy infrastructure, risk management systems and transparent regulatory policies, play an important role in ensuring the resilience of the energy system. To achieve the aim of the research, a complex of general scientific and special methods were used such as historical and logical; analyzing factors of energy resilience, statistical aggregation and comparison are used in compiling and analyzing energy resilience indices. Based on such indicators of energy resilience as The Global Energy Vulnerability Index and The Energy Sovereignty Index, the vulnerabilities of the energy systems of the EU and Ukraine are assessed and their path to energy independence is outlined. The analysis revealed a significant dependence of the EU countries on energy imports, which affects their self-sufficiency, while noting progress in

ЛЕБЕДЕВА Лариса,
к. е. н., доцент, доцент кафедри
економічної теорії та конкурентної політики
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0001-8632-5460
l.lebedeva@knute.edu.ua

ШКУРОПАДСЬКА Діана,
доктор філософії (Економіка),
старший викладач кафедри економічної теорії
та конкурентної політики
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0002-6883-711X
diana.shkuropadska2016@knute.edu.ua

ДЕТЕРМІНАНТИ СТІЙКОСТІ ЕНЕРГОСИСТЕМ

Зазначено важливість енергетичної стійкості для країн ЄС та України в умовах геополітичних конфліктів і викликів, спричинених російською агресією. Підкреслено необхідність модернізації енергетичних мереж, постійного моніторингу та аналізу енергетичної ситуації. Метою дослідження стало визначення факторів, що впливають на енергетичну стійкість і державну політику стійкості енергосистем. Висунуто гіпотезу, що у часи кризи державне регулювання, зокрема підтримка диверсифікованих джерел енергії, будівництво ефективної енергетичної інфраструктури, системи управління ризиками та прозора регуляторна політика, відіграє важливу роль у забезпеченні стійкості енергетичної системи. Для досягнення мети дослідження використано комплекс загальнонаукових і спеціальних методів: історичний та логічний – під час аналізу факторів енергетичної стійкості; статистичне агрегування та порівняння – для складання й аналізу індексів енергетичної стійкості. На основі таких показників енергетичної стійкості, як The Global Energy Vulnerability Index та The Energy Sovereignty Index, оцінено вразливості енергосистем країн ЄС і України та окреслено їх шлях до енергетичної незалежності. За результатами аналізу виявлено відчутну залежність країн ЄС від імпорту енергії, що впливає на показники

renewable energy, particularly in Denmark, Finland, and Sweden. Ukraine's position in this ranking is quite low and comparable to European countries such as Slovakia, Poland, and Lithuania, which is a consequence of its dependence on energy imports, as well as low economic resilience and energy efficiency. Most EU countries have achieved their performance targets by applying holistic approaches to energy security. The factors affectting energy resilience are identified, including geopolitical conflicts, availability of energy resources, reliable infrastructure, monitoring and risk management systems, energy efficient technologies, and transparent regulatory policies. The author emphasizes Ukraine's decision to harmonize its energy policy with the EU principles, which provides for the update of the Energy Strategy of Ukraine to ensure resilient economic development and climate neutrality by 2050.

Keywords: energy resilience, European Union, energy crisis, energy sector, russian-ukrainian war.

самозабезпечення, водночас відзначено прогрес у відновлюваній енергетиці, зокрема в Данії, Фінляндії та Швеції. Позиція України в цьому рейтингу досить низька і може бути порівняна з такими європейськими країнами, як Словаччина, Польща і Литва, що є наслідком залежності від імпорту енергії, а також низької економічної стабільності та енергоефективності. Цільові показники ефективності досягнуті більшістю країн ЄС завдяки застосуванню цілісних підходів до енергетичної безпеки. Визначено фактори, що впливають на енергетичну стійкість, зокрема геополітичні конфлікти, наявність енергетичних ресурсів, надійна інфраструктура, системи моніторингу та управління ризиками, енергоефективні технології й прозора регуляторна політика. Підкреслено рішення України узгодити власну енергетичну політику з принципами ЄС, що передбачає оновлення Енергетичної стратегії України для забезпечення сталого економічного розвитку та кліматичної нейтральності до 2050 р.

Ключові слова: енергетична стійкість, Європейський Союз, енергетична криза, енергетичний сектор, російсько-українська війна.

JEL Classification: F40, F52, H56, L94, O19, P33, Q42, Q43, Q48.

Introduction

Energy systems produce, process, convert, transport, store, and distribute primary or secondary energy to meet the demands of economic activities (Hughes, 2012). Power systems are essential elements of national economies that facilitate economic activity. Reliable electricity grids are vital for ensuring the smooth operation of economies as any power fluctuations and blackouts can lead to economic losses. Thus, the resilience of energy systems to external volatility defines the future development in any economy.

As it can be seen from the history of economic development, the energy systems are susceptible to shock influences. The examples are the energy crisis of the 1970s, 2008 financial crisis and disturbances on the crude oil market in 2014, 2020 COVID-19 fluctuations that have affected the energy prices. Energy policy has always been a geopolitical issue, and this has become even more evident with Russia's war against Ukraine. In response to Russia's invasion of Ukraine, Western countries imposed sanctions against Russia. The Kremlin, taking advantage of the dependence of the EU countries on Russian gas, partially cut off its supply, which caused an energy crisis and provoked inflation. Thus, maintaining the functioning of an energy system is critical for energy governance and macroeconomic policy in the face of external shocks or disturbances (Jesse et al., 2019; Lebedeva & Moskalenko, 2021).

Ukrainian and foreign researchers are actively studying the problem of ensuring energy system resilience. To the research of aspects of Ukraine's energy system resilience and formulating of strategy of its development as

well as other institutional aspects of development Heyets et al. (2020), Gerasymenko et al. (2022), Jesse et al. (2019), Boiko et al. (2022), Saukh (2018), Kulyk et al. (2017), Mazaraki, Melnyk (2024), Fedulova (2013), Halushchenko (2014) and others have devoted their studies. The works of Hughes (2012) is dedicated to the study of description and analysis of energy security in an energy system. A. Ranjan and L. Hughes, studied relationship between energy security and the diversity of an energy system's energy flows (Ranjan & Hughes, 2014). The most discussed topic among the scholars is the measurement of energy system resilience (Gatto & Drago, 2020; Fan et al., 2023a). To the measurement metrics of economic resilience for interdependent infrastructure, Pant et al. dedicated their work (Pant et al., 2014). Kharrazi investigated the resilience of global energy systems through an examination of a diversity measure of global embodied electricity trade and came to conclusion that secure and responsible consumption requires the diversification of not only energy generation but also energy imports (Kharrazi et al., 2015). It is also stated that the enhancement of the resilience of energy system by energy transition, infrastructure improvement, and research and development investment can contribute to economic sustainability because it mitigates the energy shocks and thus protects the productive foundation of an economic system (Fan et al., 2023*b*). D. Dumitrescu et al. stating that replacing fossil fuels in electricity generation with low-carbon sources, in particular wind researched the energy policy of the EU and its implications for economic development and hydro, is a beneficial path to achieve decarbonisation while also decreasing the EU's reliance on foreign oil and gas (Dumitrescu et al., 2023). Therefore, although many problematic aspects of energy resilience have already been revealed in the scientific literature, the issue of structuring and identifying factors influencing the resilience of energy systems in the EU and Ukraine, especially during times of armed conflict, requires further identification. This became the focus of the present study.

The aim of the research is to find significant factors influencing the EU and Ukraine energy resilience during russian-ukrainian war and government policies that helped to promote it. The hypothesis of the article is that in times of crisis, state regulation, in particular the support of diversified energy sources, building of efficient energy infrastructure, risk management systems and transparent regulatory policy play a vital role in ensuring energy system's resilience.

To fulfil of the research aim, a combination of general scientific and specialized methods were employed: the historical and logical approach to classification and understating the concept of energy system resilience; statistical aggregation and comparison for assessing the indexes of energy resilience within the EU; the logical method for practical recommendations to increase energy system resilience.

The research is divided into three parts. The concept of energy system resilience is presented in the first part. An assessment of energy resilience in EU and Ukraine is provided in the second. The practical recommendations to increase energy system resilience are proposed in the final third part.

1. The concept of energy system resilience

In economic literature, various understandings of energy system resilience can be found. Generally, the resilience of an energy system is the ability of an energy system to retain, react, overcome and overpass perturbations caused by a shock in economic, social, environmental and institutional terms, coming from the learning capacity to adapt to change (Gatto and Drago, 2020). The resilience of energy systems is also a specific to energy-economy systems, and its determinants include energy diversity, infrastructure, research and development (R&D), and governance (Fan et al., 2023*a*).

The UN (United Nations) 2030 Agenda emphasizes the development goal of "universal access to affordable, reliable, sustainable and modern energy" by enhancing the resilience of energy systems (UNECE, 2023). In the *Table 1* approaches to definition of energy system resilience by different organizations are presented.

Table 1

Approaches to understanding the resilience concept in the energy sector

Organisation	The essence
Cabinet of Ministers of Ukraine	The resilience of the energy sector's functioning is the ability of the energy sector to function normally, to adapt to constantly changing conditions, to withstand and quickly recover from threats of any kind (Cabinet of Ministers of Ukraine, 2021)
Ministry of Energy and Coal Industry of Ukraine	The resilience of the energy system is the ability to return to a stable mode after various types of disturbances without switching to an asynchronous mode, that is, to maintain synchronism between power plants. Resilience of energy systems is defined as static and dynamic. Static resilience is the ability of power systems to return to a steady state after small disturbances, in which the changes in parameters are very small compared to their average values. Dynamic resilience is the ability of power systems to return to a stable mode after significant disturbances (short circuit, disconnection of any element of the power system, sudden occurrence of an emergency power imbalance, etc.) (Ministry of Energy and Coal Industry of Ukraine, 2012)
Siemens	Resilience of energy infrastructure – the ability of electricity supply networks to anticipate, respond quickly, adapt and recover from threats of any kind through rapid, targeted and effective action directed at physical and digital infrastructure (Siemens, 2019)
United States Department of Energy	Energy resilience is the ability of the grid, buildings, and communities to withstand and rapidly recover from power outages and continue operating with electricity, heating, cooling, ventilation, and other energy-dependent services (United States Department of Energy, 2023)
United Nations Economic Commission for Europe	A resilient energy system is one where energy makes an optimal contribution to a country's social, economic, and environmental development, and that is able to withstand and recover quickly from any unanticipated shocks and reflects potential impacts of climate change on energy resources in its planning and operations (UNECE, 2023)

End the Table

Organisation	The essence
Enel North America	Energy resilience is the ability to ensure a reliable energy supply to maintain operations, even at times of grid disruption, like in the case of a power outage. Energy resilience is becoming an essential organizational priority across all industries to protect operations against extended power outages (Enel North America, 2023)
Union of the Electricity Industry	Energy resilience is the ability to avoid, prepare for, minimise, adapt to, and recover from anticipated and unanticipated energy disruptions in order to ensure energy availability and reliability that evolves maintaining a consistent supply of energy despite disruptions, whether they stem from natural disasters, cyberattacks, geopolitical tensions, or other unforeseen circumstances (Union of the Electricity Industry, 2023)

Source: compiled by authors.

The main component of the protection of the power supply system is to ensure its resilience. More resilient power supply networks have a greater ability to maintain operational efficiency in destructive conditions, reduce their impact and accelerate recovery. The resilience of power supply networks increases or decreases with the weakest (most vulnerable) component of the system. It is extremely important to identify all potential risk factors, predict accidents and provide preventive protection measures for the entire system (*Figure 1*).

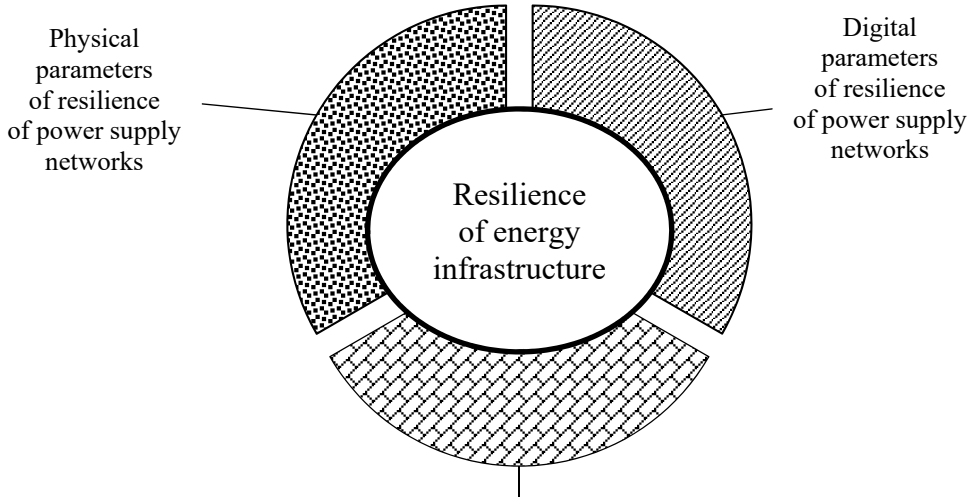


Figure 1. A comprehensive approach to ensuring the resilience of power supply systems

Source: compiled by the authors based on data (Siemens, 2019).

The physical parameters of the resilience of power supply networks include such elements as access protection and presence detection in all premises, as well as bulletproof transformer protection systems that can be

installed on new and existing systems. It also includes protection of the structure itself from damage caused by natural influences, such as floods, storms, earthquakes, lightning strikes and geomagnetic storms. Another integral part of the increased resistance to physical influences is the current control of the condition. Continuous assessment of nominal and actual values in dynamics allows to detect wear at an early stage and to take measures in advance – even before destruction becomes probable.

Since the very beginning of the introduction of digital technologies, power supply systems have evolved from relatively autonomous, simple networks to complex intelligent infrastructures, vulnerable to accidents of a natural and man-made nature at various levels. The need to address issues ranging from the potential risks associated with these inevitable processes, including climate change, the growing adoption of distributed power systems, and the sharp rise in vandalism in some countries, necessitates resilience in terms of operation, optimization and designing the entire power supply system of the future.

Without the consistent implementation of digital technologies, it is impossible to meet modern requirements for the automation of power supply systems. However, given the current changes, which are characterized by increasing dynamism, flexibility and changing roles of various involved parties, the implementation of digital technologies implies the need to take into account new risks in terms of reliability. Ensuring energy resilience requires the use of modern methods and technologies of digital protection – from continuous analysis of the state of risk associated with ensuring information security, prevention of unauthorized access and third-party interference to protection against human factors and technical errors, as well as network failures.

The coherence and intelligent interaction of all power supply system components is the central element of sustainable power supply networks. It involves systematic protection against internal and external risks of all parameters, starting from the first stage of designing the power supply system of one size or another; the company applies the appropriate level of reservation, as well as specially designed rapid response services (Siemens, 2019).

It is impossible to exclude various incidents in power supply networks completely. However, resilient power systems can anticipate and mitigate the effects of such disruptive events, adapt to them, and quickly recover from an accident. In the USA, for example, the following groups of measures are distinguished, which are formed according to different stages of the cycle of response to the emergence of a crisis situation. Emergency reaction includes four phases: Preparedness, Mitigation, Response, and Recovery (National Institute for Strategic Studies, 2023). The phase of Preparedness includes planning of: energy system protection according to the defined level of

threats / dangers; interaction plans of the involved entities and response plans; personnel training; exchange of information on best practices; analysis of the security situation and risk assessment. The Mitigation phase includes such actions as: modernization of energy facilities and equipment renewal in accordance with the identified threats and consequences of their influence (risks); reservation of systems; plans for replacement of damaged equipment, lost resources or functions; accumulation of own stocks and reserves. To the Response phase are included: use of project forces and resources in accordance with defined response threats plans; usage of additional forces and resources (local, regional, central and international); analysis of the situation and coordination of response; decision on the temporary restoration of the provision of functions / services. The Recovery phase includes such actions as: replacement / repair of energy system equipment; measures to restore full functioning, taking into account increased resilience in the future and new technological opportunities.

2. An assessment of energy infrastructure resilience

As of the end of 2023 there was USD 8.8 billion of assessment of the damage caused to the Ukrainian energy infrastructure due to the full-scale war that increases daily as these attacks continue. Since the beginning of the full-scale invasion, more than 270 Russian missiles have hit Ukrainian energy facilities. As a result, about 50% of Ukraine's energy facilities were damaged or completely destroyed, 27.5% of electricity production was lost. Namely the loses of NPP are 28%, TPP 35%, RES 36%, CHP 32% and other types of generation gained 11.4% (Top Lead, 2023).

On June 6, 2023, the Russian occupiers blew up the Kakhovka hydroelectric power station with a capacity of more than 300 MW. In the month after the detonation, Ukraine lost about 14.4 km^3 of water, which is 35% of the annual flow rate of the Dnipro River. Many settlements were under water, several regions were left without energy and water supply. The explosion of the Kakhovka HPP also had a significant impact on the environment. PJSC "Ukrhydroenergo" estimates the damage from the explosion of the Kakhovsky hydroelectric plant at more than EUR 2.5 billion, another EUR 500 million of damages were caused by Russian rocket and drone attacks on the company's facilities (Ukrhydroenergo, 2024).

War changed the EU energy policies. Russia's invasion of Ukraine has forced Europe to urgently reduce its dependence on Russian natural gas and oil imports and thus accelerated the deployment of renewable energy (*Figure 2*) (Top Lead, 2023). So, the EU renewable capacity in terms of solar energy increased by 39.5% and wind energy by 4.3% in 2023 compared to 2021 that is one of the crucial factors in energy systems resilience.

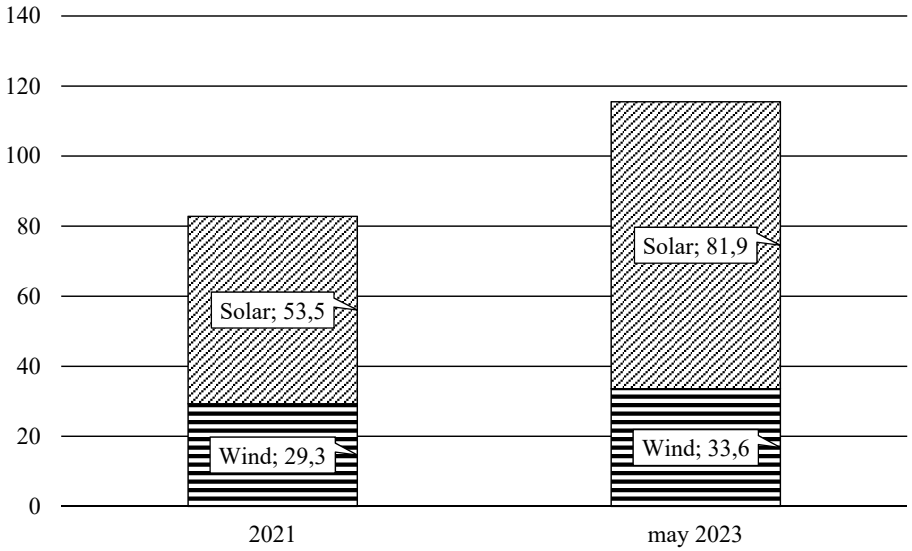


Figure 2. EU renewables capacity, GW

Source: (Top Lead, 2023).

The Global Energy Vulnerability Index is one of the tools for assessing the resilience of a country's energy infrastructure. The Global Energy Vulnerability Index seeks to evaluate the susceptibility of individual countries to energy shocks, identifying both the obstacles they encounter and the prospects they have to bolster their energy resilience. Factors such as substantial energy self-reliance, a varied energy portfolio, ample energy accessibility and efficiency, and economic prosperity contribute to a nation's ability to withstand potential energy market disruptions. Conversely, significant reliance on external energy sources and fossil fuels, inadequate infrastructure development, limited access to capital, and weak economic stability erode countries' energy resilience (Euromonitor International, 2023).

The Global Energy Vulnerability Index takes into account various aspects that affect the resilience of a country's energy system and its ability to overcome potential crisis situations. Euromonitor International used six groups of indicators to measure each country's level of energy vulnerability (Euromonitor International, 2023):

- Energy self-sufficiency (30% of total score (TS);
- Alternatives to fossils (35% TS);
- Energy reserves potential (10% TS);
- Energy accessibility (5% TS);
- Energy efficiency (10% TS);
- Economic stability (10% TS).

Index is ranged from 1 to 100 with the lowest points representing lesser vulnerability and higher points – greater. The results of the Global Energy Vulnerability Index for European Union member states and Ukraine represented in *Table 2*.

Table 2

Ukraine and EU member states in Global Energy Vulnerability Index, 2023

Country	Final rank	Energy self-sufficiency	Alterna-tives to fossils	Energy reserves potential	Energy accessi-bility	Energy efficiency	Econo-mic stability
Sweden	7	42	1	60	6	14	16
Romania	13	53	9	18	58	30	53
Denmark	15	57	29	25	38	7	18
Slovenia	16	56	5	60	23	20	26
Germany	18	74	12	38	26	9	20
Finland	23	67	3	60	9	38	19
France	24	49	15	58	17	19	33
Spain	29	71	7	52	32	25	37
Italy	37	77	43	31	44	13	24
Nether-lands	41	72	54	45	28	11	6
Croatia	45	62	26	60	50	29	38
Bulgaria	47	59	24	54	27	66	44
Portugal	50	79	22	60	43	15	35
Czech Republic	54	61	47	57	20	49	31
Hungary	55	66	41	49	53	41	32
Latvia	58	58	48	60	60	32	34
Estonia	63	40	70	60	36	34	36
Belgium	65	91	38	60	16	27	25
Greece	67	84	46	53	41	16	56
Ireland	70	94	61	60	29	1	15
Slovakia	72	82	34	60	37	52	28
Ukraine	77	45	55	35	54	100	91
Poland	78	65	78	36	45	43	45
Lithuania	90	93	75	60	73	24	40

Source: compiled by the authors according to (Euromonitor International, 2023).

The top 10 EU countries according to the Global Energy Vulnerability Index are Sweden, Romania, Denmark, Slovenia, Germany, Finland, France, Spain, Italy and the Netherlands. It must be mentioned that globally compared to Norway, Canada, Australia and the USA that rank at the top of the index due to their strong energy self-sufficiency, the EU countries have higher reliance on the energy imports. That is why the lack in the energy self-sufficiency pillar of the Index that greatly undermines the final scores of EU countries. Among the European Union countries, Sweden has the highest rank in the g Global Energy Vulnerability Index. It is due to it is high position in the alternatives to fossils pillar, high-energy accessibility, energy efficiency and economic stability. Finland and Spain have also high ranks in alternatives to fossils pillars, as well as energy accessibility, which give them high scores in the index. However, the Netherlands, Spain, Germany and Italy remain heavily dependent on energy imports that greatly undermine their rank. Therefore, as analysis shows we can conclude that the energy

sources diversification and the availability of own energy resources are among the main factors of energy system resilience.

Ukraine's rank is quite low in this index and close to such European countries as Slovakia, Poland, and Lithuania that is due to the dependency upon the energy imports, as well as a low economic stability and energy efficiency.

Russia's full-scale invasion of Ukraine prompted the European Union and its member states to reconsider the imperative of bolstering their energy sovereignty. The energy crisis in Europe commenced in 2021, following a prolonged cold winter that depleted natural gas reserves. Apprehensions about scarce supplies escalated as Russia reduced gas exports to Europe, allegedly as a coercive measure to push for the approval of the Nord Stream 2 pipeline, particularly in Germany. By the summer of 2022, European gas prices soared, exceeding EUR 300 per MWh, exacerbated by Russia's further reduction of gas supplies after the invasion of Ukraine, leveraging its gas reserves as a geopolitical tool (Forbes, 2024).

Energy sovereignty is important for ensuring the country's energy resilience, contributing to its independence in energy matters and reducing risks associated with energy crises and fluctuations in world markets. The Energy Sovereignty Index (ESI) is a tool that allows determining the level of energy independence of a country and its ability to meet its needs in energy resources. The energy sovereignty index includes four components: energy cleanness (the share of renewables and fossil fuels in the energy mix), energy independence (dependence on energy imports), energy efficiency (domestic energy demand compared with actual use), and narrative (the depth and breadth of energy sovereignty discourse within EU member states) (ECFR, 2023).

The index is graded on a scale ranging from 0 to 10. The outcomes are categorized as follows: scores up to 5.4 are classified as "failing"; those between 5.5 and 7.0 are "satisfactory"; scores falling within the range of 7.1 to 8.4 are considered "good"; those between 8.5 and 9.4 are "very good"; and scores of 9.5 or higher are characterized as "excellent" (ECFR, 2023). Based on the countries' overall scores, the index identifies four groups of countries – Laggards (Failing), Dependent achievers (Satisfactory), Emerging sovereigntists (Good), and Independent decarbonisers (Very good) – with regard to their overall energy sovereignty (ECFR, 2023).

Among European Union countries in 2023 the "very good" results has only one country – Denmark. "Good" results have four countries such as Estonia, Finland, Romania and Sweden. The "satisfactory" results have grease Greece, Croatia, Latvia, Austria, Spain, Czech Republic, Netherlands, Portugal, Slovenia, Germany, Cyprus, Italy, Luxembourg, Bulgaria, France, and Poland. The "failing" have – Ireland, Belgium, Slovakia, Hungary, Lithuania, and Malta.

The results of the Energy Sovereignty Index for European Union member states represented in *Table 3*.

Table 3

EU member states in Energy Sovereignty Index, 2023

Position	Country	Index	Cleanness	Independence	Efficiency	Narrative
1	Denmark	8.5	10.0	7.6	8.4	7.0
2	Estonia	8.3	8.0	9.5	8.3	5.5
3	Finland	8.0	9.6	5.7	8.8	7.5
4	Romania	7.7	6.2	7.7	10.0	5.5
5	Sweden	7.6	10.0	7.9	5.8	5.0
6	Greece	6.7	7.4	2.3	10.0	7.5
7	Croatia	6.5	8.1	2.9	8.4	6.5
8	Latvia	6.4	8.4	0.9	9.3	8.0
9	Austria	6.3	9.4	3.2	5.6	8.0
10	Spain	6.3	7.6	2.5	8.6	6.5
11	Czech Republic	6.2	4.9	5.9	7.5	7.0
12	Netherlands	6.2	7.6	2.6	7.5	8.5
13	Portugal	6.2	7.9	1.4	8.9	8.0
14	Slovenia	6.1	6.9	3.0	8.6	5.5
15	Germany	5.9	7.6	3.7	5.9	7.5
16	Cyprus	5.8	6.7	2.5	7.3	8.5
17	Italy	5.7	5.6	2.0	8.9	7.5
18	Luxembourg	5.6	8.3	0.0	7.8	7.5
19	Bulgaria	5.5	6.1	6.4	4.2	5.0
20	France	5.5	7.4	2.3	6.6	6.5
21	Poland	5.5	5.2	5.4	5.4	6.5
22	Ireland	5.3	6.9	2.5	6.6	5.5
23	Belgium	5.0	7.4	2.5	4.9	6.0
24	Slovakia	5.0	5.5	2.8	6.0	7.5
25	Hungary	4.8	4.9	2.5	6.7	6.0
26	Lithuania	4.6	8.4	0.1	4.0	9.0
27	Malta	4.1	2.2	1.1	8.0	7.5
EU average		6.1	7.2	3.6	7.3	6.9

Source: compiled by the authors according to (ECFR, 2023).

According to the Energy Sovereignty Index, the European union countries lack behind in the Energy independence with EU-wide average score at mere 3.6 out of 10. The lowest scores in this category have such countries as Greece, Latvia, Spain, Portugal, Cyprus, Luxembourg, Italy, Malta and Lithuania. European union countries have a progress in the European Energy Cleanness category with the EU-wide average score at 7.3 thanks to the growing renewable energy sector, the top performers here are Denmark, Finland, Sweden Austria, the lowest performer in this category is Malta with 2.2. With the category of Efficiency, the EU hits its own energy efficiency targets for 2020. In this category 16 countries score above 7, only three countries make it past 9, Greece and Romania are at the top and Lithuania lags behind. In the Narrative category that shows the depth and breadth of energy security approach (including efficient monitoring systems) such countries as Cypress, Finland, Greece, Lithuania, Luxembourg, the Netherlands, Portugal, and Slovakia have adopted a holistic approach at

building the national energy security. Their policy takes into account not only the security of energy supply, but also climate goals and energy efficiency. So, the results of the analysis confirm the significance of diversified energy sources, efficient energy infrastructure, monitoring and risk management systems as the factors of energy system resilience.

To assess the energy resilience of a state, it is important to analyse the indicator of energy intensity. The analysis of energy intensity can be used to analyse the level of resource utilization efficiency. For example, high-energy intensity signifies inefficient use of energy and resources. High-energy intensity can also indicate a high dependency of a state on energy resources. If a country uses a lot of energy to produce one unit of output, it becomes more vulnerable to fluctuations in resource prices or supply issues. A high level of energy intensity also indicates significant energy expenditures in production and consumption. The dynamics of energy intensity by EU countries from 2013 to 2022 are presented in *Figure 3*.

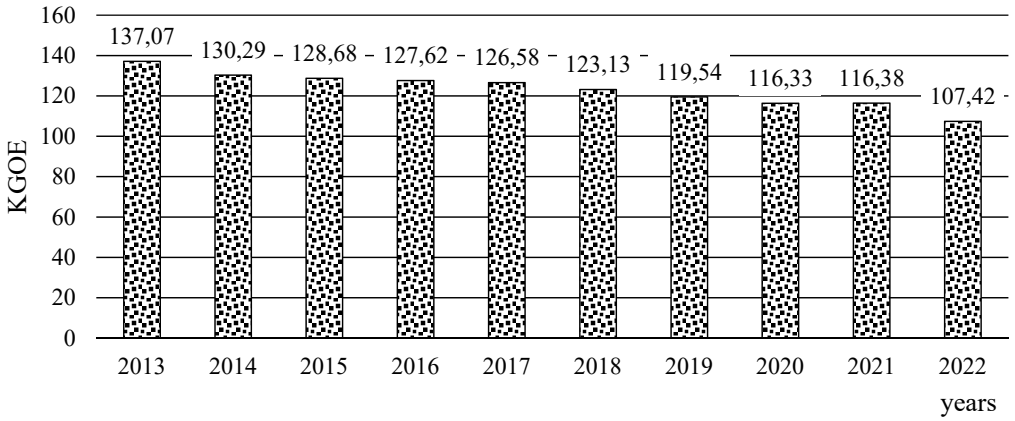


Figure 3. Energy intensity by EU countries in 2013–2022

Source: (Euroststat, n. d.).

Energy intensity is measured in kilograms of oil equivalent (KGOE) per thousand euros. From 2013 to 2022, the energy intensity of EU countries decreased by 29.65 KGOE. In recent years, the European Commission has been making significant efforts to reduce the energy intensity of member countries by implementing advanced technologies, energy efficiency programs, and promoting the use of renewable energy sources, which contributes to enhancing energy resilience.

3. Practical aspects to ensure energy system resilience

Increasing the resilience of the energy system of the EU countries requires a comprehensive approach and consideration at several levels, including infrastructural, technological, regulatory and strategic aspects. It is worth highlighting practical measures that ensure increased resilience of the EU energy system that form factors influencing the energy resilience of the country.

Geopolitical conflicts and the lack of diversified sources of energy. Reducing dependence on specific energy sources (such as coal or gas) through the development of renewable energy sources such as solar, wind, hydropower and biomass reduces the risk of crisis situations due to changes in fuel prices or geopolitical conflicts (Dinu et al., 2023).

The availability of own energy resources or reliable sources of energy supply from other sources (for example, import contracts). Development of network connections between countries that enables equalization of fluctuations in energy production and consumption, which increases the resilience of the system and provides more reliable access to energy.

A reliable and efficient energy infrastructure, including power plants, transmission and distribution networks as well as energy storage. There is the use of energy storage technologies such as batteries, mechanical storage or thermal storage systems that helps to smooth out fluctuations in energy production and consumption.

Monitoring and risk management systems help to identify potential threats to energy resilience and take timely measures to prevent or mitigate them. The introduction of modern energy system management technologies, such as monitoring and automation systems, that allows more effective response to changes in energy consumption and management of energy distribution in the network.

Decreasing energy consumption with the help of energy-efficient technologies and investments in green energy.

Quality and transparent regulatory policy in the energy sector promotes resilience and attracts investment in infrastructure development. Transparent regulatory policy in energy sector will attract new investment and boost economic growth.

These practical measures are implemented both as in individual countries as in European Union in general through joint programs and initiatives to increase the resilience of the energy system.

As associated member of EU Ukraine has made a decision to join European community that practically mean adjusting the governmental policies to the EU rules, in terms of energy policy it means adjusting to EU Energy strategy. The mission of the Energy Strategy of Ukraine until 2050 is to create conditions for the sustainable development of the national economy by ensuring access to reliable, sustainable and modern sources of energy and by 2050, the energy sector should be as close as possible to climate neutrality as noted in EU Energy strategy (European Commission, n. d.).

The energy strategy will be based on the target indicators of economic development in accordance with the National Economic Strategy for the period until 2030 and on the international obligations undertaken by Ukraine (Liga 360, 2015):

- achieving the maximum level of climate neutrality;
- maximum reduction of coal use in the energy sector;

- renewal and modernization of energy infrastructure;
- increasing the efficiency of the use of resources in the energy sector;
- comprehensive integration with the markets of the European Union and effective functioning of internal markets;
- providing the energy sector with its own resources, taking into account economic feasibility;
- development of alternative energy sources, new products and innovative solutions in the energy sector.

The Ministry of Energy of Ukraine operates a working group on the organization of humanitarian aid to the energy sector, which collects applications from Ukrainian energy companies regarding their needs, processes and forwards them to partners who are ready to provide appropriate assistance (*Figure 4*). Distribution of the provided materials and equipment is carried out primarily among the regions most affected by Russian aggression.

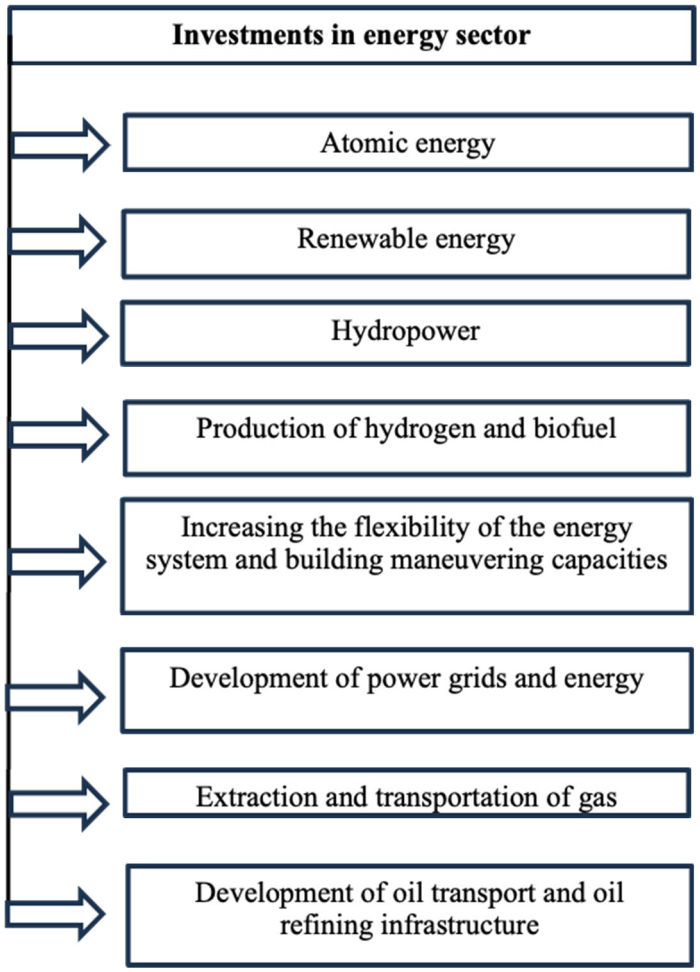


Figure 4. Key directions for investments in the energy sector of Ukraine

Source: (Ministry of Energy of Ukraine, 2022).

In April 2022, on the initiative of the European Commissioner for Energy, Kadri Simson, the Energy Community established the Energy Support Fund of Ukraine. Donors of the Fund are individual states, international companies and organizations. The main task of the Fund is to help energy companies promptly restore damaged or destroyed energy infrastructure as a result of Russian shelling. The funds of the Fund are directed to the purchase of equipment that cannot be provided by international partners in the form of humanitarian aid.

Conclusions

The policy of ensuring energy resilience of the country should be based on the modernization of energy networks, ensuring their reliability and resistance to man-made and natural disasters. Constant monitoring and analysis of the energy situation in the country and at the international level is also necessary. Understanding trends in the field of energy, the dynamics of energy prices and prospects for the development of new technologies will help the country predict risks and respond in time to changes in the global energy arena.

As the result of the research basing on the evaluation of energy resilience indicators, such as The Global Energy Vulnerability Index that ranks EU countries based on their energy vulnerability, we can conclude that EU nations, unlike Norway and Canada, heavily rely on energy imports, affecting their self-sufficiency pillar scores. Sweden leads among EU countries due to its strong performance in alternative energy sources, accessibility, and economic stability. However, countries like Netherlands and Italy struggle due to heavy energy import reliance. Ukraine's low rank, similar to Slovakia and Poland, reflects its energy import dependence and economic instability.

The Energy Sovereignty Index highlights the European Union's path towards energy independence, averaging a score of 3.6 out of 10, with countries like Greece, Spain, and Italy ranking lowest. However, EU nations excel in the European Energy Cleanness category, with Denmark, Finland, and Sweden leading due to their renewable energy advancements. Efficiency targets for 2020 are met by most EU countries, with Greece and Romania excelling, while Cyprus, Finland, and others adopt holistic energy security approaches encompassing supply security, climate goals, and efficiency.

Thus, according to analysis of the energy resilience indicators that prove the article hypothesis, the following factors influencing the energy resilience of the country can be determined:

- Geopolitical conflicts and the lack of diversified sources of energy.
- The availability of own energy resources or reliable sources of energy supply from other sources (for example, import contracts).
- A reliable and efficient energy infrastructure, including power plants, transmission and distribution networks.

- Monitoring and risk management systems that help to identify potential threats to energy resilience and take timely measures to prevent or mitigate them.
- Decreasing energy consumption with the help of energy-efficient technologies.
- Quality and transparent regulatory policy in the energy sector that promotes resilience and attracts investment in infrastructure development.

The analysis conducted highlighted the importance of the aforementioned factors for the resilience of energy systems. Future scientific research will focus on specifying these factors and assessing their impact on the components and overall level of energy resilience in EU and Ukraine.

Ukraine's decision to pursue full membership in the European Union after concluding the Association Agreement signals a significant shift in its development trajectory, necessitating alignment with EU principles and practices, notably in energy policy. The need to update Ukraine's Energy Strategy arises from both its EU aspirations and the challenges posed by energy security threats due to Russian aggression and occupation of certain territories. The updated Energy Strategy until 2050 aims to foster sustainable economic development by ensuring access to reliable, modern energy sources and achieving climate neutrality by prioritizing clean energy and innovation. Key principles guiding this strategy include economic viability, environmental sustainability, accessibility, social equity, and market integration, reflecting Ukraine's commitment to aligning with European standards and values.

REFERENCE	**СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ**
Boiko, A., Umantsiv, Yu., Cherlenjak, I., Prikhodko, V., & Shkuropadska, D. (2022). Policy measures for economic resilience of Visegrad Group and Ukraine during the pandemic. *Problems and Perspectives in Management,* (2), 71–83.	Boiko, A., Umantsiv, Yu., Cherlenjak, I., Prikhodko, V., & Shkuropadska, D. (2022). Policy measures for economic resilience of Visegrad Group and Ukraine during the pandemic. *Problems and Perspectives in Management*, (2), 71–83.
Cabinet of Ministers of Ukraine. (2021, August 4). Order of the Cabinet of Ministers of Ukraine "On Approval of the Energy Security Strategy" [Order No. 907-r].	Кабінет Міністрів України. (2021, 4 серпня). Розпорядження Кабінету Міністрів України "Про схвалення Стратегії енергетичної безпеки" [Розпорядження № 907-р].
Dinu, V., Baciu, L. E., Mortan, M., & Vereș, V. A. (2023). Effect of Economic, Institutional and Cultural Factors on the Implementation of EU Energy Policies. *Amfiteatru Economic*, *25*(63), 306–325.	Dinu, V., Baciu, L. E., Mortan, M., & Vereș, V. A. (2023). Effect of Economic, Institutional and Cultural Factors on the Implementation of EU Energy Policies. *Amfiteatru Economic*, *25*(63), 306–325.
Dumitrescu, D. G., Horobeț, A., Tudor, C. D., & Belaşcu, L. (2023). Renewables and Decarbonization: Implications for Energy Policy in the European Union. *Amfiteatru Economic, 25*(63), 345–361. https://doi.org/10.24818/EA/2023/63/345	Dumitrescu, D. G., Horobeț, A., Tudor, C. D., & Belaşcu, L. (2023). Renewables and Decarbonization: Implications for Energy Policy in the European Union. *Amfiteatru Economic, 25*(63), 345–361. https://doi.org/10.24818/EA/2023/63/345

ECFR. (2023). Energy Sovereignty Index. https://ecfr.eu/special/energy-sovereignty-index	ECFR. (2023). Energy Sovereignty Index. https://ecfr.eu/special/energy-sovereignty-index
Enel North America. (2023). What is energy resilience? https://www.enelnorthamerica.com/insights/blogs/what-is-energy-resilience	Enel North America. (2023). What is energy resilience? https://www.enelnorthamerica.com/insights/blogs/what-is-energy-resilience
Euromonitor International. (2023). *Euromonitor's first-ever Global Energy Vulnerability Index highlights international risk of energy shocks.* https://www.euromonitor.com/press/press-releases/august-2023/euromonitors-first-ever-global-energy-vulnerability-index-highlights-international-risk-of-energy-shocks	Euromonitor International. (2023). *Euromonitor's first-ever Global Energy Vulnerability Index highlights international risk of energy shocks.* https://www.euromonitor.com/press/press-releases/august-2023/euromonitors-first-ever-global-energy-vulnerability-index-highlights-international-risk-of-energy-shocks
European Commission. (n. d.). *EU Energy strategy.* https://energy.ec.europa.eu/topics/energy-strategy_en	European Commission. (n. d.). *EU Energy strategy.* https://energy.ec.europa.eu/topics/energy-strategy_en
Euroststat. (n.d.) Energy intensity. https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ei/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_ind	Eurostat. (n. d.) Energy intensity. https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ei/default/table?lang=en&category=nrg.nrg_quant.nrg_quanta.nrg_ind
Wenrui, F., Wanqing, L., & Zanxin, W. (2023a). How to measure and enhance the resilience of energy systems? *Sustainable Production and Consumption*, (39), 191–202. https://doi.org/10.1016/j.spc.2023.05.015	Wenrui, F., Wanqing, L., & Zanxin, W. (2023a). How to measure and enhance the resilience of energy systems? *Sustainable Production and Consumption*, (39), 191–202. https://doi.org/10.1016/j.spc.2023.05.015
Wenrui, F., Zanxin, W., & Wanqing, L. (2023b). Effects of the resilience of energy systems on economic sustainnability. *Sustainable Production and Consumption*, (41), 379–390. https://doi.org/10.1016/j.spc.2023.08.019	Wenrui, F., Zanxin, W., & Wanqing, L. (2023b). Effects of the resilience of energy systems on economic sustainability. *Sustainable Production and Consumption*, (41), 379–390. https://doi.org/10.1016/j.spc.2023.08.019
Fedulova, S. O. (2023). Ensuring balance between the goals of sustainable development, competitiveness, and energy security. *European Vector of Economic Development*, (2), 113–124.	Федулова, С. О. (2023). Забезпечення балансу між цілями сталого розвитку, конкурентоспроможністю та енергетичною безпекою. *European vector of economic development*, (2), 113–124.
Forbes. (2024). *End of the energy crisis. Gas prices in Europe have fallen to the level of 2021.* https://forbes.ua/news/kinets-energetichnoi-krizi-tsina-na-gaz-u-evropi-vpala-do-pokaznika-2021-roku-23022024-19435	Forbes. (2024). *Кінець енергетичної кризи. Ціна на газ у Європі впала до показника 2021 року.* https://forbes.ua/news/kinets-energetichnoi-krizi-tsina-na-gaz-u-evropi-vpala-do-pokaznika-2021-roku-23022024-19435
Gatto, A., & Drago, C. (2020). Measuring and modeling energy resilience. *Ecological Economics*, (172),106527. https://doi.org/10.1016/j.ecolecon.2019.106527	Gatto, A., & Drago, C. (2020). Measuring and modeling energy resilience. *Ecological Economics*, (172), 106527. https://doi.org/10.1016/j.ecolecon.2019.106527
Gerasymenko, A., Ozhelevskaya, T., Lebedeva, L., & Moskalenko, O. (2022). Agricultural Service Cooperatives in Ukraine: Institutional Development Drivers. *Scientific Horizons*, *25*(6), 89–99. https://sciencehorizon.com.ua/uk/journals/tom-25-6-2022	Gerasymenko, A., Ozhelevskaya, T., Lebedeva, L., & Moskalenko, O. (2022). Agricultural Service Cooperatives in Ukraine: Institutional Development Drivers. *Scientific Horizons*, *25*(6), 89–99. https://sciencehorizon.com.ua/uk/journals/tom-25-6-2022
Halushchenko, I. (2014). Issues in modeling processes of regional energy development. Economic and Mathematical Modeling of Socio-Economic Systems. *Collection of Scientific Papers*, (19), 102–114.	Галущенко, І. (2014). Проблеми моделювання процесів розвитку регіональної енергетики. Економіко-математичне моделювання соціально-економічних систем. *Зб. наук. пр*., (19), 102–114.

Heyets, V. M., Kyrylenko, O. V., Basok, B. I., & Baziiev, Y. T. (2020). Energy Strategy: Forecasts and Realities. *Science and Innovation*, *16*(1), 3–15.	Геєць, В. М., Кириленко, О. В., Басок, Б. І., & Базєєв, Є. Т. (2020). Енергетична стратегія: прогнози і реалії. *Наука та інновації*, *16*(1), 3–15.
Hughes, L. (2012). A generic framework for the description and analysis of energy security in an energy system. *Energy Policy*, (42), 221–231. https://doi.org/10.1016/j.enpol.2011.11.079	Hughes, L. (2012). A generic framework for the description and analysis of energy security in an energy system. *Energy Policy*, (42), 221–231. https://doi.org/10.1016/j.enpol.2011.11.079
Jesse, B. J., Heinrichs, H., & Kuckshinrichs, W. (2019). Adapting the theory of resilience to energy systems: A review and outlook. *Energ Sustain Soc*, *9*(1), 27. https://doi.org/10.1186/s13705-019-0210-7	Jesse, B. J., Heinrichs, H., & Kuckshinrichs, W. (2019). Adapting the theory of resilience to energy systems: A review and outlook. *Energ Sustain Soc*, *9*(1), 27. https://doi.org/10.1186/s13705-019-0210-7
Kharrazi, A., Sato, M., Yarime, M., Nakayama, H., Yu, Y., & Kraines, S. (2015). Examining the resilience of national energy systems: Measurements of diversity in production-based and consumption-based electricity in the globalization of trade networks. *Energy Policy,* (87), 455–464. https://doi.org/10.1016/j.enpol.2015.09.019	Kharrazi, A., Sato, M., Yarime, M., Nakayama, H., Yu, Y., & Kraines, S. (2015). Examining the resilience of national energy systems: Measurements of diversity in production-based and consumption-based electricity in the globalization of trade networks. *Energy Policy,* (87), 455–464. https://doi.org/10.1016/j.enpol.2015.09.019
Kulyk, M. M., Horbulin, V. P., & Kyrylenko, O. V. (2017). *Conceptual Approaches to the Development of Ukraine's Energy Sector (Analytical Materials).* Institute of General Energy of the National Academy of Sciences of Ukraine.	Кулик, М. М., Горбулін, В. П., & Кириленко, О. В. (2017). *Концептуальні підходи до розвитку енергетики України (аналітичні матеріали).* Інститут загальної енергетики НаН України.
Lebedeva, L., & Moskalenko, O. (2021). Impact of the COVID-19 pandemic on the industrial sector: implications for economic policy. *Baltic Journal of Economic Studies*, *7*(5), 114–122. https://doi.org/10.30525/2256-0742/2021-7-5-114-122	Lebedeva, L., & Moskalenko, O. (2021). Impact of the COVID-19 pandemic on the industrial sector: implications for economic policy. *Baltic Journal of Economic Studies*, *7*(5), 114–122. https://doi.org/10.30525/2256-0742/2021-7-5-114-122
Liga 360. (2015). *Project of energy strategy of Ukraine for the period until* 2035. https://ips.ligazakon.net/document/NT1513	Liga 360. (2015). *Project of energy strategy of Ukraine for the period until* 2035. https://ips.ligazakon.net/document/NT1513
Mazaraki, A., & Melnyk, T. (2024). Energy security of the country. *Foreign trade: Economics, Finance, Law*, *133*(2), 4–29. https://doi.org/10.31617/3.2024(133)01	Мазаракі, А., & Мельник, Т. (2024) Енергетична безпека країни. *Зовнішня торгівля: економіка, фінанси, право*, *133*(2), С. 4–29. https://doi.org/10.31617/3.2024(133)01
Ministry of Energy and Coal Industry of Ukraine. (2012, July 23). Order No. 539 On Approval of the Regulatory Document "Energy System Stability. Guidelines". https://online.budstandart.com/ua/catalog/doc-page?id_doc=63832	Міністерство енергетики та вугільної промисловості України. (2012, 23 липня). Наказ № 539 Про затвердження нормативного документа "Стійкість енергосистем. Керівні вказівки". https://online.budstandart.com/ ua/catalog/doc-page?id_doc=63832
Ministry of Energy of Ukraine. (2022). *Energy front.* Retrieved from https://mev.gov.ua/reforma/enerhetychnyy-front	Міністерство енергетики України. (2022). *Енергетичний фронт.* Взято з https://mev.gov.ua/reforma/enerhetychnyy-front
National Institute for Strategic Studies. (2023). *Resilience of critical functions implementation: summarizing Ukraine's experience in responding to the destruction of energy infrastructure.* https://niss.gov.ua/doslidzhennya/natsionalna-bezpeka/stiykist-zdiysnennya-zhyttyevo- vazhlyvykh-funktsiy-uzahalnennya	Національний інститут стратегічних досліджень (2023). *Стійкість здійснення життєво важливих функцій: узагальнення досвіду реагування України на руйнування енергетичної інфраструктури.* https://niss.gov.ua/doslidzhennya/natsionalna-bezpeka/stiykist-zdiysnennya-zhyttyevo-vazhlyvykh-funktsiy-uzahalnennya

Pant, R., Barker, K., & Zobel, C. W. (2014). Static and dynamic metrics of economic resilience for interdependent infrastructure and industry sectors. Reliability *Engineering & System Safety*, (125), 92–102. https://doi.org/10.1016/j.ress.2013.09.007	Pant, R., Barker, K., & Zobel, C. W. (2014). Static and dynamic metrics of economic resilience for interdependent infrastructure and industry sectors. *Reliability Engineering & System Safety*, (125), 92–102. https://doi.org/10.1016/j.ress.2013.09.007
Ranjan, A., & Hughes, L. (2014). Energy security and the diversity of energy flows in an energy system. *Energy*, (73), 137–144. https://doi.org/10.1016/j.energy.2014.05.108	Ranjan, A., & Hughes, L. (2014). Energy security and the diversity of energy flows in an energy system. *Energy,* (73), 137–144. https://doi.org/10.1016/j.energy.2014.05.108
Saukh, S. Y. (2018). Issues of Mathematical Modeling of Competitive Equilibrium in the Electricity Market. *Bulletin of the National Academy of Sciences of Ukraine*, (4), 53–67.	Саух, С. Є. (2018). Проблеми математичного моделювання конкурентної рівноваги на ринку електроенергії. *Вісник НАН України*, (4), 53–67.
Siemens. (2019). The resilience of energy infrastructure. https://www.siemens.com/ua/uk/produkty/enerhetyka/topics/stiykist-enerhetychnoyi-infrastruktury.html	Siemens. (2019). The resilience of energy infrastructure. https://www.siemens.com/ua/uk/produkty/enerhetyka/topics/stiykist-enerhetychnoyi-infrastruktury.html
Top Lead. (2023). *Russia's War on Ukraine: Environmental Impact.* https://www.topleadprojects.com/war-in-ua-environmental-impact-ukr	Top Lead. (2023). *Russia's War on Ukraine: Environmental Impact.* https://www.topleadprojects.com/war-in-ua-environmental-impact-ukr
Ukrhydroenergo. (2024). Ukrhydroenergo estimates losses from Russian attacks at over 3 billion euros [Press release]. https://uhe.gov.ua/media_tsentr/novyny/ukrhidroenerho-otsinyuye-zbytky-vid-rosiyskykh-atak-u-ponad-3-milyardy-yevro	Укргідроенерго. (2024). Укргідроенерго оцінює збитки від російських атак у понад 3 мільярди євро [Прес-реліз]. https://uhe.gov.ua/media_tsentr/novyny/ukrhidroenerho-otsinyuye-zbytky-vid-rosiyskykh-atak-u-ponad-3-milyardy-yevro
UNECE. (2023). *Building Resilient Energy Systems*. https://unece.org/sites/default/files/2023-03/5-pager_EN.pdf	UNECE. (2023). *Building Resilient Energy Systems.* https://unece.org/sites/default/files/2023-03/5-pager_EN.pdf
Union of the Electricity Industry. (2023). *How to strengthen energy resilience in an uncertain world.* https://www.eurelectric.org/in-detail/energy-resilience	Union of the Electricity Industry. (2023). *How to strengthen energy resilience in an uncertain world.* https://www.eurelectric.org/in-detail/energy-resilience
United States Department of Energy. (2023). *Energy resilience.* https://www.energy.gov/eere/energy-resilience	United States Department of Energy. (2023). *Energy resilience.* https://www.energy.gov/eere/energy-resilience

Conflict of interest. The authors certify that don't they have no financial or non-financial interest in the subject matter or materials discussed in this manuscript; the authors have no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript. Given that the authors are affiliated with the institution that publishes this journal, which may cause potential conflict or suspicion of bias and therefore the final decision to publish this article (including the reviewers and editors) is made by the members of the Editorial Board who are not the employees of this institution.

The preparation of the article was financed within the Erasmus+ Jean Monnet project: 101083497 — EUERP — ERASMUS-JMO-2022-HEI-TCH-RSCH "EU Economic Resilience Policy".

The contribution of the authors is equal

Lebedeva L., Shkuropadska D. Determinants of energy system resilience. *Scientia Fructuosa*. 2024. № 3. P. 23–41. https://doi.org/10.31617/1.2024(155)02

Received by the editorial office 12.04.2024.
Arrived after revision 13.05.2024.
Accepted for printing 17.05.2024.
Published online 11.06.2024.

DOI: 10.31617/1.2024(155)03
UDK: 005.93:[004:334.72=111

TSILVIK Oleg,
Master, Postgraduate
Student at the Department
of Management
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0002-6652-7193
o.tsilvik@knute.edu.ua

SYSTEM MANAGEMENT OF E-COMMERCE ENTERPRISES

Modern system management has in its arsenal a number of tools for effective design of enterprise management based on digital technologies and artificial intelligence. The synergy of management subsystems of e-commerce enterprises is able to ensure the formation of the effect of growth of business flexibility to changes in the external environment, optimize business processes and positively influence the behavior of online buyers. The aim of the article is to determine the role of synergistic effects of the management system of e-commerce enterprises in the context of a circular business model. It is hypothesized that the synergistic effects of e-commerce enterprise management should be considered through its analysis as a circular internal system consisting of internal and external subsystems. The circular business model essence of the e-commerce enterprise is substantiated. Conceptual approaches to the content of synergistic management are defined. It is proposed to consider the system management as a circular self-reproducing system that has internal (technological core) and external (organizational superstructure) subsystems. The content of synergistic effects according to the signs of their formation is disclosed. On the basis of a cross-approach to the core and superstructure subsystems, the products of their organic interaction were identified. Through the introduction of technologies based on artificial intelligence (AI) and through a combination with effective management technologies, such

ЦІЛЬВІК Олег,
магістр,
аспірант кафедри менеджменту
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0002-6652-7193
o.tsilvik@knute.edu.ua

СИСТЕМНИЙ МЕНЕДЖМЕНТ ПІДПРИЄМСТВ ЕЛЕКТРОННОЇ КОМЕРЦІЇ

Сучасний системний менеджмент має у своєму арсеналі низку інструментів для ефективного проєктування управління підприємствами на основі цифрових технологій і штучного інтелекту. Синергія підсистем управління підприємств електронної комерції (ПЕК) спроможна забезпечити формування ефекту росту гнучкості бізнесу до зміни умов зовнішнього середовища, оптимізувати бізнес-процеси та позитивно впливати на поведінку онлайн-покупців. Метою статті є визначення ролі синергетичних впливів системи менеджменту підприємств електронної комерції в контексті циркулярної бізнес-моделі. Висунуто гіпотезу, що синергетичні впливи управління ПЕК доцільно розглядати через його аналіз як циркулярної інтернальної системи, яка складається з внутрішніх і зовнішніх підсистем. Обґрунтовано сутність циркулярної бізнес-моделі ПЕК. Визначено концептуальні підходи до змісту синергетичного менеджменту. Запропоновано розглядати системний менеджмент ПЕК як циркулярну самовідтворювану систему, що має внутрішню (технологічне ядро) і зовнішню (організаційна надбудова) підсистеми. Розкрито зміст синергетичних ефектів за ознаками їх формування. На основі перехресного підходу до підсистем ядра й надбудови виявлено продукти їх органічної взаємодії. Шляхом впровадження технологій на основі штучного інтелекту (ШІ) та через поєднання з дієвими управлінськими технологіями такі продукти спроможні формувати

products are able to form synergistic effects that will lead to an improvement in the quality of value propositions, an increase in customer trust, and an increase in turnover and profits. It has been proven that the systematic approach to the e-commerce enterprise management is based on the synergistic interaction of external elements (management of human resources, knowledge, information technologies, financial and monetary relations) and internal elements (management of technical protection systems, data protection of customers, personnel, contractors, website, and databases) subsystems. Deepening the scientific analysis of electronic commerce tools is of practical importance for the development of strategically correct management decisions in view of diversification of risks of loss of market position, reduction of sales volumes and weakening of competitive advantages. Conceptualization of the synergistic effects of the system management will improve the processes of analyzing the field of e-commerce at the macro- and mega-economic levels and forecasting the economic growth of the industry.

Keywords: synergistic effects, synergistic management, circular business model, technological core, organizational superstructure, organic interaction.

синергетичні ефекти, що приведуть до покращення якості ціннісних пропозицій, зростання клієнтської довіри, збільшення товарообороту і прибутків. Доведено, що системний підхід до менеджменту ПЕК ґрунтується на синергетичній взаємодії елементів зовнішньої (управління людськими ресурсами, знаннями, інформаційними технологіями, фінансово-грошовими відносинами) та внутрішньої (управління системами технічного захисту, захисту даних клієнтів, персоналу, контрагентів, вебсайтом, базами даних) підсистем. Поглиблення наукового аналізу інструментарію електронної комерції має практичне значення для розробки стратегічно вірних управлінських рішень з огляду на диверсифікацію ризиків втрати ринкової позиції, скорочення обсягів продажу та послаблення конкурентних переваг. Концептуалізація синергетичних ефектів системного менеджменту ПЕК удосконалить процеси аналізу сфери електронної комерції на макро- та мегаекономічному рівнях і прогнозування економічного зростання галузі.

Ключові слова: синергетичні впливи, синергетичний менеджмент, циркулярна бізнес-модель, технологічне ядро, організаційна надбудова, органічна взаємодія.

JEL Classification: L 29, L 81, D 21, O 32.

Introduction

The transition from the traditional form of business activity in the era of globalization to the electronic one has become a natural technological consequence. This progress has also ushered in a new era of globalization known as "Globalization 4.0" (Motoryn et al., 2021).

In the conditions of globalization and increased competition, the task of permanent improvement and optimization of business models is becoming more urgent for e-commerce enterprises. E-commerce enterprises are involved in the processes of production, distribution, marketing and delivery of goods and services through electronic means, and are developing rapidly thanks to information and technological progress, which provides consumers with direct access to the online market (World Trade Report, 2018). Business processes in e-commerce are based on the processing and transmission of digital information, including texts, sounds and visual data, and system management should contribute to the creation and maintenance of a dynamic and inclusive ecosystem to achieve the goals of sustainable development (E-commerce Strategies, 2018).

E-commerce (EC) is a "subset of e-business" that has a broader definition that, in addition to direct commercial activities, includes business partners, customer support, and job management (Dragomirov, 2020).

Databases, e-mail, non-computer technology in the form of various delivery systems, payment method are additional requirements for EC besides network technologies (Kedah, 2023). Compared with the management of traditional trade enterprises, the goal of e-commerce enterprise management is to reduce the length of the trade cycle, the cost of projects, the equal distribution of information, the reduction of the use of material resources, and the expansion of market niche coverage (Li & Zhang, 2021).

The positive impact of the organization on customer trust and loyalty through the organic combination of subsystems with capital management, personnel, website and technical level of trading platforms in a highly dynamic market environment is able to produce synergistic effects that increase the efficiency of the business model in general (Xue et al., 2022).

Determining the target audience in EC activities is a primary task in developing a successful enterprise strategy, which will make it possible to increase profits and increase the number of potential customers (Freyuk & Fedotov, 2021).

The e-commerce enterprise management system is a complex entity that develops under the influence of internal (forming the internal environment) and external (forming the external environment) factors of the micro and macroeconomic environment. In modern works, management systems are also considered from the standpoint of the influence of internal factors (in particular, training of employees, their creative potential) and external factors: partners, state subsidies, state contracts (Ozen & Ozturk-Kose, 2023).

To move to a self-replicating circular business model, companies must not only be aware of, but also engage in more sustainable practices, rethink and innovate their business processes and the ways in which they deliver value to their customers (Suchek et al., 2021).

In this context, e-commerce enterprise is the best alternative to traditional enterprises and has wider prospects for the introduction of circular models compared to them. Blockchain and IoT technologies have accelerated the growth of e-commerce and the ability to create value through virtual closed supply chains (Prajapati et al., 2022). New information technologies exert a powerful influence on the action of synergistic effects, enhancing the effects of blockchain technology and business process management (Taherdoost & Madanchian, 2023), as well as the synergistic impact of algorithms of intellectual analysis of association rules on EC and the digital economy (Jiang, 2023).

By implementing technological innovations in the management of business processes – processes related to HR, financial operations, information resources, IT support, etc. – e-commerce enterprises form a new ecosystem of financial business, based on the effective management of human resources, increasing the trust of counterparties, improving the quality of financial services and value propositions. As a result, customer loyalty and sales volumes increase. Such a new ecosystem objectively requires a

rethinking of system management, a clear understanding of its structure, which consists of an internal system (technological core, organizational superstructure) and an external environment (*Figure 1*).

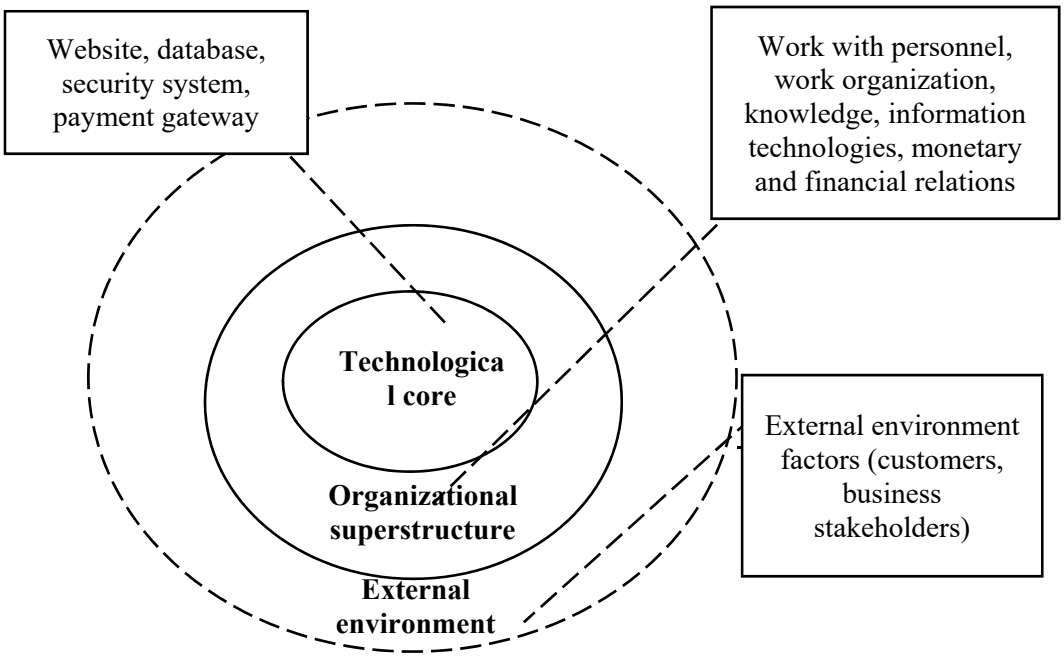


Figure 1. The management ecosystem structure of e-commerce enterprises

Source: compiled by the author.

Synergy is the "holy grail" of any agreement, a separate independent factor of production (Feix, 2020) and coordinated functioning of subsystems, which gives such effects that would be unattainable if they worked independently (Vodyanka & Yaskad, 2012).

In essence, synergy is a redundant concept (Feix, 2020). Synergistic relationships between management subsystems can create difficulties in project profitability management, which requires an analysis of the synergistic impact on the management system of the talent of project managers, consumer behavior, development potential, and material resources (Bai et al., 2023).

With the increasing availability of digital devices and increased access to the Internet, the behavior of online shoppers is changing, they are starting to use multiple devices, so retailers must operate and manage a variety of online channel formats. Along with the individual capabilities of a single online channel, interaction through electronic commerce channels (e-channels) is important in creating a holistic online shopping experience due to the synergy and complementarity effects between electronic channels and their impact on online shopper behavior (Wagner et al., 2013). Therefore, to increase their competitiveness, many dual-channel retailers have begun to apply certain channel synergy strategies (Zhang et al., 2021). According

to Western scholars, managing online stores with more than one electronic channel requires coordinating management subsystems, online distribution (website, mobile applications) and managing channel synergy and complementarity (Wagner et al., 2016).

In some works, the optimization of enterprise business models and productivity in a dynamic business environment is impossible without the synergy of education, science and knowledge management (Sudi et al., 2023). In particular, an integration concept was developed based on the project approach of integrated management systems and the realization of a synergistic effect through a scientific approach to management and the approval of a social model of management.

Depending on the sign (conditions for the emergence of synergistic effects, management strategy), the research on synergistic management can be characterized as multidimensional in approaches to its content. Conceptual analysis revealed among them organizational, digital, market, discount, structural, marketing, scientific and educational (*Table 1*).

Table 1

Conceptual approaches classification of synergistic e-commerce enterprise management essence

Sign	Conceptual approach	The essence of synergistic management
Dynamic connections	Organizational (Hrybyk, 2008; Shevtsova, 2012)	Management of synergistic effects due to the change in the behavior of the management system and the mechanism of self-organization through nonlinear dynamic relationships
The influence of digital technologies	Digital (Blake et al., 2004)	The natural result of the digital transformation of the business model and the increase in the efficiency of business relations
Market share	Market (Garzella & Fiorentino, 2017)	Managing synergies to capture market niches and target mergers and acquisitions.
Discounting of financial flows	Discount (Feix, 2020; Bai et al., 2023)	Determination of the present value of excess financial flows
New structural elements	Structural (Voronkova, 2009; Zeng et al., 2007)	The result of the appearance of new structural elements of the management system
Sales channels	Marketing (Wagner, 2013, 2016; Zeng et al., 2007; Brown & Dant, 2014; Zhang et al., 2021)	Ensuring multi-channel marketing, implementation of sales channel synergy strategies
Exchange of knowledge, scientific theories of management	Scientific and educational (Bashir & Farooq, 2019; Lestari et al., 2020)	Management based on synergy from the exchange of knowledge and scientific methods, which generates management innovations and strengthens the competitive advantages of e-commerce enterprises

Source: compiled and supplemented by the author.

Despite the existence of thorough research within the framework of the mentioned approaches, the analysis of e-commerce enterprise business models in the context of the circular economy needs to be deepened. The aim of the article is to determine the role of synergistic effects of the management system of e-commerce enterprises in the context of a circular business model. The tasks of the research are conceptualization of synergistic management, study of the content of synergistic effects of system management, analysis of synergistic effects of internal and external subsystems of e-commerce enterprise management.

The information base consists of analytical materials of the World Trade Organization, UNCTAD on e-commerce strategies, modern scientific publications, and business analytics materials.

It is hypothesized that the synergistic effects of e-commerce enterprise management should be considered through its analysis as a circular internal system consisting of internal and external subsystems.

The methodology for testing the hypothesis and its algorithm includes the method of structural analysis in the study of synergistic effects of external and internal subsystems of e-commerce enterprise management. On the basis of a cross-approach to the core and superstructure subsystems, the products of their organic interaction were identified.

The content structure of the main part of the article consists of the following elements: a study of the content of synergistic effects of e-commerce enterprise system management in the context of a circular business model; analysis of the synergistic effects of the subsystems of the technological core of the e-commerce enterprise management; analysis of synergistic effects of subsystems of its organizational superstructure.

1. Research on the content of synergistic effects of e-commerce enterprise system management in the context of a circular business model

In the framework of the study, abstracting from the factors of the external environment, attention is focused on the analysis of the management system as an internal circular system consisting of internal subsystems, the basis (processes of optimization of the website, databases, protection system, payment gateway) and external subsystems according to the basis, related to processes in the sphere of monetary and financial, labor relations and the introduction of information technologies into them.

The EC circular business model as a conceptual construction of value creation is based on the self-reproduction of the business system and is aimed at increasing the competitiveness of the value proposition, improving public welfare through the use of fewer materials, energy resources, etc. (Sun et al., 2021).

The circular business model also provides new opportunities for employment, human resource management, fair economic distribution and a

global contribution to the general well-being of society. In such a model, resource use, waste generation, emissions, and energy leaks are minimized by slowing down, closing, and narrowing material and energy cycles (Trifonov et al., 2019).

Since EC differs from traditional commerce in the implementation of commodity and monetary exchange through information technologies and Internet networks, we examine its management system in the context of the crucial role of the information technology component, which allows avoiding direct communications with customers and counterparties in physical space, minimizing resource costs, in particular and time The e-commerce enterprise management system is considered as a circular internal system consisting of a technological core and an organizational superstructure, the functioning of which is aimed at mutual ensuring of efficiency. The technological core is an internal subsystem of website optimization processes, an information protection system, and a database. The organizational superstructure is a subsystem external to the core and represents a set of processes that arise due to organizational and economic relations regarding the effective use of labor, information, and financial resources.

In order to analyze the synergistic effects of system management, a cross-sectional approach is used, according to which it is possible to reveal the effects of the organic interaction of the constituent subsystems of the core and the superstructure (*Figure 2*).

According to our approach, synergistic impact, in contrast to comparable economic, social, environmental effects, which are calculated as the ratio of benefits to costs, is not a quantitative indicator – it is only about the qualitative aggregated impact of synergy. As a result of the optimal combination of system elements, the laid down unique technology of resource use, managerial talent, a synergistic effect occurs that exceeds the simple sum of these elements[1].

Each shown in *Figure 2*, the result of interaction has qualitative indicators of measurement, which is expressed through the criteria of presence at the enterprise and work efficiency (with a maximum value of 100%). The results in the form of knowledge and digital competences can have both a qualitative (the deeper and better the knowledge, the more effective their implementation in business processes) and quantitative (for example, the share of employees with digital knowledge and competences in the total number) expression.

The study of the interaction products of the subsystems of the technological core and the organizational superstructure of management in EC is important for its analysis at the macro- and mega-economic levels and forecasting the economic growth of this industry. The system management

[1] For example, paints are separate elements and their mechanical mixing will not give a result in the form of a picture, notes are separate elements, melody is a musical work, employees in the staff are separate individuals with knowledge and competences, the final intellectual product created as a result of their teamwork and management talent is a manifestation of synergy

of e-commerce enterprises is much more complex compared to traditional enterprises, because its structure is changing due to the strengthening of the role of artificial intelligence and the technological core and the emergence of new effects in the subsystems of the organizational superstructure (see *Figure 2*).

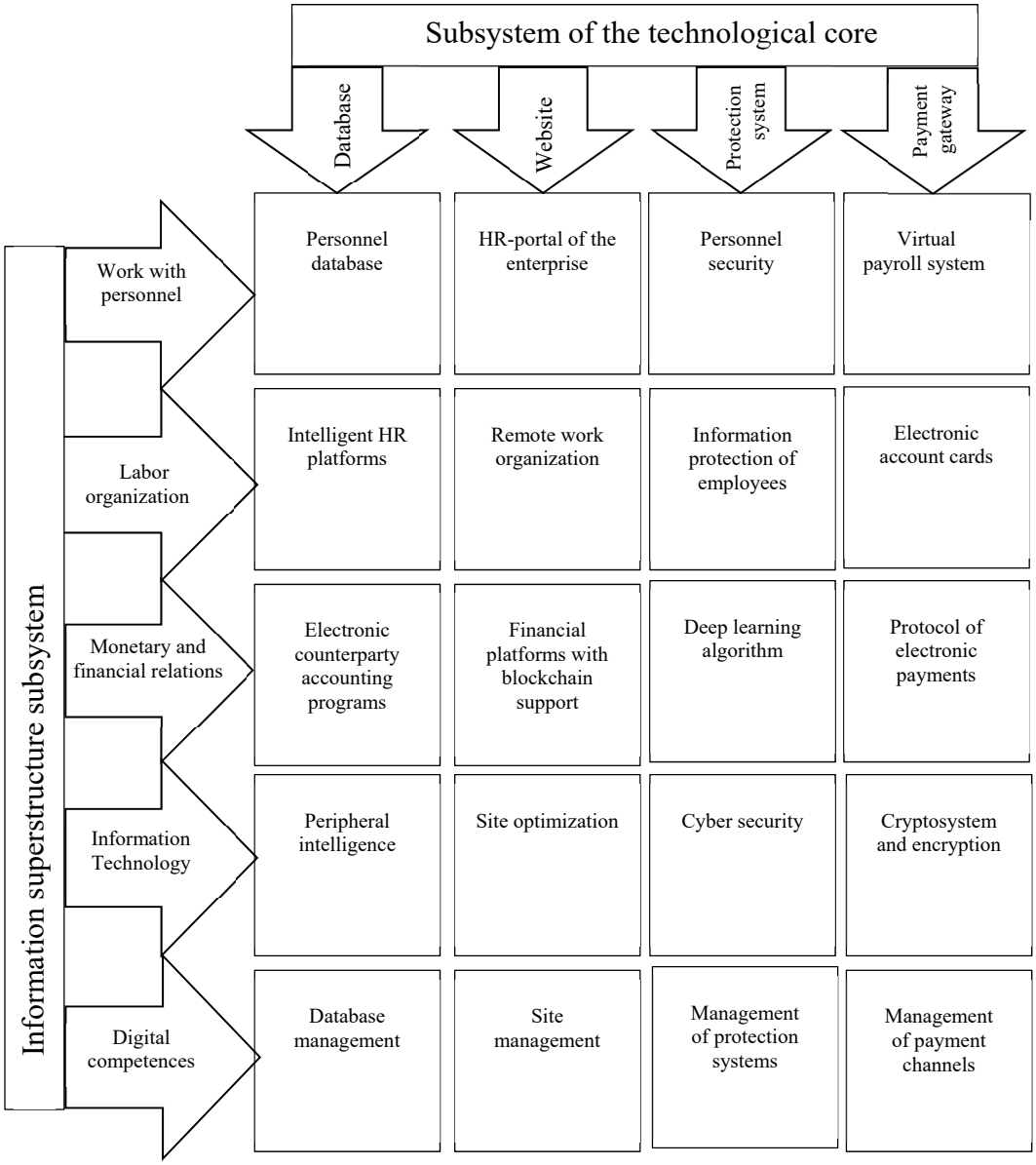


Figure 2. Interaction products of technological core subsystems and the organizational superstructure of the e-commerce enterprise management system

Source: compiled by the author.

The effectiveness of management in each subsystem affects the optimization of the entire e-commerce enterprise business model, therefore, synergistic effects should be taken into account in its management system and adjusted according to the specifics of its business processes and

strategic goals. This approach should minimize the risks of the uncertainty of the external environment and maximize the competitive advantages of the enterprise, create an impetus for the development of e-commerce enterprises thanks to the synergistic effects of system management, preserve and expand its market positions.

2. Synergistic effect analysis of the technological core subsystems of the e-commerce enterprise management

Integrated management solutions for optimization of business processes of e-commerce enterprises should also take into account their internal system elements, which are related to the technological core (see *Figure 2*). The synergy of the productive interaction of such internal subsystems is capable of producing many results. In *figure 3* shows the synergistic effects of the internal management subsystems of an e-commerce enterprise.

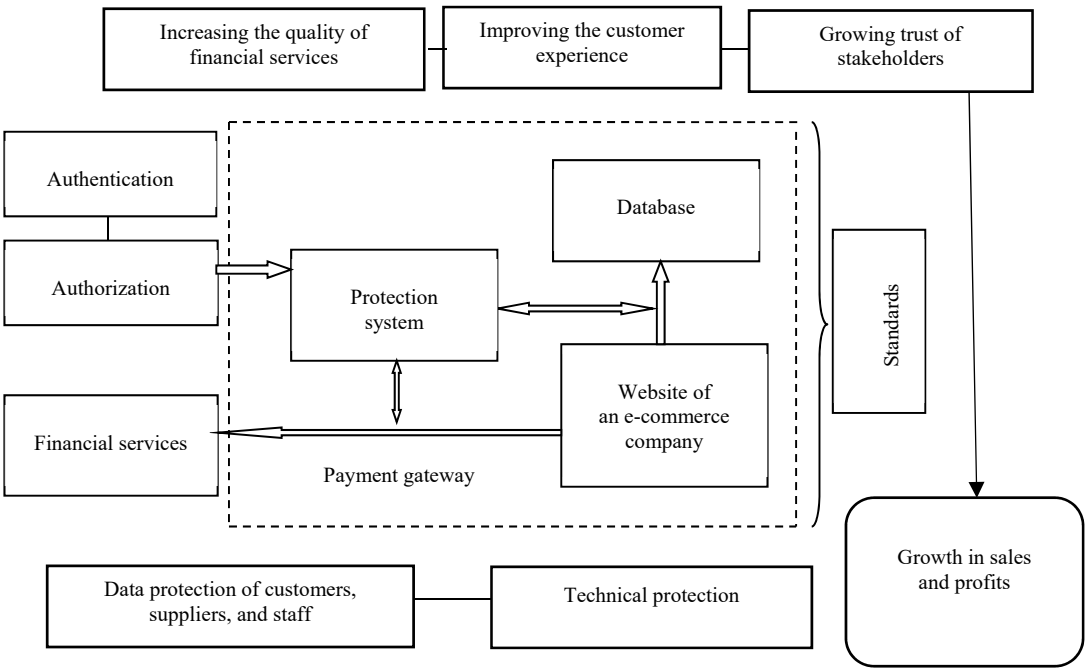


Figure 3. Synergistic effects of internal e-commerce enterprise management subsystems

Source: compiled by the author.

Mechanism of protection system in interaction with databases, website based on standardization through payment gateway tools improves the quality of financial products provided by financial services. The organic interaction of these elements provides simultaneous effects of client, personnel, partner and technical protection.

Protection of personal data, control of big data risks, comfort for customers, partners, contractors and other stakeholders of the EC business model are ensured.

Websites transform electronic catalogs of goods and services; expand customer choice, opportunities for instant purchases, increasing sales and profits. Authorization automates the process of determining the availability of the required amounts of money on client accounts at the prepayment stage. The authentication procedure allows you to verify the identity of the payer and the owner of the payment card. With the help of technical protection, the payment service is tied to the user's phone number and IP address, and encryption protocols minimize the risks of fraud. The complex effect of growth in the quality of financial services, better customer experience and the trust of stakeholders' results are increased in the sales volume and profits of e-commerce enterprises.

3. Synergistic effect analysis of the organizational superstructure subsystems of the e-commerce enterprise management

E-commerce enterprise system management should take advantage of the introduction of modern technologies, in particular based on AI, to organize an effective trade process, manage transactions, take into account the norms of legal regulation and promote the most effective interaction of all involved subjects. Cognitive, in particular, analytical abilities of managers lead to the emergence of a final management decision as a result of the interaction of the management subsystem with executive subsystems. Due to such interaction, the management subjects expect the solution of the current or strategic problem and the achievement of the expected results.

The ability of the e-commerce enterprise management system to produce balanced management decisions depends on the effects of synergy, that is, the aggregated quality products of the interaction of management subsystems, which is much greater than the effect of the action of each subsystem in the form of their simple sum. Awareness of this motivates managers to respond more precisely to any changes in the market space, productively and systematically monitoring the influence of external and internal factors on the management model.

It is worth emphasizing that EC system management involves the implementation of AI-based technologies to achieve a better customer experience, find new customers, effectively manage the supply chain, increase operational efficiency and reduce costs at the same time (Pallathadka et al., 2023).

The organizational structure of the e-commerce enterprise management system includes the following elements: HR management (work with

personnel, planning, organization, work motivation, control, and knowledge management); management of monetary and financial relations – which is implemented through information technologies.

In *Figure 4* shows the synergistic effects of the subsystems of the organizational superstructure of the e-commerce enterprise management.

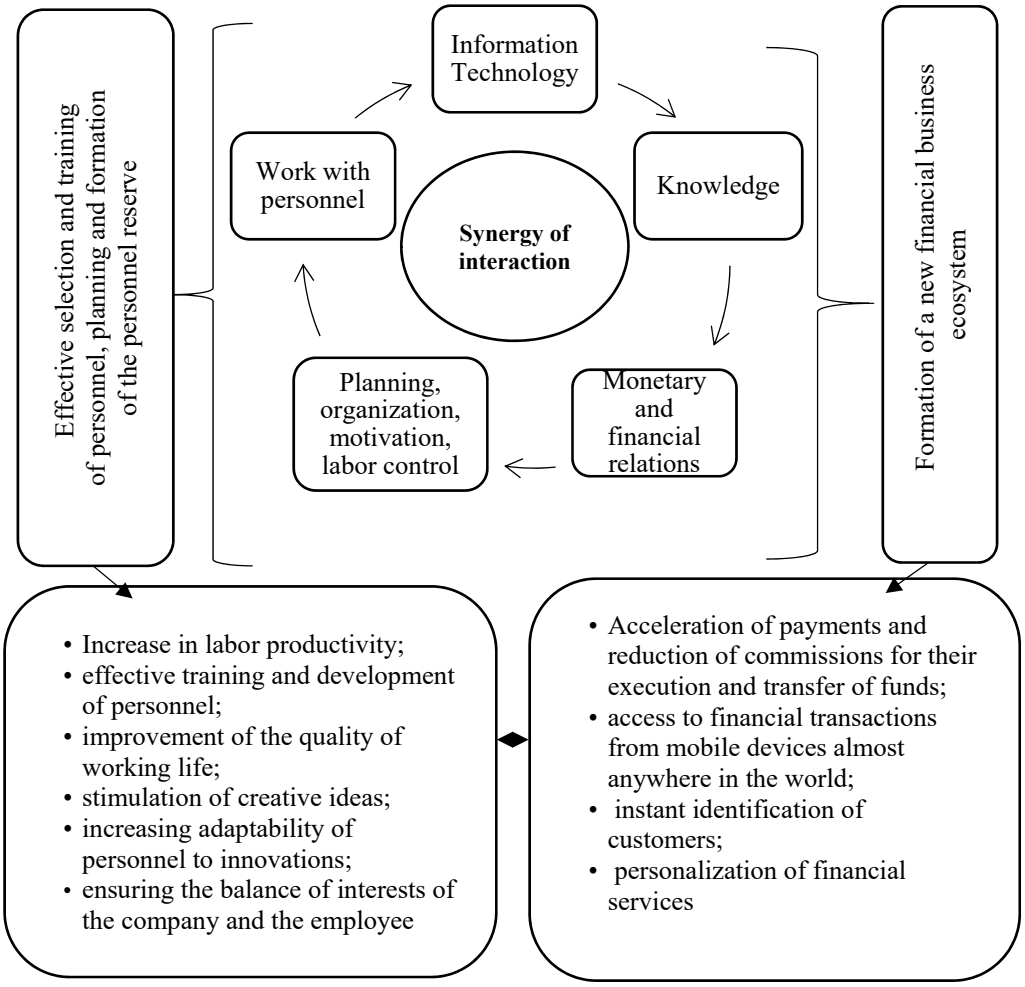


Figure 4. Synergistic effects of the organizational superstructure subsystems of the e-commerce enterprise management

Source: compiled by the author.

In combination with the effect of information technologies, personnel management in EC companies is being improved; new forms of recruitment, training, in particular outsourcing, outstaffing, and leasing, coaching, headhunting of personnel – reach a new and higher level of development. An automated personnel management information system, professionally oriented software and hardware complexes containing new technical tools of digitization and informational organizational forms of human resources management are being formed. In addition, the effectiveness of such

management should entirely depend on the employees' awareness of their own contribution to the overall result and the degree of compliance with the company's goals. Staff motivation should include not only monetary rewards, but also giving them the opportunity to express their own ideas and expectations regarding the implementation of the company's strategic goals.

At the same time, the effectiveness of monetary and financial relations increases through the formation of a new ecosystem of financial business: payments are accelerated, their commission costs are reduced, access to financial transactions from various digital devices is expanded, instant identification of clients and personalization of financial services occurs. AI improves the quality of financial accounting and resource integration of electronic trading platforms. Traditional financial products are rapidly migrating to the Internet, forming a new financial business model of capital movement, electronic payments, online investments and information services.

The synergy of the effects of such improved management of personnel and financial relations ensures greater flexibility of business processes, growth of turnover and, accordingly, profits.

Conclusions

EC's circular business model is based on the principle of self-reproduction and ensures the deepening of the qualitative properties of the value proposition, the achievement of social and environmental effects thanks to the virtualization of business processes and the optimization of the use of resources and technologies.

The hypothesis put forward in the course of the research is confirmed: the approach to the system management of e-commerce enterprises as a circular internal system (technological core and organizational superstructure) contributes to an in-depth analysis of its synergistic effects. The analysis of the source base made it possible to identify seven basic approaches to the synergistic management of EC enterprises: organizational, digital, market, discount, structural, marketing, scientific and educational. Through the cross-method, the products of organic interaction of subsystems of the technological core and the organizational superstructure of the management system were identified: personnel database, HR portal, personnel security, virtual payroll system, intelligent HR platforms, remote work organization, information protection of employees, electronic registration cards, electronic counterparty accounting programs, financial platforms with blockchain support, deep learning algorithms, e-payment protocols, peripheral intelligence, site optimization, cyber security, cryptosystem and encryption, special knowledge and digital competencies in database management, site, security systems, payment channels.

The synergistic effects of the e-commerce enterprises management system are qualitative products of the organic interaction of internal and external management subsystems, which give a much more significant result

than the sum of the effects of the subsystems as such. This is explained by the introduction into management of special management technologies based on managerial talent, information technologies and artificial intelligence.

AI technologies and digital automation of e-commerce enterprise business processes significantly improve the results of managing its labor resources and financial and monetary relations with all stakeholders of the business environment in which the enterprise operates. The synergistic effects produced in the organizational superstructure as a result of the automated management of personnel and finances increase the maneuverability of the management system and its resistance to fluctuations in the external environment, provide better labor productivity and a new, more efficient ecosystem of financial relations. Ultimately, this will contribute to the growth of sales volumes and profits. Synergistic effects in the technological core of the management system – the subsystem of the interaction of databases, the website, protection systems – increase the transparency, speed and quality of financial services, the level of client, personnel, partner and technical protection, improve the client experience, the trust of clients and partners, and also contribute to growth profits in the long term.

The scientific contribution consists in the development of a new conceptual approach to the analysis of synergistic effects in the management of e-commerce enterprises in the context of a circular business model; the practical value of the research results is in the possibility of implementing this approach for the development of management strategies and increasing the efficiency of business process management of e-commerce enterprises.

Prospects for further research are deepening the analysis of the assessment of synergistic effects of the management system of e-commerce enterprises and the development of a criterion approach to their assessment.

REFERENCE	**СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ**
Bai, L., Qu, X., Liu, J., & Han, X. (2023). Analysis of factors influencing project portfolio benefits with synergy considerations. *Engineering, Construction and Architectural Management*, *30*(7), 2691–2715.	Bai, L., Qu, X., Liu, J., & Han, X. (2023). Analysis of factors influencing project portfolio benefits with synergy considerations. *Engineering, Construction and Architectural Management*, *30*(7), 2691–2715.
Bashir, Makhmoor, & Farooq, Rayees. (2019). The synergetic effect of knowledge management and business model innovation on firm competence: A systematic review. *International Journal of Innovation Science*, *11*(3), 362–387.	Bashir, Makhmoor, & Farooq, Rayees. (2019). The synergetic effect of knowledge management and business model innovation on firm competence: A systematic review. *International Journal of Innovation Science*, *11*(3), 362–387.
Blake, M. Brian, Parsons, Simon, & Payne, Terry R. (2004). The synergy of electronic commerce, agents, and semantic Web services. *The Knowledge Engineering Review*, *19*(2), 175–180.	Blake, M. Brian, Parsons, Simon, & Payne, Terry R. (2004). The synergy of electronic commerce, agents, and semantic Web services. *The Knowledge Engineering Review*, *19*(2), 175–180.
Brown, James R., & Dant, Rajiv P. (2014). The role of e-commerce in multi-channel marketing strategy. *Handbook of strategic e-business management*, 467–487.	Brown, James R., & Dant, Rajiv P. (2014). The role of e-commerce in multi-channel marketing strategy. *Handbook of strategic e-business management*, 467–487.

Dragomirov, N. (2020). E-Commerce Platforms and Supply Chain Management–Functionalities Study. *Economic Alternatives*, (2), 250–261.	Dragomirov, N. (2020). E-Commerce Platforms and Supply Chain Management–Functionalities Study. *Economic Alternatives*, (2), 250–261.
E-commerce Strategies. (2018). Retrieved on December 30, 2023, from https://unctad.org/topic/ ecommerce-and-digital-economy/ecommerce-strategies	E-commerce Strategies. (2018). Взято 30 грудня 2023 р. з https://unctad.org/topic/ecommerce-and-digital-economy/ecommerce-strategies
Feix, Thorsten. (2020). Synergy Management. *End-to-End M&A Process Design: Resilient Business Model Innovation*, 245–281.	Feix, Thorsten. (2020). Synergy Management. *End-to-End M&A Process Design: Resilient Business Model Innovation*, 245–281.
Freyuk, O. V., & Fedotov, A. S. (2021). Guide: target audience in E-commerce. In V. O. Bogomolov (Ed.), *Problems and prospects of entrepreneurship development* (pp. 310–311). Kharkiv National Automobile and Road University.	Фреюк, О. В., & Федотов, А. С. (2021). Гайд: цільова аудиторія в E-commerce. У В. О. Богомолов (Ред.), *Проблеми та перспективи розвитку підприємництва* (с. 310–311). Харківський національний автомобільно-дорожній університет.
Garzella, S., & Fiorentino, R. (2017). Synergy Management: From Pitfalls to Value. *Synergy Value and Strategic Management: Inside the Black Box of Mergers and Acquisitions*, 53–81.	Garzella, S., & Fiorentino, R. (2017). Synergy Management: From Pitfalls to Value. *Synergy Value and Strategic Management: Inside the Black Box of Mergers and Acquisitions*, 53-81.
Gribik, I. I., Smolinskaya, N. V., & Girilo, A. M. (2008). Features of corporate culture development on the basis of self-organization and synergy. *Problems of Economics and Management*, Lviv. Polytechnic, (611), 142–147.	Грибик, І. І., Смолінська, Н. В., & Гирило, А. М. (2008). Особливості розвитку корпоративної культури на засадах самоорганізації та синергії. *Проблеми економіки та управління,* Львів. політехніка, (611), 142–147.
Jiang, Y. (2023). The Synergetic Effect of Association Rule Mining Algorithm between E-Commerce and Digital Economy. In *2023 International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE)*, 1–6.	Jiang, Y. (2023). The Synergetic Effect of Association Rule Mining Algorithm between E-Commerce and Digital Economy. In *2023 International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE)*, 1–6.
Kedah, Z. (2023). Use of e-commerce in the world of business. *Startupreneur Business Digital (SABDA Journal)*, *2*(1), 51–60.	Kedah, Z. (2023). Use of e-commerce in the world of business. *Startupreneur Business Digital (SABDA Journal)*, *2*(1), 51–60.
Lestari, S. D., Muhdalih, A, E., & Putra, A. H. P. K. (2020). E-commerce performance based on knowledge management and organizational innovativeness. *Journal of Distribution Science*, *18*(2), 49–58.	Lestari, S. D., Muhdalih, A, E., & Putra, A. H. P. K. (2020). E-commerce performance based on knowledge management and organizational innovativeness. *Journal of Distribution Science*, *18*(2), 49–58.
Li, L., & Zhang, J. (2021). Research and analysis of an enterprise E-commerce marketing system under the big data environment. *Journal of Organizational and End User Computing (JOEUC)*, *33*(6), 1–19.	Li, L., & Zhang, J. (2021). Research and analysis of an enterprise E-commerce marketing system under the big data environment. *Journal of Organizational and End User Computing (JOEUC)*, *33*(6), 1–19.
Motoryn, R., Shlyusarchyk, B., & Zheglen, P. (2021). E-commerce in the era of globalization. *Scientia fructuosa*, *136*(2), 67–78.	Моторин, Р., Шлюсарчик, Б., & Жеглен, П. (2021). E-commerce in the era of globalization. *Scientia fructuosa*, *136*(2), 67–78.
Ozen, Ozlem, & Ozturk-Kose, Ebru. (2023). Management innovation: The role of internal, external factors, and business group affiliation. *Journal of Business Research*, 164: 113964.	Ozen, Ozlem, & Ozturk-Kose, Ebru. (2023). Management innovation: The role of internal, external factors, and business group affiliation. *Journal of Business Research*, 164: 113964.
Pallathadka, H., Ramirez-Asis, E. H., Loli-Poma, T. P., Kaliyaperumal, K., Ventayen, R. J. M., & Naved, M. (2023). Applications of artificial intelligence in business management, e-commerce and finance. *Materials Today: Proceedings*, (80), 2610–2613.	Pallathadka, H., Ramirez-Asis, E. H., Loli-Poma, T. P., Kaliyaperumal, K., Ventayen, R. J. M., & Naved, M. (2023). Applications of artificial intelligence in business management, e-commerce and finance. *Materials Today: Proceedings*, (80), 2610–2613.

Prajapati, D., Jauhar, S. K., Gunasekaran, A., Kamble, S. S., & Pratap, S. (2022). Blockchain and IoT embedded sustainable virtual closed-loop supply chain in E-commerce towards the circular economy. *Computers & Industrial Engineering*, (172), 108530.	Prajapati, D., Jauhar, S. K., Gunasekaran, A., Kamble, S. S., & Pratap, S. (2022). Blockchain and IoT embedded sustainable virtual closed-loop supply chain in E-commerce towards the circular economy. *Computers & Industrial Engineering*, (172), 108530.
Shevtsova, G. Z. (2012). Synergistic management as a concept of organized synergy in enterprise management *Economics of industry*, (1–2), 202–214.	Шевцова, Г. З. (2012). Синергетичний менеджмент як концепція організованої синергії в управлінні підприємствами. *Економіка промисловості*, (1–2), 202–214.
Suchek, N., Fernandes, C. I., Kraus, S., Filser, M., & Sjögrén, H. (2021). Innovation and the circular economy: A systematic literature review. *Business Strategy and the Environment*, *30*(8), 3686–3702.	Suchek, N., Fernandes, C. I., Kraus, S., Filser, M., & Sjögrén, H. (2021). Innovation and the circular economy: A systematic literature review. *Business Strategy and the Environment*, *30*(8), 3686–3702.
Sudi, D. M., & Jusman, I. A. (2023). Performance Optimisation through Education and Knowledge Management Synergy: An Innovative Business Organisation Strategy. *Journal of Contemporary Administration and Management (ADMAN)*, *1*(3), 215–221.	Sudi, D. M., & Jusman, I. A. (2023). Performance Optimisation through Education and Knowledge Management Synergy: An Innovative Business Organisation Strategy. *Journal of Contemporary Administration and Management (ADMAN)*, *1*(3), 215–221.
Sun, M., Grondys, K., Hajiyev, N., & Zhukov, P. (2021). Improving the E-Commerce Business Model in a Sustainable Environment. *Sustainability*, (13), 12667.	Sun, M., Grondys, K., Hajiyev, N., & Zhukov, P. (2021). Improving the E-Commerce Business Model in a Sustainable Environment. *Sustainability*, (13), 12667.
Taherdoost, H., & Madanchian, M. (2023). Blockchain and Business Process Management (BPM) Synergy: A Comparative Analysis of Modeling Approaches. *Information*, *15*(1), 9.	Taherdoost, H., & Madanchian, M. (2023). Blockchain and Business Process Management (BPM) Synergy: A Comparative Analysis of Modeling Approaches. *Information*, *15*(1), 9.
Trifonov, P. V., Kirpicheva, M. A., & Khachatryan, A. A. (2019). Analysis of the Factors and Scenarios of Forming a New Direction in the 21st Century Energy-Intelligent Energy Networks (Smart Grid). In *Institute of Scientific Communications Conference* (pp. 257–264). Springer: Cham, Swizterland.	Trifonov, P. V., Kirpicheva, M. A., & Khachatryan, A. A. (2019). Analysis of the Factors and Scenarios of Forming a New Direction in the 21st Century Energy–Intelligent Energy Networks (Smart Grid). In *Institute of Scientific Communications Conference* (pp. 257–264). Springer: Cham, Swizterland.
Vodianka, L. D., & Yaskad, I. V. (2012). Synergistic effect in the activities of enterprises: classification and approaches to evaluation. *Bulletin of Khmelnytsky national university*, *1*(3), 7–12.	Водянка, Л. Д., & Яскад, І. В. (2012). Синергетичний ефект у діяльності підприємств: класифікація та підходи до оцінювання. *Вісник Хмельницького національного університету, 1*(3), 7–12.
Voronkova, V. G. (2009). *Synergistic methodology for analyzing social management.* Retrieved on January 5, 2024 from http://zgia.zp.ua/gazeta/ VISNIK_36_3.pdf	Воронкова, В. Г. (2009). *Синергетична методологія аналізу соціального управління.* Взято 5 січня 2024 р. з http://zgia.zp.ua/gazeta/VISNIK_36_3.pdf
Wagner, Gerhard, Schramm-Klein, Hanna, & Steinmann, Sascha. (2013). Effects of cross-channel synergies and complementarity in a multichannel e-commerce system – an investigation of the interrelation of e-commerce, m-commerce and IETV-commerce. *The international review of retail, distribution and consumer research*, *23*(5), 571–581.	Wagner, Gerhard, Schramm-Klein, Hanna, & Steinmann, Sascha. (2013). Effects of cross-channel synergies and complementarity in a multichannel e-commerce system – an investigation of the interrelation of e-commerce, m-commerce and IETV-commerce. *The international review of retail, distribution and consumer research*, *23*(5), 571–581.
Wagner, Gerhard, Schramm-Klein, Hanna, & Steinmann, Sascha. (2016). The Role of Synergy and Complementarity in a Multichannel E-Commerce System. In *Looking Forward, Looking Back: Drawing on the Past to Shape the Future of Marketing,* 661–661. Springer International Publishing.	Wagner, Gerhard, Schramm-Klein, Hanna, & Steinmann, Sascha. (2016). The Role of Synergy and Complementarity in a Multichannel E-Commerce System. In *Looking Forward, Looking Back: Drawing on the Past to Shape the Future of Marketing,* 661–661. Springer International Publishing,

World Trade Report. (2018). *The future of world trade: How digital technologies are transforming global commerce.* Retrieved on December 29, 2023, from https://www.wto.org/english/res_e/publications_e/world_trade_report18_e.pdf	World Trade Report. (2018). *The future of world trade: How digital technologies are transforming global commerce.* Взято 29 грудня 2023 р. з https://www.wto.org/english/res_e/publications_e/world_trade_report18_e.pdf
Xue, C., Wen, W., & Li, S. (2022). Enterprise strategy analysis of synergy between cross-border e-commerce and logistics in a dynamic environment. *Systems Science & Control Engineering*, *10*(1), 459–467.	Xue, C., Wen, W., & Li, S. (2022). Enterprise strategy analysis of synergy between cross-border e-commerce and logistics in a dynamic environment. *Systems Science & Control Engineering*, *10*(1), 459–467.
Zeng, Sai X., Shi, Jonathan J. & Lou, G. X. (2007). A synergetic model for implementing an integrated management system: an empirical study in China. *Journal of cleaner production*, *15*(18), 1760–1767.	Zeng, Sai X., Shi, Jonathan J., & Lou, G. X. (2007). A synergetic model for implementing an integrated management system: an empirical study in China. *Journal of cleaner production*, *15*(18), 1760–1767.
Zhang, Peng, Xia, Bei & Shi, Victor. (2021). The dual-channel retailer's channel synergy strategy decision. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(7), 3184–3201.	Zhang, Peng, Xia, Bei, & Shi, Victor. (2021). The dual-channel retailer's channel synergy strategy decision. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(7), 3184–3201.

Conflict of interest: The author certifies that he/she has no financial or non-financial conflicts of interest in relation to this manuscript; has no relationships with government agencies, commercial or non-commercial organizations that could be interested in presenting this viewpoint. Given that the author is affiliated with the institution that is the publisher of the journal, which may give rise to a potential conflict or suspicion of bias, the final decision to publish this article (including the selection of reviewers and editors) was made by those members of the editorial board who are not affiliated with this institution.

The author received no direct funding for this research

Tsilvik O. System management of e-commerce enterprises. *Scientia Fructuosa*. 2024. № 3. P. 42–57. https://doi.org/10.31617/1.2024(155)03

Received by the editorial office 10.01.2024.
Arrived after revision 04.04.2024.
Accepted for printing 23.04.2024.
Published online 11.06.2024.

DOI: 10.31617/1.2024(155)04
UDK: 004.8:339.138=111

PONOMARENKO Ihor,
PhD (Economics), Associated Professor, Associated Professor of the Department of Marketing State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0003-3532-8332
i.ponomarenko@knute.edu.ua

ARTIFICIAL INTELLIGENCE IN DIGITAL MARKETING

Development of a comprehensive approach to the integration of artificiale intelligence (AI) into a company's marketing strategy in the digital environment is important to directly ensure the loyalty of customers and achieve an economically primed level of sales conversion period. In this article it was focused on the direct integration of digital marketing algorithms of artificiale inteligence to optimize interaction between companies and target audiences. During the research, the use of fundamental scientific methods of analysis and synthesis was carried out to characterize the AI main algorithms that are used in digital marketing; empirical methods, graphical images, and system structural analysis. The AI role in digital marketing has been emphasized and the importance of using current algorithms to ensure effective communications between companies and vendors has been proved. A comprehensive analysis of the main digital marketing tools and the features of their use to ensure the competitive position of companies on the Internet was carried out. The scheme of obtainning information from users and optimizing the use of AI tools based on the applying of effective mathematical algorithms is given. The key trends in the development of the market for generative AI in the field of digital marketing have been identified. A subdivision of content created by generative AI has been presented. It has been determined that piece intelligence is a priority in the marketing strategies of companies in the digital environment, which allows companies to ensure personalization of the approach to each client.

ПОНОМАРЕНКО Ігор,
к. е. н., доцент, доцент кафедри маркетингу Державного торговельно-економічного університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0003-3532-8332
i.ponomarenko@knute.edu.ua

ШТУЧНИЙ ІНТЕЛЕКТ У ЦИФРОВОМУ МАРКЕТИНГУ

Розробка комплексного підходу щодо інтеграції штучного інтелекту (ШІ) у маркетингові стратегії компаній в цифровому середовищі є важливим напрямом забезпечення лояльності користувачів і досягненяня економічно обґрунтованого рівня конверсії. Метою статті є обґрунтування напрямів інтеграції алгоритмів штучного інтелекту в цифровий маркетинг для оптимізації взаємодії між компаніями та цільовою аудиторією. Під час проведення дослідження застосовано загальнонаукові методи аналізу та синтезу для характеристики основних алгоритмів ШІ, що використовуються у цифровому маркетингу; емпіричні методи, графічне зображення та системно-структурний аналіз. Розглянуто роль ШІ у цифровому маркетингу й доведено доцільність застосування сучасних алгоритмів для забезпечення ефективних комунікацій між компаніями та користувачами. Проведено комплексний аналіз основних інструментів цифрового маркетингу та особливостей їх використання для забезпечення конкурентних позицій компаній в інтернеті. Наведено схему отримання інформації від користувачів та оптимізації застосування інструментів ШІ на основі використання ефективних математичних алгоритмів. Досліджено ключові тенденції розвитку ринку генеративного ШІ у сфері цифрового маркетингу. Представлено розподіл контенту, створеного генеративним ШІ. Визначено пріоритетні напрями використання ШІ у маркетингових стратегіях компаній у цифровому середовищі, які дозволяють забезпечити персоналізований підхід до кожного клієнта.

Keywords: digital marketing, artificial intelligence (AI), target audience, communications, loyalty.

Ключові слова: цифровий маркетинг, штучний інтелект (ШІ), цільова аудиторія, комунікації, лояльність.

JEL Classification: C45, D11, D21, M31.

Introduction

The development of information technologies leads to the active transformation of all types of economic activity at the national and global levels. The digitalization process stimulates companies in a highly competitive environment to introduce advanced technologies to secure high positions in the functioning markets. Focusing on the needs of modern users forces companies to implement complex marketing strategies in the digital environment. The main generations that use the Internet in everyday life are generations Y, Z, and Alpha, which requires brands to develop specific communication models. Comprehensive influence on the target audience thanks to the use of effective digital marketing tools allows companies to achieve the maximum level of loyalty. The intensive development of technologies stimulates the transformation of marketing strategies in the digital environment to meet the needs of users. Promoting relevant content through effective digital marketing tools allows brands to ensure a cost-effective conversion rate. Along with this, the functioning of companies on the Internet makes it possible to accumulate large volumes of heterogeneous information.

The growing popularity of artificial intelligence (AI) in today's environment allows companies to use big data to improve marketing campaigns in the digital environment. The presence of a large number of mathematical algorithms leads to the selection of optimal solutions in specific space-time conditions.

The AI use in digital marketing makes it possible to correctly divide the target audience into groups according to the chosen system of metrics and to form specific models of communications with the relevant groups of users. Thanks to the automation of specialized marketing processes, it is possible to optimize the interaction between companies and consumers on the Internet, choosing effective communication models and achieving a high level of loyalty.

Scientific studies are shown the significant potential of integrating artificial intelligence into digital marketing tools. At the same time, the greatest attention is paid to the influence of AI on the development of marketing strategies in the digital environment. The problem of integrating AI into digital marketing is highlighted in the works of the following scientists: Nalbant & Aydin (2023), Nirwana (2023), Kaperonis (2024), Gabay (2024), Bhardwaj (2021), Colleoni & Corsaro (2022), Bhattarai (2023), Tauheed et al. (2024), Makasarashvili & Giguashvili (2023). Scientific works pay considerable attention to highlighting directions for adapting AI algorithms to improve the implementation of digital marketing approaches. Along with this, there is a need for a comprehensive study of ways to strengthen relationships

between companies and users thanks to the use of modern digital marketing tools based on AI algorithms. To achieve optimal results, it is important to focus on choosing the best mathematical algorithms that will allow companies to establish long-term communications with their target audience.

The aim of the article is to substantiate the direction of integration of artificial intelligence technologies in digital marketing.

According to the aim, the hypothesis was formulated that artificial intelligence allows to significantly increase the effectiveness of the implementation of marketing strategies of companies in the digital environment. AI allows for the identification of hidden relationships in user behavior and facilitates the automation of communications with the target audience. The generation of big data in the digital environment allows training algorithms to implement personalized marketing strategies and create unique content for the needs of a specific consumer.

The presented research involves the use of the following scientific research methods, such as: analysis and synthesis to characterize the main artificial intelligence algorithms used in digital marketing; empirical methods, graphic representation, and system-structural analysis.

Despite the positive aspects of digital marketing strategy optimization thanks to the AI use, there are ethical problems regarding the violation of consumer privacy, technological limitations of the implementation of complex mathematical algorithms, and the high cost of processing large data of various forms of expression.

The main part of the article reveals the features of the implementation of digital marketing tools. An analysis of the dynamics of the actual and forecast values of Generative AI in Digital Marketing size for 2023–2033 is carried out, and the distribution of the use of generative AI by marketers to create specialized content by the use of communication channels is given. The main directions of AI using in digital marketing to ensure effective and long-term communications with the audience are considered. The expediency of further development of modeling for marketing has been proven.

1. Digital marketing and Artificial intelligence: basic concepts

The implementation of an effective marketing strategy by modern companies involves the use of a complex of advanced approaches in the offline and online environment. Digitalization leads to the gradual prevalence of interaction with the target audience on the Internet, as demographic processes encourage a change of generations and the growth of the share of innovation-oriented consumers. The intensive development of technologies and software leads to qualitative transformations of digital marketing and opportunities to ensure closer communications with the target audience. *Figure 1* shows today's digital marketing tools used by companies in a highly competitive environment.

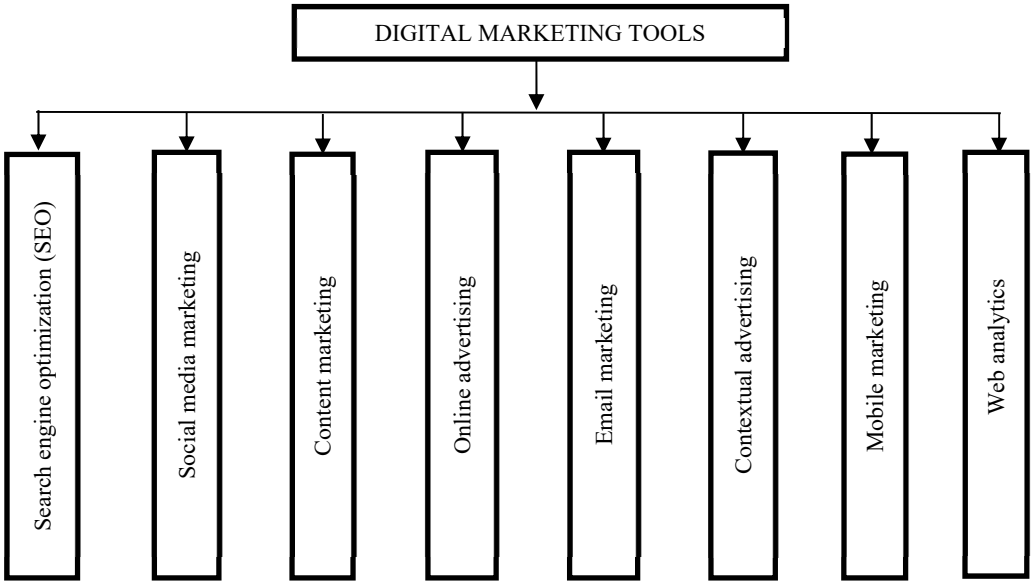


Figure 1. Modern digital marketing tools

Source: compiled by the author from (Silva, 2024, March 27).

Modern users are characterized by various models of behavior on the Internet, forming a demand for relevant resources and thematic content. A significant number of Y, Z, and Alpha generations use social media daily to communicate with other users and brands. Maximum coverage by the company of the target audience involves the use of relevant digital marketing tools, the list of which changes by the change in the influence of environmental factors. The social, economic and cultural characteristics of consumers in different countries of the world should be taken into account when carrying out activities by brands at the international level. Adjusting the marketing strategy in the digital environment is carried out based on complex information that companies receive from various sources, including web analytics services.

Here are the characteristics of modern digital marketing tools.

Search Engine Optimization (SEO) involves the implementation of a set of measures to increase the positions of companies' web resources in search engines. By the beginning of 2024, more than 90% of the market is occupied by Google, which requires the company to adapt to the requirements of the search algorithms of the presented service on the Internet. Organic traffic is an important element of interaction with the target audience, as about 50% of traffic to the web resources of companies is attracted as a result of the formation of user requests in search engines and the transition to resources according to the received links. The formation of the semantic core of the site and the updating of the keywords list with the permanent marking of the content posted on the resource helps ensure high positions in requests. Conducting an audit of web resources to identify the

optimality of its architecture, monitoring external and internal links, updating content and other measures are important for the effectiveness of SEO.

Social Media Marketing is a very effective digital marketing tool because it allows companies to interact permanently with the vast majority of the Y, Z, and Alpha generations. Ensuring a large number of followers and maintaining interest in the long term requires a company to develop and implement an effective marketing strategy in relevant social media. The presence of a large number of social media, among which YouTube, Facebook, Instagram, TikTok, and Snapchat are the most popular, involves the creation of specialized content by the specifics of a certain network: text materials, audio, photos, and videos. Attracting attention is ensured thanks to content that is in significant demand among the target audience, accordingly, there is a need to constantly study the interests of users. Maintaining interest is achieved through the formation of an effective content plan, which provides for the placement of publications according to the identified optimal time intervals.

Content Marketing stands out as a separate tool because, in today's digital environment, companies constantly generate large volumes of heterogeneous content to attract the attention of the target audience. The formation of digital noise leads to the loss of interest of many consumers in large volumes of diverse content, which requires brands to implement complex marketing strategies to attract new users. There is a need not only to create relevant content but also to implement effective communication models with the target audience. An important element of content marketing is also comprehensive research of the target audience interests and competitive intelligence, which allows companies to generate high-quality engaging content.

Online Advertising is used to promote companies on the Internet on various resources that act as convenient platforms for placing thematic advertising content. A characteristic feature of the digital environment is the possibility of integrating advertising in different formats in various resources and all content. The main types of online advertising are media advertising, spam, teaser advertising, and landing pages.

Contextual advertising is distinguished as a separate type of online advertising, as targeting is carried out according to the requests of the relevant users. The target audience's search for specific goods and services leads to the display of thematic advertising content. Keywords allow companies to select advertising for an individual consumer, stimulating the purchase of certain brands products.

Email Marketing is used to establish interaction with the target audience by sending emails. The presented digital marketing tool is characterized by a different level of popularity in the countries of the world, which is related to cultural characteristics and orientation to various resources on the Internet for communication. Thanks to the use of automated services, it is possible to set up

a mailing for certain groups of consumers at an established time with the use of personalized appeals and integrated thematic content.

Mobile marketing is used by companies due to the significant popularity among modern users of smartphones and tablets. Members of Generations Y, Z, and Alpha spend a significant amount of time every day for work, study, and leisure thanks to mobile devices. The implementation of complex marketing strategies on mobile devices involves the use of web resources adaptive versions for the screen sizes of the corresponding gadgets and specialized applications. Cameras integrated into mobile devices are used to scan QR codes, which allow convenient and quick access to web resources of brands or individual products.

Web analytics allows monitoring various activities of the company in the digital environment, as well as evaluating user behavior and conducting competitive analysis. Thanks to the use of specialized services, it is possible to collect complex information on an ongoing basis. The web analytics flexibility involves the selection of the necessary system of metrics and its adjustment in accordance with existing needs. The company can use Google Analytics to evaluate the marketing strategy for its web resources. Evaluation of competitors' resources is carried out thanks to various products available on the market, among which it is advisable to pay attention first of all to Adobe Analytics, Ahrefs, Kissmetrics, HubSpot and SimilarWeb. Monitoring the digital environment allows companies to assess the current situation, identifying potential risks and opportunities for effective development.

Formation of the company's information environment based on relevant digital marketing tools allows companies to accumulate big data and store it in cloud services. The availability of heterogeneous information and its exponential growth in modern conditions has led to the popularization of Data science approaches. The information processing market is actively developing thanks to scientific research and the accumulation of significant practical experience in various fields. Modern mathematical algorithms integrated into specialized products and implemented on the basis of powerful servers allow to optimize the process of processing heterogeneous large data sets and to form effective management solutions in the field of digital marketing. In the conditions of digitization, artificial intelligence is gaining significant popularity, which leads to qualitative transformations of marketing strategies and the formation of communication innovative models with the target audience. Artificial intelligence involves the use of such algorithms as Machine learning, Deep learning, Natural language processing, Sampling algorithms, Genetic algorithms, Optimization algorithms, etc. *Figure 2* shows a conceptual scheme for collecting information about users in the process of using digital marketing tools and choosing optimal artificial intelligence algorithms for forming personalized communications with customers.

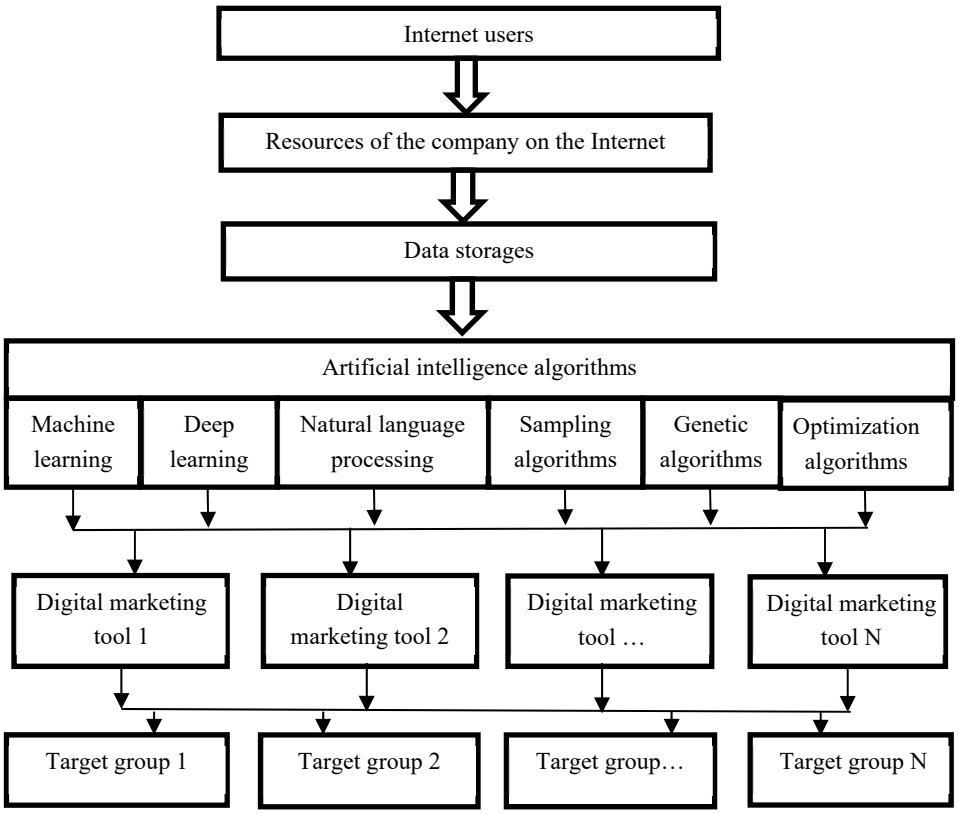


Figure 2. AI-based digital marketing tools for company communication with target groups

Source: compiled by the author from (Baluja, 2024, February 7).

By interacting with various resources on the Internet, users act as a source of information for specialized online data collection services. Companies get the opportunity to collect information about the activity of the target audience on their web resources and accumulate data on servers. The received data is processed thanks to various algorithms of AI and optimal models are selected, which involve the use of appropriate digital marketing tools. The flexibility and effectiveness of using artificial intelligence are explained by the constant training of algorithms based on growing data and the constant search for optimal solutions. Companies get the opportunity to interact with unique groups of consumers using specialized digital marketing tools. Adaptation to the needs of specific consumers significantly increases the effectiveness of marketing communications.

2. AI-based digital marketing: research and trends

Increasing the effectiveness of artificial intelligence technologies leads to an increase in the number of companies that actively use the presented technologies to optimize marketing strategies. Several types of artificial intelligence are used in real business systems and allow them

to achieve effective results in the long term. In digital marketing, generative AI, which allows the creation of new content and objects with human perception-oriented characteristics, has become widely used. *Figure 3* presents the actual and forecast values of generative AI in Digital Marketing size for 2023–2033.

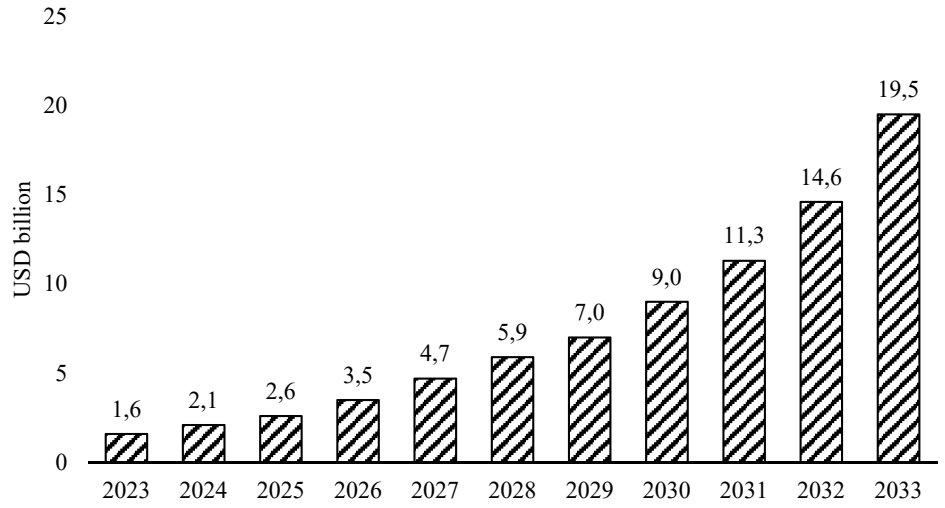


Figure 3. Generative AI in Digital Marketing size, 2023–2033

Source: (MarketResearch, 2024, April).

The market for generative artificial intelligence in digital marketing is expected to grow from USD 1.6 billion in 2023 to USD 19.5 billion in 2033, according to research. During the analyzed period, annual growth in the introduction of advanced approaches in the field of artificial intelligence is expected to be 29.2%.

The leading position among the countries of the world in the use of artificial intelligence in the field of marketing is occupied by the USA, which is explained by the significant development of the economic system. In conditions of significant competition, American companies are actively using advanced technologies, which allows them to implement effective marketing strategies in the digital environment. The struggle for paying customers, among whom a significant share are innovation-oriented users, stimulates the introduction of innovative technologies. Tech giants in the field of digital technologies are constantly producing cutting-edge solutions that are in high demand. First of all, it is necessary to pay attention to the companies located in the USA, OpenAI, Google, Microsoft, Boston Dynamics, and others are considered leaders in the development of artificial intelligence. The Massachusetts Institute of Technology, the Institute for Ethics and Emerging Technologies, the University of California (Berkeley), Stanford University, and others deal with the scientific and applied problems of the development and implementation of mathematical algorithms.

Interaction with a wide audience on the Internet involves the use of various digital marketing tools, the list of which is selected by the features of the company's functioning in specific spatial and temporal conditions. The integration of AI into marketing technologies allows companies to implement qualitative transformations and increase the effectiveness of communications with the target audience. A survey of marketers in the field of B2B and B2C in different countries of the world made it possible to identify the features of the use of AI in the field of marketing in 2024. *Figure 4* shows the distribution of marketers' use of generative AI to create specialized content following the use of communication channels on the Internet.

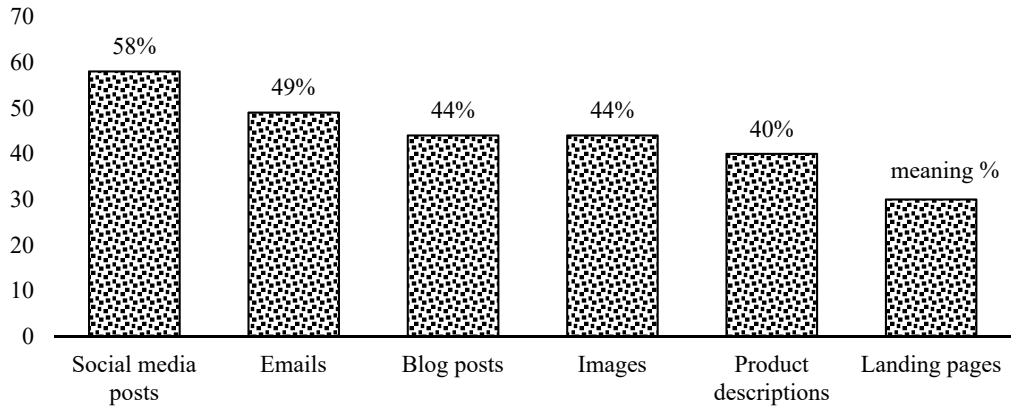


Figure 4. Distribution of marketers' use of generative artificial intelligence to create specialized content, 2024

Source: (Iskiev, 2024, September 1).

Social media is the most widespread digital marketing tool precisely because of the possibility of communications based on the exchange of thematic content. Posts in thematic communities act as an incentive to engage a large audience and discuss topical issues. The topics of discussions in social media based on textual content, which is generated by artificial intelligence, are very diverse. The popularity among certain email users allows for the integration of specialized services based on generative AI. The visual orientation of the majority of modern users leads to the active development of algorithms for creating photo and video content that adapts to the needs of consumer groups.

Improving the quality of services based on the formation of a high level of trust and loyalty of the target audience is possible thanks to the use of artificial intelligence powerful algorithms. The creation of various types of content at the current level of mathematical algorithm development is carried out in a short time. Generative AI is used to create text, audio, photo, and video content, which is then placed on the company's web resources. The dynamism of the digital environment requires the company to constantly update information to maintain the interest of visitors. Accordingly, content

marketing specialists on the Internet are in high demand among various companies.

Generative AI significantly expands the capabilities of specialists in the field of marketing, optimizing time for the creation of thematic content. 45% of surveyed respondents indicated that they use AI to find interesting ideas and inspiration in thematic areas. Combining mathematical algorithms with human creativity allows brands to create unique content that will allow companies to stand out among a large number of competitors in the relevant market.

As an outline, the results of generative AI are used by 31% of specialists in the field of digital marketing. The presented approach is advisable to use for creating text content since the obtained materials can be expanded by the characteristics of the target audience and the characteristics of specific products. Marketers, according to professional skills, process and supplement the generated text, achieving a high level of uniqueness and attractiveness, which is appreciated by representatives of generations Y, Z, and Alpha.

Only 6% of surveyed marketers completely entrust the task of creating content to generative AI. The process of intensive interaction with users in the digital environment stimulates the rapid creation of textual content and placing it on the company's web resources. The presented approach allows interaction with a significant number of users in conditions of limited financial, human, and time resources. However, in many cases, using only generated text reduces the level of trust of the target audience in the company.

At this stage of technology development, it is not possible to replace marketers with solutions in the AI field. In future, the development of Strong AI will be intensified, which will use complex mathematical models that will imitate elements of human creativity. In the existing realities, marketers mainly use AI as an assistant that optimizes time spent on routine tasks. It is necessary to be aware of the limitations of modern AI and to take into account the identified technical characteristics when developing and implementing a digital marketing strategy.

3. Artificial intelligence applied to digital marketing

The evolution of technology leads to the appearance on the market of new products in the field of digital marketing. AI refers to one of the important directions that allows qualitatively transformed communications between companies and users in the digital environment. Specialists in the field of data analysis are constantly working on improving artificial intelligence methods and searching for more powerful mathematical algorithms. Let's consider the main directions of using AI algorithms in digital marketing.

Analysis of big data. Complex information that companies have the opportunity to receive on the Internet acts as a valuable resource when conducting AI-based predictive analytics. The implementation of machine learning algorithms makes it possible to identify existing trends and calculate

predictive values of key marketing phenomena. Supply and demand research is used to forecast users' needs for products and form specialized marketing campaigns in the digital environment to stimulate the interests of the target audience for relevant goods and services.

Historical data is used to determine the future effectiveness of various digital marketing tools. Thanks to artificial intelligence, the optimization scenarios of marketing communications are modeled, which will ensure a high level of target audience loyalty. The use of effective digital marketing tools is explained by the expediency of spending limited resources.

Digitalization processes lead to evolution in various spheres of human activity, accordingly, AI algorithms can allow companies to identify promising directions for the development of marketing strategies in the digital environment. Predictive analytics allows companies to ensure flexibility and quick adaptability to changes in the influence of external factors, which contributes to obtaining competitive advantages over other participants in the market. The development of cloud computing makes it possible to implement AI algorithms online and offer multivariate predictive models.

Personalization of content. Classification refers to one of the important tasks of AI and involves assigning units from the studied population to the appropriate group based on the information used. Popular methods used in solving classification problems include clustering, logistic regression, neural networks, decision trees, etc. Determining the implicit relationships between the used metrics allows companies to form specific customer groups and implement unique communication models. For selected groups of consumers, it is advisable to use specialized content, which will contribute to the formation of long-term loyal relations. Modern algorithms of AI make it possible to effectively influence individual consumers and form the idea of a personalized approach. Providing information to users about relevant products contributes to a significant increase in sales of goods and services.

Content generation. There are products on the market based on artificial intelligence that allow companies to generate diverse content. The leader is the OpenAI company, which created the ChatGPT and Dall-E products. High competition in the AI market has led to the emergence of such products as Copilot (Microsoft), Gemini (Google), Bedrock (Amazon), Llama 3 (Meta), etc. Relevant content plays an important role in the implementation of digital marketing strategies. Accordingly, companies regularly use thematic content that is interesting to the target audience and allows them to constantly maintain the interest of consumers in the respective brands. First of all, there is a need to post content with a certain frequency in social media, since the communication process involves ensuring interaction continuously. Today's users are visual, which requires companies to create high-quality photos and videos and then post them on brands' social media pages. Text generated by AI can be used as scripts for advertisements, stories of communication with the target audience, and answers to questions.

Customer support. Modern users demand a high level of service based on the achievements of scientific and technical progress. The pre-sale, sale, and post-sale periods involve the provision of informational support by companies to users. Thanks to the use of AI, it is possible to identify the characteristics of a specific client to choose a specific model of interaction and provide conclusions. For communications, chatbots are used, which form answers to questions based on effective mathematical algorithms. Modern chatbots based on artificial intelligence not only work by generating text responses but also know how to interact with the audience thanks to the reproduction of the human voice. The services allow companies to generate male and female voices, which are chosen for communication according to the characteristics of a specific client.

Sentiment analysis. Evaluating the sentiments of the target audience is an important area of research into the effectiveness of the company's marketing strategy in the digital environment. Basic statistics about visiting a company's web resources and buying its products on the Internet are not enough to ensure the effectiveness of a marketing strategy in the long term. Evaluating user sentiment makes it possible to identify effective models of interaction and product promotion in the digital environment. Along with the classic approach, which involves the use of analysis of likes and reactions, it is advisable to use AI. Sentiment analysis refers to the important directions of evaluating user reactions based on the implementation of mathematical algorithms. The source of information for researching the reaction of the target audience to the company and its products in social media is text comments, emoticons, and pictures. The first approach involved the identification of positive, neutral, and negative attitudes of users towards the activity of companies on the Internet. At this stage of development, artificial intelligence algorithms allow companies to distinguish various emotions.

Conclusions

Interaction between companies and users in the digital environment involves the use of innovative technologies. AI refers to important technologies in the field of marketing, that allow to increase the efficiency of interaction between companies and users in the digital environment. The presence of a large number of AI algorithms allows for flexibility in the processing of big data and the selection of optimal models for specific digital marketing strategies.

The results of the research have confirmed the feasibility of integrating AI algorithms into the marketing strategies of Ukrainian companies. The process of optimizing the marketing strategy involves the following stages: data collection on the Internet; information processing and its storage on specialized servers; testing AI algorithms and selecting the optimal ones; integration of effective mathematical models into digital marketing tools; periodic training of AI algorithms and decisions on choosing the most effective ones by the needs of the company. Reorientation to AI-based digital

marketing tools will allow domestic companies to increase the effectiveness of the communication process with the target audience on the Internet at the national and international levels.

Further research will be focused on web scraping and the use of the obtained data for the implementation of neural networks in digital marketing to more accurately identify user groups and increase the level of communication process efficiency.

REFERENCE

Baluja, H. (2024, February 7). *The Complete Guide to AI Algorithms.* https://blog.hubspot.com/marketing/ai-algorithms

Bhardwaj, K. (2021). *AI for Data Driven Digital Marketing* [Doctoral dissertation, Delhi Tehnological University].

Bhattarai, A. (2023). Exploring Customer Engagement through Generative AI Innovative Strategies in Digital Marketing Campaigns. *Quarterly Journal of Emerging Technologies and Innovations, 8*(12), 1–9.

Colleoni, E., & Corsaro, D. (2022). Critical issues in artificial intelligence algorithms and their implications for digital marketing. In *The Routledge handbook of digital consumption* (pp. 166–177). Routledge.

Gabay, J. J. (2024). *Practical Digital Marketing and AI Psychology: How to Gain Online Consumer Trust and Sales Using Technologies and Psychology.* Routledge.

Iskiev, M. (2024, September 1). *The 2024 State of Marketing & Trends Report.* https://blog.hubspot.com/marketing/hubspot-blog-marketing-industry-trends-report

Kaperonis, S. (2024). How Artificial Intelligence (AI) is Transforming the User Experience in Digital Marketing. In *The Use of Artificial Intelligence in Digital Marketing: Competitive Strategies and Tactics* (pp. 117–141). IGI Global.

Makasarashvili, T., & Giguashvili, G. (2023). The Opportunities of Using Artificial Intelligence in Digital Marketing. *Grail of Science*, (31), 53–58.

MarketResearch (April, 2024). *Generative AI in Digital Marketing.* https://marketresearch.biz/report/generative-ai-in-digital-marketing/

Nalbant, K. G., & Aydin, S. (2023). Development and transformation in digital marketing and branding with artificial intelligence and digital technologies dynamics in the Metaverse universe. *Journal of Metaverse, 3*(1), 9–18.

Nirwana, A. (2023). Implementation of artificial intelligence in digital marketing development: A thematic review and practical exploration. *Jurnal Manajemen Bisnis. Akuntansi dan Keuangan, 2*(1), 85–112.

Silva, K. (2024, March 27). 10 *Effective Digital Marketing Channels & How to Use Them.* https://www.semrush.com/blog/digital-marketing-channels

Tauheed, J., Shabbir, A., & Pervez, M. S. (2024). *Exploring the Role of Artificial Intelligence in Digital Marketing Strategies.*

Conflict of interest: The author certifies that he/she has no financial or non-financial conflicts of interest in relation to this manuscript; has no relationships with government agencies, commercial or non-commercial organizations that could be interested in presenting this viewpoint. Given that the author is affiliated with the institution that is the publisher of the journal, which may give rise to a potential conflict or suspicion of bias, the final decision to publish this article (including the selection of reviewers and editors) was made by those members of the editorial board who are not affiliated with this institution.

The article was written within the scope of the research work "Digital Marketing Management" (state registration number is 0124U000158).

Ponomarenko I. Artificial intelligence in digital marketing. *Scientia Fructuosa*. 2024. № 3. P. 58–70. https://doi.org/10.31617/1.2024(155)04

Received by the editorial office 22.04.2024.
Arrived after revision 29.04.2024.
Accepted for printing 07.05.2024.
Published online 11.06.2024.

DOI: 10.31617/1.2024(155)05
UDC: 659.126:339.17=111:

KARKUSHKA Oleksandr,
Master, Postgraduate student at the Department
of Marketing State University
of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0001-7654-6542
O.Karkushka@knute.edu.ua

BRANDING OF RETAIL ENTERPRISES

Branding is an integral part of the promotion and development of goods by retail trade enterprises (RTE). A comprehensive branding process is a key success factor, as it allows enterprises to identify themselves among competitors and attract a larger target audience. In this direction, it is important to substantiate the use of branding models aimed at increasing the competitiveness and RTE profitability. The aim of the article is to define the key concepts, the main components of branding, to substantiate the construction of a branding model and to characterize its elements. The following general scientific research methods were used such as analysis and synthesis, to present the main brand attributes; branding models and their characteristics; empirical, system and structural analysis and graphical display. The key concepts and basic branding principles have been defined, the main attributes (appearance of the product, its physical characteristics, brand name, logo, slogan, color scheme, fonts, character, music and sounds, related attributes) of the RTE brands have been analyzed. The process of choosing a positioning and its role in brand formation has been considered. The comparative characteristic of branding models has been presented, the main components, advantages and disadvantages of each model have been indicated. Based on the results, the author has developed his own model of RTE brand formation. The main advantages of using the developed model by the RTE and the main differences from other models have been indicated.

Keywords: brand, branding, branding models, brand attributes, brand management.

КАРКУШКА Олександр,
магістр, аспірант кафедри маркетингу
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0001-7654-6542
O.Karkushka@knute.edu.ua

БРЕНДИНГ ПІДПРИЄМСТВ РОЗДРІБНОЇ ТОРГІВЛІ

Брендинг є невіддільною складовою просування та розвитку товарів підприємств роздрібної торгівлі (ПРТ). Комплексний процес брендингу – ключовий чинник успіху, оскільки дає змогу підприємствам ідентифікувати себе з-поміж конкурентів та залучити більшу цільову аудиторію. У цьому напрямі важливим є обґрунтування застосування моделей брендингу, спрямованих на підвищення конкурентоспроможності та прибутковості ПРТ. Метою статті є визначення ключових понять, основних складових брендингу, обґрунтування побудови моделі створення брендів та характеристика її елементів. Використано такі загальнонаукові методи дослідження: аналізу та синтезу – для представлення основних атрибутів бренду, моделей брендингу та їх характеристики; емпіричні, системно-структурний аналіз та графічне відображення. Визначено ключові поняття та основні сладові брендингу, проаналізовано головні атрибути (зовнішній вигляд товару, його фізичні характеристики, назва бренду, логотип, слоган, кольорове рішення, шрифти, персонаж, музика та звуки, супутні атрибути) брендів ПРТ. Розглянуто процес вибору позиціювання та його роль у формуванні бренду. Представлено порівняльну характеристику моделей брендингу, зазначено основні складові, переваги та недоліки кожної моделі. За результатами розроблено власну модель формування бренду ПРТ. Зазначено основні переваги використання ПРТ розробленої моделі та головні відмінності від інших моделей.

Ключові слова: бренд, брендинг, моделі брендингу, атрибути бренду, управління брендом.

JEL Classification: D21, E20, E21, L81, M31.

Introduction

Branding of retail trade enterprises (RTE) is an urgent and important problem in modern economic context. Retail plays a significant role in economy which requires enterprises in this sector to effectively position themselves in market and create their own unique image to attract and retain customers. The brand in retail not only identifies goods or services, but also conveys meaning, creates an emotional connection with the consumer and determines the uniqueness of the enterprise among competitors. An effective brand in retail is a key success factor because it allows businesses to stand out in market, increase visibility and attract a target audience.

Research into the retail branding process includes analysis of positioning strategies, brand creation and management, ways to communicate with customers, and usage of digital tools to improve the effectiveness of implemented measures.

As competition in retail continues to grow, the development and implementation of an effective branding strategy becomes critical for the successful functioning of enterprises. Therefore, research in this area is important for practitioners and scientists, as it contributes to an improved understanding of branding processes and the development of strategies aimed at increasing the competitiveness and profitability of retail enterprises. The analysis and synthesis of scientific literature are aimed at developing recommendations that will help retailers to effectively use their own potential to achieve their strategic goals in the modern market environment.

The analysis of the main approaches for the development and management of brands of retail enterprises, in particular, the strategy of communication, creating a positive perception of consumers, as well as usage of digital technologies in the process of branding is highlighted in the works of such scientists and practitioners: Aaker & Joachimsthaler (2009), Zozulyov & Nesterova (2011), Nadtochiy et al. (2019), Pedrosa (2021), Prosvirina (2022), Smerichevsky et al. (2019), Shevchenko (2012), Yastremska et al. (2013), Ustik et al. (2023). Research to analyze branding issues reveals important aspects of this approach in brand management, but attention should be focused on the effectiveness of choosing a branding model, understanding the main aspects, choosing the right elements, positioning and adapting strategies to different segments. Taking into account all the processes of brand creation, as well as the development of digital technologies, are critical aspects for successful branding of enterprises.

The article is aimed at defining key concepts, basic branding and concluding the construction of the model of creating brands and characterising its elements.

In accordance with this aim, a hypothesis has been formulated that the branding process can be carried out using different models, each of which has its own purpose and specificity. The specificity of retail enterprises requires the construction of a new model for creating brands, which is aimed

at implementing an integrated approach to the formation of retail enterprises brands and optimization of processes due to their logical systematization.

To test the proposed hypothesis, the following general scientific research methods were used such as: methods of analysis and synthesis, to represent the main attributes of the brand; branding models and their characteristics; empirical methods; system and structural analysis; comparison and graphic image.

Even with all the positive aspects of the application of branding models, there are certain challenges that are associated with their implementation.

In the main part of the article, key concepts and basic glade elements of branding are recognized, the main attributes of brands of retail enterprises are analyzed. The analysis of models of brands and their structural elements influencing the formation of a certain holistic image of the retail enterprise brand in the consciousness of the consumer is carried out. A modern model of branding of retail enterprises has been proposed, the introduction of which will allow to build a strong relationship between the brand of retail enterprise and the consumer.

1. Branding: definitions and main components

The brand is a key element for the effective operation of retailers, which determines their recognition and success in the market. The importance of the brand lies in its ability to identify the company among competitors and create a positive image among consumers. All elements of brand management models are aimed at creating and developing a brand that in turn can strengthen the company's position in the market.

A significant number of retail enterprises operate on the Ukrainian market, using innovative methods and tools to create and promote brands. The development of this industry is constant, with new brand management mechanisms, the evolution of techniques and the growth of opportunities and achievements, the brand is becoming an increasingly important management asset, generating significant profits for enterprises. Consequently, brands' modern operating environment requires them to be flexible and responsive to change as possible (Ustik et al., 2023). Despite a significant number of interpretations of the concept of "brand", their conditional can be combined into several approaches:

- intangible asset of the company;
- perception of the company as a whole (the brand can cover impressions of all aspects of the company, including service, products and corporate culture);
- guarantee of consumer expectations (the brand can be considered as a guarantee that the company meets consumer expectations and has predictable behavior);
- identification element (a brand that has a strong image of the consumer's consciousness can be a strong tool for quickly identifying the product among competitors).

If we consider the concept of "brand" in terms of building long-term relationships with consumers, or as an intangible asset of the enterprise, these processes are fully implemented in the context of the processes of brand management of the enterprise, but the creation of brand elements, such as logo, fonts, color solutions are also constituent elements of the process of brand management, but these processes are called – branding.

The analysis of scientific literature divided scientists and practitioners into two groups, some believe that brand management and branding are identical concepts and there is only a problem with translation, others have the opposite opinion. We believe that these two concepts are not identical, in our opinion, branding is the process of creating the brand itself, that is, its attributes, and not managing it. The term "branding" comes from the English word "brand" – the stigma closest to the meaning of the translation – to make a name for yourself.

Branding includes product positioning, brand name, slogan, visual and verbal identification systems (trademark, corporate identity, packaging, special sounds, etc.), using of identification and communication media that reflect and broadcast the idea of the brand (Nadtochiy et al., 2019).

According to the proposed definition, branding is a process that results in a built holistic brand image that includes all the constituent attributes of the brand (*Figure 1*). Brand attributes are external features by which customers recognize the company and its products. They reflect brand values, influence competitiveness, building trust, and building a positive attitude towards goods and services.

Brand can help to create reputation, positive idea of the company, maintain the image, positioning and accelerate the first purchase by the consumer (Karkushka, 2023).

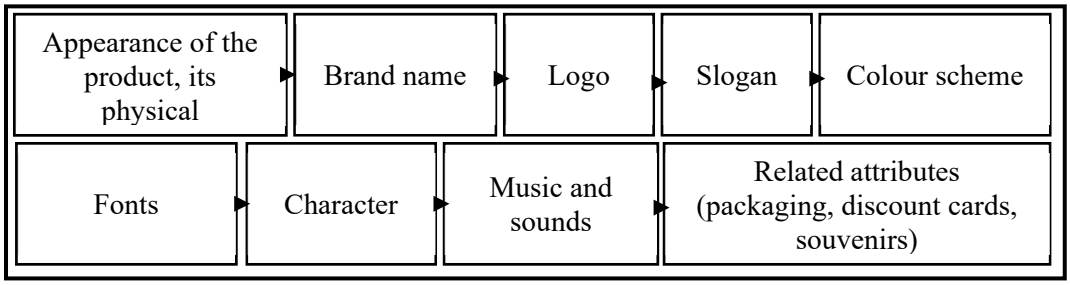


Figure 1. Retail enterprise brand attributes

Sourse: (SendPuls, 2023; Kebeta, 2023).

The elements shown in *Figure 1* are only the external components of the brand the main function of which is identification of the product among similar products of competitor, as practice shows, most products have a logo, fonts, color solution, but are not a brand. Since the presence of brand attributes in a product is not the end result, building a holistic brand includes much more components than just a name or slogan.

2. Models of building brands and characteristics of their elements

Brand creation is a complex process, including a large number of elements that are related to each other. The process of building a brand is better reflected in models, the main goal of which is to create a unique product that includes not only the external elements of the product, but also the essence, vision of the brand, its individuality, positioning and strength.

Scientists and practitioners have proposed a significant number of models for building brands (*Figure 2*), there are those developed directly by companies for their own brands, each of these models takes into account the characteristics of goods and its purpose. However, it is worth noting that in *Figure 2*, the authors divide the models into four groups, which include brands creating, managing them and determining the value of brand. It should be noted that the branding process, namely brand creation, is reflected only in the first group of models: the brand wheel, the TTB model, the Unilever Brand Key model, Zozulyov's model and the Brand name Development Services model. Three other groups of models are already integral elements of the brand management system, that is, included in the process of managing enterprises brands.

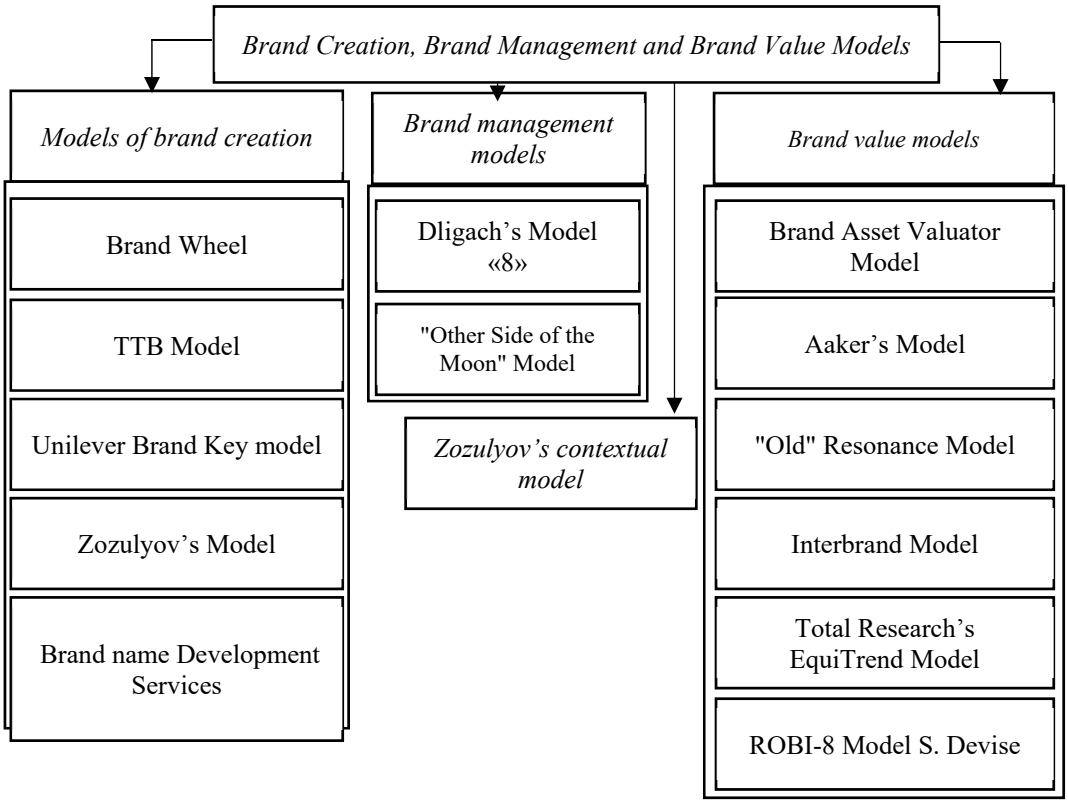


Figure 2. Models of forming, managing and determining the value of brands

Source: compiled by the author on the basis of (Zozulyov & Nesterova, 2011; Yastremskaya et al., 2013).

The fourth "Contextual Model" was proposed by Zozulyov, aimed at taking into account the life cycle of product, brand and market, while the author claims that other modules do not take into account the market context, that is, do not show a connection with the characteristics of the market in which the construction and management of the brand takes place and do not take into account the dynamic relationships between trend management and market status and trends (Zozulyov & Nesterova, 2011). In our opinion, each of these models has its own specifics and components, which are the starting point for building a comprehensive brand management system. Dividing models determines their role, and depending on the needs of the company, it is possible to use different models.

The first group of models, whose main function is to create the basic characteristics of brand, includes various components, but in our opinion the most important elements that form the basis for the creation and further effective functioning of brand of enterprise are: attributes, individuality, identity, value, brand strength and positioning. Each of the brand creation models shown in *Figure 2* includes certain elements that we have listed above, but none of the models presents all these elements together. It is also worth describing the models, noting their components, advantages and disadvantages, in order to evaluate each of them more meaningfully and to justify the need to build our own model capable of building a complete branding system (*Table 1*).

Table 1

Comparative features of branding models

Model name	Essence	Constituent	Advantages	Disadvantages
Brand Wheel	The brand is considered as a sequence of nested levels, starting with the essence, after which: individuality, values (emotional), preferences (rational benefits) and attributes of the goods are distinguished	Essence, individuality, values, advantages, attributes	Allows you to define the essence of the brand and associate it with the specific properties of the product offered to the consumer	It has a factorial character and does not take into account the process of creating a brand
Thompson Total Branding	A brand is treated as a collection of layers, each of which is the centre for the next layer. The core of the brand is the product, then – positioning, target group, individuality. The overall impression of the brand is formed under the influence of a number of factors, the most important of which in the model are: product, manufacturer, name, packaging, advertising, distribution, promotion, price, consumers and context of consumption, competitors, history	Product, manufacturer, name, packaging, advertising, promotion, price, distribution, location, consumers and context of consumption, competitors, history	Makes it possible to create a system of factors that shape the impression of the brand and convey to the consumer the essence of the brand's individuality	Has a factorial character and does not take into account the process of brand creation

End the table 3

Model name	Essence	Constituent	Advantages	Disadvantages
Unilever Brand Key	Branding is based on defining and focusing on the target audience and analysing the competitive environment. The next step is to identify the dominant motives of the target consumers, which can be used to build a brand based on the competitive environment. On this basis, the essence of the brand is formed in terms of elements such as: brand definition, brand utility, value and personification, and the answer to the question of why the consumer should trust the brand	Brand essence, utility, brand definition, value and personification, reasons to trust the brand, determinants of consumer motives	Takes into account motives Behaviour and choice the target audience's product and the competitive environment. Combines factor and process approaches	Does not fully reveal the essential emotional and rational component of the brand
Zozulev's Model	This model emphasises that the work of creating a brand cannot be a one-off exercise. It takes time and constant systemic marketing efforts for the brand to become successful. Image and reputation cannot be created in a day, sometimes it takes years. In terms of funding, the process of creating a brand should be seen as a long-term investment and should be valued accordingly	Consumers' awareness of the existence of the brand, awareness of its characteristics, awareness of its features and competitive advantages, creation of psychological differentiation, economic differentiation	The model takes into account the economic component of the brand and is geared to the long term	Does not take into account the process of brand creation, there are no constituent elements of brand construction
Brand creation stage model (Brand name Development Services)	Within this model, the focus is on the brand building stage. As you can see from the model, market positioning is at the heart of brand building. The next stage is the development of a brand strategy, followed by the development of a creative idea and a test of the legal purity of the future brand. Our stages within this model are completed by linguistic testing (especially important when a brand is present on the international market) and brand testing during marketing research using qualitative and quantitative methods	The process of building a brand consists of the following stages: market positioning, development of a brand strategy, development of a creative idea, verification of legal purity	Allows you to create a brand according to detailed steps	It is procedural in nature. It does not reveals the essence and main components of the brand

Source: compiled by autor based on (Zozulyov & Nesterova, 2011; Yastremskaya et al., 2013).

With regard to brand attributes in *Figure 1*, we indicate the main constituent elements of the brand that identify the product of the retail enterprise. There is no need to describe each component in detail, since each of us is a consumer of certain goods and as a buyer, we have the opportunity to evaluate all these components and make decisions accordingly regarding the purchase made. But with such elements as individuality, value, essence, vision, brand strength you need to get acquainted in more detail, since these components affect the formation of a certain holistic image of the retail enterprise brand in the consciousness of the consumer.

It is worth starting with the concept of "brand individuality" according to David Aaker – this is a set of characteristic personality traits of a person with whom this brand is associated (Aaker & Joachimsthaler, 2009). Modern brands of retail enterprises are not only about profit, or the creation of a unique trade offer, but also about the creation of trends that can form a certain model of consumer behavior. As an example, brands can change the attitude of society to a problem, pay more attention to consumers. That is, brands are the driving force and it is important that those characteristics that form the individuality of the brand best correspond to the target audience, its qualities and characteristics.

Brand identity is how a company defines its brand, what meanings it puts into it, what mission and vision it has, what values and priorities it has. Identity defines ways in and out of the company (Bazilik, 2021). Brand identity combines the elements, attributes of the brand and its main characteristics, while the conscious and purposeful formation of the brand identity will allow you to manage how it will be perceived.

Brand values are the feelings and emotions that the brand carries along with its functionality, for example, brand ownership gives a person a sense of self-confidence, belonging to a particular social group, a position in society, a sense of prestige, confidence in the high quality and reliability of the product – all this gives the consumer deep satisfaction from the use of the brand (Prosvirina, 2022). Retail brands are most often sold to end consumers, meaning they affect most of life. Giving them the appropriate values, characteristics, emotions, allow the consumer to feel belonging to something that is important to him.

One of the characteristics is the strength of the brand – this is an indicator of how close the connection between company and audience. There are four levels of audience connection to brand:

- knowledge (the first level of communication between the audience and the company – informing the person about the brand or its product);
- understanding (the second level – understanding the idea that the brand carries, namely the idea of people about the company or its products should correspond to the position that the brand itself speaks of);
- commitment (the third level is emotional loyalty, thanks to it, the audience continues to buy brand products, even if a more profitable offer has appeared on the market);

• participation (higher level of brand and audience communication: people not only share brand values, but also are ready to take an active part in the development of the company – give feedback, offer ideas) (IMG, 2021).

All the previous components of brand, are fundamental to building a holistic brand of retail enterprise. Since there are thousands of competing brands on the Ukrainian market, and in this case the creation of a logo is not enough, there is a need to create a unique offer for consumer and correct positioning on the market.

According to P. Kotler: "Positioning is a set of measures, thanks to which in the minds of target consumers this product occupies its own, different from others and profitable for the company place in relation to similar products." That is, by positioning we means the processing of a group of consumers (market segment) to create a system of ideas about goods and to form the proper attitude of the consumer to them (Shevchenko, 2012).

D. Aaker defines this as the trademark position is the set of associations that the consumer associates with the trademark. They can cover physical attributes, lifestyle, use situations, brand image, stores where it is sold. The trademark position has been developing for years through advertising, rumors and usage experience. The position of the trademark in the consumer's mind is a relative concept, which is based on the consumer's comparative assessment of this trademark with competing ones (Aaker & Joachimsthaler, 2009). The definitions of the two founders of brand management have similar features, the main one, which is focused on a certain position that the brand occupies on the market and in the consciousness of the consumer. Brand positioning development is the starting point for the implementation of all marketing and branding tools, since positioning lays down the main brand identification components that will be taken into account in marketing communication policy and other supporting tools for brand promotion and development. The process of creating convincing positioning for the retail brand can be divided into five consecutive steps (*Figure 3*). This process takes into account both the functional and emotional needs of consumers. But you need to take into account that functional needs are able to measure and meet with the help of specific characteristics of product, with emotional needs – more difficult. They are less material and more related to feelings that cause the product in the consumer.

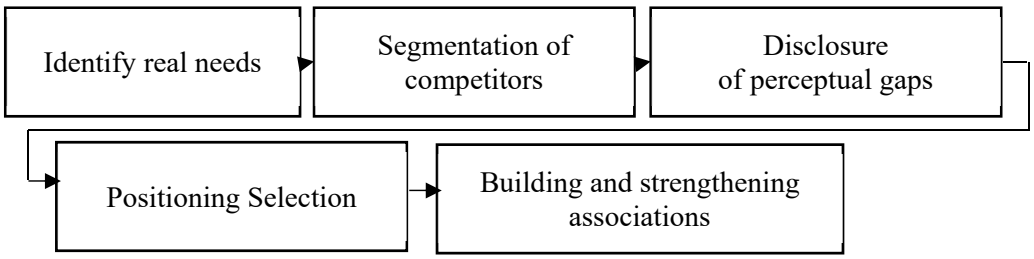


Figure 3. Process of Brand Positioning

Source: (Pedrosa, 2021).

The proposed process of creating brand positioning begins with determining the needs of consumers and, accordingly, provide answers to questions that arise for consumers when buying a product under the appropriate brand.

It is necessary to take into account the needs of all target groups that can be consumers of the company. For this, competitors are segmented (*Figure 4*). This can be done quantitatively by applying statistical analysis, or popular Boston Consulting Group (BCG) or McKinsey matrices for General Electric, as well as using qualitative marketing research techniques, primarily using focus group discussions or in-depth interviews.

The choice of characteristics or criteria may vary depending on industry, the specifics of company's product, existing competitive advantages or in general depending on the situation on the market. The first two stages have clear research methods, which guarantees relevant data as a result. Regarding the disclosure of perceptual gaps, they are supposed to reflect unoccupied areas in the minds of consumers.

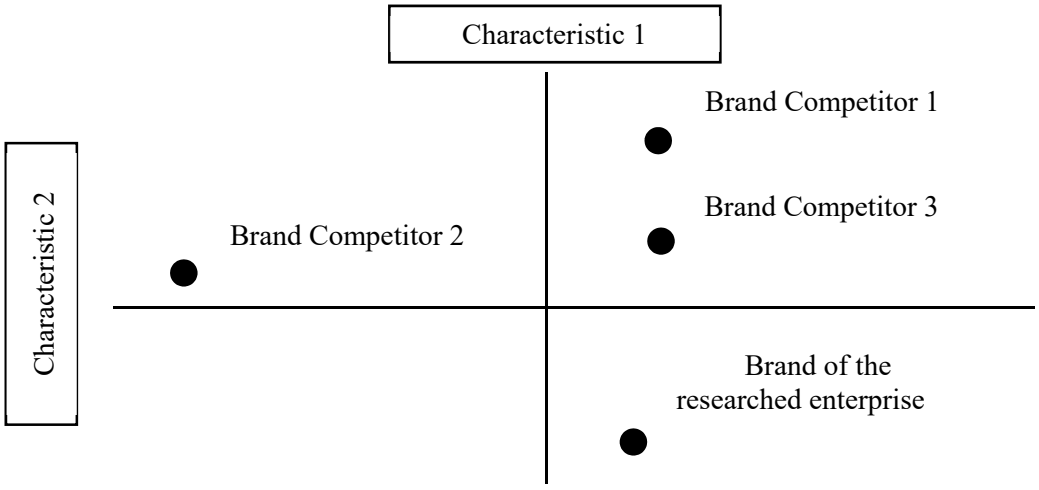


Figure 4. Segmentation of competitors

Source: (Pedrosa, 2021).

Accordingly, this step involves the construction of a perceptual map, which will distinguish an unoccupied niche. Also, at this stage, it is worth figuring out which brands in each specific quadrant have the strongest position and market share, and which, respectively, are the weakest, to make appropriate decisions in future (Pedrosa, 2021).

The next stage is the choice of the most convincing positioning, according to which a differentiated and significant value proposition will be based. Brand positioning involves using of various strategies in marketing activities, such as commodity, price, sales, service or advertising approaches. Depending on which of these areas is the most important for a particular situation or brand, different types of positioning are distinguished (*Figure 5*).

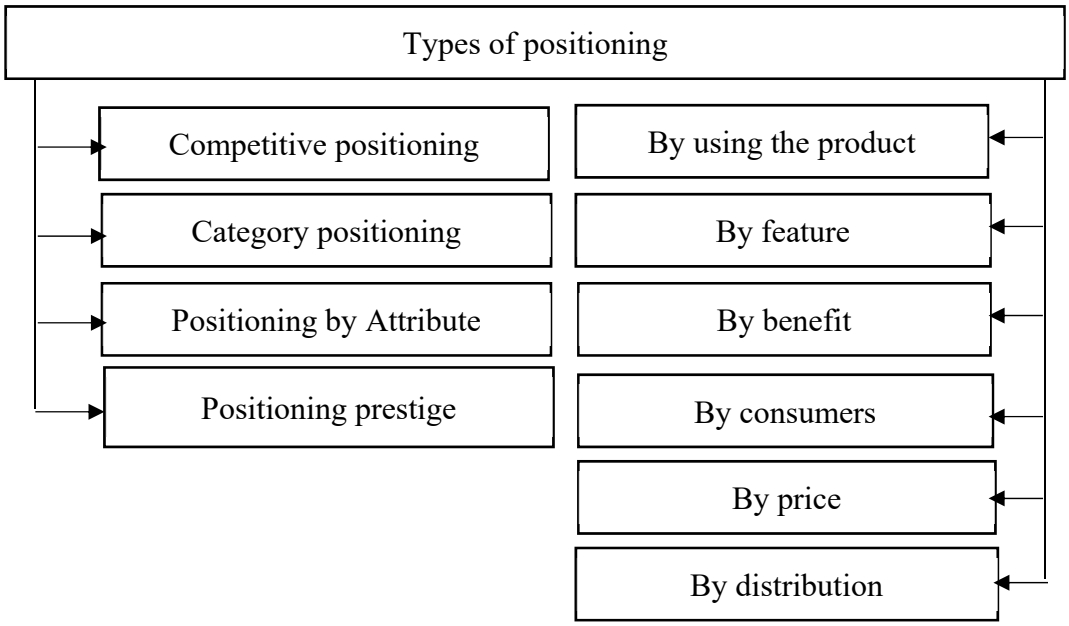


Figure 5. Types of positioning of brands of retail enterprises

Source: compiled by autor based on (Smerichevsky et al., 2019; Pedrosa, 2021).

Choice of positioning is determined in the balance from which aspect of the activity is considered key to achieving a competitive advantage. This can be an emphasis on quality characteristics of the product, price competitiveness, efficiency of the sales system, providing a high level of service or an emphasis on advertising and communication. The distinction in these areas allows brands to effectively position themselves in the market and impress their target audience. Choosing the right brand archetype can also help. Archetypes are universal images consisting of a set of known behavior characteristics and patterns (Skillsetter, 2022). In the case of a person, the archetype determines its innate structure of the psychic matrix: priorities, type of thinking, emotions and desires. The same with the brand – the archetype can be part of branding, strengthen communication or even become a starting point for any manifestations.

However, unlike a person, the archetype for the brand can be chosen. It, like all structural elements of branding, becomes part of positioning (Bazilik, 2021). According to L. Pedrosa, the author of the "Brand Positioning Process" the choice of positioning is not the final stage, he proposes to focus at the end on the development and strengthening of associations. Strengthening brand positioning can strengthen associations that will help strengthen the individualized position in the minds of the target consumer. Also, a scheme is proposed by which associations are calibrated (*Figure 6*), which are able to position the brand of the retail enterprise and convince the consumer that the brand is fulfilling its promises (Pedrosa, 2021).

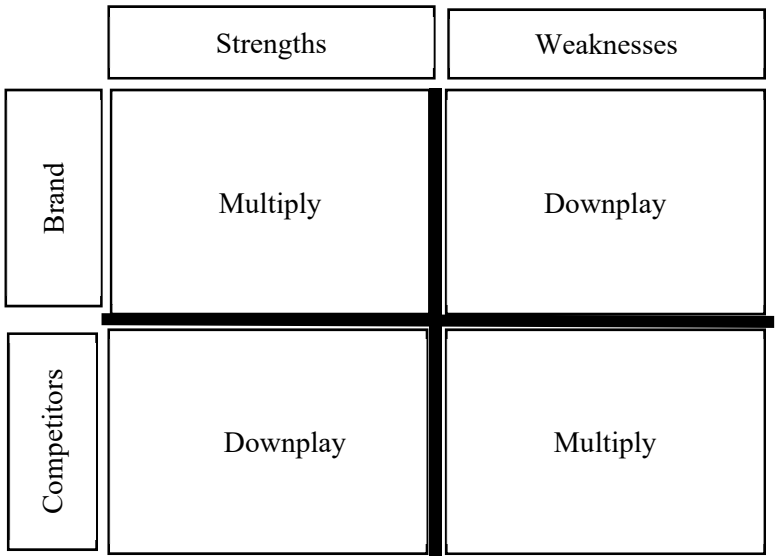


Figure 6. Brand Association Scheme

Source: (Pedrosa, 2021).

Taking into account these aspects allows retail enterprises to effectively direct their efforts to form positive associations in the minds of consumers, creating a unique and memorable image of the brand in the market. The detailed analysis of the positioning process is due to the importance of this characteristic and the complexity of choosing a brand position in an oversaturated market environment.

The studied models of brand building, somehow reflect in their structure – the positioning process, in our opinion, is strategic, aimed at defining and strengthening the idea of the brand in the minds of the target audience. This can be achieved using modern digital communication tools, artificial intelligence and loyalty programs, all these tools of the ability to build a strong relationship between the retail brand and the consumer.

3. Branding model of retail enterprises

All the components considered in the proposed models of branding are important for the creation of an integral product of the company. Each of the models has its advantages and disadvantages, which are presented in *Table 1*. According to the analysis, we have highlighted that none of the proposed branding models combines all the constituent elements of the brand that are emphasised at the beginning of the article.

The main problem for a retailer in building a brand is that it is not always the manufacturer of the products it sells. In most cases, such companies combine a large number of brands from different manufacturers or intermediaries. This complicates the process of forming the consumer's loyalty to a particular retail enterprise, because in this case the most difficult and at the same time the most important thing is to create a retail enterprise brand, which will be the flagship

and the main element ensuring the identification of the enterprise among competitors. The result of the created brand of a retail company will be that the consumer, looking for a certain product, which is represented in the offer of the competing companies, will look for a certain retail company, which will be remembered due to the created brand.

There are a large number of retail companies operating in the Ukrainian market, not all of which have their own production facilities or sell goods under their own brand. Nevertheless, they have created a strong corporate brand that distinguishes them from similar companies. An example of such companies can be the most famous store chains in Ukraine, such as Silpo, ATB, Novus. Each of these companies started its activity without its own brands in the assortment of stores, but each of the companies formed its own retail enterprises, which differ from other components of the brand. That is, each company has different physical attributes, identity and individuality, formed values and positioning different from competitors. All these components of the brand are followed at all stages of the implementation of the brand building and management processes. This proves that companies use brand building models, but the specifics of the retail company needs to create a brand building model in terms of its characteristics, as well as, this one should have an integrated approach given the future prospects.

In view of analysis, we proposed our own model of brand creation (*Figure 7*), consisting of 5 blocks that take into account all the key elements of creating and promoting the brand of a retail enterprise.

The first block of the model contains the basic components of the brand, its quality characteristics and the brand itself, which will unite the goods sold by the retail company. In the future, there will be a process of forming a retail company's brand from the main components of the brand presented in the model. It is mandatory in our opinion in the first block to determine the responsible persons, job/functional responsibilities, motivation of the staff, that is, to create a foundation for the formation of the internal brand of the company, none of the predecessor models took into account this. Next, testing of the proposed ideas takes place, analysis is carried out and appropriate decisions are already made in accordance with the results and a strategy is adopted to achieve certain goals. The model does not specify processes such as choosing goals, goals, tasks, since they must be consistent with the goals of the company and meet them. The first block is the main one in terms of creating a visual image of the brand, choosing its positioning and characteristics, which will later be reflected in all elements of branding of retail enterprises.

As mentioned in the article above, the most difficult task is to create and develop the brand of a company that simultaneously sells products of different brands from different manufacturers. That is why in the proposed model a lot of attention is paid to the first block, i.e. the development of basic elements, and these components themselves are indicated. The branding models proposed by scientists and practitioners did not combine all these

elements of brand building. Furthermore, the models studied do not take into account components such as:

– Corporate Identity, which is one of the main components of building a holistic visual image of the brand, which should then be followed at all stages of promoting the retailer's brand;

– tone of voice, which is the "key" with which the brand addresses its consumers.

Competition in the retail market is usually very fierce and filling the usual name or logo with something more than colour and font can play a crucial role for the company given the specificities of the retail sector.

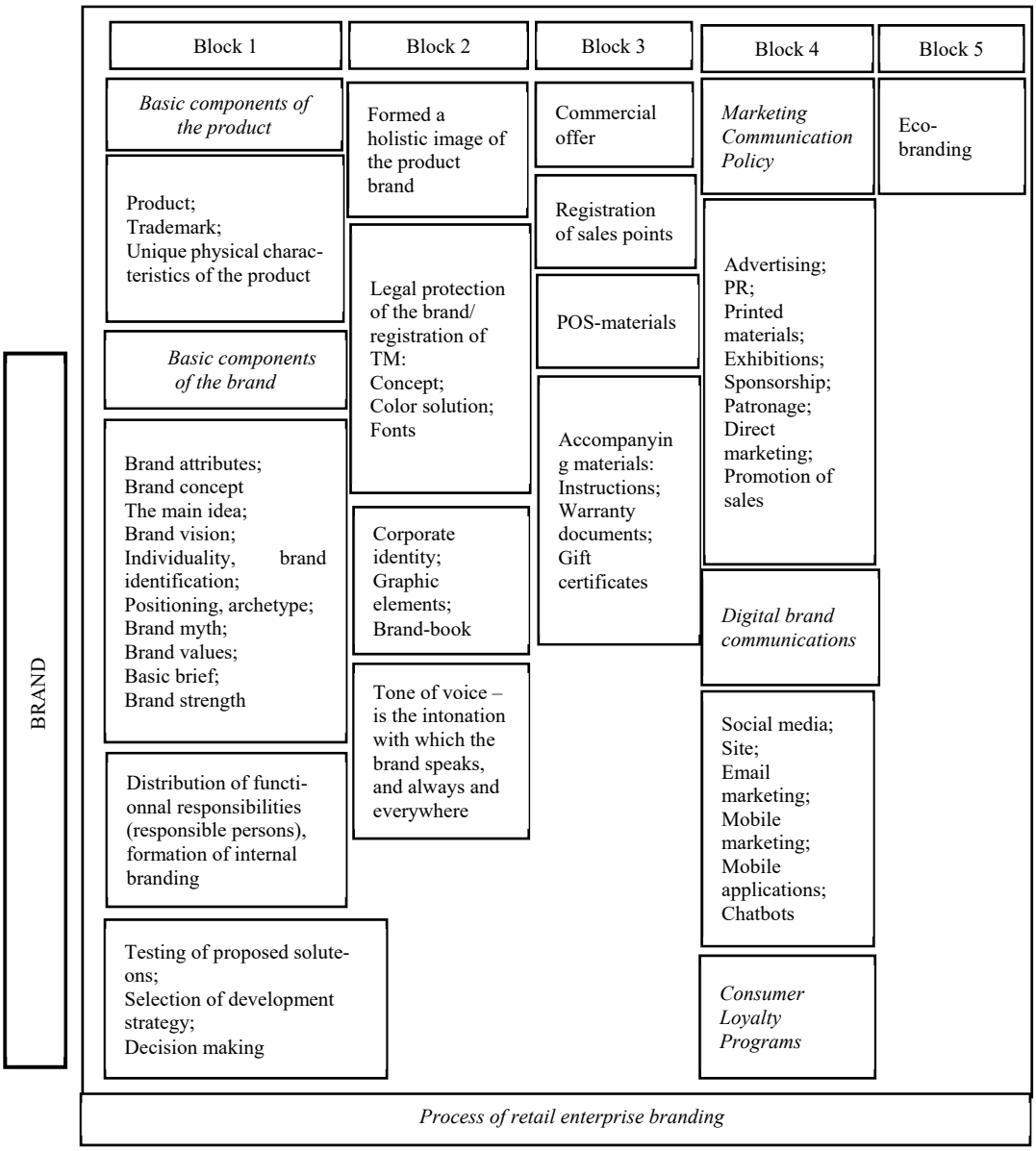


Figure 7. Retail enterprise branding model

Source: compiled by author.

The second block has a starting point, namely brand that was written above, in the future there is a process of registration of the trademark (determined by law), which will provide legal guarantees for the company regarding the misuse of brand by other enterprises. In parallel, a corporate identity is created, graphic solutions on the basis of which the company's brand book is built. The last component of the second block is the choice of tone of voice brand, this component will later be used primarily in communications with consumers.

The third block is the final in the construction of the brand and its accompanying components, it includes the creation of a holistic commercial offer of the company, as well as the formation of a unified design of company's office, points of sale, POS-materials and other accompanying documents, which are also elements of a holistic image of retail enterprise brand. When thinking about building the brand of a retail company, you must always think about offline points of sale and they must also be part of the formed image of brand.

The fourth block includes all components of communication activities, in relation to brand formation. It also includes the creation of a customer loyalty programme, which is currently one of the most effective ways of building commitment to a retailer's brand.

The fifth block of the retail branding model focuses on eco-branding issues. This is by far the most painful direction for companies, society and the world as a whole. We believe that this component should be considered when building a corporate brand and should be integrated into the activities of every company. We have found that the brand is the driving force, and consideration of environmental changes, global problems of humanity and the reflection of this in the brand of retail companies can influence and change the attitude towards various problems that are important for society.

All proposed solutions are based on the implementation of a comprehensive approach to building a retail enterprise brand and optimizing these processes due to their logical systematization. All the elements of brand formation are aimed at systematization and structuring of all tools for creating brands, which will allow to obtain the maximum result from their implementation in the activities of retail enterprises.

Conclusions

The process of branding is an integral component of the promotion and development of goods enterprising trade. That is why the research of branding models and their structural components is increasingly paid attention to practitioners and scientists in the field of brand management and marketing. In the context of the overall dynamics of market transformations and changes in consumer preferences, branding becomes of particular importance. A balanced combination of elements (individuality, value, essence, vision, positioning, brand strength) of branding models requires not

only understanding the preferences of the consumer, but also the ability to adapt to the rapid pace of innovations and challenges of the digital era.

The results of the research have been indicated that various branding models are used by retail entrepreneurs, such as: brand wheel, TTB, Unilever Brand Key, Zozulyov's model, model of stage of brand creation «Brand name Development Services». Each of these models has its own specifics and components, which are the starting point for the construction of a comprehensive system for managing brands of retail enterprises. The studied models in their composition have different elements of branding and accordingly have their advantages and disadvantages. According to the research, the specifics of retail companies require the construction of a new branding model, which combines the main elements of the brand, taking into account modern market requirements, which confirms the formed hypothesis.

Further research will be aimed at the development of a complex model of brand management of retail companies, the basis of which will be the proposed branding model.

REFERENCE	**СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ**
Aaker, D. A., & Joachimsthaler, E. (2009). *Brand Leadership: Building Assets In an Information Economy*. The Free Press.	Aaker, D. A., & Joachimsthaler, E. (2009). *Brand Leadership: Building Assets In an Information Economy*. The Free Press.
Bazilik. (2021). *Brand identity, brand image and corporate identity.* https://bazilik.media/identychnist-brendu-imidzh-brendu-ta-firmovyj-styl/	Bazilik. (2021). *Ідентичність бренду, імідж бренду та фірмовий стиль.* https://bazilik.media/identychnist-brendu-imidzh-brendu-ta-firmovyj-styl/
IMG. (2021). *8 brand strength factors.* https://www.marketing-ua.com/article/visim-faktoriv-sili-brendu/	ММГ. (2021). *8 факторів сили бренду.* https://www.marketing-ua.com/article/visim-faktoriv-sili-brendu/
Karkushka, O. O. (2023). Brand and customer loyalty, mechanisms of client retention and formation of a database of brand lawyers. In *Synergy of knowledge: New Horizons in Global Scientific Research* (pp. 130–133). International Science Unity.	Каркушка, О. О. (2023). Бренд і клієнтська лояльність, механізми утримання клієнтів та формування бази адвокатів брендів. У *Synergy of knowledge: New Horizons in Global Scientific Research* (с. 130–133). International Science Unity.
Kebeta. (2023). *Brand attributes, brand identification.* https://kebeta.agency/article/ atributi_brenda	Kebeta. (2023). *Атрибути бренду, ідентифікація бренду.* https://kebeta.agency/article/atributi_brenda
Nadtochiy, I. I., Rusnak, A. V., & Gritsenyuk, V. V. (2019). The essence of branding and its role in ensuring the competitiveness of the enterprise. *Effective Economics*, (12). http://www.economy.nayka.com.ua/pdf/12_2019/158.pdf	Надточій, І. І., Руснак, А. В., & Гриценюк, В. В. (2019). Сутність брендингу та його роль у забезпеченні конкурентоспроможності підприємства. *Ефективна економіка*, (12). http://www.economy.nayka.com.ua/pdf/12_2019/158.pdf
Pedrosa, L. (2021). *Flexible brands.* Yakaboo Publishing.	Педроса, Л. (2021). *Гнучкі бренди.* Yakaboo Publishing.
Prosvirina, A. (2022). *Brand values. 10 ways to create brand values.* https://koloro.ua/ua/blog/brending-i-marketing/cennosti-brenda.-10-sposobov-sozdat-cennosti-brenda.html	Просвіріна, А. (2022). *Цінності бренду. 10 способів створити цінності бренду.* https://koloro.ua/ua/blog/brending-i-marketing/cennosti-brenda.-10-sposobov-sozdat-cennosti-brenda.html
SendPuls. (2023). *Attribution to the brand.* https://sendpulse.ua/support/glossary/brand-attributes	SendPuls. (2023). *Атрибути бренду.* https://sendpulse.ua/support/glossary/brand-attributes

Shevchenko, O. L. (2012). Brand positioning: key factors of influence on the consumer. *Formation of market economy*, (27). https://core.ac.uk/download/pdf/32607366.pd	Шевченко, О. Л. (2012). Позиціонування бренду: ключові фактори впливу на споживача. *Формування ринкової економіки*, (27). https://core.ac.uk/download/pdf/32607366.pdf
Skillsetter. (2022). *12 arkhetipiv to the brand: back that self.* https://skillsetter.io/blog/how-to-archetypes-ua	Skillsetter. (2022). *12 архетипів бренду: як обрати той самий.* https://skillsetter.io/blog/how-to-archetypes-ua
Smerichevsky, S. F., Petropavlovska, S. E., & Radchenko, O. A. (2019). *Brand management.* NAU.	Смерічевський, С. Ф., Петропавловська, С. Є., & Радченко, О. А. (2019). *Бренд-менеджмент.* НАУ.
Ustik, T., Karmazinova, V., Shurpa, S., Zhuk, O., Boiko, O., & Radkevych, L. (2023). *The Impact of Digitalization on Marketing Communications: New Challenges for Branding and Advertising Business.* https://wseas.com/journals/isa/2023/a745109-1079.pdf	Ustik, T., Karmazinova, V., Shurpa, S., Zhuk, O., Boiko, O., & Radkevych, L. (2023). *The Impact of Digitalization on Marketing Communications: New Challenges for Branding and Advertising Business.* https://wseas.com/journals/isa/2023/a745109-1079.pdf
Yastremska, O. M., Timonin, O. M., & Timonin, K. O. (2013). *Brands of industrial enterprises: formation and efficiency of use.* Ed. HNEU.	Ястремська, О. М., Тімонін, О. М., & Тімонін, К. О. (2013). *Бренди промислових підприємств: формування та ефективність використання.* Вид-во ХНЕУ.
Zozulyov, O. V., & Nesterova, U. V. (2011). *Branding models: classification and compressed characteristics.* https://ela.kpi.ua/bitstream/123456789/37121/1/MvU-2006-5_p44-49.doc	Зозульов, О. В., & Нестерова, Ю. В. (2011). *Моделі брендингу: класифікація та стисла характеристика.* https://ela.kpi.ua/bitstream/123456789/37121/1/ MvU-2006-5_p44-49.doc

Conflict of interest: The author certifies that he/she has no financial or non-financial conflicts of interest in relation to this manuscript; has no relationships with government agencies, commercial or non-commercial organizations that could be interested in presenting this viewpoint. Given that the author is affiliated with the institution that is the publisher of the journal, which may give rise to a potential conflict or suspicion of bias, the final decision to publish this article (including the selection of reviewers and editors) was made by those members of the editorial board who are not affiliated with this institution.

The article was written within the scope of the research work "Digital Marketing Management" (state registration number is 0124U000158).

Karkushka O. Branding of retail enterprises. *Scientia Fructuosa*. 2024. № 3. P. 81–87. https://doi.org/10.31617/1.2024(155)05

Received by the editorial office: 01.03.2024.
Arrived after revision: 18.03.2024.
Accepted for printing: 02.04.2024.
Published online: 11.06.2024.

DOI: 10.31617/1.2024(155)06
UDC: 336.221:332.1=111

BAGATSKA Kateryna,
Doctor of Sciences (Economics), Associate Professor, Professor at the Department of Business Economics and Finance
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0003-2184-2971
k.bagatska@knute.edu.ua

FINANCING OF INFRASTRUCTURE PROJECTS IN TERRITORIAL COMMUNITIES

The issues of financial support for the restoration of critical infrastructure are of utmost relevance during martial law, characterized by limited resources and capabilities and increased risks, and must be addressed comprehensively at the state and local levels. The structural redistribution of local budget revenues and expenditures that occurs during martial law necessitates the search for effective ways to attract off-budget instruments for financial support of infrastructure in communities. The aim of the article is to assess the financial capacities and opportunities for restoring the infrastructure of territorial communities and to review promising financial mechanisms. The research is based on the hypothesis that it is necessary to develop combined forms of financial support at the level of territorial communities with an emphasis on intensifying the involvement of international donors. The research methods were used, such as systematic and comparative analysis and synthesis, abstract and logical method, and logical generalization. The research is based on materials from government sources on the state and local budgets and on the basis of scientific works by Ukrainian scholars. The article has presented the opinions of scientists on the financial support essence and systematized its forms, methods and tools for direct financial support of infrastructure projects in

БАГАЦЬКА Катерина,
д. е. н., доцент, професор кафедри економіки та фінансів підприємства
Державного торговельно-економічного університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0003-2184-2971
k.bagatska@knute.edu.ua

ФІНАНСОВЕ ЗАБЕЗПЕЧЕННЯ ІНФРАСТРУКТУРНИХ ПРОЄКТІВ У ТЕРИТОРІАЛЬНИХ ГРОМАДАХ

Питання фінансового забезпечення відновлення критичної інфраструктури мають надзвичайну актуальність в період воєнного стану, що характеризується обмеженими ресурсами і можливостями та підвищеними ризиками, і мають комплексно вирішуватися на державному і на місцевому рівнях. Структурний перерозподіл у системі доходів і видатків місцевих бюджетів, що відбувається протягом дії воєнного стану, зумовлює необхідність пошуку ефективних способів залучення позабюджетних інструментів фінансового забезпечення інфраструктури в громадах. Метою статті є оцінка фінансових спроможностей та можливостей до відновлення інфраструктури територіальних громад та огляд перспективних фінансових механізмів. Представлене дослідження базується на гіпотезі про необхідність розвитку комбінованих форм фінансового забезпечення на рівні територіальних громад з акцентом на активізації залучення міжнародних донорів. Методами дослідження є системний і порівняльний аналіз та синтез, абстрактно-логічний метод, логічне узагальнення. Дослідження виконане за матеріалами урядових джерел щодо державного та місцевих бюджетів і на основі наукових праць українських вчених. Викладено думки науковців щодо сутності фінансового забезпечення, систематизовано його форми, методи та інструменти прямої дії фінансового забезпечення

communities; revealed the possibilities and prospects for their application under martial law. The expediency of choosing combined forms of financial support as those that balance the interests of the participants has been substantiated. Based on the state analysis of budgetary financing of infrastructure projects at the state and local levels, the availability of financial capacity in local budgets and the continuing trend of long-term projects by international donors at the national level were established. The main method of financial support for projects at the state level is loan programs from international financial institutions and foreign governments. The author has proposed the development of promising forms of financial support for the restoration of infrastructure projects in the form of loan and grants programs combination from the Nordic Environment Finance Corporation (NEFCO).

Keywords. Financial provision, financing, capital investments, infrastructure projects, territorial communities, utility sector.

інфраструктурних проєктів в громадах, розкрито можливості й перспективи їх застосування в умовах воєнного стану. Обґрунтовано доцільність вибору комбінованих форм фінансового забезпечення як таких, що забезпечують баланс інтересів учасників. На основі аналізу стану бюджетного фінансування інфраструктурних проєктів на державному і місцевому рівнях встановлено наявність фінансової спроможності у місцевих бюджетів та збереження тенденції довгострокових проєктів міжнародними донорами на загальнодержавному рівні. Основним методом фінансового забезпечення проєктів на державному рівні є кредитні програми від міжнародних фінансових інституцій та урядів зарубіжних країн. Запропоновано розвиток перспективних форм фінансового забезпечення відновлення інфраструктурних проєктів у формі поєднання кредитних та грантових програм від Північної екологічної фінансової корпорації (НЕФКО).

Ключові слова: фінансове забезпечення, фінансування, капітальні інвестиції, інфраструктурні проєкти, територіальні громади, комунальний сектор.

JEL Classification: E69, H54, R51.

Introduction

The problem of ensuring the proper condition and functioning of municipal infrastructure remains one of the primary tasks in managing territorial communities, the solution of which requires significant amounts of capital. The full-scale invasion of Ukraine, which caused significant damage to this infrastructure, increased the urgency of the issue of proper financial support for its restoration in those communities that are closer to the front line and its intensive use in regions that received and continue to receive internally displaced persons and ensure the relocation of enterprises.

Scientists emphasized the urgent need to update the infrastructure and the effectiveness of its financial support even in the pre-war period. Thus, Kyrylenko and Maksymchuk (2021, p. 6) note the problematic situation in the country with the renewal of fixed assets and emphasize that this problem requires budget expenditures calculated for the long term, the transition to investment-oriented budgeting, the need for the state to ensure a favorable investment climate and improving the efficiency of the use of local budget funds. Malyniak and co-authors (2021, p. 578–579) draw attention to the interdependence of maintaining an adequate infrastructure level and the quality of public service provision, which is realized through the effective direction of public expenditures. In the same paper, the authors summarize the opinions of foreign scientists regarding the consequences of the war for the economy and the budget system, among which it is worth highlighting theses about the feasibility of intensifying the work of government structures

in the direction of attracting external capital to finance the economy during military operations (Malyniak et al., 2021, p. 575).

The urgency of the need to renew infrastructure in the country, even in the pre-war period, was substantiated in one of the previous works (Bagatska & Matusova, 2021), which analyzed the dynamics of wear and tear of fixed assets (62% at the end of 2020) and established a significant increase in the level of their wear: up to 83.5% in 2014 – in the first year of the beginning of the partial invasion of the territory of Ukraine. Although the overall level of wear and tear decreased in subsequent years, wear and tear of 60% was exceptionally threatening from the point of view of infrastructure safety, which was pointed out by such scientists as Kudria (2017), Repich (2021), Mikhailenko (2019), Zhadan (2020).

The problematic issues of financial support for the restoration of critical infrastructure during the period of martial law are raised at the national and local levels by governmental and non-governmental structures and scientists. For example, Kudryashov (2022, p. 50–51) considers the issue of attracting private capital under state guarantees, emphasizes the importance of using funds from foreign countries and international financial organizations to finance the restoration of infrastructure facilities, and justifies the feasibility of using debt financing instruments, in particular military bonds. Bystryakov et al. (2023) emphasized the need to strengthen the state's role in the financial support of critical infrastructure institutions and noted the limited financial capacity of the state to finance the sustainable functioning of these facilities.

The structural redistribution in the system of revenues and expenditures of local budgets during martial law makes it necessary to find effective ways to attract extra-budgetary instruments to support community infrastructure.

The article aims to assess the financial capabilities and opportunities to restore the infrastructure of territorial communities and review promising financial mechanisms. The objectives facilitating the article's goal entail clarifying territorial communities' financial support classification, evaluating state budget-level infrastructure project financial backing, and revealing promising financial support modalities. The presented study is based on the hypothesis of the need to develop combined forms of financial support at the level of territorial communities, with an emphasis on the activation of the international donors' involvement.

Research methodology includes systematic and comparative analysis and synthesis, abstract-logical method, and logical generalization. The research was carried out based on the official data of the Ministry of Finance of Ukraine on state and local budgets and on the scientific works of Ukrainian scientists.

The first section within the aim of the article is dedicated to the theoretical study of financial support, emphasizing the categorization of its various types. Following this, the second section undertakes an evaluation of the capacity of local budgets in financing infrastructure projects, coupled with an analysis of the primary initiatives by international donors at the national level. Subsequently, the third section elucidates the principal programs facilitating the funding of infrastructure projects. The conclusions

drawn substantiate recommendations concerning the implementation of prospective mechanisms for financial support aimed at enhancing infrastructure projects within territorial communities.

1. Classification of infrastructure projects financial provision

The "financial provision" concept in the Ukrainian scientific literature is considered one of the subsystems of the financial (financial and credit) mechanism at the macro- and micro-levels.

In particular, according to Kireitsev (2002), "Financial provision consists in the allocation of a certain amount of financial resources to solve certain tasks of the financial policy of a business entity. At the same time, a distinction is made between its protective and regulatory effects. The provisioning action is manifested in establishing sources of financing, that is, the coverage of everyday needs, and characterizes the passive influence of financial provision. Regulatory action exerts influence through allocating sufficient funds and through a specific form of financial support, and characterizes its active influence." We agree with distinguishing two directions of implementing financial support: direct (supportive) and indirect (regulatory).

For his part, Oparin (2005, p. 13) understands financial provision as "a subsystem (method of financial impact) of the enterprise's financial mechanism, the components of which are such forms as self-financing, lending, external financing (investment, budget allocations, etc.). Different forms of financial provision are used in practice simultaneously by establishing the ratio between them that is optimal for a given stage of society's development." Here, the scientist emphasizes the forms of manifestation, which also details the essential characteristics of financial provision.

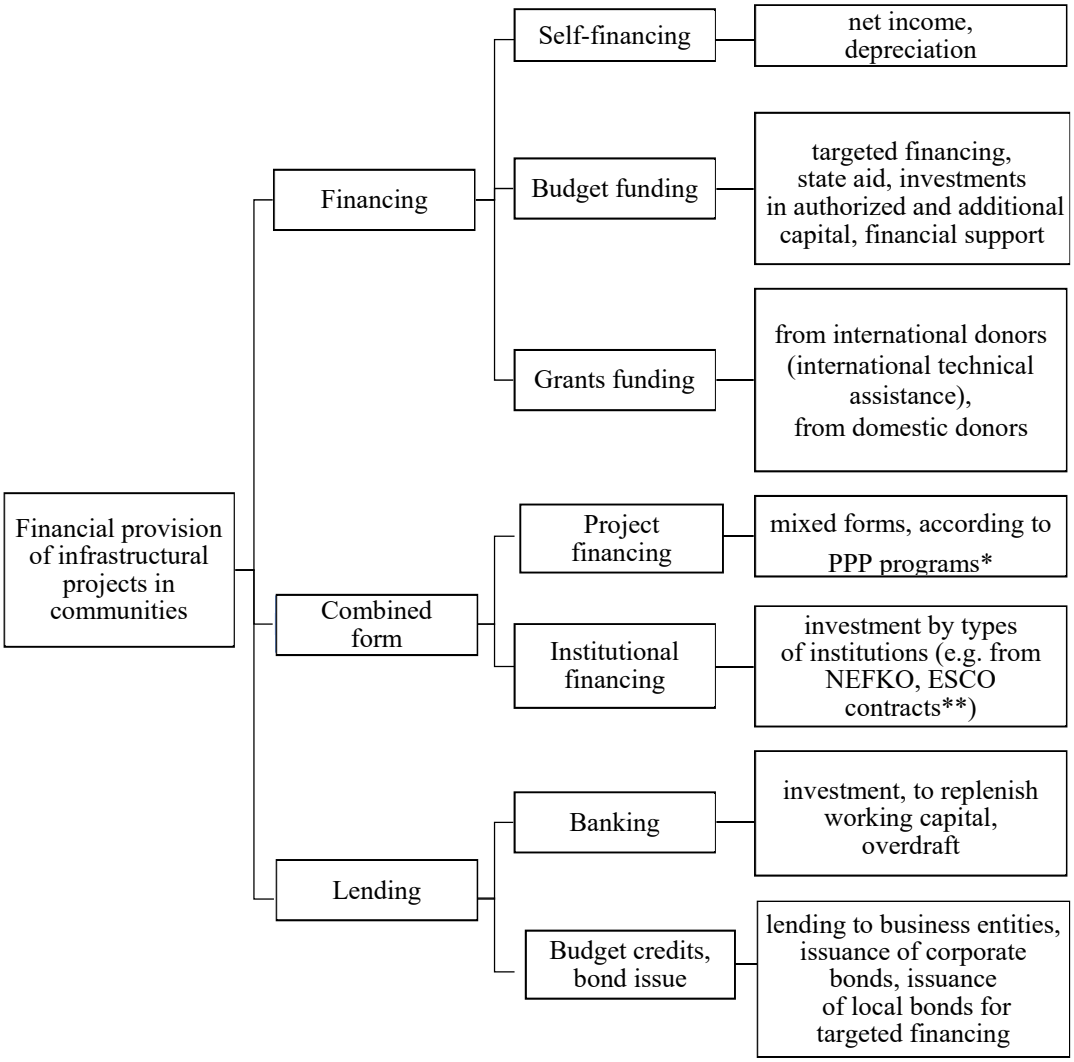
An alternative approach to financial provision is the definition of Vasylyk (2000), who understood it as a set of measures defined by legislation aimed at creating a financial base to achieve specific goals. The author focuses on the target function of financial provision, which is also worth agreeing with because this interpretation does not contradict previous approaches.

The addition of the word 'mechanism' to the concept of 'financial provision' is the strongest way to emphasize the need for a deep interpretation of its forms, to reveal the internal components of the concept and explain how it works. The division of 'mechanisms' in finance into directive and regulatory, as described in (Kireitsev et al., 2001), is an important essential feature of the subject.

A directive mechanism is the implementation of financial relations with the direct involvement of the state, or with one party to the relations acting as an agent on the state's behalf. The instruments of this mechanism are taxes, state credit, budget financing, and so on. The peculiarity of these instruments is the clear directives available for their implementation in the form of regulatory legal acts. The directive mechanism is the opposite of the regulatory mechanism. The latter is used for financial relations in the private sector or for the shadow economy, where financial flows are controlled. It is

important to note that the mechanism of financing commercial municipal enterprises can be considered a combination of directive and regulatory. Local governments represent the interests of the state and their own community interests, while municipal-owned enterprises have greater financial autonomy and less accountability. When describing the mechanism of financial provision for infrastructure projects in territorial communities, we focus on the form of its implementation, methods and tools.

Financial provision for projects in territorial communities is a comprehensive approach that generates both material and financial resources, including capital, to achieve strategic and tactical goals set by local governments. Financial provision for projects is generally carried out through such methods as financing (including project financing and self-financing), lending, issuing, investing, and has a direct and indirect (regulatory) effect (*Figure* below).



Forms, methods and tools of direct action for financial provision of infrastructure projects in communities

* PPP – public-private partnership
** ESCO – energy service contracts

Source: compiled by the author.

International financial assistance in the form of grants is also financing by its economic nature. It is provided on a non-refundable basis and is targeted, as it is financed for approved projects, plans, and programs. The issuance of debt instruments corresponds to lending by its economic nature.

Indirect instruments of financial security include tax rates, lending rates, exchange rates, etc. Grant funding for infrastructure projects can be obtained indirectly through grants to local budgets in the form of international technical assistance. Combined forms of financing are the most promising, offering flexibility and variation in the methods, instruments, and participants in the financial provision process.

Project financing is a method used to finance large-scale infrastructure projects, usually with the participation of various funders and several sources of financing in various forms, including loans, which are repaid from the funds received from the project. To manage project financing, a separate legal entity is often created to allocate resources and control of all cash flows. Unlike conventional lending, the lenders are secured by the cash flows from the project itself, which is called the term "limited recourse".

While project financing is not widespread in Ukraine, financing of road and transport facilities repair can be classified as such. Financing under Public-Private Partnership (PPP) programs involves a private partner making investments in a PPP object, which are the objects specified in clause 1 of Article 4 of the Law of Ukraine "On Public-Private Partnership" (2023). These include water collection, treatment and distribution, waste management, construction and overhaul of buildings, etc. PPPs are implemented in the form of concession agreements, property management agreements, joint venture agreements and other agreements. There are two ways to finance PPP. One is to combine it with lending and involve both budgetary and private financing in various ways. The other way is to have private financing dominate, when the investor company raises its own or credit resources to invest in the project. As Doroshenko (2013, p. 61) correctly states, the dominance of private financing in a PPP project carries significant risks for community residents. These include a significant increase in utility tariffs and/or deterioration in the quality of services provided. This is because the price of attracting private investment capital is higher than public. Furthermore, investments must be recouped, so the utility tariff of the PPP object must include profit. That’s why the dominance of private capital in PPPs in Ukraine is inefficient.

At the same time, Ukrainian scholars Parubets, Sugonyako, and Krasnyanska (2017) are clear that a variety of resources must be used to achieve a balance of interests between the public and private sectors in this area, with particular emphasis on PPPs and municipal partnerships. At the same time, local authorities will undoubtedly benefit from cooperation within the framework of PPPs, receiving a renovated municipal property object along with an established system of its operation upon completion of the

partnership. Private sector involvement in local utilities is another avenue worth exploring; corporatization with mixed ownership of the community and private business may prove to be a significant incentive for the private sector to participate in PPPs at the local level.

Study Kyiv as an example. The city council controls six joint-stock companies and three limited liability companies, with a shareholder holding less than 50% interest in 18 joint-stock companies and 18 limited liability companies.

Lending is not widely used as a method of financial support, although Ukrainian banks offer specialist loan programs for municipal enterprises. Cities that are financially capable can provide loans to businesses, including municipal enterprises. A review of the financial practices of local councils and municipal enterprises reveals that financing mechanisms prevail over lending ones. An exception may apply to tariff-based critical infrastructure enterprises, such as water utilities, heating companies, and electric transport companies, which implement investment projects under international loan programs.

It is clear that the issuance of local loan bonds is not an affordable form for all local councils. This is because this form of lending is only allowed to ARC and cities (the Decision of the NSSMC No. 391, 2018). However, bond issuance has not become widespread among city councils in recent years. For example, between 2003 and 2020, only 19 city councils issued bonds (Bakhur, 2021). In the period 2019–2022, only Lviv, Kharkiv, Kyiv, and Ivano-Frankivsk city councils issued local bonds through an open offer procedure. Municipal enterprises did not use bonds as a source of financial support at all.

The limited use of bonds is likely due to a combination of factors. Firstly, there are only a few issuers, and cities lack the financial capacity to repay these debt instruments. Secondly, there is a shortage of experienced professionals and qualified advice. However, the adoption of the Law of Ukraine "On Capital Markets and Organized Commodity Markets" (2020) expanded the list of types of bonds that may be of interest to territorial communities. This includes targeted bonds, green bonds, infrastructure bonds, and more.

A municipal enterprise, if it is a commercial enterprise, may issue corporate bonds despite its unitary status. It is the full payment of contributions to the authorized capital that determines the ability to issue. The maximum amount of interest-bearing and/or discount corporate bonds may be issued is three times the amount of equity capital or the amount of collateral provided to the company by third parties for this purpose. The decision to issue bonds of a municipal enterprise must be made by the relevant local authority. The funds raised from the issue must be used for the purposes specified in the prospectus or the decision on the issue.

Green bonds issued to finance environmental projects are an important addition to the instruments for financing energy modernization in communities. One example of the feasibility of using such an instrument in the

municipal sector is the construction of waste processing plants using environmental technologies. Such projects will ensure compliance with clause 10 of Article 18 of the Law of Ukraine "On Capital Markets...": "The decision to issue bonds or the bond prospectus may provide that the sources of repayment of green bonds and payment of income on them are proceeds from the commissioned facility, the This includes financing or the sale of which was carried out at the expense of funds raised from the placement of green bonds, as well as other proceeds provided for by the decision to issue bonds or the bond prospectus (Law of Ukraine "On Capital Markets and Organized Commodity Markets", 2020).

The capitalization of municipal enterprises through bonds can be achieved indirectly through the issuance of municipal loan bonds by the local council to finance the restoration, construction or overhaul of vital infrastructure facilities on the balance sheet of municipal enterprises, including water utilities, heating, roadways, transport, etc. India provides a clear example of the success of this mechanism. As described in Kozak and Moskvin (2017, p. 37–39), municipal corporations issued bonds in 2000, which were exempt from taxation and did not have the status of corporate. However, the authors are clear that India's experience in financing municipal infrastructure with municipal bonds shows that this instrument can only be used by large and medium-sized cities, while small cities lack the institutional capacity to do so.

For the municipal sector, financing capital investments through the issuance of municipal bonds issued by local authorities is a highly profitable mechanism. Enterprises capitalize their value and upgrade their material base, while the costs and risks are mainly borne by the local budget. Local authorities can be reassured that bond issuance by subordinate enterprises is a safer instrument from a risk perspective. The local budget acts only as a guarantor in this process, and does not bear direct costs.

Parubets, Palioha and Sugonyako (2016, p. 304) are adamant that the municipal lending system must be developed through the creation of a network of municipal banks that will place valuable municipal securities and provide support in their sale. The idea of establishing municipal banks in Ukraine was actively discussed 10–15 years ago and was put on hold after the 2014 banking system reform, during which many well-known banks with municipal ownership were liquidated. Subsequently, the development of the banking system was directed towards consolidation and comprehensive digital transformation, which makes banking services available anywhere in Ukraine with Internet access. Therefore, the issue of establishing municipal banking institutions has lost its relevance.

2. Status of budgetary financing of investment projects

The ability of municipalities to finance capital expenditures, including investments, has increased since the beginning of the budget decentralization reform. Thus, according to (Chernyshov, 2021), over the 5 years of the

reform, capital expenditures of local budgets increased by more than 60% and in 2020 amounted to UAH 96.8 billion, which is UAH 5.6 billion more than in 2018 and UAH 64.6 billion more than in 2015. In 2021, the share of special funds in the structure of local budgets will reach almost 30%. However, the war forced a reduction of such expenditures to 12.9% of the structure of revenues and 10.2% of local budget expenditures (Onyshchuk, 2023). The financing of capital expenditures by municipalities during the war was largely driven by an increase in PIT revenues in municipalities where military units were registered. Thus, in 2022 and the first 9 months of 2023, local budgets were in surplus. In the first half of 2023, the surplus of local budgets amounted to UAH 64.5 billion (Gaidai, 2023). Excluding loans and financing, revenues of local budgets exceeded expenditures in 2022, and the share of transfers from the state budget decreased. The share of local budgets in consolidated budget revenues (excluding transfers) increased to 24.4%, the highest since 2017. Therefore, the local budgets of the less affected regions have the financial capacity, the only question is the priority of budget expenditure allocation. However, due to the high public outcry over the adequacy of funding, especially for wartime improvements, military PIT revenues were centralized in the state budget in October 2023.

The central executive authorities are working to raise funds from international financial institutions and foreign governments to finance infrastructure projects at the municipal level. Long-term loan agreements on favorable terms for municipalities are the result of this work. Martial law did not stop Ukraine's cooperation with international lenders. The *Table* below shows the results of this cooperation.

Table

International loans attracted by the State to the Special Fund of the State Budget of Ukraine for 2022–2024 for the implementation of investment projects

Creditor	Project	Total amount of invest-ments	Program	Amounts of borrowing, UAH million		
				2022	2023	2024 (plan)
IBRD	Urban infrastructure development project II,	USD 326.6 million	Implementation and coordi-nation of project activities	60.9	26.7	23
			Development of urban infrastructure and measures in the sector of centralized heat supply, water supply in Mykolaiv and Chernivtsi	949.6	5018.5	1915.5
			Subvention from the state budget to local budgets for the recovery of critical infrastructure facilities	–	–	519. 5

Continuation the Table

Creditor	Project	Total amount of invest-ments	Program	Amounts of borrowing, UAH million		
				2022	2023	2024 (plan)
	"Increasing energy efficiency in the centralized heat supply sector of Ukraine"	USD 205 million	Development of urban infrastructure and measures in the sector of centralized heat supply, water supply in Mykolaiv and Chernivtsi	949.6	225	31.6
			Implementation and coordination of project activities	23.3	16.4	4.16
	"Eastern Ukraine: reunification, restoration and revival (Project 3B)"	USD 100 million	Development of agricultural infrastructure in Luhansk region	30	–	–
EBRD	"Completion of construction of the subway in Dnipro"	EUR 152 million	Subvention from the state budget to the budget of the Dnipro urban territorial community for the completion of the construction of the metro in the city of Dnipro	684.4	229.1	55
	"Extension of the third metro line in Kharkiv "	EUR 160 million	Subvention from the state budget to the budget of the Kharkiv urban territorial community for the extension of the third line of the metro in the city of Kharkiv	303.3	76..2	502.5
	"Emergency credit program for the recovery of Ukraine"	EUR 200 million	Subvention from the state budget to local budgets for project implementation within the program	–	1703.4	2360.2
EIB	"Municipal infrastructure development program of Ukraine"	EUR 400 million	Municipal infrastructure development program	500	4661.8	2534.5
			Implementation and coordination of project activities	9.3	15.1	15.1
	"Development of the water supply and drainage system in the city of Mykolaiv"	EUR 15.54 million	Development of urban infrastructure and measures in the sector of centralized heat supply, water supply in Mykolaiv and Chernivtsi	102.6	241.9	353.8
	"Program for the recovery of Ukraine"	EUR 340 million	Subvention from the state budget to local budgets for project implementation within the program	502.7	5292	4499

Continuation the Table

Creditor	Project	Total amount of invest-ments	Program	Amounts of borrowing, UAH million		
				2022	2023	2024 (plan)
	"Development of urban passenger transport in Ukrainian cities"	EUR 400 million	Development of urban passenger transport in Ukrainian cities	1006	6226.6	3528.1
	"Completion of onstruction of the subway in Dnipro""	EUR 152 million	Subvention from the state budget to the budget of the Dnipro urban territorial community for the completion of the construction of the metro in the city of Dnipro	460.3	2290.9	494.1
	"Extension of the third metro line in Kharkiv"	EUR 160 million	Subvention from the state budget to the budget of the Kharkiv urban territorial community for the extension of the third line of the metro in the city of Kharkiv	10	755.3	219.5
Credit institution for recon-struction	Chernivtsi municipal water management project	stage 1 – EUR 17 million; stage 2 – EUR 21.55 million	Development of urban infrastructure and measures in the sector of centralized heat supply, water supply in Mykolaiv and Chernivtsi	219.6	543	696.7
	"Energy efficiency in communities"	EUR 25,5 million	Energy efficiency of public buildings in Ukraine	86.7	257	338
Japan Agency for Interna-tional Coopera-tion	"Reconstruction of wastewater treatment facilities and construction of a technological line for processing and disposal of sediments of the Bortnytsky aeration station"	JPY 108 193 million	Development of urban water supply	132.8	10.2	10.2
Governmen t of the French Republic	Drinking water supply project in Mariupol	EUR 64 million	Implementation of the drinking water supply project in Mariupol	150	–	–
	Project to improve water supply in the city of Kyiv	EUR 70 million	Development of urban water supply	100	1118.3	89.6

End the Table

Creditor	Project	Total amount of invest-ments	Program	Amounts of borrowing, UAH million		
				2022	2023	2024 (plan)
	The project to improve the supply of drinking water in the Luhansk region	EUR 70 million	Implementation of an investment project for the supply of drinking water in the Luhansk region	59.4	–	–
	Total for the year			25 537	169 956	62 159.7

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

The table is shown that in 2022–2024 international financial institutions and foreign governments provided and are providing loans to 14 investment projects for the development of municipal infrastructure, with the project to restore the heat and water supply infrastructure in Mykolaiv and Chernivtsi financed by four lenders and the project to complete the metro in Dnipro and Kharkiv financed by two. With the onset of the full-scale invasion, lending to projects in the East ceased. It is worth noting that the total volume of lending to Ukraine's infrastructure will increase significantly in 2023 (by five times, or 565%). In 2024, the planned volume of lending to municipal infrastructure was reduced by 63.4%, but these volumes remain almost one and a half times higher than in 2022.

Over the period analyzed, the share of municipal infrastructure lending in all international financial assistance programs has increased significantly. While in 2022, 13.65% of the international partners' funds were planned to be allocated to municipal infrastructure financing, in 2023 this share was already 16% and in 2024 it was to increase to 28.3% of the total amount of funds. However, in absolute terms, it is planned to finance projects worth UAH 17.6 billion in 2024, which is UAH 9.6 billion less than in 2023, when international lenders allocated UAH 27.2 billion for infrastructure financing.

Prospective programs for the financial support of projects in the infrastructure sector

The lending programs of international and national financial institutions are usually implemented to ensure the achievement of the strategic goals of sustainable development (SDGs), in particular goals 6 – Clean water and adequate sanitation, 7 – Renewable energy, 11 – Sustainable cities and communities, 12 – Responsible consumption, 13 – Combating climate change, 15 – Conservation of terrestrial ecosystems. One example is the lending of the Nordic Environment Finance Corporation (NEFCO), established in 1990 by the Nordic countries to finance environmental projects in Central and Eastern Europe. NEFCO finances projects that improve the environment and deliver cost-

effective results. NEFCO works with a number of financial institutions. It also manages funds on behalf of other organizations that provide funding for environmental projects, including the European Commission and Nordic governments. In Ukraine, NEFCO finances two programs: "Cleaner Production" and "Eco-Efficiency". These programs finance only the modernization of existing facilities, with a minimum borrower contribution of 10%. The funds generated by the savings from improved energy efficiency and resource conservation are used to repay the loan.

The municipal sector is eligible for loans under the Eco-Efficiency Program. The minimum loan amount is UAH 350 000 and the maximum UAH 3 million. The maximum loan term is 8 years. The Clean Production Program provides loans to both municipal and private enterprises to implement measures to improve the use of natural resources.

Before the full-scale invasion, NEFCO had financed 320 projects in Ukraine, resulting in the energy upgrading of more than 420 municipal buildings (Ministry of Finance, 2014).

According to Kolosova (2022), the greatest lending activity under NEFCO programs was observed in the period 2013–2018. During this time, the company financed loans worth EUR 86 million and grants worth EUR 26 million. The amount of local co-financing under NEFCO programs was EUR 118 million, or 51%. However, in the period 2019–2022, before the full-scale invasion began, NEFCO suspended projects in 18 cities, resulting in Ukraine receiving about 20% less investment and losing about EUR 35 million. At the same time, the grants that financed the preparation of these projects were lost or not provided, and, accordingly, communities lost about UAH 160 million a year in savings that could have been achieved from the implementation of the projects. The corporation cited bureaucratic obstacles, inconsistency of local authorities, and lack of qualified specialists as one of the reasons for the unimplemented projects.

In July 2022, NEFCO launched the NEFCO Green Recovery program in Ukraine, aimed at long-term eco-recovery activities in communities affected by the consequences of the hostilities. The program was launched in cooperation with Scandinavian, European and international donors and institutions. NEFCO works directly with communities to help them plan and finance sustainable recovery. Contributions to existing facilities and initiatives managed by NEFCO can be repurposed for the new program based on the immediate recovery need and complemented by new initiatives and contributions. The program is available on an ongoing basis and will provide financial and technical assistance to communities for a variety of repair and reconstruction projects that will be carried out in an environmentally sound manner, as well as support them in developing local green recovery plans. The first participants in the program were the EU, Denmark, Finland, Norway, and Sweden.

The disadvantage of financing mechanisms through NEFCO is that the economic impact of the projects is delayed, as the utility customer will pay the amount of savings on utility bills to NEFCO for a long period of time. NEFCO's use of financing mechanisms and their combination is limited in terms of objects of application, but these mechanisms allow for the modernization and eventual capitalization of infrastructure projects that often pose the greatest financial burden on local budgets.

Conclusions

The crisis conditions in which the country finds itself require the search for optimal forms of financing capital investments for infrastructure restoration. Permanent threats and risks, uneven availability of own sources of funding among territorial communities, and changes in government policy on financial decentralization under martial law exacerbate this urgent problem. While it is certainly a positive development that many communities in the central and western parts of the country have retained the capacity to finance infrastructure, security and defense remain the top priorities. Therefore, local governments should only fund projects that are directly related to these needs and the priority needs of community life support.

We consider the choice of combined forms of financial support for infrastructure restoration to be the most promising, as the presence of paid and repayable sources in the financing structure will encourage communities to find ways to grow their own revenue base, expand the horizons of international partnership, and strengthen the institutional capacity to attract external foreign capital.

The continued funding of infrastructure projects by international donors, even in those regions of the country close to the contact line, demonstrates the confidence of international partners in a positive outcome of the hostilities for Ukraine, which can also be considered a positive signal. It is worth noting that the reduction in planned funding by international donors in 2024 cannot be considered a sign of a decrease in international support in general, as the article provides data only on funds that go through the state budget. Local grant and loan programs to support local economic development, including in terms of infrastructure, continue. An example is the European Commission's Mayors for Economic Growth (M4EG) grant program, which has been operating in Ukraine since 2017 and did not stop with the start of the full-scale invasion, and is aimed at financing infrastructure in communities along with measures to support local businesses.

The financing of infrastructure projects under martial law is certainly associated with significant risks, so further research will be devoted to finding the best ways to manage them.

REFERENCES	СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ
Bagatska, K. V., & Matusova O. M. (2021). Financing of capital investments in insuring economic security of non-financials corporations in Ukraine. *Public security and public order,* (26), 6–16.	Bagatska, K. V., & Matusova O. M. (2021). Financing of capital investments in insuring economic security of non-financials corporations in Ukraine. *Public security and public order,* (26), 6–16.
Bakhur, N. (2021). *Expanding opportunities to attract funds for development through the issuance of local loan bonds*. National Institute of Strategic Studies: Center for Regional Studies. https://niss.gov.ua/sites/default/files/2021-08/obligatsii-mistsevyh-pozyk.pdf	Бахур, Н. (2021). *Розширення можливостей залучення коштів для розвитку шляхом емісії облігацій місцевих позик*. Національний інститут стратегічних досліджень: Центр регіональних досліджень. https://niss.gov.ua/sites/default/files/2021-08/obligatsii-mistsevyh-pozyk.pdf
Bystryakov, I., Klynovyi, D., & Petrov'ska, I. (2023). *Financing mechanism for reconstructive development of critical infrastructure.* National Institute of Strategic Studies. https://niss.gov.ua/sites/default/files/2023-12/tezi-gch_gotove_final_28.pdf	Бистряков, І. К., Клиновий, Д. В. & Петровська, І.О. (2023). *Механізм фінансування реконструктивного розвитку критичної інфраструктури*. Національний інститут стратегічних досліджень. https://niss.gov.ua/sites/default/files/2023-12/tezi-gch_gotove_final_28.pdf
Chernyshov, O. (2021). *Capital expenditures of local budgets increased by more than 60% during the seven years of the reform.* Government portal. https://www.kmu.gov.ua/news/oleksij-chernishov-pro-uspihi-decentralizaciyi-kapitalni-vidatki-miscevih-byudzhetiv-za-sim-rokiv-reformi-zrosli-na-ponad-60	Чернишов, О. (2021). *Капітальні видатки місцевих бюджетів за сім років реформи зросли на понад 60%*. Урядовий портал. https://www.kmu.gov.ua/news/oleksij-chernishov-pro-uspihi-decentralizaciyi-kapitalni-vidatki-miscevih-byudzhetiv-za-sim-rokiv-reformi-zrosli-na-ponad-60
Doroshenko, S. (2013). Financing mechanisms of public-private partnership. *State and Regions. Series: public administration*, *1*(41), 60–66.	Дорошенко, С. (2013). Механізми фінансування державно-приватного партнерства. *Держава та регіони. Серія: державне управління*, *1*(41), 60–66.
Gaidai, Y. (2023). *Billions in local budgets: at whose expense do local authorities purchase drums for shelters*. Center for Economic Strategies. https://ces.org.ua/milyardi-v-misczevih-byudzhetah-za-chij-kosht-misczeva-vlada-zakupovu%D1%94-barabani-v-ukrittya/	Гайдай, Ю. (2023). *Мільярди в місцевих бюджетах: за чий кошт місцева влада закуповує барабани в укриття*. Центр Економічних стратегій. https://ces.org.ua/milyardi-v-misczevih-byudzhetah-za-chij-kosht-misczeva-vlada-zakupovu%D1%94-barabani-v-ukrittya/
Kireitsev, H. H. (2002). *Financial management*. 2nd ed. TSUL.	Кірейцев, Г. Г. (2002). *Фінансовий менеджмет.* 2-ге вид. ЦУЛ.
Kireitsev, H., Aleksandrova, M., & Maslova, S. (2001). *Money, Finance, Credit*. ZHITI.	Кірейцев, Г., Александрова, М., & Маслова, С. (2001). *Гроші, фінанси, кредит*. ЖІТІ.
Kolosova, V. (2022). *Cooperation between NEFKO and Ukraine: status and problems.* National Institute of Strategic Studies: Center for Foreign Policy Studies, 4. https://niss.gov.ua/sites/default/files/2022-04/ nefko.pdf	Колосова, В. (2022). *Співпраця НЕФКО з Україною: стан і проблеми*. Національний інститут стратегічних досліджень: Центр зовнішньополітичних досліджень, 4. https://niss.gov.ua/sites/default/files/2022-04/nefko.pdf
Kozak, V. I., & Moskvin, S. O. (2017). *Issue of municipal bonds and local loans: a practical guide*. DESPRO.	Козак, В. І., & Москвін, С. О. (2017). *Емісія облігацій комунальних підприємств та місцевих позик: практичний посібник*. DESPRO.

Kudria, Ja. V. (2017). *Modernization of fixed capital in the system of ensuring technical development of industrial enterprises.* SU "Institute of Regional Studies named after E. Dolishnyi National Academy of Sciences of Ukraine".	Кудря Я. В. (2017). *Модернізація основного капіталу у системі забезпечення технічного розвитку промислових підприємств*. ДУ "Інститут регіональних досліджень ім. М. І. Долішнього НАН України".
Kudryashov, V. P. (2022). Infrastructure financing in the period of overcoming the consequences of the war. *Finances of Ukraine,* (4), 46–66.	Кудряшов, В. П. (2022). Фінансування інфраструктури в період подолання наслідків війни. *Фінанси України*, (4), 46–66.
Kyrylenko, O. P., & Maksymchuk, O. S. (2019). Capital investments from local budgets: modern practice and prospects for improvement. *Investments: practice and experience*, (2), 5–11.	Кириленко, О. П, & Максимчук, О. С. (2019). Капітальні інвестиції з місцевих бюджетів: сучасна практика та перспективи удосконалення. *Інвестиції: практика та досвід*, (2), 5–11.
Law of Ukraine "On Capital Markets and Organized Commodity Markets" No. 738-IX. (2020). https://zakon.rada.gov.ua/laws/show/3480-15#Text	Закон України "Про ринки капіталу та організовані товарні ринки" № 738-IX. (2020). https://zakon.rada.gov.ua/laws/show/3480-15#Text
Law of Ukraine "On Public-Private Partnership" № 2404-VI (2023). https://zakon.rada.gov.ua/laws/show/2404-17#Text	Закон України "Про державно-приватне партнерство" № 2404-VI (2023). https://zakon.rada.gov.ua/laws/show/2404-17#Text
Malyniak, B., Kyrylenko, O., Horyn, V., & Derlytsia, A. (2021). Exogenous determinants of public spending in the modern globalized world. *Financial and Credit activities: Problems of Theory and Practice*, *6*(41), 572–581.	Малиняк, Б. С., Кириленко, О. П., Горин, В. П., & Дерлиця, А. Ю. (2021). Екзогенні детермінати публічних видатків у сучасному глобалізованому світі. *Фінансово-кредитна діяльність: проблеми теорії і практики*, *6*(41), 572–581.
Mikhailenko, O., & Borodii, D. (2019). Analysis of the Fixed Assets state of Food industry enterprises. *Market infrastructure*, (32), 403–407. http://www.market-infr.od.ua/ journals/2019/ 32_2019_ukr/61.pdf	Михайленко, О. В., & Бородій, Д. А. (2019). Аналіз стану основних засобів підприємств харчової промисловості**.** *Інфраструктура ринку,* (32), 403–407. http://www.marketinfr.od.ua/journals/2019/32_2019_ukr/61.pdf
MinFin. (2014). *Activities of NEFCO.* https://mof.gov.ua/uk/news/dijalnist-nefko (access25.03.2024 p.)	Мінфін. (2014). *Діяльність НЕФКО*. https://mof.gov.ua/uk/news/dijalnist-nefko (взято 25.03.2024 р.)
MinFin. (n. d.). *Information from the Ministry of Finance of Ukraine on the implementation of the State Budget of Ukraine.* https://mof.gov.ua/uk/budget_2023-582 (access 20.03.2024).	Мінфін. (б. д.). *Інформація Міністерства фінансів України про виконання Державного бюджету України*. https://mof.gov.ua/uk/budget_2023-582 (взято 20.03.2024).
NSSMC. (2024). *State register of securities issuance.* https://www.nssmc.gov.ua/derzhavnyi-reiestr-vypuskiv-tsinnykh-paperiv/#tab-1	НКЦПФР. (2024). *Державний реєстр випуску цінних паперів.* https://www.nssmc.gov.ua/ derzhavnyi-reiestr-vypuskiv-tsinnykh-paperiv/#tab-1
Onyshchuk, I. (2023). *Analysis of the implementation of local budgets for 2022.* Decentralization. https://decentralization.gov.ua/news/16105	Онищук, І. (2023). *Аналіз виконання місцевих бюджетів за 2022 рік*. Децентралізація. https://decentralization.gov.ua/news/16105
Oparin, V. M. (2005). *Financial system of Ukraine (theoretical and methodological aspects).* KNEU.	Опарін, В. М. (2005). *Фінансова система України (теоретико-методологічні аспекти)*. КНЕУ.
Parubets, O., Sugonyako, D., & Krasnyanska, Yu. (2017). Directions for improving the housing and communal services financing mechanism of Ukraine. *Eastern Europe: Economics, Business and Management*, *3*(08), 302–306.	Парубець, О., Сугоняко, Д., & Краснянська, Ю. (2017). Напрями вдосконалення механізму фінансування житлово-комунального господарства України. *Східна Європа: економіка, бізнес та управління*, *3*(08), 302–306.

Parubets, O. M., Paljoha, O. V., & Sugonyako, D. O. (2016). The evolution of the development of the communal lending system in Ukraine. *Economy. Finance. Law, 11*(5), 17–20.	Парубець О.М., Пальоха О.В., & Сугоняко Д.О. (2016). Еволюція розвитку системи комунального кредитування в Україні. *Економіка. Фінанси. Право*, *11*(5), 17–20.
Repich, T. A., & Bulekhovets, A. M. (2021). The current state of development of the transport infrastructure of Ukraine. *Young scientist*, *1*(89). https://molodyi-vchenyi.ua/index.php/journal/article/view/155	Репіч, Т. А., & Булеховець А. М. (2021). Сучасний стан розвитку транспортної інфраструктури України. *Молодий вчений, 1*(89). https://molodyi-vchenyi.ua/ index.php/journal/article/view/155
The decision of the NSSMC "Regulations on the procedure for issuing bonds of domestic local loans and their circulation" № 391 (2018). https://zakon.rada.gov.ua/laws/show/z0808-18#Text	Рішення НКЦПФР "Положення про порядок емісії облігацій внутрішніх місцевих позик та їх обігу" № 391 (2018). https://zakon.rada.gov.ua/ laws/show/z0808-18#Text
Vasylyk, O. D. (2000). *Theory of Finance*. NIOS.	Василик, О. Д. (2000). *Теорія фінансів*. НІОС.
Zhadan, T. A., Nazarenko V. V., & Tokarev O. O. (2020). *Analysis of the current state and trends in the development of fixed assets of industrial enterprises of Ukraine.* Digital repository of KhNUCH named after Beketova. https://eprints.kname.edu.ua/57723/1/%D0%9A%D0%9E%D0%9D%D0%A4%D0%95%D0%A0%D0%95%D0%9D%D0%A6%D0%98%D0%AF%20%D0%A2%D0%95%D0%97%D0%98%D0%A1%D0%AB%202020%281%29-96-101.pdf	Жадан, Т. А., Назаренко, В. В., & Токарев О. О. (2020). *Аналіз сучасного стану та тенденцій розвитку основних засобів промислових підприємств України*. Цифровий репозиторій ХНУМГ ім. Бекетова. https://eprints.kname.edu.ua/57723/1/%D0% 9A%D0%9E%D0%9D%D0%A4%D0%95%D0%A0%D0%95%D0%9D%D0%A6%D0%98%D0%AF%20%D0%A2%D0%95%D0%97%D0%98%D0%A1%D0%AB%202020%281%29-96-101.pdf

Conflict of interest: The author certifies that he/she has no financial or non-financial conflicts of interest in relation to this manuscript; has no relationships with government agencies, commercial or non-commercial organizations that could be interested in presenting this viewpoint. Given that the author is affiliated with the institution that is the publisher of the journal, which may give rise to a potential conflict or suspicion of bias, the final decision to publish this article (including the selection of reviewers and editors) was made by those members of the editorial board who are not affiliated with this institution.

The author received no direct funding for this study.

Bagatska K. Financing of infrastructure projects in territorial communities. *Scientia Fructuosa*. 2024. № 3. P. 88–104. https://doi.org/10.31617/1.2024(155)06

Received by the editorial office: 02.04.2024.
Arrived after revision: 17.04.2024.
Accepted for printing: 19.04.2024.
Published online: 11.06.2024.

DOI: 10.31617/1.2024(155)07
UDC: 336.713=111

KALYTA Oksana,
PhD (Economics), Associate Professor
at the Department of Banking
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0003-2020-5751
o.kalyta@knute.edu.ua

GORDIIENKO Tetiana,
PhD (Economics), Associate Professor,
Associate Professor at the Department
of International Economic Relations,
Management and Business
Ukrainian-American Concordia University
8/14, O. Konyskyi St., Kyiv, 01054, Ukraine

ORCID: 0000-0001-7812-3877
tetiana.gordiienko@uacu.edu.ua

ERKES Olena,
PhD (Economics), Associate Professor,
researcher (Cyprus)

ORCID: 0000-0002-1746-590X
elener1987@gmail.com

NEOBANKING REGULATION

A set of recommendations for regulating the activities of Ukrainian neobanks has been formulated, embodying a balanced approach, promoting European integration, while ensuring compliance with requirements and supporting their competitiveness. The aim of the article is to extrapolate valuable foreign insights for developing recommendations on constructing regulatory and legal framework that will contribute to the inclusion of Ukrainian neobanks into the EU's financial space. The research is based on the hypothesis that the existing regulatory gap in the organization and supervision of neobanking in the EU and Ukraine prevents Ukrainian neobanks from fully realizing their innovative and competitive potential. The research aim was accomplished thanks to the application of a wide range of general scientific and specialized methods, in particular a comprehensive review of scientific sources, legal, comparative, statistical performance analysis, case study, grouping and systematization, as well as formulation of neobanks regulation policy content. The relevance of improving the regulation system of neobanks has been proven, taking into account the acceleration of the global

КАЛИТА Оксана,
к. е. н., доцент кафедри банківської справи
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0003-2020-5751
o.kalyta@knute.edu.ua

ГОРДІЄНКО Тетяна,
к. е. н., доцент, доцент кафедри
міжнародних економічних відносин,
менеджменту та бізнесу Українсько-
американського університету Конкордія
вул. О. Кониського, 8/14,
м. Київ, 01054, Україна

ORCID: 0000-0001-7812-3877
tetiana.gordiienko@uacu.edu.ua

ЕРКЕС Олена,
к. е. н., доцент,
дослідник (Кіпр)

ORCID: 0000-0002-1746-590X
elener1987@gmail.com

РЕГУЛЮВАННЯ НЕОБАНКІНГУ

Сформульовано комплекс рекомендацій щодо регулювання діяльності українських необанків, що втілюють збалансований підхід, сприяючи європейській інтеграції, водночас забезпечуючи дотримання вимог і підтримку конкурентоспроможності необанків. Метою статті є екстраполяція цінного іноземного досвіду для розроблення рекомендацій щодо побудови нормативно-правової бази, яка сприятиме включенню українських необанків у європейський фінансовий простір. В основу дослідження покладено гіпотезу, що наявна нормативна прогалина в організації та нагляді за діяльністю необанків в ЄС та Україні заважає українським необанкам повною мірою реалізувати свій інноваційний і конкурентоспроможний потенціал. Дослідницька мета досягнута завдяки застосуванню широкого спектра загальнонаукових і спеціалізованих методів, зокрема комплексного огляду наукових джерел, правового, порівняльного, статистичного аналізу продуктивності, кейс-стаді, групування та систематизації, а також формулювання засад політики регулювання необанків. Доведено актуальність вдосконалення системи регулювання необанків

expansion of neobanks as an alternative to the traditional banking business. The article reveals development trends and reasons for the growing popularity of neobanks in certain countries, as well as successful regulatory initiatives that can be adapted for implementation in Ukraine in order to overcome the challenges and threats that Ukrainian neobanks are currently facing. A particular emphasis is placed on the study of the regulatory system of neobanks in the EU countries, which is based on the principles of financial stability, consumer protection, and prevention of financial crimes. On the basis of a comparative analysis of different approaches, successful initiatives for implementation in Ukraine have been determined, which will make it possible to adapt the regulatory infrastructure of the neobanking sector to the level of best practices. Such adaptation is necessary, since the imperfection of the current regulatory and legal framework makes it impossible to comprehensively analyze and effectively control the neobanks' activities, which causes risk of uncertainty, unreliability of services, threats to security and compliance with international regulatory and legal requirements. This diminishes trust on the part of clients and investors, thereby hindering their international competitiveness. To ensure the sustainable development of neobanks in Ukraine, a roadmap for the step-by-step formation of the regulatory infrastructure of the neobanking sector has been developed.

Keywords: alternative banking, compliance, neobank, regulatory framework, regulation, regulatory gap, fintech, digitization.

з огляду на прискорення їхньої глобальної експансії, що є альтернативою традиційному банківському бізнесу. Розглянуто тенденції розвитку та причини зростання популярності необанкінгу в окремих країнах, а також успішні регуляторні ініціативи, які можуть бути адаптовані для реалізації в Україні з метою подолання викликів і загроз, з якими наразі стикаються українські необанки. Акцентовано на дослідженні системи регулювання необанків у країнах ЄС, що ґрунтується на принципах фінансової стабільності, захисту споживачів і запобігання фінансовим злочинам. На основі порівняльного аналізу різних підходів визначено успішні ініціативи для впровадження в Україні, що дасть змогу адаптувати регуляторну інфраструктуру необанківського сектору до рівня найкращих практик. Така адаптація є необхідною, оскільки недосконалість чинної нормативно-правової бази унеможливлює комплексний аналіз та ефективний контроль за діяльністю необанків, що спричиняє ризики невизначеності, ненадійності послуг, загрози безпеці та відповідності міжнародним нормативно-правовим вимогам. Це знижує довіру з боку клієнтів та інвесторів, перешкоджає їх міжнародній конкурентоспроможності. З метою забезпечення стійкого розвитку необанків в Україні розроблено дорожню карту поетапного формування регуляторної інфраструктури необанківського сектору.

Ключові слова: альтернативне банківництво, комплаєнс, необанк, нормативно-правова база, регулювання, регулятивна прогалина, фінтех, цифровізація.

JEL Classification: G21, G28, O16, O38, O43.

Introduction

Digital or alternative banking, have gained significant prominence in recent years, disrupting traditional banking models. The growth of neobanks has been fueled by technological advancements and changing consumer preferences for digital financial services. Alternative banking all over the world stimulates economic development by fostering innovation, improving access to financial services, and attracting investment. This is of particular importance for countries like Ukraine as they seek to strengthen their financial sectors.

Presently, the regulatory framework for neobanks remains unsettled. Scholars and practitioners highlight varying challenges encountered by neobanks, emphasizing the need for the incorporation of a range of elements, methods, and approaches into the regulatory system.

According to the Bank for International Settlements (Bank for International Settlements, 2021, 13 July), regulators need to balance the

innovation and efficiency brought by new entrants with the potential challenges for oversight, enforcement and consumer protection.

The scientific works of domestic and international scientists are devoted to the development trends of Ukrainian and foreign neo-banks. In particular, scientists Irshak and Tvorydlo (2022) investigated the issue of the functioning mechanism of neobanks and certain features of neobanks licensing based on the license obtained from the parent bank.

Scientists Teslyuk et al. (2021) considered the legislative regulation mechanism of the neobanks activity in Ukraine, and summarized the peculiarities of the activities and development trends of the largest European neobanks.

The scientists Fedina and Bogrinovtseva (2022) focused their research on the neobanks development models, which are evident in foreign practice, and the analysis of their product and technological specifics.

Scientists Lobozinska et al. (2021) have revealed the specifics of the neobanks activities in the minds of the digital transformation of the financial market, and identified the prospects for a responsive eco-system to develop neobanks in Ukraine.

Unlike previous studies, the insights and recommendations presented in this article provide an achievable roadmap for policymakers, financial institutions, and entrepreneurs in Ukraine. They collectively aim to establish a regulatory environment that fosters growth, encourages innovation, and, most importantly, ensures the successful participation of Ukrainian neobanks in the ever-evolving European financial landscape.

The aim of the article is to extrapolate valuable foreign insights for developing recommendations on constructing regulatory framework that facilitates the inclusion of Ukrainian neobanks into the European financial space.

The tasks of the article are:

- to explore foreign experiences in regulating neobank activities and identify the most promising initiatives for implementation in Ukraine;
- to identify the challenges and obstacles faced by Ukrainian neobanks because of the imperfect regulatory framework;
- to develop a comprehensive regulatory framework proposal that aims for European integration and addresses the specific needs and goals of Ukrainian neobanks.

The research hypothesis is the statement that the existing regulatory gap in the organization and supervision of neobank activities in the European Union and Ukraine prevents Ukrainian neobanks from fully realizing their competitive potential and seamlessly integrating into the European financial space. The investigation of foreign neobank regulatory experiences makes it possible to uncover valuable patterns for regulatory adaptation. Addressing the inadequacies in the current Ukrainian regulatory environment, and formulating a comprehensive regulatory framework that aligns with European standards while catering to the specific needs of Ukrainian

neobanks, will lead to an environment conducive to innovation, sustained growth, and increased competitiveness in the Ukrainian neobanking sector.

The research aim was accomplished through the implementation of a comprehensive array of general scientific and specialized methods. *Comprehensive literature review* of academic papers, reports, and relevant literature on neobanking and banking regulatory frameworks was conducted to understand the current state of neobank regulation and integration in the European Union and Ukraine. *Legal analysis* was employed to examine the existing legal documents, statutes, and regulatory frameworks governing neobanks in Ukraine and the EU. This aimed to identify legal barriers, inconsistencies, and areas that require alignment with European standards. *Comparative analysis* was undertaken to collate the existing regulatory environment of neobanks in European countries with the regulatory conditions in Ukraine. This analysis aimed to identify regulatory similarities, differences, gaps, and patterns. *Statistical and performance analysis* was conducted to identify and interpret trends in the development of national and multinational neobanking markets. The goal was to explore the effectiveness of neobanks' activities and define potential areas for improvement through regulatory measures. *Case studies* were employed to investigate successful regulatory experiences in other countries. This involved examining the challenges they faced and the strategies implemented, aiming to derive valuable insights for adapting regulations in Ukraine. *Grouping and systematization* were applied to spot the key elements of neobank regulation and unite them into a comprehensive framework. *Policy formulation* was carried out to develop a comprehensive regulatory framework aligned with the specific needs of Ukrainian neobanks while also conforming to EU standards.

The main part of the article comprises four sections structured as follows: the first delves into the evolution and global rise of neobanks, the second highlights innovative regulatory approaches worldwide and their impact on neobank development, the third focuses on the regulatory landscape within the European Union, and the final section explores opportunities for Ukraine to adopt successful regulatory practices and outlines a roadmap for the phased formation of its neobanking regulatory infrastructure.

1. Exploration of neobank development in Europe and globally

At the beginning of the 20th century, traditional banks dominated the financial services sector. Initially, the services offered by banks included deposit-taking, lending, and capital management services. In the latter half of the 20th century, traditional banking underwent shifts towards consolidation, but most significantly, substantial deregulation. This led to the emergence of large transnational banks, which later in the 21st century swiftly adopted technology to enhance efficiency and expand operations. However, despite significant

digitization influencing the structure of banks, many still heavily rely on physical presence and personal interaction as part of their offerings to clients.

The worldwide expansion of neobanks experienced a notable acceleration due to the COVID-19 pandemic, prompting a global adjustment to a new reality. Consequently, consumers were compelled to embrace online services, including banking. The internet has seamlessly integrated into our daily lives, social networks have gained extensive popularity, and technological companies are providing innovative products and services with elevated standards of quality, speed, and convenience for consumers, all made possible through digital solutions.

Additionally, the surge in labor migration has led to an increase in international money transfers. Small and medium-sized businesses began seeking alternative financing methods, while private investors explored new opportunities for earnings. All these factors contributed to the emergence of new technological solutions in the banking sector and generated a strong demand for digital services, driving the development of virtual banks (neobanks) as significant players in both global and national markets, including Ukraine. Neobanks, which exclusively provide digital financial services, should be appropriately regarded as an alternative to traditional banks.

The global market for neobanking services is steadily expanding, currently estimated at USD 66.82 billion, compared to USD 34.77 billion in 2020. According to forecasts from Grand View Research, it is anticipated that the scale of neobanking services will grow by 53.4%, surpassing USD 2 billion by the year 2025 (24 Neobank Statistics to Help with Risk and Compliance, 2022, 30 June).

Certainly, neobanking is a global phenomenon that covers various segments and banking models in key markets across the globe. The most popular neobanks are mainly concentrated in Europe, with countries such as the United Kingdom, France, Finland, and Germany taking the lead in the domains of mobile connectivity and enhanced user experience (*Figure 1*).

Presently, there is a growing trend of people relying exclusively on digital banks. In the United States, as of January 1, 2023, the percentage of users exclusively using digital banks constituted 13.7% of the total population, and projections indicate that this figure is expected to reach 20% by the year 2025 (*Figure 2*).

Europe holds the largest market share in neobanking, contributing to over 30% of the global revenue. This is credited to the emergence of numerous technological startups and the growing acceptance and integration of advanced technologies within the financial sector. The growing implementation of internet services and the widespread use of smartphones are expected to accelerate the expansion of services provided by neobanks (Europe neobanking market, 2023).

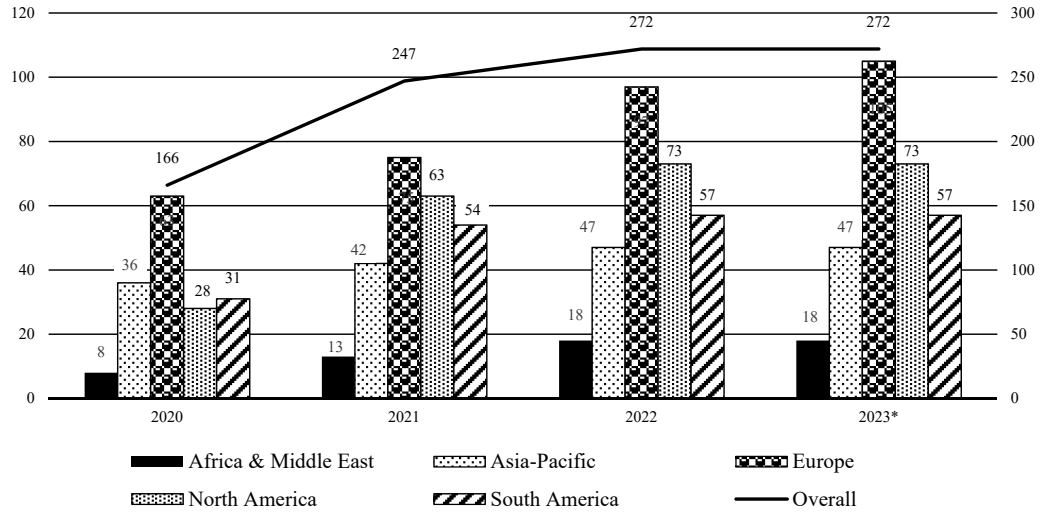


Figure 1. Number of neobanks
in the regional breakdown for 2020–2023, as of January 01, pcs.

*2023–2025 – projected figures.

Source: The list of neobanks and digital banks in the world (2023, 1 September).

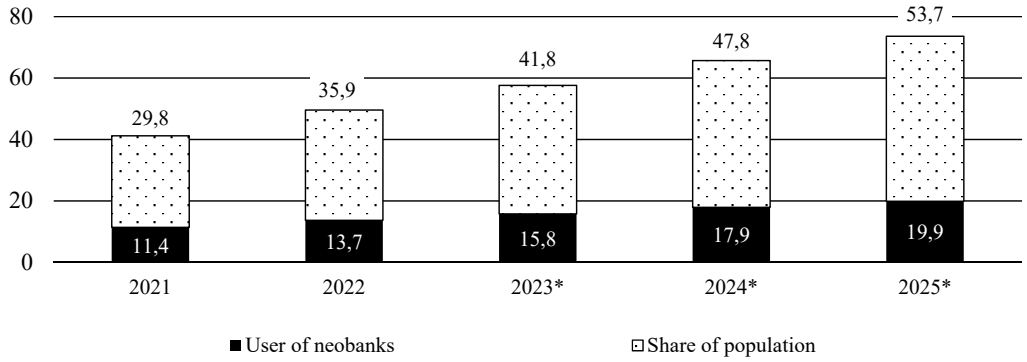


Figure 2. Neobank users in the US in 2021–2025*

*2023 – projected figures.

Source: (Spiridonova, 2023).

During the COVID-19 pandemic in 2020, Germany had the highest number of users in the digital commerce sector. The average transaction value of digital commerce per user was USD 2 084, which was the second-highest level globally after the United States. People with higher and medium income levels showed a preference for neobanks, especially considering the limitations imposed during the pandemic for offline transactions (Europe neobanking market, 2023).

It is anticipated that the European neobanking sector will grow by 19.53% between 2023 and 2027, reaching a market volume of USD 4.66 trillion by 2027. As of May 2023, there are ninety-eight online banks in Europe, among which N26, Wise, Revolut, Bunq, and Monzo are some of the most popular (Best European Neobanks in 2023, 2023).

Neobanks contribute to the increased accessibility of banking services, evident in the rising number of online bank accounts being opened. Consumers benefit from the convenience of digital technologies. For example, in Europe, the registration process with a neobank can be completed from any location with a reliable Wi-Fi connection. Customers typically need to prepare identification documents, proof of residence, and confirmation of employment or enrollment. In 2022, the customer base of the largest European neobanks reached approximately 34.6 million people.

In the Statista Market Insights report for 2023, the user adoption rate is forecasted to be 15.5%, and over the next five years, it is expected to grow to 22.8%. As of the third quarter of 2023, Brazil, India, and Ireland are global leaders in the number of individuals holding accounts with neobanks (*Table 1*).

Table 1

Anticipated metrics for the neobanking adoption across countries during 2023–2027*

Country	Number of people with a neobank account (2027)	% of people with a neobank account (2027)	Increase from 2023
Philippines	39788800	32	161
Mexico	54144600	41	148
Portugal	3349500	33	133
United Arab Emirates	4022100	41	122
Malaysia	10001600	28	122
South Africa	19505200	31	115
United States	52065000	15	91
Spain	14663000	31	82
India	685400000	46	84
Germany	19934400	24	71

*The above values are predictive.

Source: (Kadar, 2023).

In Brazil, about 43% of the population have neobanking accounts. The most popular neobank is NuBank, boasting over 48 million users and holding the second-largest capital investment of USD 4.1 billion since its launch in 2012. It is surpassed only by the American neobank Robinhood, which attracted USD 6.2 billion in capital investments since its inception in the same year (Kadar, 2023).

In India, about 26% of the population use neobanking accounts, while in Ireland, this figure is 22%. According to forecasts, the number of neobank users is expected to increase each year. In 2023, approximately 13% of the

population in the Philippines used neobanks, but Finder predicts that by 2027, this figure will rise to around 32% (approximately 39.8 million people) – a 161% increase compared to 2023.

By the year 2027, an estimated 54.1 million residents in Mexico, constituting 41% of its population, will be utilizing neobanking. This reflects a substantial 148% increase compared to the situation in 2023 when only 17% of the population exclusively held digital banking accounts.

Approximately 14% of the population in Portugal used neobanking in 2023, and according to forecasts, this figure is expected to increase to around 33% by 2027, equivalent to 3.35 million people. This indicates a 133% growth in neobanking adoption in Portugal from 2023 to 2027.

Therefore, implementing regulatory conditions for neobanks is an important task for all countries worldwide.

2. Progressive foreign regulatory initiatives governing neobanks

The development of neobanking institutions is creating substantial investment opportunities, leading to a swift rise in demand and interest from consumers and investors. The commencement of neobanking activities involves specific bureaucratic procedures, notably the acquisition of a license for banking operation.

One of the first countries to implement a licensing and regulatory framework for neobanks (digital banks) is Pakistan. The State Bank of Pakistan (SBP) has developed and introduced the "Licensing and Regulatory for Digital Banks" (State Bank of Pakistan, n. d.).

According to the SBP document, neobanks can be granted two types of licenses: Digital Retail Bank (DRB) with a limited license, and Digital Full Bank (DFB). DRBs primarily concentrate on activities related to retail customers, while DFBs operate with both retail customers and businesses, including legal entities.

The process of obtaining neobank licenses in Pakistan consists of distinct stages: the pilot stage, the transitional stage and the acquisition of the commercial license.

The pilot stage, which lasts from 3 to 9 months, involves the neobank operating under a limited license. During this stage, the institution is prohibited from accepting deposits from the public and can only engage with a restricted group of individual clients. It is permitted to open deposit accounts for them and provide basic banking services. Regarding lending, the provision of credit services is restricted to 50% of the total deposit base of the bank.

The transitional stage lasts for three financial years after the launch of the neobank, but the SBP may shorten this period to one year if the bank complies with the licensing conditions, including regulatory capital requirements. During this stage, the bank is required to submit quarterly reports to the central bank detailing compliance with the necessary capital levels and the execution of the business plan.

In terms of the minimum capital requirements, DRB has to maintain a minimum capital of PKR[1] 1.5 billion (about USD 5 million) during the pilot phase. This amount will gradually rise over the three-year transitional period to reach PKR 4 billion (USD 13 million). Upon successfully completing the transitional phase, DRB becomes eligible to apply for a DFB license, as long as it satisfies the required minimum capital standards and successfully completes a two-year progress stage. The specific capital requirements are detailed in the *Table 2* (State Bank of Pakistan, n. d.).

Neobanks are also required to follow specific liquidity and leverage standards that are generally applicable to commercial banks. These standards include the Statutory Liquidity Ratio (SLR), Cash Reserve Requirements (CRR), Net Stable Funding Ratio (NSFR), Liquidity Coverage Ratio (LCR), and Leverage Ratio (LR).

Table 2

The minimum capital requirements for digital banks in Pakistan, PKR billion/USD million

License Type	At grant of restricted license for pilot stage/ DFB license	At commercial launch	During each financial year after the year of commercial launch/ DFB license		
			year 1	year 2	year 3
DRB	1.5 / 4.9	2 / 6.5	2.5 / 8.2	3 / 9.8	4 / 13
DFB	6.5 / 21	–	8 / 26	10 / 36.7	–

Source: developed by the authors on the basis of (State Bank of Pakistan, n. d.).

The Central Bank of Thailand also has implemented an advanced regulatory framework for neobanks, exemplified by the creation of the "Virtual Bank Licensing Framework" (Bank of Thailand, 2023, January). However, they plan to issue licenses from 2024 onwards. The Central Bank of Thailand has established compliance criteria for neobanks, known as the "Green Line" and "Red Line". The "Green Line" refers to the utilization of technologies, data, and the experience of digital services to provide financial services that create a new value proposition for better meeting the needs of each customer segment. Virtual banks must:

- offer a full range of financial services tailored to each customer segment, especially assisting underserved segments of retail customers and SMEs in conducting business and promoting financial discipline. Examples may include.
- deposit products where clients can set amounts and deposit frequencies that align with their cash flows and behavior.
- credit products where credit limits, terms, and interest rates are determined by each client's behavior and risk profile, discouraging excessive indebtedness;

[1] PKR – Pakistani Rupees.

• provide a superior user experience for clients when utilizing financial services. Interfaces, processes, and procedures should be convenient, fast, secure, and align with clients' lifestyles.

• encourage healthy competition within the financial institutions system. All players are encouraged to engage in competitive innovations and enhance financial services, promoting proper financial access and offering products with higher quality, competitive prices, convenience, and user-friendly simplicity.

What virtual banks ("red lines") should not do is engage in business that creates risks for financial stability, depositors, and consumers in general. The Central Bank of Thailand expects that virtual banks should avoid:

• using unstable business models that create risks for the virtual bank's own business and its depositors;

• initiating "a race to the bottom" practices that lead to risks for financial stability. In particular, virtual banks should not employ aggressive pricing strategies to attract clients that are not sustainable in the long term. They should also refrain from encouraging excessive indebtedness through irresponsible lending;

• providing preferences to related parties or abusing a dominant market position. This can lead to unfair competition and harm consumer interests. Examples include offering preferential loans to related parties or compelling business partners of the virtual bank's related parties to use the financial services offered by the virtual bank (Bank of Thailand, 2023, January).

To ensure that virtual banks operate according to the "green line's" while not creating unacceptable behaviors by crossing the "red lines" mentioned above, the Central Bank of Thailand sets the licensing, regulatory, and supervisory framework.

First, virtual banks may provide full-service banking businesses to be flexible in accommodating changing customer needs. They must be registered in Thailand and establish a local headquarters in Thailand, provide a comprehensive range of services to meet customer needs and serve clients exclusively through digital channels.

Second, virtual bank applicants must meet qualifications to ensure they can achieve Green Lines sustainably.

Third, virtual banks shall go through a restricted phase during the initial years of operation. They must possess adequate capital and prepare an exit plan in case of business wind-downs. These would ensure virtual banks operate prudently during the initial years while not posing systemic risks. Virtual banks shall go through a restricted phase during the first 3–5 years. The Central Bank of Thailand will closely communicate and monitor the operations of newly licensed virtual banks during this period.

Newly established virtual banks shall have a paid-in capital of at least 5 billion baht on the day of business commencement. The level of paid-in capital shall gradually increase to at least 10 billion baht before the virtual

banks complete the restricted phase and operate in a full- functioning manner. This will ensure that virtual banks have adequate capital to support business expansion and cushion against potential initial losses.

Fourth, virtual bank applicants may request waivers on shareholding limits on a case-by-case basis. The Central Bank of Thailand shall consider the qualifications and behavior of the virtual bank applicant and may impose additional conditions prior to granting the request.

Fifth, virtual banks shall comply with the same regulations and supervision as traditional commercial banks. The Central Bank of Thailand will supervise virtual banks in a risk-proportionate manner, placing great importance on robust corporate governance and a sound risk culture. They must contribute to the Financial Institutions Development Fund (FIDF) and the Deposit Protection Agency (DPA) like all other financial institutions from the commencement of business during the restricted phase. Deposits at virtual banks will therefore receive the same protection as deposits at other financial institutions (Bank of Thailand, 2023, January).

3. Regulatory framework for neobanks within the EU

The regulatory landscape for neobanks in the European Union (EU) represents a dynamic framework designed to govern and supervise the operations of these innovative financial entities. The European regulatory framework for neobanks is rooted in principles aimed at fostering financial stability, consumer protection, and the prevention of financial crimes. *Table 3* delves into the key elements of the regulatory environment governing neobanks in the EU, examining the roles played by regulatory authorities, compliance requirements, and the evolving guidelines that shape the landscape for these fintech entities.

Table 3

Regulatory framework for neobanks in the European Union

Element	Description
Payment Services Directive 2 (PSD2) (Directive (EU) 2015/2366, 2015, 25 November)	This regulatory initiative aims to enhance competition, innovation, and security in the payment services market. Directive influences neobanks by promoting Open Banking and requiring strong customer authentication. Neobanks leverage PSD2 to access customer account information, offer innovative payment services, and compete with traditional banks in a more dynamic and consumer-focused financial landscape. The directive fosters a competitive environment while emphasizing data privacy and consent in the evolving relationship between neobanks and regulatory frameworks
Electronic Money Directive (EMD) (Directive 2009/110/EC, 2009, 16 September)	The EMD establishes a regulatory framework for electronic money institutions, including neobanks. Neobanks holding an electronic money license are permitted to provide payment services and issue electronic money

Continuation the table 3

Element	Description
Licensing (Europe Central Bank, 2018, March)	Neobanks must obtain the necessary licenses to operate legally. This may include electronic money institution (EMI) licenses or full banking licenses, depending on the services offered. Neobanks may choose the type of license based on their business model, strategic objectives, and the range of services they intend to offer. Obtaining a full credit or banking license, subject to the regulations imposed by the European Banking Authority (EBA) and national supervisory authorities, allows neobanks to offer a broader range of financial services, including lending and deposit-taking. However, this entails more substantial regulatory and compliance obligations, often accompanied by increased capital requirements. Most neobanks have a payment license or electronic money institution (EMI) licenses, which allows neobanks to issue electronic money, provide payment services, and offer related financial products. Licenses are issued by a regulatory or supervisory body, such as the Federal Financial Supervisory Authority (BaFin) in Germany, the Autorité de Contrôle Prudentiel et de Résolution/Prudential Control and Resolution Authority (ACPR) in France, NCAs, and other national competent authorities (NCAs)
Prudential Regulation (Europe Central Bank, 2023, September)	Neobanks with full banking licenses are subject to prudential regulations. The EU prudential requirements are part of the EU Single Rulebook, which aim to strengthen the resilience of the EU banking sector, while ensuring that banks continue to finance economic activity and growth. The prudential framework is composed of a directive – the Capital Requirements Directive (CRD V) – and a Regulation – the Capital Requirements Regulation (CRR II). These rules put the Basel III international standards into EU law
Consumer Protection Regulations (European Banking Authority, 2023, September a)	Neobanks must comply with rules that safeguard consumer rights, promote clear communication of terms and conditions, and facilitate effective dispute resolution. Adherence to consumer protection regulations is mandatory for neobanks, necessitating fair and transparent practices, and ensuring that disclosures regarding terms, fees, and risks are easily comprehensible to consumers. Neobanks must refrain from engaging in unfair commercial practices that could deceive or unduly influence consumers, including misleading advertising or any behavior that might harm consumers' economic interests
Anti-Money Laundering (AML) and Know Your Customer (KYC) Regulations (European Banking Authority, 2023, September b)	Neobanks must adhere to Anti-Money Laundering (AML) and Know Your Customer (KYC) regulations to counteract financial crime and uphold the integrity of the financial system. Ensuring stringent AML and KYC procedures is imperative for neobanks to prevent money laundering and terrorist financing. These processes encompass comprehensive customer identification, diligent due diligence, and the reporting of suspicious activities to the relevant authorities. The guidelines, which amend EBA/2021/02, focus on customer due diligence and the factors that credit and financial institutions should consider when evaluating the risk of money laundering and terrorist financing associated with individual business relationships and occasional transactions (referred to as "The ML/TF Risk Factors Guidelines") under Articles 17 and 18(4) of Directive (EU) 2015/849

End the table 3

Element	Description
Cybersecurity and Data Protection (Europe Data Protection Board, 2023, October)	Neobanks must comply with data protection regulations, such as the General Data Protection Regulation (GDPR). Ensuring the security and confidentiality of customer data is critical, and neobanks must implement robust cybersecurity measures to protect against data breaches
Regulatory Facilitation Initiatives (AMF, 2016, 30 May; BaFin, 2023, September)	Some EU countries have introduced regulatory initiatives to facilitate innovative financial products and services, including those offered by neobanks, particularly: France fosters fintech innovation through the Autorité des Marchés Financiers (AMF) having created the Fintech, Innovation, and Competitiveness Division. It focuses on identifying topics of importance in competitiveness and innovation and is responsible for analyzing the opportunities and new forms of risk to which the regulator and possibly investors have to respond. It is involved in the European discussions and tasked with assessing the need to adjust French regulations, or AMF policy, while maintaining a high level of investor protection. The FIC division is involved in financial center matters connected with international competitiveness. In Germany Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) is actively involved in supporting fintech initiatives, notably through the FinTech Innovation Hub. This initiative offers a comprehensive overview of business models, technologies, licensing requirements, and supervisory laws, enabling clear and structured communication while aiding stakeholders in understanding assessments and specifications for a range of innovative financial technologies, including digital banking. In the Netherlands, the Autoriteit Financiële Markten (AFM) and De Nederlandsche Bank (DNB) have collaborated to provide market participants with information regarding the regulation of innovative financial services and products, resulting in the establishment of the AFM & DNB Innovation Hub. This collaborative initiative offers insights into specific supervisory rules, guidance for navigating the Dutch supervisory landscape, information on potential supervision issues, and clarifications on supervisory rules applicable to innovative products and services of digital financial institutions. Additionally, by partnering with the Authority for Consumers & Markets (ACM), the Innovation Hub provides a resource for businesses seeking answers and guidance on competition rules. At the same time, while these initiatives collaborate within the legal frameworks, they are not "Regulatory Sandboxes" where laws and regulations are (temporarily) set aside or suspended

Source: developed by the authors.

The regulatory landscape surrounding neobanks in the European Union, significantly influenced by directives PSD2 and EMD, underscores a commitment to fostering competition, innovation, and security in the financial sector. Through stringent licensing requirements, prudential regulations, consumer protection measures, and anti-money laundering protocols, neobanks are navigating a complex yet essential framework that prioritizes both market dynamism and consumer rights. Moreover, collaborative regulatory facilitation initiatives across EU countries amplify support for fintech innovation, cementing a foundation where neobanks can flourish while upholding regulatory standards and financial integrity.

4. Integration of positive regulatory experiences in neobanking into Ukrainian practices

Researching the domestic experience of neobank development in terms of their creation and licensing, it should be noted that Ukrainian neobanks have the opportunity to operate solely based on existing licenses of traditional banks. This is due to the absence of regulatory acts that govern their activities in Ukraine. However, in our view, such a form of existence has several drawbacks, with the main one being the inability to analyze the functioning of their activities from both the regulator's perspective and that of the users.

Additionally Ukrainian neobanks may encounter challenges and obstacles stemming from an imperfect regulatory framework, including:

- uncertainty and ambiguity, in particular, neobanks' founders and administrations may face challenges due to a lack of clarity or consistency in the regulatory environment. This uncertainty can hinder their ability to make informed business decisions and develop strategies for their growth, as well as restrain the attraction of investments in the neobanking sector;
- unreliability of services. In the absence of robust regulatory oversight, there may be a lack of confidence in customer protection measures, such as fraud detection mechanisms, data privacy, cybersecurity assurance, and the implementation of fair treatment practices and dispute resolution mechanisms. These challenges cause customers' distrust and low loyalty and impede neobanks from building a stable client base;
- security threats. Weak regulatory environments may expose banks to increased risks of engaging in financial frauds and cybercrimes, fostering conditions for money laundering, machinations, and inadequate cyber-security. The absence of stringent oversight can lead to unethical business practices, market manipulation, and a heightened vulnerability to illicit financial activities, threatening both the integrity of the financial security and customer welfare;
- regulatory misalignments and cross-border compliance complexities. Inconsistent legislation with international norms poses a significant challenge, potentially straining resources and impeding the seamless execution of cross-border operations. This hurdle hinders the establishment of a cohesive international presence for neobanks. Moreover, the lack of adequate legislative support and detachment from foreign regulatory initiatives serve as impediments to fair competition within the global financial arena. This shortfall creates a disadvantage for Ukrainian neobanks, limiting their ability to compete on a level playing field with foreign financial institutions.

Considering this, it is necessary to develop and implement regulatory requirements for the functioning of neobanks. Therefore, we propose a roadmap for the implementation of regulatory conditions for the full functioning of neobanks in Ukraine (*Figure 3*).

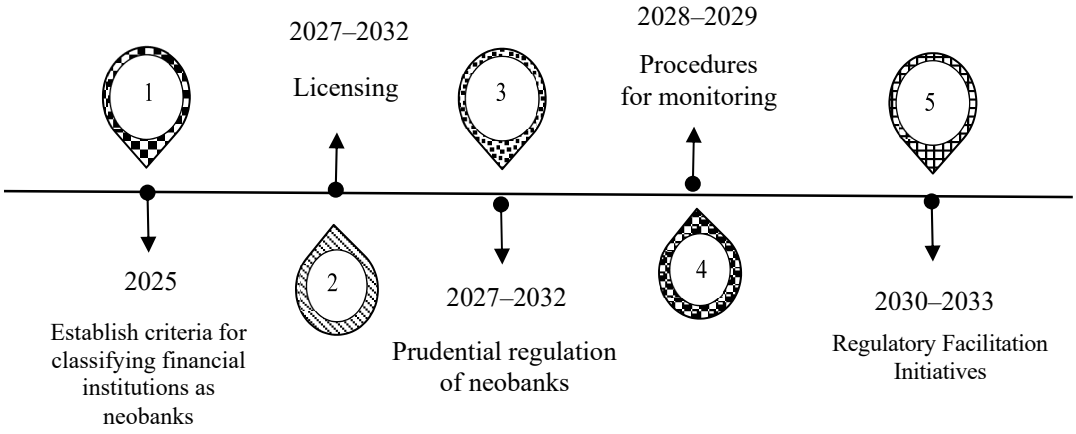


Figure 3. Roadmap for the implementation of regulatory conditions for neobanks' activity in Ukraine

Source: developed by the authors.

Analyzing the roadmap, we believe it is crucial, at the initial stage, to clearly define the primary criteria for classifying financial institutions as neobanks. Additionally, we recommend incorporating the concept of "neobanks" into the Law of Ukraine "On Banks and Banking Activities". It is important to highlight that Ukraine is actively integrating into the European market, and to facilitate this integration, alignment with the PSD 2 and Electronic Money directives is essential. While some domestic legislation has already adapted to these directives, incorporating specific regulatory requirements into the Law of Ukraine "On Payment Services" and other relevant laws, it is imperative to emphasize that these adjustments yet represent adaptation rather than complete integration.

Regarding *the second stage* of "Licensing" (during 2027–2032), we suggest the implementation of two types of licenses for neobanks: full and partial. A full license entails establishing a new financial institution that operates remotely and provides a comprehensive range of services. On the other hand, a partial license involves the operation of a neobank based on an existing license of a traditional bank, with the introduction of separate financial reporting and compliance with the regulator's requirements and standards. However, during the adaptation period of neobanks in the market, a "limited license" will be granted.

At *the third stage*, it is necessary to introduce changes to the prudential regulation of neobanks. During the period of the "limited license", which can be valid for 1 to 5 years, "special" capital conditions will be applied. As an example, recommendations developed by the central bank of Pakistan, which were reviewed earlier, can be considered. Additionally, the regulator should pay special attention to operational risks of neobanks, especially cybersecurity risks. Social engineering, malicious software, and phishing/farming are the three main cybersecurity threats faced by neobanks. These threats are aimed at gaining access to users' personal information, funds in bank

accounts, or other potentially destructive actions. Neobanks must adhere to European standards such as Know Your Customer (KYC) Regulations and the General Data Protection Regulation (GDPR).

The *fourth stage*, spanning from 2028 to 2029, aims to develop specific procedures for monitoring the activities of neobanks. In our view, it is pertinent to establish a new department within the National Bank for remote inspections of neobanks and consumer rights protection management, considering the specific nature of their operations. A particular focus should be placed on addressing money laundering by implementing robust processes to counter both money laundering and terrorist financing. Moreover, it is recommended to adopt European norms, particularly the Guidelines EBA/2021/02 on customer due diligence and the risk factors credit and financial institutions should consider. Additionally, adopting the ML/TF Risk Factors Guidelines under Articles 17 and 18(4) of Directive (EU) 2015/849 is crucial for aligning with international standards.

At the *fifth stage* (during 2030–2033), we propose to enhance the regulatory framework to facilitate the implementation of innovative financial products and services, especially those offered by neobanks, while simultaneously ensuring consumer protection and financial stability.

First of all, it is expedient to use the experience of the UK on setting up a regulatory sandbox, which establishes a secure space for businesses to experiment and refine their ideas, free from concerns about regulatory limitations impeding innovation, thus enabling early identification and mitigation of risks in the development process. The UK's Financial Conduct Authority (FCA) has successfully used regulatory sandboxes to encourage innovation, allowing fintech companies including neobanks to experiment within certain regulatory parameters (Regulatory Sandbox, 2023, August). Implementing a regulatory sandbox that allows neobanks to test innovative products and services in a controlled environment without facing immediate regulatory consequences in Ukraine will foster a dynamic environment that adapts to technological advancements and promotes the overall resilience and efficiency of the financial sector. This initiative may not only attract investments but also positions Ukraine as a favorable destination for financial technology development, potentially establishing the country as a regional hub for innovation in the financial industry. Secondly, following the approval of the Open Banking Concept by the National Bank of Ukraine (NBU, 2023, 10 August), there are plans to implement this innovation across the entire market and to extend support for the new payment infrastructure and other specified interactions by August 1, 2025. Starting from this date, banks and neobanks holding accounts must open interfaces and share customer information with certified Third-Party Providers (TPPs) providers, subject to customer consent. After completing the pilot phase, it becomes imperative to establish the necessary legal, technical, and human capabilities for thorough API analysis, resolution of conflicts between banks and TPPs, and effective

coordination among financial market regulators. It is crucial to tailor these capabilities to accommodate the specific needs and distinctive features of neobanks' activities.

Conclusions

Summarizing the results of the research, we can conclude that the global financial market is developing very intensively. The number of neobanks and their users in the world is growing rapidly. Neobanks are attracting a lot of interest from investors, because the development of neobanks opens up significant investment opportunities. The domestic banking sector is gradually introducing and implementing innovations in accordance with global trends in the development of banking services. Domestic neobanking gained a particularly noticeable development during the coronavirus pandemic and now in the conditions of martial law. These circumstances stimulate the active development of digitalization and digital transformation of all processes in the country, and in particular domestic neobanking. The dynamic growth observed in the neobank sector necessitates regulators to establish a judicious and agile regulatory framework.

The regulatory approaches for neobanks vary globally, with notable examples from Pakistan, Thailand, and the European Union (EU). Pakistan's State Bank has implemented a detailed licensing and regulatory framework for neobanks, providing distinct licenses and staged processes to ensure a gradual and controlled entry into the market. Meanwhile, Thailand's Central Bank has introduced a "Virtual Bank Licensing Framework" with clear criteria, focusing on technology utilization and customer service, while establishing "Green Line" and "Red Line" guidelines to balance innovation and risk. In the EU, neobanks operate under a dynamic framework rooted in principles promoting financial stability, consumer protection, and prevention of financial crimes, with specific regulations like PSD 2, EMD, and robust prudential, consumer protection, AML/KYC, and cybersecurity standards. Moreover, certain EU countries, such as France, Germany, and the Netherlands, have introduced regulatory initiatives to facilitate innovation without compromising legal frameworks, emphasizing clear communication and support for fintech initiatives. Overall, these diverse regulatory models provide valuable insights for shaping a comprehensive and adaptive regulatory framework for neobanks in Ukraine, addressing the specific challenges and opportunities within the country's financial landscape.

The current regulatory landscape in Ukraine presents both opportunities and challenges for neobanks. While the absence of specific regulations allows them to operate under traditional bank licenses, this approach comes with drawbacks, notably the inability to undergo comprehensive analysis from regulatory and user perspectives. The imperfect regulatory framework further exposes neobanks to uncertainties, service unreliability, security threats, and cross-border compliance complexities, impeding their growth,

customer trust, and international competitiveness. Addressing these challenges through the development of a robust and aligned regulatory framework is essential for fostering a secure, transparent, and globally competitive neobanking sector in Ukraine. So, for now, the future development of domestic neobanks directly depends on state support for their activities and internal regulatory policy.

Considering the identified challenges, a roadmap for the implementation of regulatory conditions for neobanks' activity in Ukraine has been devised. The proposed roadmap outlines five strategic stages, emphasizing the need for clear classification criteria, alignment with European directives, and the implementation of distinct licenses for neobanks. The plan addresses prudential regulation, cybersecurity, and monitoring procedures, culminating in the promotion of innovation through the establishment of a regulatory sandbox and adherence to the Open Banking Concept. This comprehensive approach aims to position Ukraine as a regional hub for financial technology development while ensuring regulatory compliance and fostering a dynamic and resilient financial ecosystem.

Future research endeavors could focus on evaluating the effectiveness of the proposed regulatory roadmap, gauging its influence on the development of neobanks, and examining the role of state support in shaping the trajectory of domestic neobanking. A comprehensive analysis of stakeholders' perceptions and experiences within the evolving neobanking landscape would offer valuable insights into the sector's broader impact on financial inclusion and consumer needs satisfaction.

REFERENCE	**СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ**
Unit21. (2022, 30 June). *24 Neobank Statistics to Help with Risk and Compliance.* https://www.unit21.ai/blog/neobank-statistics#statistics-about-neobank-market-size-and-share	Unit21. (2022, 30 June). *24 Neobank Statistics to Help with Risk and Compliance.* https://www.unit21.ai/blog/neobank-statistics#statistics-about-neobank-market-size-and-share
AMF. (2016, 30 May). *The AMF announces the creation of a FinTech, Innovation and Competitiveness division headed by Franck Guiader.* https://www.amf-france.org/en/news-publications/news-releases/amf-news-releases/amf-announces-creation-fintech-innovation-and-competitiveness-division-headed-franck-guiader	AMF. (2016, 30 May). *The AMF announces the creation of a FinTech, Innovation and Competitiveness division headed by Franck Guiader.* https://www.amf-france.org/en/news-publications/news-releases/amf-news-releases/amf-announces-creation-fintech-innovation-and-competitiveness-division-headed-franck-guiader
BaFin. (2023, September). *FinTech Innovation Hub*. https://www.bafin.de/DE/Aufsicht/FinTech/fintech_node.html	BaFin. (2023, September). *FinTech Innovation Hub*. https://www.bafin.de/DE/Aufsicht/FinTech/fintech_node.html
Feyen, Erik, Frost, Jon, Gambacorta, Leonardo, Natarajan, Harish, & Saal, Matthew (Eds.). (2021, 13 July). BIS Papers No 117. *Fintech and the digital transformation of financial services: implications for market structure and public policy.* Bank for International Settlements. Monetary and Economic Department. https://bis.org/publ/bppdf/bispap117.htm	Feyen, Erik, Frost, Jon, Gambacorta, Leonardo, Natarajan, Harish, & Saal, Matthew (Eds.). (2021, 13 July). BIS Papers No 117. *Fintech and the digital transformation of financial services: implications for market structure and public policy.* Bank for International Settlements. Monetary and Economic Department. https://bis.org/publ/bppdf/bispap117.htm

Bank of Thailand. (2023, January). *Virtual Bank Licensing Framework.* https://www.bot.or.th/content/dam/bot/financial-innovation/digital-finance/virtual-bank/virtual-bank-en.pdf	Bank of Thailand. (2023, January). *Virtual Bank Licensing Framework.* https://www.bot.or.th/content/dam/bot/financial-innovation/digital-finance/virtual-bank/virtual-bank-en.pdf
Best European Neobanks in 2023. (2023). *Team PCN*. https://teampcn.com/best-european-neobanks-in-2023/	Best European Neobanks in 2023. (2023). *Team PCN*. https://teampcn.com/best-european-neobanks-in-2023/
Directive (EU) 2015/2366 of the European Parliament and of the Council (2015, 25 November). *Official Journal of the European Union.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32015L2366	Directive (EU) 2015/2366 of the European Parliament and of the Council (2015, 25 November). *Official Journal of the European Union.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32015L2366
Directive 2009/110/EC of the European Parliament and of the Council (2009, 16 September). *Official Journal of the European Union.* https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32009L0110	Directive 2009/110/EC of the European Parliament and of the Council (2009, 16 September). *Official Journal of the European Union.* https://eur-lex.europa.eu/legal-content/en/TXT/?uri= CELEX% 3A32009L0110
Europe Central Bank. (2018, March). *Finance Licensing Guide.* https://www.bankingsupervision.europa.eu/banking/tasks/authorisation/html/index.en.html	Europe Central Bank. (2018, March). *Finance Licensing Guide.* https://www.bankingsupervision.europa.eu/banking/tasks/authorisation/html/index.en.html
Europe Central Bank. (2023, September). *Prudential Regulation.* https://finance.ec.europa.eu/banking/banking-regulation/prudential-requirements_en	Europe Central Bank. (2023, September). *Prudential Regulation.* https://finance.ec.europa.eu/banking/banking-regulation/prudential-requirements_en
Europe Data Protection Board. (2023, October). https://edpb.europa.eu/edpb_en	Europe Data Protection Board. (2023, October). https://edpb.europa.eu/edpb_en
Europe neobanking market size & share analysis – growth trends & forecasts (2024–2029). (2023). *Mordor intelligence.* https://www.mordorintelligence.com/industry-reports/europe-neobanking-market	Europe neobanking market size & share analysis – growth trends & forecasts (2024–2029). (2023). *Mordor intelligence.* https://www.mordorintelligence.com/industry-reports/europe-neobanking-market
European Banking Authority. (2023, September *b*). *Anti-Money Laundering and Countering the Financing of Terrorism.* https://www.eba.europa.eu/regulation-and-policy/anti-money-laundering-and-countering-financing- terrorism	European Banking Authority. (2023, September *b*). *Anti-Money Laundering and Countering the Financing of Terrorism.* https://www.eba.europa.eu/regulation-and-policy/anti-money-laundering-and-countering-financing- terrorism
European Banking Authority. (2023, September *a*). *Consumer Protection Regulations.* https://www.eba.europa.eu/regulation-and-policy/consumer-protection-and-financial-innovation	European Banking Authority. (2023, September *a*). *Consumer Protection Regulations.* https://www.eba.europa.eu/regulation-and-policy/consumer-protection-and-financial-innovation
Fedina, V., & Bogrinovtseva, L. (2022). Neobanks: world experience and domestic practice. *Problems of modern transformations,* (6). https://doi.org/10.54929/2786-5738-2022-6-08-02	Федина, В. В., & Богріновцева, Л. М. (2022). Необанки: світовий досвід та вітчизняна практика. *Проблеми сучасних трансформацій*, (6). https://doi.org/10.54929/2786-5738-2022-6-08-02
Irshak, O., & Tvorydlo, O. (2022). Development of neo-banks in Ukraine. *Economy and society*, (36). https://doi.org/10.32782/2524-0072/2022-36-10	Іршак, О., & Творидло, О. Р. (2022). Розвиток необанків в Україні. *Економіка і суспільство*, (36). https://doi.org/10.32782/2524-0072/2022-36-10
Kadar, T. (2023). Neobanking Index: The State of Neobank in 2023. *SEON*. https://seon.io/resources/neobanking-index/	Kadar, T. (2023). Neobanking Index: The State of Neobank in 2023. *SEON*. https://seon.io/resources/neobanking-index/
Lobozynska, S., Skomorovych, I., & Vladychyn, U. (2021). Activities of neo-banks in the market of financial services in Ukraine and the world. *Financial space*, *3*(43), 7–21. https://doi.org/10.18371/fp.3(43).2021.071821	Лобозинська, С., Скоморович, І., & Владичин, У. (2021). Діяльність необанків на ринку фінансових послуг в Україні та світі. *Фінансовий простір*, *3*(43), 7–21. https://doi.org/10.18371/fp.3(43).2021.071821
NBU. (2023, August 10). *The concept of open banking in Ukraine*. https://bank.gov.ua/ua/news/all/kontseptsiya-vidkritogo-bankingu-v-ukrayini	НБУ. (2023, 10 серпня). *Концепція відкритого банкінгу*. https://bank.gov.ua/ua/news/all/kontseptsiya-vidkritogo-bankingu-v-ukrayini

Financial Conduct Authority. (2023, August). *Regulatory. Sandbox.* https://www.fca.org.uk/firms/innovation/ regulatory-sandbox	Financial Conduct Authority. (2023, August). *Regulatory. Sandbox.* https://www.fca.org.uk/firms/innovation/ regulatory-sandbox
Spiridonova, K. (2023). *How to create a neobank from scratch: functions and expenses*. Purrweb. https://www.purrweb.com//blog/kak-sozdat-neobank-s-nulya-funkcii-i-traty/	Spiridonova, K. (2023). *How to create a neobank from scratch: functions and expenses.* Purrweb. https://www.purrweb.com//blog/kak-sozdat-neobank-s-nulya-funkcii-i-traty/
State Bank of Pakistan. (n. d.). *Licensing and Regulatory Framework for Digital Bank*. https://www.sbp.org.pk/dfs/Digital-Bank-Regulatory.html	State Bank of Pakistan. (n. d.). *Licensing and Regulatory Framework for Digital Bank.* https://www.sbp.org.pk/dfs/Digital-Bank-Regulatory.html
Teslyuk, S., Matviychuk, N., Derkach, O., & Korkh, N. (2021). Neobanks: the essence and prospects of development in Ukraine. *Economic journal of Lesya Ukrainka Volyn National University*. *Section 3. Finance, Banking and Insurance*, (3), 61–71. https://doi.org/10.29038/2786-4618-2021-03-61-71	Теслюк, С., Матвійчук, Н., Деркач, О., & Корх, Н. (2021). Необанки: сутність та перспективи розвитку в Україні. *Економічний часопис Волинського національного університету імені Лесі Українки. Розділ 3. Фінанси, банківська справа та страхування*, (3), 61–71. https://doi.org/10.29038/2786-4618-2021-03-61-71
Neobanks.app. (2023, 1 September). *The list of neobanks and digital banks in the world* https://neobanks.app/	Neobanks.app. (2023, 1 September). *The list of neobanks and digital banks in the world* https://neobanks.app/

Conflict of interest: The authors certify that they have no financial or non-financial interest in the subject matter or materials discussed in this manuscript; the authors have no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript. Given that the authors are affiliated with the institution that publishes this journal, which may cause potential conflict or suspicion of bias and therefore the final decision to publish this article (including the reviewers and editors) is made by the members of the Editorial Board who are not the employees of this institution.

The authors received no direct funding for this study.

The contribution of the authors is equal.

Kalyta O., Gordiienko T., Erkes O. Neobanking regulation. *Scientia Fructuosa*. 2024. № 3. P. 105–124. https://doi.org/10.31617/1.2024(155)07

Received by the editorial office 19.01.2024.
Arrived after revision 12.02.2024.
Accepted for printing 16.02.2024.
Publication online 11.06.2024.

DOI: 10.31617/1.2024(155)08
UDC: 657.37:338.45=111

POLOVYK Yevheniia,
Master,
Postgraduate student of the Department
of Accounting and Taxation
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0002-3091-6242
y.polovyk@knute.edu.ua

KOROL Svitlana,
Doctor of Science (Economics),
Professor, Professor of
the Department of Accounting and Taxation
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0002-3091-6242
s.korol@knute.edu.ua

NON-FINANCIAL REPORTING IN THE INDUSTRIAL SECTOR

Non-financial reporting has become an important aspect of corporate reporting, especially in the industrial sector, providing enhanced information on the social, environmental and ethical aspects of a company's activities. By promoting transparency and accountability, non-financial reporting (NFR) can help companies mitigate negative environmental impacts and strengthen their overall sustainability efforts. The aim of the article is to review the regulatory framework and international practice of preparing non-financial reports by industrial enterprises, to identify the specific features of ESG reporting and to provide recommendations on the content of non-financial reports of industrial enterprises in Ukraine. The methods of theoretical generalization and grouping of information, induction, analysis, synthesis and logical generalization were applied. It was determined that the unification of regulatory and legal regulation in the field of NFR is an important issue for business entities, including industrial enterprises. Many international organizations have developed a set of their own regulations in the field of non-financial reporting, which reflect public attention to important issues and the actual practice of solving them by enterprises and organizations. Based on the international practice of non-financial reporting, the lack of universal approaches to the preparation of NFR was revealed. Companies should adapt to

ПОЛЬОВИК Євгенія,
магістр,
аспірант кафедри обліку та оподаткування
Державного торговельно-економічного
університету
вул. Кіото, 19. м. Київ, 02156, Україна

ORCID: 0000-0002-3091-6242
y.polovyk@knute.edu.ua

КОРОЛЬ Світлана,
д. е. н., професор кафедри обліку та
оподаткування
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0003-0958-8720
s.korol@knute.edu.ua

НЕФІНАНСОВЕ ЗВІТУВАННЯ У ПРОМИСЛОВОМУ СЕКТОРІ

Нефінансова звітність стала важливим аспектом корпоративної звітності, особливо у промисловому секторі, надаючи розширену інформацію про соціальні, екологічні й етичні аспекти діяльності підприємств. Сприяючи прозорості та підзвітності, нефінансова звітність (НФЗ) може допомогти підприємствам пом'якшити негативний вплив на навколишнє середовище і посилити їхні загальні зусилля щодо сталого розвитку. Метою статті є огляд нормативно-правового регулювання та міжнародної практики підготовки нефінансової звітності промисловими підприємствами, встановлення особливостей ESG-звітності та надання рекомендацій щодо змістовного наповнення нефінансових звітів промислових підприємств в Україні. Застосовано методи теоретичного узагальнення і групування інформації, індукції, аналізу, синтезу та логічне узагальнення. Визначено, що уніфікація нормативно-правового регулювання у сфері НФЗ є важливою проблемою для суб'єктів господарювання, включаючи промислові підприємства. Багато міжнародних організацій розробили набір власних регламентів у сфері НФЗ, які відображають суспільну увагу до важливих проблем та реальну практику їх розв'язання підприємствами й організаціями. На основі міжнародної практики НФЗ виявлено відсутність універсальних підходів до її складання. Підприємства мають адаптуватися

certain environmental conditions, take into account the specifics of their activities, organizational structure and strategic goals. The relevance and benefits of implementing ESG principles are determined. The article highlights the shortcomings of information disclosure in the NFRs of Ukrainian industrial enterprises. An important result of the study is the provision of recommenddations on the content of non-financial reports of industrial enterprises in Ukraine. Taking into account the experience of international companies will allow them to improve their approach to business, improve their NFR, and provide a comprehensive and transparent view of their ESG performance.

Keywords: non-financial reporting, corporate social responsibility, ESG reporting.

до певних умов зовнішнього середовища, зважати на специфіку своєї діяльності, організаційну структуру та стратегічні цілі. Визначено актуальність та переваги впровадження принципів ESG. Виділено недоліки розкриття інформації в НФЗ українських промислових підприємствах. Важливим результатом дослідження є рекомендації щодо змістовного наповнення нефінансових звітів промислових підприємств в Україні. Врахування досвіду міжнародних підприємств дасть змогу вдосконалювати підхід до бізнесу, покращувати НФЗ, надати комплексне та прозоре уявлення про свою ефективність з ESG.

Ключові слова: нефінансова звітність, корпоративна соціальна відповідальність, *ESG*-звітність.

JEL Classification: M14, M49.

Introduction

In recent years, non-financial reporting has become an important component of corporate reporting, especially in the industrial sector. It provides interested parties with extended information about the social, environmental and ethical aspects of the company's activities. This information can be used by stakeholders to assess the company's commitment to sustainable development goals, management approach and make informed decisions regarding investment or various types of cooperation. The industrial sector includes enterprises that produce goods that are used both for the production of other goods (means of production) and for final consumption. The main purpose of the enterprise of this sector is the production of goods, resources and services that are indirectly beneficial to the end consumer. For example, if all enterprises in an industrial group increase their efficiency, the final product will automatically inherit it. As a result, people will tend to buy such products. And, as a result, the gross domestic product will also grow (Wall Street Mojo, n. d.). In the S&P 500 global sector equilibrium weight index, the industrials sector is the second largest at 11 (14%) (S&P Dow Jones Indices, 2022). In Ukraine, in 2022, industrial enterprises accounted for 35% of the volume of sales and 29% of employed workers in the country (*Table 1*).

Such a significant influence of industrial enterprises on the GDP and employment of the country's population has a reverse side. One of the features of their activity is a significant, mostly negative impact on the environment, the potential generation of a large amount of emissions and waste, and the use of considerable amounts of energy. In order to reduce this impact, many enterprises have recently been actively implementing sustainability and carrying out measures to reduce emissions, use cleaner and energy-saving technologies, waste management and other corporate social responsibility initiatives.

Table 1

Industry structure of the products volume sold and the number of employees in Ukraine, 2022

Branch	Realized products		Employees	
	volume, thousand UAH	Structure, %	number, thousands of people	Structure, %
Industry	1 737 833	29	4 008 466	35
Wholesale and retail trade	1 309 998	22	4 452 094	39
Transport activity	670 759	11	541 965	5
Health care	668 368	11	179 953	2
Agriculture	448 393	7	682 412	6
Construction	235 452	4	264 519	2
Activities in the field of administrative services	206 939	3	102 984	1
Financial and insurance activities	171 803	3	483 026	4
Professional, scientific and technical activity	171 214	3	296 463	3
Others	467 348	8	473 974	4
In total	6 088 107	100	11 485 855	100

Source: compiled by the author based on the data of the State Statistics Service of Ukraine (2022a, 2022b).

The negative impact of industrial enterprises on the environment is a serious problem that requires effective control and management. This situation determines the need for non-financial reporting and increases the interest of interested parties in such information. The lack of uniform standards and a clear methodology for non-financial reporting (NFR) leads to differences in the interpretation and presentation of non-financial information by industrial enterprises. Many enterprises do not fully understand the importance of non-financial reporting or do not understand how to use this information to make strategic decisions, increase their competitiveness and investment attractiveness.

In recent years, the interest of researchers-scientists in NFR is growing. In particular, Semenova and Shpyrko considered the peculiarities and experience of European countries in the preparation of integrated reporting (Semenova & Shpyrko, 2022; Semenova, 2023). In their work, Oliynyk et al. (2020) analyzed the NFR practice of enterprises in the

extractive industry of Ukraine. The scientist Botsyan (2014) studied the use of standards for the NFR preparation and publication and the experience of Ukrainian enterprises. Aluchna and Roszkowska-Menkes (2019) reviewed the conceptual framework, regulation and practice of NFR s. However, the authors do not pay enough attention to the study of the fact of the NFR expansion, improving its quality and increasing the NFR comparability in the context of the branch affiliation of the reporting entities.

In particular, there is a need to formalize the requirements for meaningful filling of non-financial reports of industrial enterprises, taking into account current regulations in the field of non-financial reporting and international experience.

The aim of the article is to review the regulatory and legal regulation and international practice of preparing non-financial reports by industrial enterprises, establish the features of ESG-reporting and provide recommendations on the content of non-financial reports of industrial enterprises in Ukraine.

The research is based on the hypothesis that the analysis of current regulations and non-financial reports published by large international industrial enterprises will make it possible to reveal the peculiarities of disclosure of ESG-aspects of their activities and to provide recommendations for meaningful content of non-financial reports of such enterprises in Ukraine.

The theoretical and methodological basis of the study is the scientific works of Ukrainian and foreign scientists on the NFR practice, the materials of analytical and research structures (the State Statistics Service of Ukraine, the Center "CSR Development"), as well as the reporting of industrial enterprises.

During the study, the following methods of theoretical generalization and grouping of information were used to determine organizations and standards in the field of financial reporting: the induction method was used to establish patterns and trends in the practice of non-financial reporting among industrial enterprises, analysis and synthesis – to identify successful practices and problematic aspects of information disclosure and meaningful content of the NFR, logical summarization of research results – for the formulation of conclusions and specific proposals for improving the practice of non-financial reporting in the industrial sector.

The main part of the article consists of four interrelated sections. In the first of them, the basics of regulatory regulation in the field of non-financial reporting are defined. In the second part, the international practice of non-financial reporting is analyzed. In the third part, the features of ESG reporting of industrial enterprises are characterized. In the latter, recommendations were formulated regarding the meaningful content of non-financial reports of industrial enterprises.

1. Legal regulation in the field of non-financial reporting

The regulatory framework in the field of non-financial reporting began to form in the 1950s and currently includes various regulatory documents that establish requirements for disclosure of information about social, environmental and management practices of enterprises (Korol, 2011, 2013; Korol et al., 2022). International and regional organizations that develop relevant regulatory documents play an important role in defining methodological principles and principles of reporting; contribute to improving transparency and responsible business practices. The most common are the regulations prepared by a number of international organizations (*Table 2*).

Table 2

International organizations are developers of NFR standards and frameworks

Organization	Main goal	Standards
Global Reporting Initiative, GRI	Providing organizations with standards for reporting on economic, social and environmental aspects of activity	GRI Standards
International Organization for Standardization, ISO	Ensuring quality and safety standards for products and services on an international scale	ISO 26000
International Sustainability Standards Board, ISSB	Development of standards for effective disclosure of information about sustainable development by enterprises	IFRS S1 IFRS S2
Climate Disclosure Standards Board, CDSB	Development of standards for effective disclosure of information on climate and environmental aspects	CDSB Framework
Carbon Disclosure Project, CDP	Collection and publication of information on greenhouse gas emissions and climate mitigation strategies	CDP Rating
Task Force on Climate-Related Financial Disclosures, TCFD	Facilitating the disclosure of financial risks and opportunities related to climate change	77 industry-based
International Integrated Reporting Council, IIRC	Development of principles for integrated reporting that combines financial and non-financial information	International Integrated Reporting Framework
Sustainability Accounting Standards Board, SASB	Development of standards for sustainability reporting taking into account specific aspects of industries	SASB Standards Board
AccountAbility (AA)	Development of tools and standards to ensure sustainable management and reporting	AA1000

Source: Compiled by authors based on GRI (n. d.); ISO (n. d.); IFRS S1 (2023); IFRS S2 (2023); CDSB (n. d.); CDP (n. d.); TCFD (n. d.); IIRC (2021); SASB (n. d.); Accountability (n. d.).

These organizations and standards play an important role in establishing reporting guidelines and principles, helping to improve transparency and responsible business practices. They establish methodological principles

that help organizations determine what information is required for inclusion in the NFR, how to collect and analyze it, and how to properly present it in the report. The mentioned regulatory documents are mostly of a recommendatory nature and are used on a voluntary basis (Korol, 2013).

At the same time, there are standards in the NFR field, which are mandatory for a certain category of enterprises. An example of such a regulatory document is the European Reporting Directive (Corporate Sustainability Reporting Directive – CSRD) (European Commission, n.d.). Its scope extends to the majority of European and non-European enterprises that are registered and operate on regulated EU markets. Businesses will report under this directive for the first time from 2024 (PwC, n.d.). Information disclosure requirements are established by the European Sustainability Reporting Standards (ESRS). These standards cover a range of areas related to the environment, social sphere and corporate governance – all ESG aspects, including climate change, biodiversity, human rights and more. The main purpose of ESRS is to provide simple and understandable information about sustainable development. In the long term, it is expected that the implementation of the ESRS and the implementation of the CSRD will contribute to the realization of the EU's goal of achieving climate neutrality by 2050 and the objectives of the European Green Deal, such as ensuring a "globally competitive and sustainable industry, renovated energy-efficient buildings and cleaner energy and advanced clean technology innovation' (PwC, n. d.).

Mainly international and regional regulatory documents, including EU and US regulations, are aimed at disclosing information on achieving the goals of sustainable development, ensuring greater transparency and standardizing NFR practice. It is expected that 2024 will be the year when more enterprises will begin to take seriously the preparation of reports on ESG aspects of their activities (Semenova & Shpyrko, 2022).

The unification of regulatory and legal regulation in the NFR sphere is an important problem for business entities, including industrial enterprises. One of the main problems of unification is the great diversity and specificity of the activities of enterprises in various industries. Even within the same industry, there can be significant differences in accounting policies, measurement methods and other aspects of reporting due to different business strategies, approaches to management and organization of production, market conditions and other factors. In practice, industrial enterprises can choose one or another standard, instruction, conceptual basis for the NFR preparation; develop internal standards taking into account the requirements of national legislation, their specific needs or requests of interested parties (primarily providers of financial capital). A combination of different indicators and approaches is useful for enterprises, as it best reflects the social, environmental and management aspects of their activities. For example, companies can use GRI to disclose a wide range of social and environmental indicators, and SASB to identify key financial indicators that affect their performance in a particular industry.

The preparation of the NFR taking into account the requirements and recommendations of the specified regulatory documents contributes to:

satisfying the information needs of users (such as investors, consumers, government bodies and other interested parties); improving communication between all market participants; business transparency; understanding and assessment of the social, environmental and economic impact of enterprises.

2. International practice of non-financial reporting

In order to analyze the NFR international practice, six large industrial enterprises that are leaders in the world market, have significant export volumes, a high reputation and occupy dominant positions in their field have been selected. The analysis of the corporate reporting of the selected group of enterprises, as well as information about them from open sources and their official websites, made it possible to draw certain conclusions regarding the practice of non-financial reporting by international industrial enterprises (*Table 3*). It is worth noting that each of the companies has separate sections on their websites (especially for investors) where you can find details about their corporate governance, sustainable development strategy and other key aspects of their activities.

Table 3

submission structure of non-financial reports of TOP international industrial enterprises in 2022

Company	Report name	Country	Volume, pages
UPS	2022 Annual Report on Form 10-K	USA	245
	2022 Social Impact Report		15
	2022 GRI		61
	2022 DEI Impact Report		10
	2022 Sustainability Highlights		6
Siemens AG	Annual report 2022	Germany	26
	2022 Siemens Institutional and ESG Report		55
	Annual report 2022 sie. ACCELERATE Digital Transformation		260
RTX	2022 Annual Report	China	143
	2022 Environmental, Social and Governance Summary		17
CATL	2022 ESG report		78
Honeywell	2022 ANNUAL REPORT	USA	144
	2022/2023 Environmental, Social and Governance Report		120
	2022 CDP		119
Boeing	2022 SUSTAINABILITY REPORT		89
	2022 Annual Report		168

Source: compiled by the author based on the websites and reports of UPS (n. d.), Siemens AG (n. d.), RTX (n. d.), CATL (2022), Honeywell (n. d. *a*), Honeywell (n. d. *b*), Boeing (n. d.).

As shown by the given data, enterprises approached the choice of the form of the National Insurance Fund in different ways. In particular, four enterprises prepared annual reports that included both financial and non-financial information. The most common form of NFR is the ESG report (*Figure 1*).

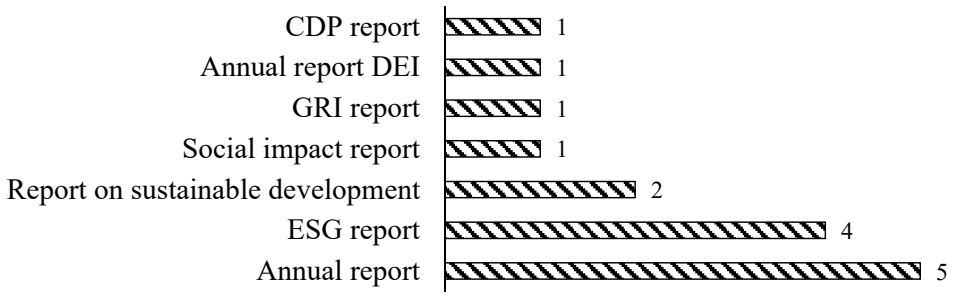


Figure 1. NFR forms, which are made by industrial enterprises.

Source: created by the author based on the materials of the official websites of the enterprises: UPS (n. d.); Siemens AG (n. d.); RTX (n. d.); CATL (n. d.); Honeywell (n. d. *a*), Honeywell (n. d. *b*), Boeing (n. d.).

In general, annual corporate reports represent a comprehensive review of the financial and other activities of enterprises during the year. Summarizing the practice of disclosing information and filling in the NFR, it is possible to highlight the following main components:

- notice to shareholders – an overview of important events and achievements in the reporting year, an address from the general director or president of the enterprise;
- overview of the enterprise – a brief description of the enterprise's business and strategy;
- financial reports – balance sheet, profit and loss statement, other reports;
- audit report;
- management review – detailed analysis of the financial situation, results of operations and management strategies;
- information on social and environmental initiatives of the enterprise, report on corporate responsibility;
- corporate governance – information on the structure and functioning of the management and supervisory board;
- risk management – analysis of the main risks that may affect the enterprise's business;
- other sections containing specific information about the relevant industrial sector, acknowledgments, awards, statistical data and other sections of the company's own choice.

As mentioned, annual corporate reports are primarily aimed at investors, shareholders, financial analysts and other parties interested in the financial aspect of the company's activities. This mostly determined their structure

and information content. They mainly focus on financial information and its analysis. ESG reports focus on disclosing non-financial information. At the same time, the studied international enterprises of the industrial sector follow various regulations when preparing non-financial reports. Individuals publish several reports according to different requirements; others disclose information about different environmental and social initiatives in one non-financial report. This is due to several reasons:

- different standards and initiatives. As already mentioned, there are many different standards and initiatives of the NFR (see *Table 2*). Enterprises choose those that best match their strategy and stakeholder needs;
- requirements of different countries (jurisdictions). Enterprises can take into account various regulations when preparing their NFR, taking into account their recognition in the country, in particular in national regulatory documents;
- evolution of non-financial reporting standards. The NFR field is dynamic, and the relevant international and regional organizations are constantly improving their regulations. Businesses are forced to adapt their own approaches to meet new or updated standards;
- cooperation of international organizations in the field of corporate reporting. Cooperation between different international organizations can lead to the emergence of new initiatives and standards that will have important advantages for enterprises seeking to adhere to the best practices in the NFR field. An example is the joining in 2022–2023 of a number of organizations – TCFD (n. d.), CDSB (n. d.), SASB (IFRS Foundation, n.d.) to the IFRS Foundation for the development of a single system of international standards for sustainable development;
- high costs for preparing corporate reports. The development and preparation of the NFR is a resource- and time-consuming procedure, especially for enterprises with complex business or operations in many countries. The costs of collection, analysis and reporting may vary depending on the size and complexity of the enterprise.

Therefore, the modern practice of corporate reporting is not limited to one universal approach. Enterprises must adapt to certain conditions of the external environment and make decisions regarding the choice of approaches to the NPF, taking into account the specifics of their activities, organizational structure, priorities of key stakeholders and their own strategic goals.

3. Features of ESG reporting of industrial enterprises

As more and more businesses recognize the benefits of incorporating ESG principles into their operations, ESG reporting has become increasingly popular in recent years (Wall Street Mojo, n. d.). Thus, 4 out of 6 investigated enterprises, namely CATL, RTX, Honeywell and Siemens, prepared and published ESG reports.

In addition to characterizing the specifics of its environmental, social and governance practices, in 2021 RTX formalized an ESG strategy that sets out aspirations and alignment with its areas of impact and business strategy. She has demonstrated support for staff development and a focus on addressing the global challenges of climate change. In the following year, the company continued to develop and integrate this strategy. A drive for innovation and collaboration, defined by the desire for a more secure and connected world, is at the heart of its ESG strategy (RTX, n. d.).

CATL, in turn, published its ESG report for the second time in 2022 with the aim of providing stakeholders with detailed information on its corporate philosophy, management approaches, actions and achievements in the field of sustainable development. The report is prepared in accordance with the requirements of GRI and SDGs. In particular, in the appendices to the report, the company indicated which disclosures were made in accordance with these requirements (CATL, n. d.).

Honeywell's report focuses on innovation to address ESG issues. The company constantly evaluates the development of the ESG strategy, including the perspectives and expectations of both internal and external stakeholders. In addition, Honeywell's ESG report additionally discloses information according to SASB and TCFD standards. Going forward, the company aims to continue to disclose additional information, given the materiality, availability and reliability of the data, as well as sensitivity to competition (Honeywell, n. d. *a*).

Siemens refers to the three "pillars" of ESG and aims to contribute to building a better future through an approach that keeps society within the planet, by building a culture of trust, empowerment and growth for everyone. This, as stated, should ensure the corporation's ability to remain strong and relevant in the future (Siemens AG, n. d.).

ESG reports of enterprises contain sections devoted to such issues as:

• *ecology*: measures to protect the environment; actions aimed at stimulating decarbonization throughout the value chain and achieving the highest standards of environmental protection, circular economy and responsible product design;

• *social responsibility:* using a holistic strategy that focuses on people and their needs, individual interests and skills; striving to create diverse and inclusive teams. In particular, information is given on providing assistance to the company's employees in preparation for the era of digital technologies, their professional training. Social responsibility ensures the realization of the most urgent needs of the communities in which enterprises operate;

• *management:* combating and preventing corruption and violations of laws and rules of business conduct within the enterprise and in supply chains. To this end, as stated in the report, they strictly and irrevocably adhere to the criteria of respect for human rights and have undertaken to work honestly and responsibly.

For example, the management personnel of the Siemens enterprise state that presenting an ESG report is a healthy practice for companies that value transparency (Siemens AG, n. d.). For them, the concept of good business is inseparable from ESG concepts. They have followed it for several years to inform stakeholders about the effectiveness of their commercial activities, to demonstrate their positive impact on society and Siemens' environmental, social and managerial performance.

One of the key advantages of ESG reporting for enterprises is the potential financial benefit (Makarenko, 2023). By implementing sustainable practices, businesses are able to mitigate the risks associated with environmental and social issues, and by disclosing this information to stakeholders, they are better placed to attract socially responsible investors. At the same time, industrial enterprises that prioritize energy efficiency and waste reduction can reduce their operating costs, improve their financial results and, in addition, increase their reputation and brand value (Office of Sustainable Solutions, 2023).

Therefore, the ESG report is not only an important tool for effective disclosure of information about environmentally and socially responsible practices and corporate governance, but also an analytical tool for supporting management decisions, forming and implementing business strategy.

4. Non-financial report problems of industrial enterprises in Ukraine

Analysis of the NFR of leading international industrial enterprises shows considerable diversity in the format, content and volume of their corporate reporting. Such flexibility enables enterprises to take into account the specifics of their activities, to meet the requirements and recommendations of various standards and the expectations of key stakeholders.

Based on a review of the NFR of industrial enterprises in Ukraine, which are among the TOP-100 largest companies by revenue in 2022, we see that the most widespread is the management report. In 2019, in the process of bringing Ukrainian legislation into line with European standards, for the first time large companies of Ukraine had to prepare a management report for the previous year 2018, which is precisely what is connected with the active submission of the NFR in 2018–2020. However, non-financial reports for the current and previous reporting periods are not presented on the companies' websites. Outdated and incomplete information in the NFR indicates a lack of openness and transparency in their activities. Given global trends, this practice negatively affects the trust of stakeholders and investors and can limit the ability of enterprises to attract investment and develop business.

Table 3

Analysis of non-financial reports of the TOP-6 largest industrial enterprises of Ukraine

Indicator	JSC "Naftogaz of Ukraine"	JSC "NAEK "Energo-atom"	PJSC "NEC "Ukrenergo"	PJSC "Zaporizh-stal"	PJSC "Arcelor-Mittal Kryvyi Rih"	PJSC "Kamet-stal"
Income in 2022, UAH billion	169.9	134.2	82.3	47	43.8	37.9
The reporting period	2014–2021	2019–2020	2019–2020	2018–2022	2020–2022	2019–2020
Name of the report (reporting period)	Annual report (2021)	Non-financial report (2020)	Manage ment report (2022)	Manage ment report (2022)	Annual information of the issuer of securities (2022)	Manage ment report (2022)
ESG	+	–	–	–	–	–
Organizational structure and description of the company's activities	+	+	+	+	–	–
Results of activity	+	+	+	+	+	+
Liquidity and liabilities	+	+	+	+	+	+
Environmental aspects	+	+	+	+	+	+
Social aspects and personnel policy	+	+	+	+	+	+
Risks / risk management	+	+	–	+	+	+
Research and innovation	+	+	+	+	+	+
Financial investments	+	+	+	+	+	+
Development prospects	+	+	+	+	+	+
Corporative management	+	+	+	+	+	+
Measures of corporate social responsibility	+	+	+	–	+	+
Interaction with interested parties	+	+	–	–	–	–

Source: created by the author based on materials from the websites of Naftogaz Ukrainy OJSC (n. d.), SE "NAEK Energoatom" (2020), PJSC NEC "Ukrenergo" (2022), PJSC "Zaporizhstal" (2022) , PJSC "Arcelor-Mittal Kryvyi Rih" (2022), PJSC "Kamet-steel" (2022).

From the analysis of non-financial reports of industrial companies in Ukraine, we can identify the main problems and shortcomings of completeness/lack of information disclosure. In particular, enterprises:

- focus only on compliance with legislation on emissions and waste management, but do not consider the wider environmental aspects of the activity, such as the impact on biodiversity or the rational use of resources;
- do not provide in-depth analysis and disclosure of data related to ESG indicators;
- are limited only to the fulfillment of minimum requirements for occupational safety, without considering a wide range of social relations with employees and the local community;

- do not provide sufficient information about their suppliers and socially responsible management practices throughout the supply chain;
- miss opportunities to improve their processes and reduce the impact on the environment due to insufficient attention to innovation and the latest technologies;
- do not disclose enough information about their management, internal standards and regulations, which may raise doubts among stakeholders about their ethics;
- are not active enough in interaction with the public and are not involved in initiatives and programs in the field of social development and charity.

The absence of a part of the indicators in the NFR indicates insufficient attention of companies to important aspects of their activities, which can have a significant impact on their sustainability, long-term success and their perception by the community. These issues can limit the success and sustainability of a business, as well as undermine the trust of stakeholders and consumers.

5. Recommendations for meaningful content of non-financial reports of industrial enterprises in Ukraine

On the basis of the analysis of the existing practice in Ukraine and the identified trends in the NFR field of industrial enterprises in the world, it is possible to formulate a number of recommendations regarding the disclosure of information by industrial companies in Ukraine.

- Given that industrial enterprises have a significant impact on the environment through production processes and emissions, corporate reports should emphasize environmental indicators such as emission levels, waste management and energy conservation initiatives.
- Taking into account the higher risks of injuries at work, the negative consequences for the health of workers and the impact on the sustainable development of the region of the operational activity of industrial enterprises, in their context of social responsibility, corporate reports should disclose the issues of occupational safety, relations with employees, participation in social programs for local communities, development of local infrastructure.
- Taking into account the possibility of influence on counterparties and the spread of socially responsible practices, corporate reports of industrial enterprises should disclose in sufficient detail information on the formation of sustainable supply chains, in particular compliance with the relevant principles of socially responsible and ethical business.
- Having high potential and the need for constant organizational and technical improvement of all business processes, industrial enterprises should serve as an example and incentive for socially responsible development of business partners and, accordingly, provide infor-

mation about implemented innovative solutions, research and development in the field of new technologies, which gives they will be able to work more efficiently, improve their production processes, reduce the negative impact on the environment and society.

- Taking into account the decisive influence on the economic, environmental and social efficiency of business, in corporate reports, large enterprises should provide a proper description of the business philosophy, corporate culture and practice of corporate management and business ethics, in particular regarding the transparency of decision-making, compliance with internal rules and standards, and as well as risk management.
- Considering the fact that large industrial enterprises are influential corporate citizens, their corporate reports should disclose issues of cooperation with the public, initiatives in the field of social development and philanthropy.

Therefore, the corporate report of an industrial enterprise must be devoted to ESG aspects of its activity and testify to the level of awareness of its responsibility for its impact on the environment and society in the specified areas. A high degree of openness and clarity of presentation of the specified information in the NFR can improve relations with interested parties and contribute to the sustainable development of an industrial enterprise.

It should be expected that in the future, focusing on the best international experience and using the available resources, Ukrainian industrial enterprises will improve their approach to business, improve the NFR, and provide comprehensive and transparent information about their effectiveness in ESG issues. This will enable them to increase the trust of stakeholders, their own competitiveness, investment attractiveness, and contribute to a more sustainable future.

Conclusions

The conducted research confirmed the proposed hypothesis and made it possible to identify the peculiarities of the disclosure of ESG aspects of activities by international industrial enterprises and to formulate recommenddations for meaningful content of non-financial reports of such enterprises in Ukraine.

The NFR standards and principles are constantly evolving; they define the foundations of transparent and responsible practice and are aimed at supporting sustainable development, reducing the negative impact of enterprises on the environment, employees and the local community, and responsible formation of supply chains. A number of international organizations have developed their own regulations in the NFR field which reflect public attention to urgent global problems and the contribution of enterprises and organizations to their solution. International organizations jointly work on harmonizing requirements and developing uniform standards of NFR, in particular regarding the disclosure of ESG aspects of economic activity.

Large industrial enterprises, which are leaders in the world market, actively use various NFR formats and try to more fully disclose information about their social, environmental and management practices. Based on the analysis of these reports, it has been proven that the ESG report is not only an important tool for effective information disclosure, but also an analytical tool for supporting responsible management decisions, forming and implementing business strategy. From the analysis of the NFR of the largest industrial enterprises in Ukraine, problems and shortcomings in their disclosure were highlighted, in particular, limited attention to environmental aspects, to social responsibility, insufficient information about the supply chain, lack of emphasis on innovation and new technologies, insufficient transparency of management and ethics, and insufficient interaction with the public and initiatives in the field of social development.

The study of world experience made it possible to formulate recommendations on the meaningful filling of the NFR by Ukrainian industrial enterprises. First of all, it is important to focus on the environmental aspects of the enterprises' activities and, in particular, on emission reduction measures, energy saving initiatives and their efficiency. In order to confirm their social responsibility in their corporate reports, companies should also highlight the issues of labor safety, relations with employees, participation in social programs and infrastructure projects, as well as contributions to the development of the local community. Finally, initiatives to build sustainable supply chains and cooperation with counterparties should be considered in the context of compliance with the principles of social responsibility. The disclosure of these and other NFR essential issues will make it possible to show in action the business philosophy, corporate culture and management practices, and the company's effectiveness in solving ESG issues. A high degree of openness, full and clear presentation of information in the NFR will contribute to increasing the trust of interested parties and the competitiveness of the enterprise.

Large industrial enterprises should be an example of accountability and social responsibility of business, offering innovative solutions and using new technologies to reduce the negative and increase the positive impact on both the environment and society.

Promising areas of research are the formulation of the concept of corporate reporting in the industrial sector, taking into account the latest social, environmental and management practices and the contribution of enterprises to the achievement of sustainable development.

REFERENCE	**СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ**
AccountAbility. (n. d.). *Standards*. http://www.Accountability.org/ standards/index.html	AccountAbility. (n. d.). *Standards*. http://www.Accountability.org/ standards/index.html
Aluchna, M., & Roszkowska-Menkes, M. (2019). Integrating corporate social responsibility and corporate governance at the company level. Towards a conceptual model. *Engineering Economics*, (30). 349–361. https://doi.org/10.5755/j01.ee.30.3.17511	Aluchna, M., & Roszkowska-Menkes, M. (2019). Integrating corporate social responsibility and corporate governance at the company level. Towards a conceptual model. *Engineering Economics*, (30). 349–361. https://doi.org/10.5755/j01.ee.30.3.17511

Boeing. (n. d.). *Reports*. https://investors.boeing.com/ investors/reports/	Boeing. (n. d.). *Reports*. https://investors.boeing.com/ investors/reports/
Botsian, T. (2014). The use of standards for preparation and publication non-financial reports: the experience of ukrainian reality. *Ekonomika. Management. Innovations*, *2*(112). http://eprints.zu.edu.ua/ id/eprint/23583	Боцян, Т. В. (2014). Використання стандартів зі складання та оприлюднення нефінансової звітності: досвід українських підприємств. *Економіка. Управління. Інновації*, *2*(112). http://eprints.zu.edu.ua/id/ eprint/23583
CATL. (2022). *CATL's 2022 Environmental, Social and Governance (ESG) Report*. https://www.catl.com/en/ uploads/1/file/public/202304/20230412124641_cxg8mo 2in8.pdf	CATL. (2022). *CATL's 2022 Environmental, Social and Governance (ESG) Report*. https://www.catl.com/en/ uploads/1/file/public/202304/20230412124641_cxg8mo 2in8.pdf
CDP. (n. d.). *We focus capital markets, companies, cities and governments on building a sustainable economy by measuring and acting on their environmental impact*. https://www.cdp.net/en	CDP. (n. d.). *We focus capital markets, companies, cities and governments on building a sustainable economy by measuring and acting on their environmental impact*. https://www.cdp.net/en
CDSB. (n. d.). *cdsb.net.* Date of appeal 23.12.2023. https://www.cdsb.net/	CDSB. (n. d.). *cdsb.net.* Date of appeal 23.12.2023. https://www.cdsb.net/
European Commission. (n. d.). *Corporate sustainability reporting*. https://finance.ec.europa.eu/capital- markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en	European Commission. (n. d.). *Corporate sustainability reporting*. https://finance.ec.europa.eu/capital- markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en
GRI. (n. d.). *globalreporting.org*. Date of appeal 24.12.2023. https://www.globalreporting.org/standards/	GRI. (n. d.). *globalreporting.org*. Date of appeal 24.12.2023. https://www.globalreporting.org/standards/
Honeywell. (n. d. *b*). *The Annual Report*. https://honeywell.gcs-web.com/financial-information/ annual-reports/	Honeywell. (n. d. *b*). *The Annual Report*. https://honeywell.gcs-web.com/financial-information/ annual-reports/
Honeywell. (n. d. *a*). *Foundation for the future, 2023*. Environmental, Social and Governance Report. https://www.honeywell.com/us/en/company/ esg-report	Honeywell. (n. d. *a*). *Foundation for the future, 2023*. Environmental, Social and Governance Report. https://www.honeywell.com/us/en/company/ esg-report
IFRS Foundation. (n. d.). *SASB Standards*. https://sasb.ifrs.org/	IFRS Foundation. (n. d.). *SASB Standards*. https://sasb.ifrs.org/
IFRS S1. (2023). https://www.ifrs.org/issued-standards/ ifrs-sustainability-standards-navigator/ifrs-s1-general-requirements/	IFRS S1. (2023). https://www.ifrs.org/issued-standards/ ifrs-sustainability-standards-navigator/ifrs-s1-general-requirements/
IFRS S2. (2023). https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s2-climate-related-disclosures/	IFRS S2. (2023). https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s2-climate-related-disclosures/
IIRC. (2021). International Integrated Reporting Framework (IIRF). https:// integratedreporting.ifrs.org/ resource/ international-ir-framework/	IIRC. (2021). International Integrated Reporting Framework (IIRF). https:// integratedreporting.ifrs.org/ resource/ international-ir-framework/
ISO. (n. d.). *ISO 26000 – Social Responsibility*. http://www.iso.org/iso/home/standards/iso26000.htm	ISO. (n. d.). *ISO 26000 – Social Responsibility*. http://www.iso.org/iso/home/standards/iso26000.htm
Korol, S. (2011). Non-financial reporting of the enterprise. *Bulletin of the Kyiv National University of Trade and Economics*, (6), 102–113. https://visnyk.nuwm.edu.ua/index.php/econ/article/view/ve4202015	Король, С. (2011). Нефінансова звітність підприємства. *Вісник Київського національного торговельно-економічного університету,* (6), 102–113. https://visnyk.nuwm.edu.ua/index.php/econ/article/view/ ve4202015
Korol, S. Y. (2013). Normative documents on social responsibility of business. *Ekonomika Ukrainy*, (9), 85–96. http://jnas.nbuv.gov.ua/article/UJRN-0001337974	Король, С. Я. (2013). Нормативні документи із соціальної відповідальності бізнесу. *Економіка України*, (9), 85–96. http://jnas.nbuv.gov.ua/article/UJRN-0001337974.

Korol, S., Semenova, S., & Kurbet, M. (2022). Implementation of sustainable development reporting in Ukraine: state and prospects in the context of European integration. *Business-Inform*, (1), 294–301. https://doi.org/10.32983/2222-4459-2022-1-294-301	Король, С. Я., Семенова, С. М., & Курбет, М. А. (2022). Упровадження звітності про сталий розвиток в Україні: стан і перспективи в умовах євроінтеграції. *Бізнес-Інформ*, (1), 294–301. https://doi.org/10.32983/2222-4459-2022-1-294-301.
Makarenko, I. (2023). Incorporation of ESG criteria into the activities of companies in the context of their investment screening. *Economics, management and administration*, *2*(104), 86–93. https://doi.org/10.26642/ema-2023-2(104)-86-93	Макаренко, І. О. (2023). Інкорпорація ESG-критеріїв у діяльність компаній у контексті їх інвестиційного скринінгу. *Економіка, управління та адміністрування*, *2*(104), 86–93. https://doi.org/10.26642/ema-2023-2(104)-86-93
National Joint Stock Company "Naftogaz of Ukraine". (2021). *Financial report*. https://gas.ua/uk/financial-statements	НАК "Нафтогаз України". (2021). *Фінансова звітність*. https://gas.ua/uk/financial-statements
Office of Sustainable Solutions. (2023). *ESG reporting during the war: who needs it and why?* (published on May 26, 2023).https://ukraine-oss.com/esg-zvitnist-pid-chas-vijny-komu-potribna-i-dlya-chogo/	Офіс Сталих Рішень. (2023). *ESG-звітність під час війни: кому потрібна і для чого?* (дата публікації: 26 травня 2023). https://ukraine-oss.com/esg-zvitnist-pid-chas-vijny-komu-potribna-i-dlya-chogo/
Oliynyk, Y., Kucheryava, M., Zinchenko, A., & Korytnyk, L. (2020). Practice of non-financial reporting of enterprises of the extractive industry of Ukraine. *Scientific papers of the Research Institute*, (4), 95–105. https://doi.org/10.33763/npndfi2020. 04.095	Олійник, Я., Кучерява, М., Зінченко, А., & Коритник, Л. (2020). Практика нефінансової звітності підприємств добувної галузі України. *Наукові праці НДФІ*, (4), 95–105. https://doi.org/10.33763/npndfi2020.04.095
PJSC ArcelorMittal Kryvyi Rih. (2022). *Annual information of the issuer of securities*. https://minedocs.com/21/PJSC_ArcelorMittal_Kryvyi_Rih-AR-2020ukr.pdf	ПАТ "АрселорМіттал Кривий Ріг". (2022). *Річна інформація емітента цінних паперів*. https://minedocs.com/21/PJSC_ArcelorMittal_Kryvyi_Rih-AR-2020ukr.pdf
PJSC Zaporizhstal. (2020). *Management Report.* https://zaporizhstal.com/pidpriyemstvo/informacija-dlja-akcioneriv/	ПАТ "Запоріжсталь". (2022). *Звіт про управління.* https://zaporizhstal.com/pidpriyemstvo/informacija-dlja-akcioneriv/
PrJSC Kamet-steel. (2020). *Management report.* https://dkhz.com.ua/images/corpdocs/2021/corpdoc-zvit20.pdf	ПрАТ "Камет-сталь". (2020). *Звіт про управління.* https://dkhz.com.ua/images/corpdocs/2021/corpdoc-zvit20.pdf
PrJSC NPC Ukrenergo. (2020). *Management Report.* Retrieved from https://ua.energy/wp-content/uploads/2021/04/ZP-2020.pdf	ПрАТ НЕК "Укренерго". (2022). *Звіт правління.* https://ua.energy/wp-content/uploads/2021/04/ZP-2020.pdf
PwC. (n. d.). *CSRD is resetting the ESG value-creation agenda in CEE.* https://www.pwc.com/ua/en/services/csrd.html	PwC. (б. д.). Директива ЄС про корпоративну звітність зі сталого розвитку (CSRD). https://www.pwc.com/ua/uk/services/csrd.html
RTX. (n. d.). *RTX Corporation. Reports & Proxy Statements*. https://investors.rtx.com/financial-information/annual- reports	RTX. (n. d.). *RTX Corporation. Reports & Proxy Statements*. https://investors.rtx.com/financial-information/annual- reports
S&P Dow Jones Indices. (2022). Index Investment Strategy. U.S. Equal Weight Sector Dashboard. December 30, 2022. https://on.spdji.com/rs/838-LDP-483/images/dashboard-us-equal-weight-sector-2022-12.pdf?mkt_tok=ODM4LUxEUC00ODMAAAGJGBXzWqq_0cHmvFA_sgX85pt_Wn04ap94itJ-aQxpbNF9Rwk0f50m8_paM4iy-P85WWN0UnwaHt07NmOMj9q6M6O6mWIO9RJjdZaT7M2qi4cE	S&P Dow Jones Indices. (2022). *Index Investment Strategy. U.S. Equal Weight Sector Dashboard*. December 30, 2022. https://on.spdji.com/rs/838-LDP-483/images/dashboard-us-equal-weight-sector-2022-12.pdf?mkt_tok=ODM4LUxEUC00ODMAAAGJGBXzWqq_0cHmvFA_sgX85pt_Wn04ap94itJ-aQxpbNF9Rwk0f50m8_paM4iy-P85WWN0UnwaHt07NmOMj9q6M6O6mWIO9RJjdZaT7M2qi4cE

SE NNEGC Energoatom. (2020). *Reporting*. https://old.energoatom.com.ua/parts/pdf-file/nonfin-peport2020.pdf	ДП НАЕК "Енергоатом". (2020). *Звітність*. https://old.energoatom.com.ua/parts/pdf-file/nonfin-peport2020.pdf
Semenova, S. (2023). European principles of integrated reporting of socially responsible business. *Scientia Fructuosa*, *149*(3). https://doi.org/ 10.31617/1.2023 (149)07	Semenova, S. (2023). European principles of integrated reporting of socially responsible business. *Scientia Fructuosa*, *149*(3). https://doi.org/ 10.31617/1.2023 (149)07
Semenova, S., & Spyrko, O. (2022). Features of the preparation of the integrated reporting of european companies. *Collection of scientific works NUIT. Series: Economics and Management,* (52). 65–71. https://doi.org/10.32703/2664-2964-2022-52-65-71.	Семенова, С. М., & Шпирко, О. М. (2022). Особливості підготовки інтегрованої звітності європейських компаній. *Збірник наукових праць ДУІТ. Серія «Економіка і управління»,* (52), 65–71. https://doi.org/10.32703/2664-2964-2022-52-65-71.
Siemens AG. (n. d.). *Annual Reports*. https://www.siemens.com/global/en/company/investor-relations/events-publications-ad-hoc/annualreports.html	Siemens AG. (n. d.). *Annual Reports*. https://www.siemens.com/global/en/company/investor-relations/events-publications-ad-hoc/annualreports.html
State Statistics Service of Ukraine. (2022*a*). *The number of employees employed by business entities by type of economic activity, 2022*. https://ukrstat.gov.ua/operativ/operativ2012/fin/osp/kzp/kzp_u/arch_kzp_u.htm	Державна служба статистики України. (2022*a*). *Кількість зайнятих працівників на підприємствах за їх розмірами за видами економічної діяльності, 2022*. https://ukrstat.gov.ua/operativ/operativ2012/fin/osp/kzp/kzp_u/arch_kzp_u.htm
State Statistics Service of Ukraine. (2022*b*). *Volume of sold products (goods, services) of economic entities by types of economic activity*. https://ukrstat.gov.ua/operativ/operativ2012/fin/osp/orps/orps_u/arch_orps_u.htm	Державна служба статистики України. (2022*b*). *Обсяг реалізованої продукції (робіт, послуг) суб'єктів господарювання за видами економічної діяльності, 2022*. https://ukrstat.gov.ua/operativ/operativ2012/fin/osp/orps/orps_u/arch_orps_u.htm
TCFD. (n. d.). *Task Force on Climate-Related Financial Disclosures*. https://www.fsb-tcfd.org/	TCFD. (n. d.). *Task Force on Climate-Related Financial Disclosures*. https://www.fsb-tcfd.org/
UPS. (n. d.). *Progress Reports and Disclosures*. https://about.ups.com/us/en/our-impact/reporting.html	UPS. (n. d.). *Progress Reports and Disclosures*. https://about.ups.com/us/en/our-impact/reporting.html
Wall Street Mojo. (n. d.). *Industrial sector*. (Updated: 2024, April 4). https://www.wallstreetmojo.com/industrials-sector/	Wall Street Mojo. (n. d.). *Industrial sector*. (Updated: 2024, April 4). https://www.wallstreetmojo.com/industrials-sector/

Conflict of interest. The authors certify that don't they have no financial or non-financial interest in the subject matter or materials discussed in this manuscript; the authors have no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript. Given that the authors are affiliated with the institution that publishes this journal, which may cause potential conflict or suspicion of bias and therefore the final decision to publish this article (including the reviewers and editors) is made by the members of the Editorial Board who are not the employees of this institution.

The authors received no direct funding for this study.

The contribution of the authors is equal.

Polovyk Ye., Korol S. Non-financial reporting in the industrial sector. *Scientia Fructuosa*. 2024. № 3. P. 125–142. https://doi.org/10.31617/1.2024(155)08

Received by the editorial office 23.04.2024.
Arrived after revision 07.05.2024.
Accepted for printing 17.05.2024.
Published online 11.06.2024.

DOI: 10.31617/1.2024(155)09
UDC: 339.13:336.763.3=111

ZHURAKHOVSKA Liudmyla,
PhD (Economics), Associate Professor
of the Department of Banking
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID: 0000-0003-3745-0155
l.zhurakhovska@knute.edu.ua

LYASHENKO Sergiy,
Master, Postgraduate student
of the Department of Banking
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine

ORCID:0000-0002-5656-5145
s.lyashenko@knute.edu.ua

EVOLUTION OF THE UKRAINIAN EUROBOND MARKET

The Ukrainian Eurobond market will become a critically important source for raising funds in the post-war years. This requires a quantitative analytical study of the factors affecting this market, but such studies are practically non-existent today. The aim of the article is to design the periodization of the Ukrainian Eurobond market, reveal the regularities of its functioning and analyze the interrelation of the risk and return. There is an hypothesis, as: Eurobond return rate can be positively correlated with the systematic risk. Five main stages of development of the Ukrainian Eurobond market (including corporate issues) were found. The main factors were analyzed that influenced the volumes and the coupon rate at the placement of the 2001–2021 issues at each of the first four stages of market development. It is shown that the distribution of issuers of corporate Eurobonds by the total volume of issues is a classic distribution with the "fat tail" and the reason for this distribution were shown. Regression analysis methods were used to analyze the relationship between sovereign risk of Ukraine and coupon rate at the placement of the corporate Ukrainian Eurobonds. Two market "anomalous" in the Ukrainian Eurobond market were found out: periods with exceeding of average coupon rate at the placement of the government Ukrainian Eurobonds over the same rate of the

ЖУРАХОВСЬКА Людмила,
к. е. н., доцент кафедри банківської справи
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID: 0000-0003-3745-0155
l.zhurakhovska@knute.edu.ua

ЛЯШЕНКО Сергій,
магістр, аспірант кафедри банківської справи
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна

ORCID:0000-0002-5656-5145
s.lyashenko@knute.edu.ua

ЕВОЛЮЦІЯ УКРАЇНСЬКОГО РИНКУ ЄВРОБОНДІВ

Ринок українських євробондів стане критично важливим ресурсом для залучення коштів у повоєнні роки. Це потребує вивчення кількісними аналітичними методами факторів, які впливають на цей ринок, але такі дослідження на сьогодні практично відсутні. Мета статті – провести періодизацію ринку українських євробондів, виявити закономірності його функціонування та проаналізувати взаємозв'язок ризику і дохідності. Гіпотеза: між дохідністю євробондів і систематичним ризиком може існувати позитивна кореляційна залежність. Виявлено п'ять основних етапів розвитку ринку євробондів українських емітентів (включно з корпоративними випусками). Проаналізовано головні фактори, які впливали на обсяги та дохідність при розміщенні випусків у 2001–2021 рр. на кожному із перших чотирьох етапів розвитку ринку. Показано, що розподіл емітентів корпоративних євробондів за сумарним обсягом емісій є класичним розподілом з "довгим хвостом" і пояснено причини виникнення такого розподілу. Методами регресійного аналізу проаналізовано зв'язок суверенного ризику України і купонної дохідності при розміщенні корпоративних українських євробондів. Виявлено дві ринкових "аномалії" на ринку українських євробондів: існування періодів перевищення середньої купонної дохідності державних євробондів

corporate Ukrainian Eurobonds; decreesing of the sovereign risk statistically accompanied with increasing of the average coupon rate at the placement of the corporate Ukrainian Eurobonds. The first "anomaly" explained by the increased optimism of investors in the late 10s and early 20s. The second "anomaly" associated with the rapid expansion of the market and the attraction of relatively risky corporate issues. Using the example of "Vodafone Ukraine" Eurobonds, the influence was analyzed of the introduction of martial law and restructuring events on prices and yield to maturity of the Ukrainian corporate Eurobonds in 2021–2023 years.

Keywords: Eurobonds, bonds, initial placement, issue volume, coupon rate, fat tail distribution, market anomalies, yield to maturity, sovereign risk, martial law.

Україні над цим показником для корпоративних євробондів; зниження суверенного ризику в середньому супроводжувалось зростанням купонної дохідності при розміщенні корпоративних українських євробондів. Перша "аномалія" пояснена підвищеним оптимізмом інвесторів наприкінці 10-х – початку 20-х років. Друга пов'язана зі швидким розширенням ринку і залученням відносно ризикових корпоративних емісій. На прикладі євробондів "Vodafone Україна" досліджено вплив введення воєнного стану та реструктуризаційних подій на ціни і дохідність до погашення українських корпоративних єврооблігацій протягом 2021–2023 рр.

Ключові слова: євробонди, єврооблігації, облігації, первинне розміщення, обсяг випуску, купонна ставка дохідності, розподіл з "довгим хвостом", ринкові аномалії, дохідність до погашення, суверенний ризик, воєнний стан.

JEL Classification: E44, G15, H81.

Introduction

The insufficient capacity of the domestic borrowing market prompts Ukrainian issuers to look for opportunities to enter foreign markets. Eurobonds are one of the effective means of obtaining currency resources for both the state of Ukraine and private enterprises. The deepening of the European integration of the country will certainly lead to the expansion of the possibilities of issuing Eurobonds.

Mutual interest is evidenced, in particular, by the issue in 2019 of the first sovereign Eurobond in 15 years, which is denominated in euros (Ministry of Finance of Ukraine, 2019, June 13), after which there were several more issues of sovereign and corporate Eurobonds, but most of them were denominated in USD .

We can hope that Eurobonds will be used in increasing volumes for post-war reconstruction with the growth of Ukraine's sovereign credit rating. But, from the point of view of economic efficiency, the issuer must take into account the balance of the proposed return and the desired volume of issue. Determining this balance in emerging markets, to which Ukraine belongs, must take into account many specific local factors. However, these issues are hardly covered in the scientific literature.

The main regulatory document on the issuance of Eurobonds is Council Directive 89/2298/EEC of April 17, 1989 (Council Directive 89/298/EEC, 1989).

The history of the development and peculiarities of the Eurobond market are described in detail in the works of foreign scientists. Thus, the

books of Aquanno (2021), Bertocchi et al. (2014), Michie (2021) analyzed developed European Eurobond markets, but did not consider developing markets. The works of Motamen-Scobie et al. (1999) and O'Malley (2015) describe in detail the history of the development of Eurobond markets, which may be interesting from the point of view of comparing the early stages of the development of these markets with the relatively young Eurobond market of Ukraine. Choudhry et al. (2014) provide the theoretical foundations of Eurobond settlements and general information about the relevant markets, but little attention is paid to issues in developing countries.

Separate studies concern the peculiarities of Eurobond markets issued in developing countries. Ukraine may benefit from the experience of some African countries regarding the restructuring of Eurobonds (Bradlow, 2022; Smith, 2021). Pilbeam (2023, p. 309) in his monograph provides estimates of the average yield of Eurobonds in countries with a moderate level of risk (China, Poland, South Africa) and with a high level of risk (Brazil, Mexico), which show a direct relationship between yield and risk. In a thorough study by Fabozzi (2021), among other things, information is provided on Eurobonds issued in emerging markets (for example, in Argentina), as well as selected indicators of the Ukrainian debt market. A noteworthy book, a large part of which is devoted to the study of Russia's efforts to weaken Ukraine in 2013–2015 through pressure using government Eurobonds issued during the presidency of Yanukovych (Hess, 2023).

Therefore, the history of the Ukrainian Eurobond market is practically not reflected in foreign monographs.

The use of foreign experience requires taking into account the fact that Ukraine is a developing country – the so-called emerging market – and, therefore, an area of increased risk for investors. Starting in 2022, the main risk factor for new Eurobond issues is active hostilities, and Ukrainian risks have become too great for Eurobond investors even compared to other developing countries (OECD, 2023).

The history of the Ukrainian Eurobond market is described in articles by domestic authors (Galeshchuk, 2017; Kryvoruchko, 2009; Lyvdar & Panyush, 2017; Khayetska, 2011; Shuba, 2013). But most of these publications are descriptive in nature. Although financial markets are characterized by cyclicality, it should be noted that the possibility of using historical precedents for making financial decisions by future issuers and investors is significantly limited.

Works in which quantitative analytical methods were used to analyze the Ukrainian Eurobond market are still few, for example (Tkachuk, 2017). This paper examines the dynamics of five Ukrainian corporate Eurobonds and draws a conclusion regarding the positive relationship between the price and the sovereign rating. However, this conclusion is of a qualitative nature

and is made only on the basis of data for 2016–17. The yield dynamics of Ukrainian Eurobonds in 2022 on the eve of a full-scale invasion is considered in the work of Halapsus (2022). Fedevych and Zhukova (2023) analyzed the role of Eurobonds in the structure of the public debt of Ukraine. This publication draws an important conclusion regarding the impact of international interest rates and Ukraine's sovereign credit rating on the Ukrainian government Eurobond market. In all these works, there is no quantitative analysis of the relationship between the prices and yields of Ukrainian Eurobonds and economic and financial indicators.

A separate area of study of the Ukrainian Eurobond market is the measurement of Ukraine's debt security. Although this direction of research is beyond the scope of this work, in the relevant articles (Dakhnova, 2019; Cheberyako & Zakrushevskyi, 2023) an important indicator of the Ukrainian bond market (which includes the Eurobond market) is considered – the EMBI Index (Emerging Markets Bond Index) + Ukraine. However, the detailed dynamics of the index are not given and, accordingly, the articles do not contain a quantitative analysis of the relationship of this indicator with other financial and economic indicators.

Adjacent to these works is the article by Blishchuk (2022) – one of the few works that examines the prospects of the Ukrainian Eurobond market in the conditions of a full-scale war. The author of the article considers it possible to issue Eurobonds under the guarantee of the US government. However, the authors of this article consider such a scenario unlikely.

Therefore, the authors are not aware of any articles where quantitative analytical methods are used to investigate the relationship between the indicators of the Ukrainian Eurobond market and economic indicators. Qualitative judgments regarding the influence of the sovereign rating on the prices of Ukrainian Eurobonds have not yet been confirmed by quantitative analysis. A wider application of quantitative methods for a detailed study of Ukrainian Eurobonds and the identification of objective indicators for the analysis of this market should create the basis for returning the confidence of foreign investors in the post-war period, when Ukraine will have to borrow large funds for reconstruction.

The market of Ukrainian Eurobonds, despite its importance for the attraction of funds by both the state and corporations, has not been sufficiently studied by quantitative analytical methods. Qualitative observations, such as the positive relationship between return and sovereign risk, have not been verified by quantitative methods over long periods of time.

The aim of the article is to divide the history of the Ukrainian Eurobonds market into periods and to identify the patterns of functioning of this market; using analytical methods to reveal the influence of economic factors, including sovereign risk, on the return of Ukrainian Eurobonds. This

should provide additional means: for investors – for forecasting in this market, for issuers – for determining the optimal volumes and the proposed placement rate.

The hypothesis was put forward that for the Eurobond market of Ukraine there should be a positive correlation between risk and return ("high risk – high return " rule). The hypothesis was partially confirmed, as market "anomalies" were discovered, due to which this rule was violated in certain rather long periods.

The key research method is statistical analysis, which was used by the authors to process primary data on the issue and placement of bonds and identify statistical patterns.

The information base of the study was data from the issues of Ukrainian Eurobonds (both state and corporate), provided by the CBonds project (n. d.). Data on exchange rates of the National Bank of Ukraine (n. d.) were used for cross-currency calculations. Data on the dynamics of the S&P rating of Ukraine were also applied (Trading Economics, n. d.).

It should be noted that the lack of open sources of financial information is a significant obstacle to the quantitative analysis of Ukrainian Eurobonds. Specifically, quotations of sovereign, bank and corporate Eurobonds are available in open access on the Dragon Capital website (2023) only for the current date. However, there are no publicly available historical data on the quotations of Ukrainian Eurobonds.

In three sections of the main part of the article, a quantitative analytical study of the issuance and circulation of Ukrainian Eurobonds was conducted, on the basis of which a periodization of the development of the Ukrainian Eurobond market was developed; analysis of the dynamics of the volume and coupon rate of Ukrainian Eurobond issues and the influence of political and economic factors and sovereign risk on the coupon rate of Ukrainian Eurobonds; on the basis of this analysis, two types of long-term anomalies of the relationship between sovereign risk and coupon rate when placing Ukrainian Eurobonds on the market were identified. The influence of martial law and investment events on the dynamics of prices and yield to maturity was studied using the example of Vodafone Ukraine Eurobonds.

1. Market periodization of Ukrainian Eurobonds

The Eurobond market of Ukraine is, on the one hand, a source of attracting funds by issuers, and on the other, a high-yield, albeit risky asset for investors (Fabozzi, 2021, p. 378).

The legislation of Ukraine does not provide a specialized definition for Eurobonds, and therefore the general definition given in the Law of Ukraine "On Capital Markets and Organized Commodity Markets"

No. 3480-IV (2006) should be applied to government Eurobonds: "Bonds of the external state loan of Ukraine are securities, which are placed on international capital markets and confirm Ukraine's obligations to compensate the bearers of these bonds for their nominal value with the payment of income in accordance with the terms of placement of bonds". Therefore, from the point of view of this law, it is government bonds that are classic "Eurobonds", in contrast to issues of corporate issuers. It is desirable that the existing practice of issuing Eurobonds by enterprises and banks should be clearly recorded at the legislative level.

The law also enables placement of external local loan bonds. But so far we have only isolated examples of placement of Eurobonds by local authorities, represented by a single issuer – the Kyiv City Council (Smida, 2022, December 20). Although decentralization creates prerequisites for local communities to attract funds for development using Eurobonds (Synyak, 2018), this opportunity is still limited.

Since the introduction of martial law (February 24, 2022), no Ukrainian Eurobonds have been issued, which has significantly reduced the ability of enterprises to raise funds. Therefore, the quantitative analysis of the market of Ukrainian Eurobonds in this study was carried out for the issues of 2000–2021. Summary data on the issues of Ukrainian Eurobonds for this period are shown in the *Table1*.

Table 1

Number of Eurobond issues, 2000–2021, units

Issue	Types by issuer					
	state		corporate		in total	
	Currency					
	USD	*EUR*	*USD*	*EUR*	*USD*	*EUR*
In total, *including:*	42	5	124	4	166	9
with a fixed rate	40	5	107	4	147	9
with a floating rate	2	0	17	0	19	0

Source: compiled by the authors for CBonds (n. d.).

According to the *Table 1*, corporate issues of Eurobonds dominate in terms of number (but, as will be shown below, not in terms of volumes). Consequently, business in Ukraine actively used international financial resources. There is also a significant excess of US dollar-denominated issues. This indicates a focus primarily on global institutional investors, but may also indicate a certain underestimation of the resource of potential buyers of bonds from the European Union. This additional resource will have to be taken into account when planning future issues of Ukrainian Eurobonds.

An analysis of the number of issuers by volume of corporate Eurobond issues in 2000–2021 is shown in *Figure 1*, where the Pareto chart shows the cumulative number of corporate emitters whose total emissions exceed certain threshold values. The minimum threshold value of the volume of emissions is V_{min} = USD 50 million.

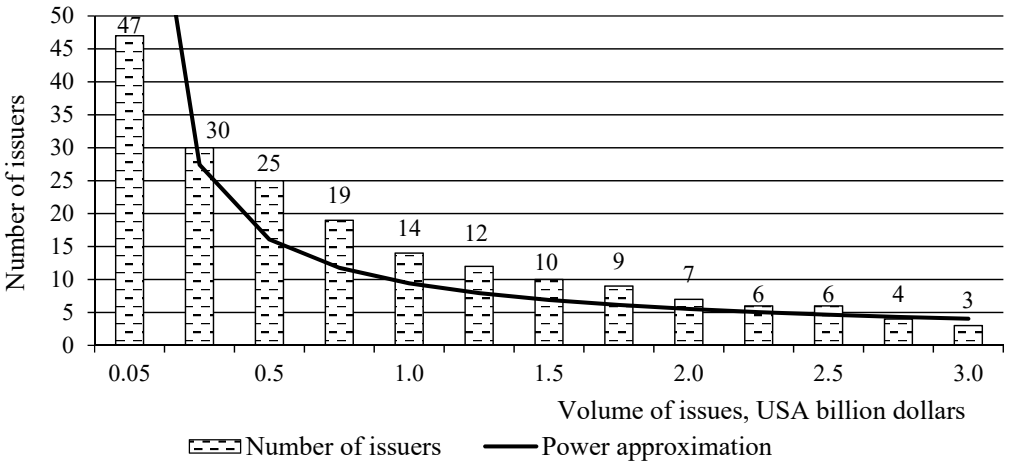


Figure 1. Pareto chart of the cumulative number of issuers of corporate Ukrainian Eurobonds with issuance dates in 2000–2021 and power correlation approximation*

* Issues denominated in EUR, converted into USD at NBU cross rates (n. d.).

Source: compiled by the authors for CBonds (n. d.).

Along with the actual data, the diagram also shows a power-law approximation of the cumulative number of issuers (E) depending on the threshold total volume of issues (V) (Arnold, 2015):

$$E = C \cdot (V/ V_0)^{(-A)}, \quad (1)$$

where $V \geq V_{min}$, V_{min} = USD 50 million, V0 = USD 1000 million.

The optimal selection of dimensionless parameters of power approximation gives: C = 9.4, A = 0.77.

The value of the exponent in the approximating dependence turned out to be close to –1, as in the classic Zipf law (Saichev et al., 2010). That is, the distribution of issuers is a classic distribution with a "fat tail", which is often found in economics and finance (Mandelbrot, 2008). Similar to the distribution of firms by size, the distribution of issuers by the total volume of issues can be explained by the following mechanism: issuers with a successful history of servicing payments on Eurobonds get better chances to place each subsequent issue, even with an increased volume.

The success of individual issuers paves the way for successful borrowing by other numerous issuers on the Eurobond market. The evolution of this market can be traced in *Figure 2*, which shows the dynamics of Eurobond issues by year.

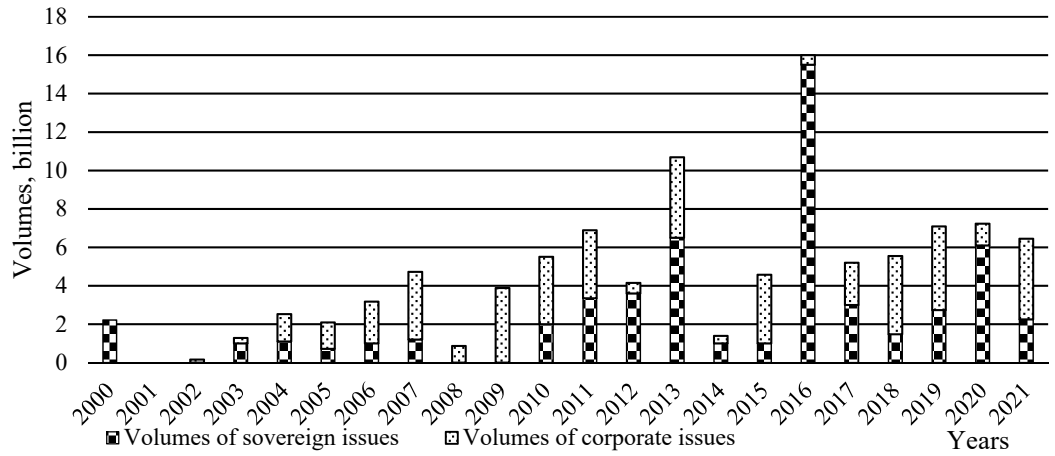


Figure 2. Dynamics of sovereign and corporate Ukrainian Eurobond issues in 2000–2021, USD*

Source: compiled by the authors for CBonds (n. d.).

* Issues denominated in EUS, converted into USD at NBU cross rates (n. d.).

Data analysis (see *Figure 2*) enabled us to develop a periodization of the development of the Ukrainian Eurobond market and to distinguish five characteristic periods:

1. *Starting: 2000–2001.* During this period, the first government Eurobonds were issued with relatively small volumes.

2. *Initial growth: 2002–2007.* With stable volumes of government issues, volumes of corporate issues gradually increased. For example, in 2003, the volume of corporate issues was 22% of the total, and in 2007 it grew to 75%. This trend coincided with the global trend, where in emerging markets, the volume of corporate borrowing through Eurobonds grew faster than sovereign issuance (Fabozzi, 2021, p. 357).

3. *Financial Crisis and subsequent growth: 2008–2013.* During this period, on the contrary, corporate placements were at an almost constant level. And the state steadily increased the volume of Eurobond issues. If in 2010 the volume of state issues was 36% of the total, then in 2013 it grew to 61%.

4. *Recovery after the start of Russian armed aggression: 2014–2021.* The main event of this period is the approval in 2016 of the restructuring of Ukrainian government Eurobonds into warrants that are tied to GDP (Ministry of Finance of Ukraine, 2015, October 27). After that, the volume of both government and corporate Eurobond issues fluctuated, but the total volume of borrowing slowly increased. It should be noted that in 2017–2019 volumes grew mainly due to corporate issues, which can be explained by the focus of the Ministry of Finance of Ukraine on attracting official (longer-term and "cheap") financing from the IMF, EIB and other international financial institutions.

5. *Stabilization of the secondary market after a full-scale invasion: 2022–2023.* There were no Eurobond issues during this period. But on the

secondary market, after the initial shock, transactions with Ukrainian Eurobonds resumed (CBonds, n. d.).

Further, the specified periodization will be used for a more detailed analysis.

2. The relation between risk and coupon rate of Ukrainian Eurobonds and market "anomalies"

In developed markets, the yield on government short-term instruments with fixed income is considered risk-free, that is, all bonds have risk and, accordingly, should have a higher yield (Fabozzi, 2021, p. 1199). However, in developing markets, this rule is not always followed. In these markets, for quite a long time, there may be "anomalies" in the returns of financial instruments, which are not characteristic of developed markets (Kang et al., 2019).

The Ukrainian Eurobond market demonstrated both compliance with the specified rule and "anomalies" during certain time intervals. These intervals can be found in *Figure 3*. Thus, during 2003–2017, the annual average coupon rate at placement of corporate Ukrainian Eurobonds exceeded the same rate of state Eurobonds, which corresponds to general trends.

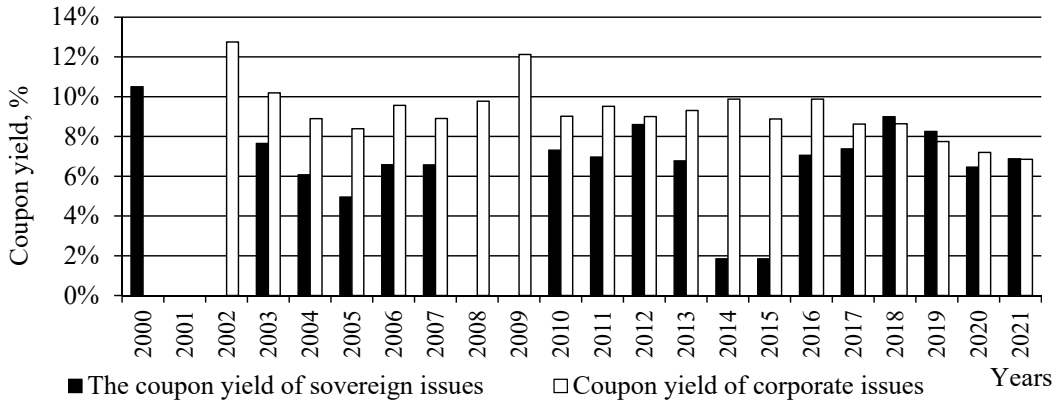


Figure 3. Dynamics of the average coupon rate at placement of sovereign and corporate Ukrainian Eurobonds in 2000–2021, %

Source: compiled by the authors for CBonds (n. d.).

Therefore, the expectation regarding the return of government financial instruments, the risk of which has only a systematic sovereign component, was confirmed, and therefore they should be less profitable than corporate bonds, which are characterized by additional individual risk.

The periodization of the market of Ukrainian Eurobonds developed by us based on the analysis of the volume of issues was also useful for the analysis of returns on this market.

It can be seen that the entire period of Initial Growth (2002–2007) the coupon rate of corporate Eurobonds "tracked" the coupon rate of government Eurobonds. The calculated correlation coefficient of these two indicators is

0.92. It can be assumed that investors, observing the stable growth of the financial market during this period, agreed to the issuers' proposed return of corporate Eurobonds, based on the corresponding return of state Eurobonds.

However, at the beginning of the next period of the Financial Crisis and subsequent growth (2008–2009), investors' confidence in the ability to predict the coupon rate of Ukrainian corporate Eurobonds based on the coupon rate of government Eurobonds was shaken. Investors began to approach the assessment of the proposed rate of corporate Eurobonds more meticulously and individually. However, throughout the period 2008–2013, the coupon rate of corporate Eurobonds remained higher than the coupon rate of government Eurobonds.

During the period of Recovery after the start of Russian armed aggression with the completion of the restructuring of government Eurobonds, their average coupon rate exceeded the average coupon rate of corporate issues for several years: in 2018 – by 0.36%, in 2019 – by 0.50% and in 2021 – by 0.02%. This "anomaly" of returns has its own explanation. The approximate constancy of annual volumes of government issues with their relatively high return allows us to assume that investors had certain limits for investing in Ukrainian government Eurobonds, and even an increase in their returns could not force investors to violate these limits. However, at the same time, investors had the opportunity to fill riskier portfolio quotas due to rising volumes of corporate issues, even despite the gradual decline in their returns. So, a certain "boom" took place in this segment of the borrowing market at the end of the 10s and beginning of the 20s.

Along with the noted temporary "anomalous" relation between coupon rate of government and corporate Eurobonds, the analysis revealed another – more long-term – "anomaly" regarding the relation between systematic risk and coupon rate of corporate Eurobonds.

To identify and analyze this anomaly, it is necessary to introduce a measure of the systematic risk component. Generally accepted indicators of systematic (sovereign) risk are the sovereign ratings of Ukraine, determined by the rating agencies Moody's (since 1998), S&P and Fitch (since 2001) (Trading Economics, n. d.).

In order to use quantitative methods of analysis, it was necessary to move from an ordinal scale (which is each sovereign rating with literal values) to a quantitative scale (measure). For this, the authors assigned numerical ranks to the sovereign ratings on a scale from 1 to 9 (*Table 2*). For each ordinal rating scale (Moody's, S&P, and Fitch), the best rating received by Ukraine during 2000–2023 is assigned a rank of 9, and the worst is assigned a rank of 1. Intermediate the ratings received consecutive numerical ranks with a constant step (different for different agencies). At the same time, some ratings received incomplete ranks, as the number of different rating values in the specified period depended on the rating agency.

Table 2

Ranks assigned by rating agencies

S&P rating	*BB–*	*B+*	*B*	*B–*	*CCC+*	*CCC*	*CCC–*	*CC*	*SD*
S&P rank	9	8	7	6	5	4	3	2	1
Moody's rating	*B*1	*B*2	*B*3	*Caa*1	*Caa*2	*Caa*3	*Ca*		
Moody's rank	9	7.7	6.3	5	3.7	2.3	1		
Fitch rating	*BB–*	*B+*	*B*	*B–*	*CCC*	*CC*	*C*	*RD*	
Fitch rank	9	7.9	6.7	5.6	4.4	3.3	2.1	1	

Source: developed by authors.

As you can see in *Figure 4*, the ranks of the ratings of different agencies correlate well enough with each other.

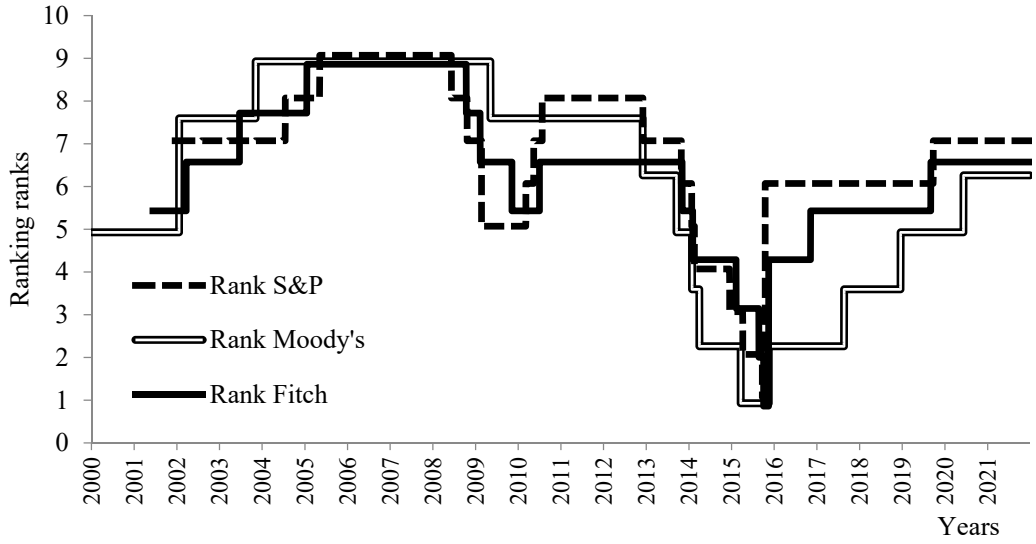


Figure 4. Dynamics of Ukraine's sovereign ratings in 2000–2021

Source: compiled by the authors based on Trading Economics (n. d.). Rankings of Moody's, S&P, and Fitch sovereign ratings are given in accordance with *Table 2.*

For each value of the S&P sovereign rating, stability periods are defined (horizontal links, see *Figure 4*). In total, there were 18 such periods for 2000–2021. For all issues of corporate Eurobonds that took place during any stability period for each fixed rating, the number of issues and average coupon rates at placement for all such issues were calculated. These data are shown in *Figure 5*.

Corresponding linear regressions, presented below, were also calculated.

Regression of the number of issues of corporate Eurobonds (N_{corp}) on the rank of the S&P sovereign rating ($Rang_{S\&P}$): $N_{corp} = -8.8 + 4.6 \cdot Rang_{S\&P}$.

Regression of average coupon rate at placement (r_q) on S&P sovereign rating rank ($Rang_{S\&P}$): $r_q = 8.2\% + 0.18\% \cdot Rang_{S\&P}$.

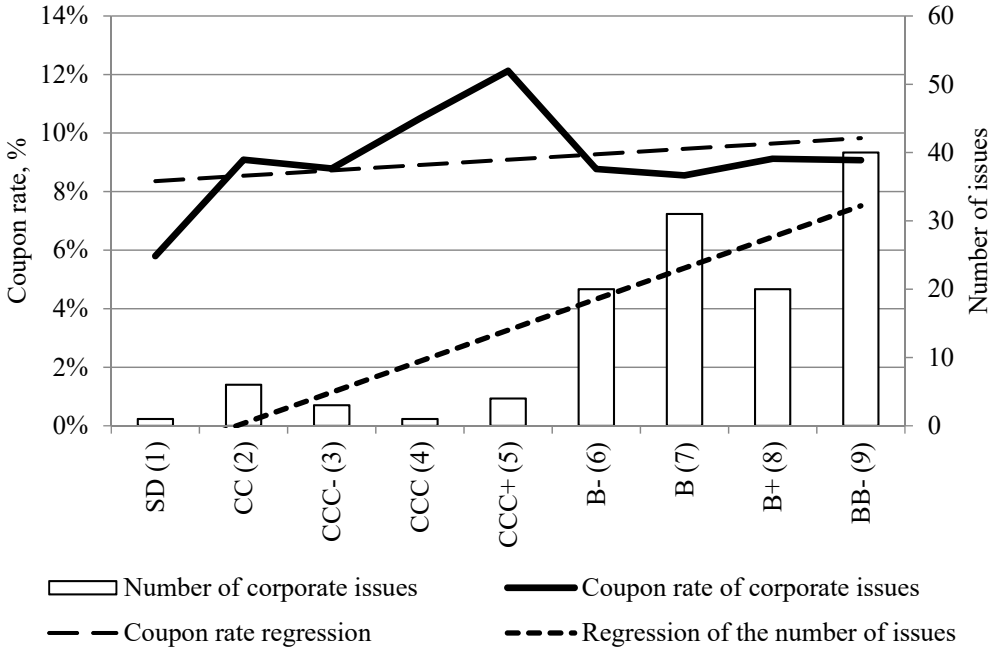


Figure 5. Dependence of the number of issues and the average coupon rate at placement of corporate Eurobonds on the rank of the S&P rating of Ukraine for the period 2000–2021

Source: compiled by the authors for CBonds (n. d.).

As the research results showed (see *Figure 5*), the dependence of the number of corporate Eurobond issues on Ukraine's sovereign rating turned out to be positive, which corresponds to general market trends: when the issuer's risks are reduced, investor demand grows and, accordingly, a larger number of corporate issuers initiate issues to satisfy this demand.

But the dependence of the average coupon rate at placement on the sovereign rating also turned out to be positive (that is, on average, a decrease in sovereign risks was accompanied by an increase in the coupon rate). Such a phenomenon may seem paradoxical and is hardly observed in developed markets, but it has an explanation. When new issuers of Eurobonds appear on the market, investors should take into account not only the sovereign rating of Ukraine, but also the individual risks inherent in these issuers. When issuers with relatively low risks cannot meet demand, investors agree to buy less reliable Eurobonds, but demand a higher return at placement. Therefore, the expansion of the market leads simultaneously to an increase in the number of issues and to an increase in the average placement rate. It should be noted that such dynamics are characteristic primarily of periods of optimism for both investors and issuers. These periods are typical for the post-crisis stages of the development of the Eurobond market with relatively high sovereign ratings. But such periods were also relatively long-lasting, since the crisis periods (2008–2009 and 2014–2015) constituted a smaller part of the existence of the Ukrainian Eurobond market, when issues took place on it.

3. The impact of political, economic and military events on the price and coupon rate of Ukrainian Eurobonds

Since the beginning of the full-scale invasion of Russian troops into Ukraine, no new issues of Eurobonds have taken place due to a significant increase in risks. However, the existing issues continued to be quoted and traded, although they had lost significantly in value at the beginning of the invasion. From the point of view of investment theory, this period can be used to study the adaptation of the security market to significant shocks.

For a more detailed review, the issue of corporate Eurobonds "Vodafone Ukraine", ISIN code XS2114201622, has been selected with the placement date of February 3, 2020, the maturity date of February 11, 2025, denominated in USD with a coupon rate at placement of 6.2%. This issue demonstrated quite typical dynamics for the Ukrainian Eurobond market, as the period of its rotation began long before the start of the full-scale invasion and ends several years after this event.

Let's consider how political and economic factors in Ukraine affected the nature of price dynamics and yield to maturity of Eurobonds of this issue (*Figure 6*).

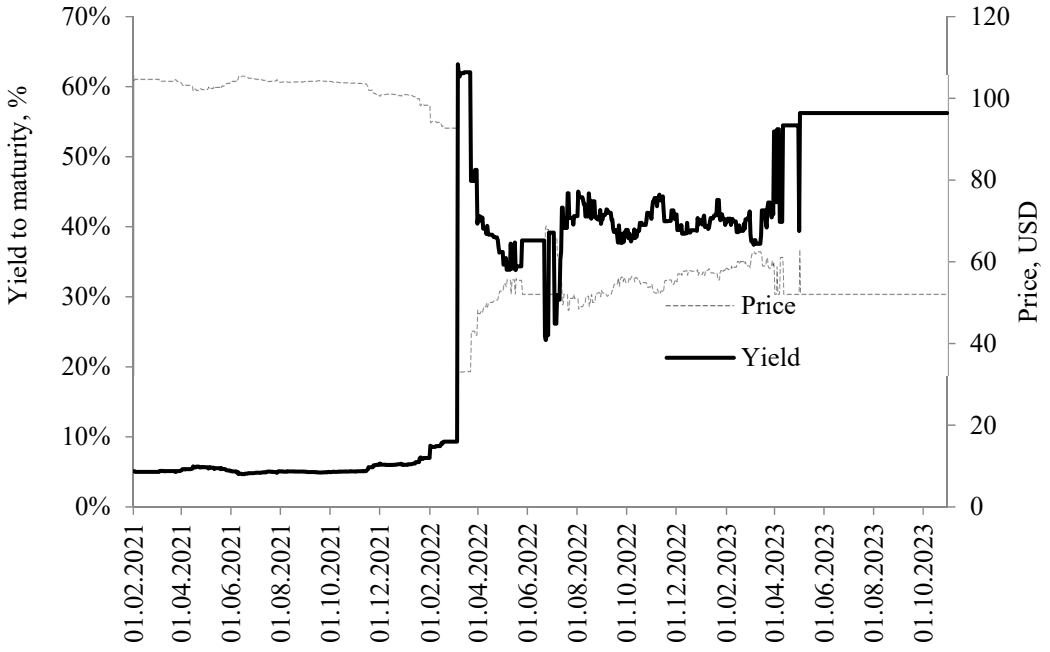


Figure 6. Bond price and yield to maturity of corporate Eurobonds "Vodafone Ukraine" (XS2114201622) for January 2021 – September 2023

Source: compiled by the authors for CBonds (n. d.).

In early 2022, Eurobond prices began to decline due to the risk of a full-scale Russian invasion. In February, the decline accelerated (UBN, 2022, January 20).

After the start of the full-scale invasion, the price of Vodafone Eurobonds fell only on March 7, 2022. The reason was a certain shock of investors and their hopes that a return to "business as usual" was possible.

The next period was characterized by a partial recovery of investor confidence until the end of April 2022, and then there was a period of price volatility that lasted until March 31, 2023.

Against the background of this volatility, at the end of June there were significant "excesses" in price increases and yield-to-maturity reductions, due to investors' optimism in connection with the announcement of a speech by the CEO of "Vodafone Ukraine" at the International Conference on the Reconstruction of Ukraine in 2022 (Ustinova, 2022, 26 July). It should be noted that this was a short-term event, moreover, related to Eurobonds of one issuer, which had no impact on the market in general.

Another important event at the beginning of August 2022 was the signing of an agreement with the majority of holders of sovereign Ukrainian Eurobonds on changes to the terms of issuance of all bonds of external state loans, state derivatives of Ukraine and Eurobonds guaranteed by the state (Ministry of Finance of Ukraine, 2022, August 10). Investors agreed that the term of circulation of Eurobonds has been extended for 2 years ("the grace period"), and the coupon payments must still be deferred for this period. This agreement, although it predicted a worsening of the financial result for investors, nevertheless increased their confidence in the ability of Ukraine to service its debt obligations. This indirectly reduced the risk assessments of corporate Ukrainian Eurobonds as well, including those issued by Vodafone, and slightly increased their value, which can be seen in *Figure 6*.

One of the risk factors of Ukrainian Eurobonds is the "thin market" – a situation where, in conditions of low liquidity, even a small change in the activity of both buyers and sellers can significantly affect prices in the short term. This is exactly the situation that took place at the end of March – beginning of April 2023, when the price of Eurobonds fell from 60% to 52% of the nominal value in one day, rose to 59% of the nominal value in the next three days, followed by a repeated daily drop to 52% of the nominal value and then by growth to 61% of the nominal three days later. Such a situation can serve as a typical example of the combined interaction of a low sovereign rating and low liquidity of the issue.

The obtained results can be used by issuers of Eurobonds, as well as potential investors in these financial instruments.

In the future, the authors plan to conduct a more detailed analysis of price fluctuations of Ukrainian Eurobonds on the array of all issuers in order to isolate the role of systematic (market) factors.

Conclusions

Based on the analysis results of the issue dynamic volumes and the coupon rate upon placement, five main stages of the Ukrainian Eurobond market development for the period 2000–2023 were identified: initial (2000–2001);

initial growth (2002–2007); financial crisis and subsequent growth (2008–2013); recovery after the beginning of Russian armed aggression (2014–2021); stabilization of the secondary market after a full-scale invasion (2022–2023).

Various political and economic events in Ukraine at different stages of market development significantly affect the placement potential and coupon rate of Ukrainian Eurobonds. In particular, the financial crises led to a sharp drop in the demand of foreign investors for Ukrainian Eurobonds, and in the conditions of relative stability of the annual volumes of government issues, when investors get the opportunity to fill riskier portfolio quotas due to the growing volumes of corporate issues, even despite the gradual decrease in their profitability, there was a noticeable revitalization

An analysis of the factors that created an "abnormal" excess of the average coupon rate when placed for government Eurobonds over this indicator of corporate Eurobonds of Ukraine revealed that such an excess, which took place in 2018, 2019 and 2021, can be explained by the increase in the portfolio quotas of investment funds for corporate issues of Eurobonds in developing markets.

On the other hand, the sovereign risk factor of Ukraine also affects the coupon rate at placement of corporate Ukrainian Eurobonds. The reason for the coexistence of an "abnormally" high average coupon rate at placement of corporate Ukrainian Eurobonds and a relatively low sovereign risk is the rapid growth of demand for corporate Eurobond issues in the "thin market", which causes an increase in the number of issues along with an increase in the average coupon rate.

The introduction of martial law and restructuring events also affected the prices of Ukrainian Eurobonds, which is clearly visible on the example of Vodafone Ukraine Eurobonds: the combined interaction of a low sovereign rating and low liquidity of the issue can lead to daily price fluctuations of up to 10% of the face value.

Prospects for further research consist in quantifying the role of systematic (market) factors in the price change of Ukrainian Eurobonds using primary data on price dynamics of the entire range of issues.

REFERENCE	**СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ**
Aquanno, S. M. (2021). *The Crisis of Risk. Subprime Debt and US Financial Power from 1944 to Present*. Edward Elgar Publishing.	Aquanno, S. M. (2021). *The Crisis of Risk. Subprime Debt and US Financial Power from 1944 to Present*. Edward Elgar Publishing.
Arnold, B. C. (2015). *Pareto Distributions*. 2nd ed. CRC Press.	Arnold, B. C. (2015). *Pareto Distributions*. 2nd ed. CRC Press.
Bertocchi, M., Consigli, G., D'Ecclesia, R., Giacometti, R., Moriggia, V., & Ortobelli, S. (2014). Euro Bonds: Markets, Infrastructure and Trends. *Worlds Scientific*.	Bertocchi, M., Consigli, G., D'Ecclesia, R., Giacometti, R., Moriggia, V., & Ortobelli, S. (2014). Euro Bonds: Markets, Infrastructure and Trends. *Worlds Scientific*.
Blishchuk, K. M. (2022). Peculiarities of public finance management in the war period. *Efficiency of public administration*, *1/2*(70/71), 62–67. https://epa.nltu.edu.ua/Archive/70/507008.pdf	Бліщук, К. М. (2022). Особливості управління публічними фінансами у воєнний період. *Ефективність державного управління*, *1/2*(70/71), 62–67. https://epa.nltu.edu.ua/Archive/70/507008.pdf

Bradlow, D. (2022). A Proposal for a New Approach to Restructuring African Eurobonds. The DOVE Fund and Principles. *ResearchGate*.	Bradlow, D. (2022). A Proposal for a New Approach to Restructuring African Eurobonds. The DOVE Fund and Principles. *ResearchGate*.
CBonds. (n. d.). *Data platform for financial market professionals and investors*. https://cbonds.ua/	CBonds. (б. д.) *Інформаційне середовище для професіоналів фінансового ринку та інвесторів*. https://cbonds.ua/
Cheberyako, O., & Zakrushevskyi, R. (2023). Government securities in ensuring the debt security of Ukraine in conditions of full-scale war. *University Economic Bulletin*, *10*(57), 142–151. Hryhorii Skovoroda University in Pereiaslav. https://economic-bulletin.com/index.php/journal/issue/view/44/57%2C%202023	Чеберяко, О., & Закрушевський, Р. (2023). Державні цінні папери в забезпеченні боргової безпеки України в умовах повномасштабної війни. *Економічний вісник університету*, *10*(57), 142–151. Університет Григорія Сковороди в Переяславі. https://economic-bulletin.com/index.php/journal/issue/view/44/57%2C%202023
Choudhry, M., Moskovic, D., & Wong, M. (2014). Fixed Income Markets. Management, Trading and Hedging. 2nd ed. *Wiley*.	Choudhry, M., Moskovic, D., & Wong, M. (2014). Fixed Income Markets. Management, Trading and Hedging. 2nd ed. *Wiley*.
Council Directive 89/298/EEC of 17 April 1989 coordinating the requirements for the drawing-up, scrutiny and distribution of the prospectus to be published when transferable securities are offered to the public. (1989). https://eur-lex.europa.eu/eli/dir/1989/298/oj/eng	Council Directive 89/298/EEC of 17 April 1989 coordinating the requirements for the drawing-up, scrutiny and distribution of the prospectus to be published when transferable securities are offered to the public. (1989). https://eur-lex.europa.eu/eli/dir/1989/298/oj/eng
Dakhnova, O. Ye. (2019). Estimate of the State of Debt Security of Ukraine. *Money, finance and credit,* (31), 625–630. http://market-infr.od.ua/journals/2019/31_ 2019_ukr/95.pdf	Дахнова, О. Є. (2019). Оцінка стану боргової безпеки України. *Гроші, фінанси і кредит*, (31), 625–630. http://market-infr.od.ua/journals/2019/31_2019_ukr/95.pdf
Dragon Capital. (2023). *Ukrainian Eurobonds*. https://dragon-capital.com/ua/what-we-do/research/fixed_income/	Dragon Capital. (2023). *Українські єврооблігації*. https://dragon-capital.com/ua/what-we-do/research/fixed_income/
Fabozzi, F. J. (Ed.) (2021). *The Handbook of Fixed Income Securities*. 9th ed. McGraw Hill.	Fabozzi, F. J. (Ed.) (2021). *The Handbook of Fixed Income Securities*. 9th ed. McGraw Hill.
Fedevich, L. S., & Zhukova, K. O. (2023). Analysis of Eurobonds in the Structure of the Sovereign Borg of Ukraine. *Science and technology today*, *14*(28), 309–317. http://perspectives.pp.ua/ index.php/nts/article/view/8234/8278	Федевич, Л. С., & Жукова, К. О. (2023). Аналіз євробондів в структурі державного боргу України. *Наука і техніка сьогодні*, *14*(28), 309–317. http://perspectives.pp.ua/index.php/nts/article/view/8234/8278
Galeshchuk, S. (2017). Eurobonds: Study of the essence of the debt instrument, reflection in the financial statements of the issuer and accounting of exchange rate differences. *Journal of European Economy, 1*(12), 257–267. http://dspace.wunu.edu.ua/jspui/bitstream/316497/20237/1/%D0%93%D0%B0%D0%BB%D0%B5%D1%89%D1%83%D0%BA%20%D0%A1.pdf	Галещук, С. (2017). Єврооблігації: Дослідження сутності боргового інструменту, відображення у фінансовій звітності емітента та облік курсових різниць. *Журнал Європейської економіки, 1*(12), 257–267. http://dspace.wunu.edu.ua/jspui/bitstream/316497/20237/1/%D0%93%D0%B0%D0%BB%D0%B5%D1%89%D1%83%D0%BA%20%D0%A1.pdf
Halapsus, G. D. (2022). The influence of the political situation on the economy of Ukraine and its investment situation. Modern strategy for managing public and private finances in Ukraine. *Interservice*, 142–145. https://ekmair.ukma.edu.ua/server/api/core/bitstreams/d9d78dd9-b43c-4844-aa37-cc2959896b9c/content	Халапсус, Г. Д. (2022). Вплив політичної ситуації на економіку України та її інвестиційний стан. Сучасна стратегія управління публічними та приватними фінансами в Україні. *Інтерсервіс*, 142–145. https://ekmair.ukma.edu.ua/server/api/core/bitstreams/d9d78dd9-b43c-4844-aa37-cc2959896b9c/content
Hess, M. (2023*). Economic War. Ukraine and the Global Conflict Between Russia and the West*. Lightning Source Inc.	Hess, M. (2023*). Economic War. Ukraine and the Global Conflict Between Russia and the West*. Lightning Source Inc.
Kang, J., So, K., Kang, & Tziortziotis, T. (2019). Embedded Betas and Better Bets. Factor Investing in Emerging Market. *Journal of Investment Management*, *3*(17), 1–37. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3196018	Kang, J., So, K., Kang, & Tziortziotis, T. (2019). Embedded Betas and Better Bets. Factor Investing in Emerging Market. *Journal of Investment Management*, *3*(17), 1–37. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3196018

Khaets'ka, I. (2011). Eurobonds as an effective mechanism for attracting capital by Ukrainian companies. *Actual problems of International Relations,* 95, p. II, 107–108. http://www.irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv/cgiirbis_64.exe?C21COM=2&I21DBN=UJRN&P21DBN=UJRN&IMAGE_FILE_DOWNLOAD=1&Image_file_name=PDF/apmv_2011_95(2)__43.pdf	Хаєцька, І. (2011). Єврооблігації як ефективний механізм залучення капіталу українськими компаніями. *Актуальні проблеми міжнародних відносин,* 95, ч. II, 107–108. http://www.irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv/cgiirbis_64.exe?C21COM=2&I21DBN=UJRN&P21DBN=UJRN&IMAGE_FILE_DOWNLOAD=1&Image_file_name=PDF/apmv_2011_95(2)__43.pdf
Krivoruchko, O. V. (2009). Evaluation of the advantages of using Eurobonds to attract investments. *Investments: practice and experience, 3/2009*, 14–16. http://www.investplan.com.ua/pdf/3_2009/6.pdf	Криворучко, О. В. (2009). Оцінка переваг використання єврооблігацій для залучення інвестицій. *Інвестиції: практика та досвід, 3/2009*, 14–16. http://www.investplan.com.ua/pdf/3_2009/6.pdf
Law of Ukraine "On Securities and Stock Market" No. 3480-IV. (2006). https://zakon.rada.gov.ua/laws/show/3480-15#Text	Закон України "Про ринки капіталу та організовані товарні ринки" № 3480-IV. (2006). https://zakon.rada.gov.ua/laws/show/3480-15#Text
Lyvdar, M. V., & Paniush, L. F. (2017). Eurobonds as instruments of capital market. *Economy and Society, 9/2017*, 1005–1011. https://economyandsociety.in.ua/journals/ 9_ukr/173.pdf	Ливдар, М. В., & Панюш, Л. Ф. (2017). Єврооблігації як інструменти ринку капіталу. *Економіка і суспільство, 9/2017*, 1005–1011. https://economyandsociety.in.ua/journals/9_ukr/173.pdf
Mandelbrot, B. B. (2008). *The (Mis)Behavior of Markets. A Fractal View of Financial.* Profile Books.	Mandelbrot, B. B. (2008). *The (Mis)Behavior of Markets. A Fractal View of Financial.* Profile Books.
Michie, R. C. (2021) *Banks, Exchanges, and Regulators: Global Financial Markets from the 1970s*. Oxford University Press.	Michie, R. C. (2021). *Banks, Exchanges, and Regulators: Global Financial Markets from the 1970s*. Oxford University Press.
Ministry of Finance of Ukraine. (2019, June 13). Ministry of Finance of Ukraine. *Ukraine returns to the Euro market with the first issue of Eurobonds for the first time in 15 years.* https://mof.gov.ua/uk/news/ukraina-povertaietsia-povertaietsia-na-rynok-ievro-iz-pershym-vypuskom-ievrobondiv-nominovanykh-v-ievro-vpershe-za-rokiv	Мінфін України. (2019, 13 червня). *Україна повертається на ринок євро із першим випуском євробондів вперше за 15 років.* https://mof.gov.ua/uk/news/ukraina-povertaietsia-povertaietsia-na-rynok-ievro-iz-pershym-vypuskom-ievrobondiv-nominovanykh-v-ievro-vpershe-za-rokiv
Ministry of Finance of Ukraine. (2015, 27 October). *Ministry of Finance of Ukraine supports the exchange offer made by the City of Kyiv for its 2015 and 2016 Eurobonds*. https://www.kmu.gov.ua/en/news/248662475	Мінфін України. (2015, 27 жовтня). *Ministry of Finance of Ukraine supports the exchange offer made by the City of Kyiv for its 2015 and 2016 Eurobonds*. https://www.kmu.gov.ua/en/news/248662475
Ministry of Finance of Ukraine. (2022, August 10). *Investors supported Ukraine's proposals to change the terms of issuance and placement of state financial instruments*. https://mof.gov.ua/uk/news/investors_supported_consent_solicitation_transactions_initiated_by_ukraine-3557	Мінфін України. (2022, 10 серпня). *Інвестори підтримали пропозиції України щодо зміни умов випуску і розміщення державних фінансових інструментів.* https://mof.gov.ua/uk/news/investors_supported_consent_solicitation_transactions_initiated_by_ukraine-3557
Motamen-Scobie, H., Valeur, C., & Cagliesi, G. (1999). *The Euro Bond Market Risk Executive Report*. European Economics and Financial Centre.	Motamen-Scobie, H., Valeur, C., & Cagliesi, G. (1999). *The Euro Bond Market Risk Executive Report*. European Economics and Financial Centre.
NBU. (n. d.). *Official Exchange Rates*. https://bank.gov.ua/ua/markets/exchangerates	НБУ. (б. д.). *Офіційний курс гривні щодо іноземних валют*. https://bank.gov.ua/ua/markets/exchangerates
OECD. (2023). *OECD Economic Outlook, November 2023. Organisation for Economic Co-operation and Development*. https://www.oecd.org/economic-outlook/november-2023/	OECD. (2023). *OECD Economic Outlook, November 2023. Organisation for Economic Co-operation and Development*. https://www.oecd.org/economic-outlook/november-2023/
O'Malley, C. (2015). Bonds without Borders. A History of the Eurobond Market. *Wiley*.	O'Malley, C. (2015). Bonds without Borders. A History of the Eurobond Market. *Wiley*.

Pilbeam, K. (2023). *International Finance*. 5nd ed. Bloomsbury Academic.	Pilbeam, K. (2023). *International Finance*. 5nd ed. Bloomsbury Academic.
Saichev, A., Malevergne, Y., & Sornette, D. (2010). *Theory of Zipf's Law and Beyond.Springer-Verlag.*	Saichev, A., Malevergne, Y., & Sornette, D. (2010). *Theory of Zipf's Law and Beyond.Springer-Verlag.*
Smida. (2022, December 20). *Kyiv paid for Eurobonds issued in 2018*. https://smida.gov.ua/news/allnews/kiivsplativzavipusenimiu2018rocievrobondami	Smida. (2022, 20 грудня). *Київ сплатив за випущеними у 2018 році євробондами*. https://smida.gov.ua/news/allnews/kiivsplativzavipusenimiu2018rocievrobondami
Smith, G. (2021). *Where Credit is Due: How Africa's Debt Can Be a Benefit, Not a Burden*. Oxford University Press.	Smith, G. (2021). *Where Credit is Due: How Africa's Debt Can Be a Benefit, Not a Burden*. Oxford University Press.
Synyak, D. (2018). *Bonds as tool for urban development*. https://decentralization.ua/en/news/9009	Synyak, D. (2018). *Bonds as tool for urban development*. https://decentralization.ua/en/news/ 9009
Tkachuk, M. (2017). State dependence. The macroeconomic situation in the country will remain the key driver of Ukrainian Eurobonds for a long time. *Apostrophe*. https://apostrophe.ua/ua/article/economy/macroeconomy/2017-11-21/gosudarstvennaya-zavisimost/15610	Ткачук, М. (2017). Державна залежність. Ключовим драйвером українських євробондів ще довго буде залишатися макроекономічна ситуація в країні. *Апостроф*. https://apostrophe.ua/ua/article/economy/macroeconomy/2017-11-21/gosudarstvennaya-zavisimost/15610
Trading Economics. (n. d.). *Ukraine – Credit Rating*. https://tradingeconomics.com/ukraine/rating	Trading Economics. (n. d.). *Ukraine – Credit Rating*. https://tradingeconomics.com/ukraine/rating
UBN. (2022, January 20). *Ukrainian Eurobonds are recovering from a sharp fall*. https://ubn.news/ukrainian-eurobonds-are-recovering-from-a-sharp-fall/	UBN. (2022, January 20). *Ukrainian Eurobonds are recovering from a sharp fall*. https://ubn.news/ ukrainian-eurobonds-are-recovering-from-a-sharp-fall/
Ustinova, O. (2022, 26 July). *Abstracts from the speech of Vodafone Ukraine CEO Olga Ustinova at the International Conference on the Restoration of Ukraine 2022*. https://career.vodafone.ua/news/tezi-iz-vistupu-ceo-vodafone-ukrayina-olgi-ustinovoyi-na-miznarodnii-konferenciyi-z-pitan-vidnovlennya-ukrayini-2022-98	Устинова, О. (2022, 26 липня). *Тези із виступу CEO Vodafone Україна Ольги Устинової на Міжнародній конференції з питань відновлення України 2022*. https://career.vodafone.ua/news/tezi-iz-vistupu-ceo-vodafone-ukrayina-olgi-ustinovoyi-na-miznarodnii-konferenciyi-z-pitan-vidnovlennya-ukrayini-2022-98
Shuba, O. A. (2013). Features of eurobond borrowing of the countries with emerging markets. *Investments: practice and experience, 22/2013*, 35–38. http://www.investplan.com.ua/pdf/22_2013/9.pdf	Шуба, О. А. (2013). Особливості єврооблігаційних запозичень країн з ринками, що розвиваються. *Інвестиції: практика та досвід, 22/2013*, 35–38. http://www.investplan.com.ua/pdf/ 22_2013/9.pdf

Conflict of interest: The authors certify that they have no financial or non-financial interest in the subject matter or materials discussed in this manuscript; the authors have no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript. Given that the authors are affiliated with the institution that publishes this journal, which may cause potential conflict or suspicion of bias and therefore the final decision to publish this article (including the reviewers and editors) is made by the members of the Editorial Board who are not the employees of this institution.

The authors received no direct funding for this study.

The contribution of the authors is equal.

Zhurakhovska L. Lyashenko S. Evolution of the Ukrainian Eurobond market. *Scientia Fructuosa*. 2024. № 3. P. 143–160. https://doi.org/10.31617/1.2024(155)09

Received by the editorial office 13.03.2024.
Arrived after revision 09.04.2024.
Accepted for printing 17.04.2024.
Published online11.06.2024.