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Problems and challenges in regulating the insurance market of Ukraine in the context of European integration

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Abstract. In Ukraine, the insurance market has historically faced problems with its development, which have been exacerbated by the full-scale Russian invasion. The study of difficulties in this area, assessing the prospects for European integration, remains relevant. The purpose of this study was to provide recommendations for more effective development of the insurance market in Ukraine based on the experience and principles of European countries. The methods that were used in the framework of the study were forecasting, systematisation, formal and legal. The paper assessed the role of the insurance market in the country, described the need for more active development, considering the positive aspects that arise in the case of a high level of development of this institution. It is concluded that significant losses were acquired in the insurance market of Ukraine due to a full-scale invasion of Russia, the causes of losses, and consequences in the future are described. Some opportunities for introducing the latest technologies into the sphere were also noted, both to improve the functioning of the market as a whole, and for its easier implementation in the structure of the European Union. As a result of the analysis of the regulatory framework of Ukraine and the European Union, it was concluded that the norms of EU unification are more stringent. This is conditioned by the stricter regulations described in some directives. Based on the analysis, recommendations have been formulated that can be used in the future to facilitate the European integration of the Ukrainian market. The results obtained in the framework of the study can be used in the development of the national policy of Ukraine for the development of the insurance sector

Keywords: finance; investment; latest technologies; macroeconomics; institutionalism

Introduction

The insurance market plays an important role in the development of the Ukrainian economy, performing several key functions that ensure financial stability, protect the interests of citizens, and contribute to the investment attractiveness of the country. The insurance market provides citizens and entrepreneurs with the opportunity to obtain financial protection and allows policyholders to compensate for losses from unforeseen events, such as natural disasters, accidents, fires, theft. In addition, it helps to maintain stability and continue to operate, even in the event of significant financial shocks. In Ukraine, this market is still in its infancy, as the country faced many difficulties during its development stages that prevented it from developing effectively. In 2024, Ukraine is moving towards integration with the European Union, so despite this, the development of uniform rules for the functioning of various markets remains important, in the context of which the issue of creating common principles for regulating the insurance market arises. Thus, it is important to conduct research on what problems and challenges arise in this direction.

In the Ukrainian scientific literature, much attention is not paid to the development of the insurance sector, since other topics play a much larger role, namely the development of small and medium-sized businesses,

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the agricultural sector, providing opportunities for post-war recovery. However, ensuring that the insurance sector can function more efficiently in the country remains important. Some researchers have paid attention to this issue, in particular O.O. Shevchenko & H.M. Shovkoplyas (2019) assessed current problems and existing prospects for the development of the insurance market in Ukraine. They wrote that current economic processes in the country determine the need to reform and develop the insurance market, namely, to increase the efficiency of tools used to increase the competitiveness of insurance companies at the Ukrainian and international levels. In the context of the regulatory framework, the need to develop non-state pension insurance, life insurance, health insurance and mortgage lending was emphasised. S. Onyshchenko *et al.* (2023) substantiated the need for more active development of the insurance market in Ukraine to ensure the country's financial stability. L. Chvertko *et al.* (2022) paid more attention to how the insurance sector in Ukraine can develop in the context of digitalisation.

The impact of the war on the insurance market in Ukraine was considered by L. Dobryk *et al.* (2024). They described the losses caused by Russia's full-scale invasion of Ukraine, and, in particular, what changes had taken place in the country's insurance market. Researchers drew attention to the improvement of the situation in 2023, an increase in demand for insurance services among the population, the return of individual companies to the market; in addition, the possibility of significant development of this market in Ukraine after the end of the war was noted. Approaches to insurance management in Poland and Ukraine were compared by M. Balytska & M. Tymoshenko (2023). They showed that Polish practice demonstrates enhanced internal management and control in insurance companies that Ukrainian firms can adopt. Polish regulators have effectively dealt with violations of capital norms, a model that the National Bank of Ukraine can use to improve the effectiveness of supervision. The researchers also described in sufficient detail how such principles can be implemented, why they are effective, and what needs to be done in order to achieve better results in this area.

T.V. Kniazieva *et al.* (2021) considered the problems faced by the insurance industry in Ukraine in the context of the global financial and economic crisis and the COVID-19 crisis, in particular due to increased risks for such enterprises. It is worth noting that similar difficulties, but on a much higher scale, arose in connection with the beginning of a full-scale Russian invasion of Ukraine. The development of the Ukrainian market during martial law was assessed by V. Vovk *et al.* (2023). The researchers described the difficulties that arose within the framework of the functioning of the market, and also wrote about the need to cover losses, in particular with the help of state bodies caused as a result of military operations. D.O. Khroponiuk & O.V. Dluhopolskyi (2023)

considered the prospects for market development, taking into account the problems observed as of 2024. The researchers noted that a significant number of problems in the market were formed before the war and require a comprehensive solution involving both the state and the private sector. Thus, in the modern Ukrainian economic literature, quite little attention is paid to finding opportunities for European integration of the insurance market.

The purpose of the study was to provide recommendations on the creation of conditions for regulating the insurance market in Ukraine in the context of the development of a legislative framework similar to the European one.

Materials and Methods

As part of the study, the authors analysed individual parts of the regulatory framework and some official documents. Information from the Strategy of Ukrainian Financial Sector Development until 2025 (2020) document was used, which defines the key areas of development of the country's financial sector. The strategy focuses on creating a favourable environment for the development of financial technologies, improving the regulatory framework and improving the financial literacy of the population. In addition, the paper examined the information of Law of Ukraine No. 1909-IX "On Insurance" (2024), the main purpose of which is to develop the legal basis for activities in the insurance sector, to ensure the protection of the rights and interests of policyholders and insurance companies, and to promote the development of the insurance market in Ukraine. The law is aimed at establishing clear rules and standards that would ensure the stability and transparency of the insurance market.

In addition, the laws of the European Union were considered, namely Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 "On the Taking-up and Pursuit of the Business of Insurance and Reinsurance (Solvency II) (recast)" (2009) – a framework document of the association that sets requirements for the solvency and financial stability of insurance and reinsurance companies in the EU. Directive 2002/92/EC of the European Parliament and of the Council of 9 December 2002 "On Insurance Mediation" (2018) creates a single regulatory regime for insurance intermediaries within the European Union. The Directive is aimed at improving the level of consumer protection, promoting the development of an integrated insurance market, and ensuring the same rules for all participants in this market. The purpose of the Directive (EU) 2016/97 of the European Parliament and of the Council of 20 January 2016 "On Insurance Distribution (recast)" (2024) is to improve regulation and supervision of the distribution of insurance products in the European Union. Three directives were analysed, as they form the basis for developing the principles of functioning of the insurance market in the EU. The formal legal method

helped to investigate logical connections in terms of the studied regulatory framework. The comparison helped to assess the specifics of the functioning of the European and Ukrainian insurance markets based on the analysis of the regulatory framework and other sources of information. The systematisation helped to investigate the individual components of the functioning of each of the insurance markets in Ukraine and European countries and present them within a single system, the factors within which actively interact with each other.

The paper evaluated statistical data related to the analysis of the situation on the insurance market. Data on the number of insurance companies on the Ukrainian market in the period from 2014 to the first half of 2023, and the volume of assets, were estimated. Regarding the volume of assets, an assessment was made both with and without inflation: an assessment based on inflation is important, since it allows making an assessment together with the UAH depreciation factor. All constructions and calculations were performed using Microsoft Excel.

Results

There are a number of problems in Ukraine that prevent significant progress in the development of the insurance market. The country has historically had an unstable economic situation caused by inflation and devaluation of the national currency. This has always created additional risks for insurance companies, complicating their financial stability and solvency. It is worth noting that these difficulties only increased with the beginning of a full-scale invasion of Russia, despite the fact that partner countries are involved in solving these problems, providing financial assistance. Another problem is the lack of transparency in the activities of insurance companies and insufficient level of disclosure of information about

the financial condition, the results of activities undermine the confidence of consumers and investors, and imperfect legislative framework, problems of regulation and control over the industry. There are difficulties inherent in the problems of the development of the financial system of Ukraine, namely, the low level of financial literacy of the population, since the citizens of the country as a whole do not have sufficient knowledge about insurance products and services, which limits the demand for insurance services and reduces the overall level of insurance protection.

Russia's full-scale invasion of Ukraine has significantly affected the country's insurance market: the number of insurance payments related to the loss of residential and commercial real estate and vehicles has increased, especially in regions where active military operations are taking place. This has led to an increase in demand for certain types of insurance products, such as auto insurance, personal insurance, health insurance, and liability insurance, while demand for other types of insurance has declined. Due to rising risks, insurance companies are forced to raise insurance rates to ensure adequate coverage of risks and losses. In response to these challenges, changes are taking place in insurance legislation and regulation. Insurance companies are developing new risk management strategies and implementing innovative insurance products aimed at reducing the impact of war-related risks. Since 2020, the National Bank of Ukraine has been implementing state regulation and supervision of the activities of non-bank financial services market participants, which has led to a significant reduction in the number of insurance companies due to the optimisation of legislation and market transformation. During the period from 2020 to 2023, the number of insurance companies in Ukraine significantly decreased (Fig. 1).
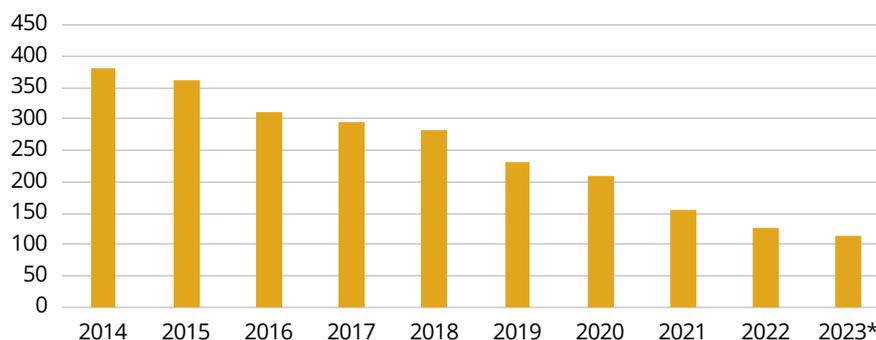
Figure 1. *Number of insurance companies in Ukraine in the period from 2014 to 2023*
Note: ** – value for 2023 is indicated for the first half of the year, since more recent data are not available*
Source: *compiled by the author based on Statistics of the insurance market of Ukraine (2024)*

Figure 1 shows that the number of insurance companies in Ukraine as a whole has been declining since 2014. During this period, the decline was almost 70%, while from 2020 – 45%, and from 2022 – 10%. It can be

concluded that the number of insurance companies in the country is decreasing over time. Similar conclusions can be drawn by analysing changes in the context of asset volumes (Fig. 2).
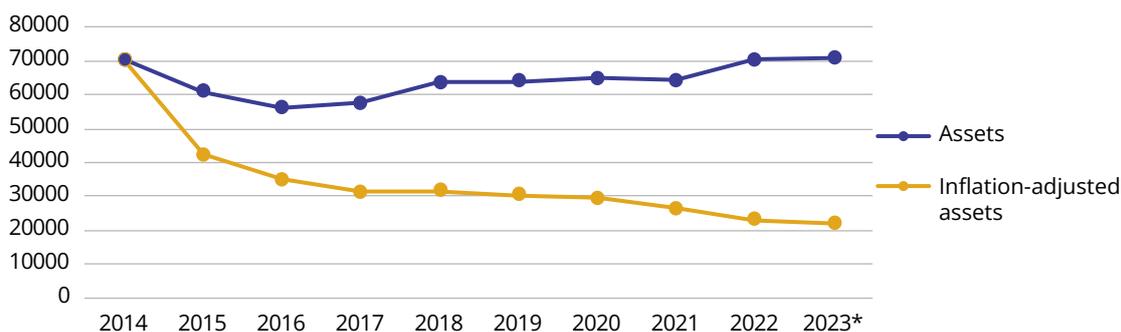
Figure 2. *Volume of assets of insurance companies in Ukraine,*
including and excluding inflation in the period from 2014 to 2023, mln UAH
Note: ** – value for 2023 is indicated for the first half of the year, since more recent data are not available*
Source: *compiled by the author based on Statistics of the insurance market of Ukraine (2024)*

Figure 2 shows that in absolute terms, the volume of assets of insurance companies in Ukraine did not decrease in the period from 2014 to 2023, but on the contrary – increased. However, considering the inflation factor, t is evident that real assets have declined: the decline over time was 68.7%; since 2020 – 25.4%; since 2022 – 4.25%. This reduction is conditioned by both the war and the COVID-19 crisis, as well as new requirements of the regulator. However, in 2023, there was a stabilisation associated with adaptation to new conditions. It is important to ensure high-quality conditions for the development of a regulatory framework, and strict supervision of the industry. In addition, the development of tariff policies and modernisation of tax approaches are important for the functioning of the sector.

Regulation of the insurance market of Ukraine and the European Union countries as a whole has a number of significant differences, which is associated with different levels of development of the legal framework, the economic environment, and the specifics of integration processes in the EU. In Ukraine, the main regulation governing insurance activities in Ukraine is the Law of Ukraine No. 1909-IX "On Insurance" (2024), which regulates the general principles of functioning of the insurance market and the activities of its participants, and the specifics of state regulation and supervision of the insurance market, protection of the rights and legitimate interests of clients. In addition, regulation is carried out by a number of bylaws, resolutions of the National Bank of Ukraine (NBU), which performs the functions of a regulator. In the European Union, the main regulation of insurance activities in the EU is Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 "On the Taking-up and Pursuit of the Business of Insurance and Reinsurance (Solvency II) (recast)" (2009) on starting and conducting activities in the field of insurance and reinsurance. There are also a number of other directives, such as Directive 2002/92/EC of the European Parliament and of the Council of 9 December 2002 "On Insurance Mediation" (2018), Directive (EU) 2016/97 of the European Parliament and of the Council of 20 January 2016 "On Insurance Distribution (recast)" (2024).

Directive (EU) 2016/97 of the European Parliament and of the Council of 20 January 2016 "On Insurance Distribution (recast)" (2024) sets strict capital, solvency, and risk management requirements for insurance companies: it introduces three levels of solvency requirements: minimum capital (MCR), settlement capital (SCR), mandatory reports and disclosure. SCR is the level of capital that an insurance company must have to cover risks over the one-year horizon with a 99.5% probability. This means that the company must be able to withstand serious financial stress with a 99.5% probability of survival. This includes underwriting risk, market risk, credit risk, and operational risk. The MCR is the minimum level of capital below which the regulator immediately intervenes, set as an absolute amount or as a share of the SCR, usually in the range of 25% to 45% of the SCR. In Ukraine, insurers must assess their solvency in terms of compliance with capital adequacy and minimum capital requirements calculated using the basic approach (hereinafter – basic approach solvency assessment), if at least the conditions are met (Fig. 3). The insurer has the right to switch from the basic approach to the simplified approach (compliance with capital adequacy and minimum capital requirements calculated using the simplified approach) only after obtaining the regulator's permission if none of the criteria set out in part five of Article 5 of Law of Ukraine No. 1909-IX "On Insurance" (2024) has been met for the last three calendar years and will not be met for the next three years in accordance with its business plan. The minimum capital of the company must cover unexpected losses from risks accepted by the insurer over the next 12 months, with a confidence level established by regulatory norms, but not higher than 85%: the calculation involves a linear combination of various factors (technical reserves, insurance premiums, risk capital, deferred taxes and administrative expenses) using coefficients established by regulatory norms, with the exception of external reinsurance. If the calculated minimum capital

is between 25% and 45% of the solvency capital, this figure is used for the solvency assessment; is less than 25% of the solvency capital, the minimum capital is set

at 25% of the solvency capital; exceeds 45% of the solvency capital, the minimum capital is set at 45% of the solvency capital.
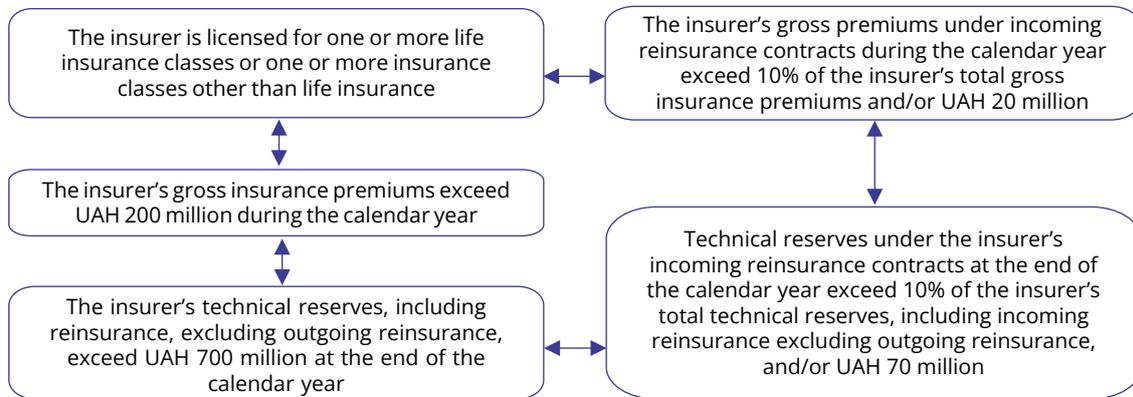
Figure 3. *Capital adequacy conditions for minimum capital requirements calculated using the basic approach*
Source: *compiled by the author based on the Law of Ukraine No. 1909-IX "On Insurance" (2024)*

Directive (EU) 2016/97 of the European Parliament and of the Council of 20 January 2016 "On Insurance Distribution (recast)" (2024) also requires insurance companies to regularly disclose information about their financial condition, risks and management. Companies should regularly publish financial position and solvency reports (SFCR) and internal risk and solvency assessments: reports should contain detailed information about risk and capital assessment methodologies, and risk management measures. In Ukraine, financial disclosure requirements are less detailed: insurance companies must submit regular reports to the NBU, but public reports do not contain as much information as SFCR in the EU. Information about the financial condition of insurers is not always published in full. This may lead to additional risks in the context of the functioning of such companies, but it simplifies their ability to work in the market, and therefore makes the Ukrainian market more attractive for them.

The adoption of the Strategy of Ukrainian Financial Sector Development until 2025 (2020) has led to a change in the context of regulation, including the insurance sector. Until July 2020, the regulatory powers of the National Bank of Ukraine were limited to banks, but they were expanded to cover non-bank financial institutions such as insurers, credit unions, financial companies, and lessors. This expansion was aimed at implementing a risk-based approach, protecting consumer rights, ensuring transparent access to financial services, and ensuring compliance with legislation through oversight and licensing mechanisms. These regulatory changes, consistent with EU standards and international obligations, have led to a restructuring of the insurance market. The introduction of new licensing conditions and capital requirements led to the withdrawal of several insurance companies that failed to meet these standards, which led to increased

concentration and reduced competition in the market. Despite the decline in the number of insurance companies, total assets increased due to currency revaluation, rather than actual asset growth; risk insurance and life insurance premiums also increased (although they are lower than pre-war premiums as of 2024).

Based on the analysis carried out as part of the study, it is possible to develop recommendations for improving the stability, transparency, and overall efficiency of the insurance market. It is necessary to introduce a tighter monetary and fiscal policy to control inflation and stabilise the national currency and other economic processes within the country, as this will increase the level of stability in the state, and therefore, allow attracting more insurance companies in the future. It is also worth working with international financial institutions to obtain financial assistance and investments aimed at economic stabilisation. From the standpoint of jurisprudence, it is important to ensure that the regulatory framework of Ukraine in the field of insurance is brought in line with EU standards, in particular, with the Directive (EU) 2016/97 of the European Parliament and of the Council of 20 January 2016 "On Insurance Distribution (recast)" (2024): this agreement should focus on implementing strict requirements for capital, solvency, and risk management. The exchange of knowledge and experience between the regulatory authorities of Ukraine and the EU is also effective in this context. In addition, more comprehensive financial disclosure requirements for insurance companies should be introduced, such as EU financial position and solvency reports, internal risk assessment. It is also necessary to strengthen anti-fraud measures in the insurance industry by strengthening regulatory oversight and cooperation with law enforcement agencies, and introducing strict penalties for fraud and non-compliance with disclosure requirements.

One of the most effective approaches to improving the level of development of the insurance market can also be a campaign aimed at improving the level of financial literacy among the population: for this purpose, a form of cooperation with educational institutions can be used, which would include basic financial literacy in school programmes. In the context of the educational and scientific sphere, the introduction of innovative technologies in the sphere remains effective, but this can be quite difficult, given the military conditions in Ukraine. In order to be able to implement the latest technologies at the relevant enterprises, quite significant amounts of investment may be required, which will be difficult to attract in war conditions. Another option is to provide state support, but the state pays much more attention to the possibilities of improving the situation at the front, and maintaining the highest possible standard of living of the population, maintaining the economy. Given this, it is difficult to imagine significant assistance from the state in this area. An alternative is to receive a grant from international organisations or other countries that would be aimed at improving the situation in this area. It is also worth noting that improving the situation in the international arena in the context of communication with other countries is very important, as this will help to get significantly better positions in the context of economic development, ensuring a better social condition of the population, and providing a greater level of military support. Compliance with the described principles and the creation of such a long-term strategy in the insurance sector will significantly improve the level of development of the industry and its overall condition.

Discussion

The insurance market is crucial for the economy and society, providing financial protection against risks such as property loss, accidents and diseases, which increases financial stability and promotes investment: the market accumulates significant financial resources through premiums, investing them in sectors such as real estate and infrastructure, which encourages economic growth. As noted by N. Apergis & T. Poufinas (2020), U.K. Pata & A. Samour (2023), it helps reduce the financial impact on individuals and businesses, providing them with financial stability and confidence in the future. In addition, the insurance market helps attract investment to the country: they accumulate significant financial resources through insurance premiums that can be invested in various sectors of the economy, including real estate, securities and infrastructure projects, which contributes to the country's economic growth and development. Business risk insurance allows businesses to reduce the risks associated with their operations, which encourages entrepreneurship and innovation (Chen, 2021). This is also indicated by B. Li *et al*. (2022). In addition, the level of social protection is improving: insurance programmes such as health, pension and social insurance provide social

protection to citizens, which helps reduce social inequality, improves living standards, and provides support to vulnerable segments of the population (Lee & Kim, 2020). Insurance programmes reduce the burden on the state budget, as part of the financial obligations for compensation and assistance payments is transferred to insurance companies (Babuna *et al*., 2020; Goodman-Bacon, 2021). This allows the state to allocate more resources to other important social and economic needs.

The spread of the latest technologies in the insurance sector (Dhatterwal *et al*., 2022). Blockchain technology provides transparency, security, and immutability of data, which is especially important for managing large amounts of data and for dealing with insured events (Kar & Navin, 2021). The use of smart contracts automates payments and verification of claims, reducing administrative costs and processing time, which is quite effective in any field related to finance, including insurance (Eckert & Osterrieder, 2020). S. Grima *et al*. (2020) and S. Trivedi (2023) considered factors that may affect the spread of blockchain in the insurance industry and the financial sector as a whole. Although the research did not pay much attention to how the latest technologies can be used for the functioning of the insurance market, it should be recognised that their use will improve opportunities for the development of the sector, both in the short and long term. Despite this, researchers D. Lanfranchi & L. Grassi (2021), J. Liu *et al*. (2023) studied the application of InsurTech in the insurance industry and their impact on the sustainability of insurance companies. S. Rawat *et al*. (2021) examined insurance application factors using exploratory data analysis.

Research in the context of the introduction of certain innovative technologies in the insurance sector of the European Union was conducted by S. Grima *et al*. (2021). The researchers noted that the introduction of blockchain technology will help to more effectively meet all the requirements that exist for countries that have plans to integrate into the European insurance system, which requires compliance with DORA (Digital Operational Resilience Act) requirements. The complexity of this process lies in the fact that the development of such technologies is at an initial level, despite all the innovations regularly introduced in the sector. The technology is rapidly developing, and the regulatory conditions for its use are still not approved in all countries of the world. The possibilities of using blockchain technology in the insurance sector were investigated by R. Brophy (2020), considering the operational and regulatory aspects of technology in the insurance industry, and noting the effectiveness of using technology in this area. The researcher wrote about the effectiveness of using such innovations in the insurance industry, and about all the benefits that they bring for insurance companies and for their customers. In Ukraine, it is also important to use the available opportunities for the development of the latest technologies in the industry. Factors of digital

transformation of the insurance industry, their advantages and difficulties faced by consumers were studied by S. Saxena & R. Kumar (2022). Difficulties arise due to problems with economic development and a full-scale invasion of Russia: because of these problems, Ukraine does not have significant opportunities to raise funds for the introduction of innovations in the insurance sector. Therefore, two different approaches can be applied: to raise funds from international organisations or partner countries at low rates (if such opportunities arise), or to do this more thoroughly after the end of the war in the context of Ukraine's economic recovery.

The introduction of the latest technologies in the Ukrainian market is not possible, given both general economic difficulties and increased risks due to the full-scale invasion of Russia, lack of transparency, low level of financial literacy and regulatory problems. Difficulties also arise in the context of the development of this area as a whole. The number of insurance companies in Ukraine has been declining since 2014, including the real volume of assets. To strengthen the market, it is recommended to develop stricter monetary and fiscal policies that are consistent with European Union standards; improve financial disclosure, anti-fraud measures, and implement financial literacy campaigns. The same applies to machine learning, which can be used for risk forecasting, artificial intelligence, for automating many processes, the Internet of Things (Simona *et al.*, 2022). This can help attract investment to the sector and form new partnerships in the industry. It is the blockchain technology that has the most prospects, given its features and affinity with the financial sector.

In Ukraine, the insurance sector has traditionally had many problems and has not been able to develop effectively since the collapse of the Soviet Union. Despite this, the beginning of the COVID-19 crisis has negatively affected the functioning of this sector. A big blow for it was the beginning of a full-scale Russian invasion of Ukraine. In the future, it is expected that the regulations that are being implemented in the sector and will be developed (in order to comply with European standards) should improve the opportunities for the sector's development. The level of financial stability of the European financial market during the COVID-19 crisis was studied by K. Pulawska (2021). The researcher noted that COVID-19 has negatively affected the European insurance sector, in particular, it was manifested in a decrease in the average return on assets of insurance companies. Solvency ratios have also declined in insurance sectors in many countries. Nevertheless, the companies were able to remain solvent and generally survive the crisis effectively. This indicates both the efficiency of the functioning of this market in Europe as a whole, and in particular the quality of its regulation, which allows it to simultaneously develop and remain stable. In terms of the impact of the COVID-19 crisis on the insurance market in the European Union and Ukraine, it was less severe for the EU

countries. This is conditioned by the greater efficiency of the sector in the European Union. This shows that actions aimed at further development of the sector in the country are particularly important, including through the integration of the Ukrainian market into the European one, the introduction of local practices and norms.

The main need to ensure the development of the financial sector is related to the overall well-being of the state. The same applies to the insurance market: its underdevelopment, problems in regulating and providing opportunities for functioning, were one of the reasons for the relatively insignificant pace of development of the country in the period after the collapse of the Soviet Union. The ability to ensure high-quality conditions for the functioning of the sector is still important. The impact of financial sector reforms on economic growth in Europe between 1996 and 2016 was investigated by R.P. Pradhan *et al.* (2020). The paper separately examined the causal relationships between banking competition, stock market development, insurance market development, and economic growth using a multi-factor system. The results show that there is a relationship between all variables: thus, in the short term, there is a bidirectional causal relationship between the development of the stock market and the insurance market, and in the long term, variables such as banking competition, the development of the insurance market, and the development of the stock market become one of the reasons for the country's economic growth. Therefore, the experience of the European Union countries shows that the development of the insurance market has a positive impact on the possibilities of ensuring the country's well-being in the future. Despite this, the implementation of actions aimed at improving the situation in Ukraine in this sector remains relevant.

The challenges faced by lawmakers, companies, and individuals regarding artificial intelligence and some other areas have been addressed by J. Chamberlain (2022). The study notes that there is a need to develop, define, and differentiate risk in the legal context of artificial intelligence, build responsibility for artificial intelligence systems at the EU level, and balance public and individual interests. The solution to these problems remains very complex, the proposed rules are in the development process, but there is no single approach to this process. Given the fact that there are opportunities for using artificial intelligence, in particular in the insurance sector, the development of such approaches in the industry also remains relevant. In the future, Ukraine will probably have to implement European approaches to regulating artificial intelligence in the state.

Conclusions

The insurance market is one of the main components of the country's economic and social stability, given that it offers financial protection against various risks, such as loss of property, accidents, illnesses and other unforeseen events, mitigating the negative consequences after

the occurrence of situations that lead to financial losses.

The paper showed that the insurance sector is undergoing a technological transformation: special attention was paid to blockchain technology, which allows achieving transparency, security, and immutability of data, which is especially important when working with large amounts of information. Automating payment and claim verification with smart contracts can reduce administrative costs and processing time, improving operational efficiency. Similarly, the integration of machine learning and artificial intelligence can simplify the process of risk forecasting and process automation.

The Ukrainian insurance market faces many challenges. Historically, with problems related to economic instability, inflation, and currency devaluation, insurance companies in Ukraine have tried to maintain financial stability and solvency, but the beginning of a full-scale Russian invasion of Ukraine has only complicated the existing difficulties. The number of claims related to the loss of property and vehicles has increased, especially in conflict zones. This surge has increased demand for certain insurance products, such as auto insurance and health insurance, while reducing demand for others.

Accordingly, insurance companies had to raise premiums to ensure proper risk coverage. Despite this, Ukraine has a goal related to the further integration of the Ukrainian and European insurance markets. The study compared the regulatory framework of the European Union and Ukraine: it was shown that the norms of EU unification are more stringent than the Ukrainian ones. New legislative acts are created in such a way as to ensure a greater level of compliance with foreign standards.

Further activities in this area would help to align Ukrainian standards with European ones, and thus achieve the main goal of uniting the two markets, which will lead to overall economic growth and improve social welfare in Ukraine. The assessment of other financial markets and areas in Ukraine for their development in the context of integration with the European market is promising for further research.

Acknowledgements

Conflict of Interest

None.

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Проблеми та виклики у регулюванні страхового ринку в Україні в контексті євроінтеграції

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Анотація. В Україні з розвитком страхового ринку історично складаються проблеми, що посилилися з початком повномасштабного вторгнення Росії. Дослідження складнощів в цій сфері, оцінюючи перспективи євроінтеграції, залишається актуальним. Метою даного дослідження стало надати рекомендації для більш ефективного формування страхового ринку в Україні на основі досвіду та принципів країн Європи. Методами, що були використані в рамках дослідження, стали прогнозування, систематизація, формально-юридичний. В роботі було проведено оцінку ролі страхового ринку в країні, описана потреба більш активного його розвитку зважаючи на позитивні аспекти, що виникають у випадку високого рівня розвитку даного інституту. Зроблено висновок про значні втрати, що були набутими на страховому ринку України через повномасштабне вторгнення Росії, описані причини збитків та наслідки в майбутньому. Також зазначалися окремі можливості для впровадження новітніх технологій у сферу, як для підвищення функціонування ринку в цілому, так і для більш простої його імплементації в структуру Європейського Союзу. У результаті аналізу нормативно-правової бази України та Європейського Союзу було зроблено висновок про те, що норми об'єднання ЄС є більш суворими. Це пов'язано із більш жорсткими нормативно-правовими нормами, описаними в деяких директивах. Зважаючи на проведений аналіз, були сформовані рекомендації, що можуть бути використані в подальшому для полегшення євроінтеграції українського ринку. Результати, отримані в рамках дослідження, можуть бути використані при формуванні державної політики України для розвитку страхової сфери

Ключові слова: фінанси; інвестиції; новітні технології; макроекономіка; інституціоналізм
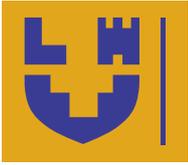
Human capital in the sustainable development of EU countries: A longitudinal data analysis

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Abstract. One of the prominent areas focused on identifying the key trends and factors of human capital formation for sustainable development in the EU countries is the use of panel data. This study specified the dependence of human capital in the EU countries on four factor attributes that affect its place and role in sustainable development using longitudinal data analysis. The methodological framework of this study included the econometric modelling toolkit for constructing multivariate regression equations of three types: pooled regression, fixed effects, and variable effects. To determine the parameters of multivariate regression equations, the study employed Eurostat statistics for 21 EU countries for 2013-2021, based on the completeness of the statistical indicators presented for the resultant and factor attributes and the incompleteness of such data for 2022-2024. For the three types of multivariate regression equations, the endogenous variable describing human capital is the number of students enrolled in higher education institutions in the EU and four exogenous variables. The analysis found that the best specification of the impact on human capital in the EU countries is an econometric model described by a multivariate fixed-effects regression equation. It includes three factor variables: total government spending on higher education, employment with higher education, and total environmental taxes. Considering the parameters of this equation, human capital in the sustainable development of EU countries depends on the situation on the labour market for highly skilled individuals, government policy in higher education, and environmental taxation. It was found that the values of the fixed effects for each of the EU countries are positive, specifying the differences in these countries in the formation of human capital. The multivariate regression equation of human capital in the EU countries will help to improve understanding of approaches to building partnerships in the EU countries for the implementation of sustainable development policy measures

Keywords: higher education institutions; panel data; econometric modelling; fixed and variable effects; pooled regression; employment

Introduction

Human capital (HC) is one of the key drivers of sustainable development (SD) in the EU, contributing to strengthening economic potential, innovation, and improving social conditions. Due to changes in the economy, technological shifts, and the use of SD principles, the need to identify the main patterns of HC formation in the EU countries is becoming increasingly relevant. For Ukraine, consideration of the factors of influence on the HC available in the EU is significant due to its European integration aspirations and post-war economic reconstruction.

In the EU, SD is defined as a priority goal of Ukrainian and foreign policy, and progress towards achieving 17 goals is monitored (EU "whole-of-government approach," 2024). The development of the new European Agreement for the Future, which identifies 10 priority areas, is also linked to the SD. Due attention is paid to HC because of the need to reduce the risk of poverty and

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social exclusion, strengthen the European Education Area, and increase scientific literacy (Lafortune *et al.*, 2024). Accordingly, the successful formation and use of HC in EU countries is the basis for ensuring sustainable development and achieving positive changes in society.

In EU countries, there has been a growing scientific debate on the significance of investing in HC at the local level, based on a panel regression model with municipal fixed effects (Biedka *et al.*, 2022) and a dynamic longitudinal microsimulation model (Myrskylä *et al.*, 2024). Using cross-sectional autoregression with a distributed lag, the researchers identified the direct and moderate impact of HC on carbon emissions in nine leading countries and proposed a roadmap for sustainable growth based on individual Sustainable Development Goals (SDGs) (Payab *et al.*, 2023). In addition, for 21 EU countries, it was found that HC increases carbon emissions at low levels of HC financial development and reduces them at high levels (Çakar *et al.*, 2021). In other words, it is important to transform HC into a factor that facilitates the transition to environmentally sustainable economic development. Based on econometric modelling methods, K. Kluza *et al.* (2021) found that the implementation of SDG4 (ensuring inclusive and equitable quality education and promotion of lifelong learning opportunities) and SDG17 (strengthening of the means of implementation and enhancement of global partnerships for SD) in the EU directly contribute to the achievement of environmental policies. Using the statistical model "method of moments of quantile regression", G. Han & X. Cai (2024) found that the presence of HC plays a significant role in maintaining environmental quality, but the economic globalisation has a negative impact on environmental indicators in the N-11 countries. In other words, it is crucial to ensure that HC contributes to the transition to environmentally sustainable economic development.

There is a range of scientific and methodological approaches that consider the role of HC, education, and employment in the country's transition to the SD. Using quantitative methods, M. Simionescu *et al.* (2021) found that HC has a positive impact on economic development through the innovative skills of people that increase the productivity of physical capital and can determine the adoption of external technologies by absorbing new equipment and ideas from these factors. In terms of SD, J. Wyrwa *et al.* (2020) found that there is moderate variation in the level of social development in EU countries and considerable variation in the level of development of Industry 4.0. In other words, there is a multifaceted impact of HC on SD and structural transformation in the analysed countries.

HC is considered in close connection with educational, cultural, and institutional factors of SD. B. Égert *et al.* (2020) found that for European and OECD countries, higher pre-school attendance, greater autonomy of schools and universities, and other factors contribute to the growth of the HC through increased public spending on education. E.O. Özbal (2021) assessed the long-term dynamic impact of higher education expenditure in OECD countries and higher education enrolment rates on the HC to accelerate economic growth. In this way, the development of education and cultural values form the basis for improving labour market outcomes and employment growth.

Notably, scientific and methodological developments of scientists in the field of SD and HC propose measures to formulate effective policies in the field of employment, education, and ecologisation of national economies. However, in EU countries, there is a need to identify the key factors that influence the HC for SD using panel data.

The purpose of this study was to assess the place and role of HC in the EU countries' SD based on longitudinal data analysis by specifying the types of dependencies that influence its formation.

Materials and Methods

This study was conducted within the framework of the research area of the Department of Economics of Ukraine at the Ivan Franko Lviv National University, and the statistical data were collected and analysed in January-April 2024 on the Eurostat (2024). To reveal the influence of factor attributes on the LC for SD of the EU countries on the main panel data, it is necessary to specify multivariate pooled regression equations with fixed and random effects. In general, the multivariate pooled regression equation can be written as follows:

$$Y_{it} = a_0 + a_1 * X_{1it} + a_2 * X_{2it} + \cdots + a_j * X_{jit} + \cdots + a_m * X_{mit} + \varepsilon_{it},\ (1)$$

where X_{jit} – j exogenous variable for observation i in time period t; parameters a_j are constant for all values of t and i, $i = \overline{1, n}$, $J = \overline{0, m}$, $t = \overline{1, T}$.

This model is a panel data model without effects, which assumes that the relationships between the exogenous variables are constant over time and across all cross-sectional units in the sample. For a multivariate regression equation with fixed effects, the function will have the following form:

$$Y_{it} = \beta_{it} + \beta_1 * vX_{1it} + \beta_2 * X_{2it} + \cdots + \beta_j * vX_{jit} + \cdots + \beta_m * X_{mit} + v_{it},\ (2)$$

where β_1, β_2,... β_j... β_m are unknown parameters of the model, β_{it} are different values of the intercept (fixed effects) for each EU country, $i = \overline{1, n}$, $J = \overline{0, m}$, $t = \overline{1, T}$.

In Model 2, different values of intercepts β_{it} are introduced; this dependence is constant for different time periods. The specific feature of Equation 2 is that different values of β_{it} are estimated for different EU countries, which reflect the influence of factors specific to these countries. The model parameters β_1, β_2,... β_j,... β_m are the same for all EU countries and for all time periods. The multivariate regression equation with random effects will look as follows:

$$Y_{it} = \mu + \eta_1 * X_{1it} + \eta_2 * X_{2it} + \cdots + \eta_j * X_{jit} + \cdots + \eta_m * X_{mit} + \vartheta_{it}, \quad (3)$$

where $\eta_{2it}\,\eta_{2it},...\eta_{jit},...\eta_{mit}$ are unknown parameters of the model, μ is the constant, ϑ_{it} is the random error, invariant in time for each EU country.

Model 3 accommodates the fact that the formation of HC for one EU country may differ from the existing conditions in another EU country. The specific feature of Equation 3 is that the constant μ is estimated for different EU countries and errors ϑ_{it} individual for each object of observation, it has the same parameters $\eta_{2it}\,\eta_{2it},...\eta_{jit},...\eta_{mit}$ for all EU countries and time periods.

The sample includes 21 EU countries ($i = \overline{1,21}$), the time period covers 2013-2021($t = \overline{1,9}$), 189 observations, statistics taken from Eurostat (2024). Given the completeness of officially available statistics, the following countries were considered: Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Greece, Ireland, Italy, Latvia, Lithuania, Germany, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Hungary, and the United Kingdom. A limitation of the analysis was the lack of complete data for the presented endogenous and exogenous variables for the EU countries included in the sample for 2022-2023 on the Eurostat (2024). Furthermore, annual statistics were used, which makes it impossible to include operational statistics for 2024 in the analysis. Additionally, it should be borne in mind that the submission of statistical data to Eurostat (2024) is delayed due to the nature of statistical reporting by EU countries.

In the study, HC is represented as the outcome variable Y_{it} – students studying in higher education institutions in EU countries, people. This can be explained by the fact that the growth of HC in a country's economy is due to the accumulation of knowledge through learning. Independent variables are X_{1it} – resource productivity in EU countries, EUR/kg; X_{2it} – total budget expenditures on higher education (levels 5-8) in EU countries, EUR mn; X_{3it} – employment with higher education (levels 5-8) in countries aged 15 to 64, thsd people; X_{4it} – total environmental taxes, EUR mn.

Results and Discussion

The study resulted in the following theses: there may be spatial differences in the development of the HC in the EU countries; the HC in the EU countries, which is associated with the number of students enrolled in higher education institutions, may be influenced by the state of employment after graduation, the conditions of state funding of higher education, the dynamics of resource productivity and environmental taxation; differences between EU countries in the formation of the HC may be due to fixed and random effects.

As presented in Table 1, the selected endogenous and exogenous variables for the EU HC panel data model have their specific features. In 2013-2021, there was a tendency to increase differences among EU countries in the formation of HC in terms of average values, range of variation, standard deviation, and coefficient of variation. In other words, the dynamic of the number of students pursuing higher education in the EU countries suggests that spatial differences in the formation of HC have gradually increased in the population under study. The growing differences in HC may indicate heterogeneity and different conditions for achieving the SDGs across the EU.

Table 1. *Descriptive statistics for dependent and independent variables*

Indicator	Variable	2013	2015	2016	2017	2018	2019	2020	2021
Average	Y_{it}	743231.2	737770.0	738224.8	743677.3	750852.4	763179.4	772632.9	794060.5
	X_{1it}	1.5816	1.6908	1.7364	1.7560	1.7890	1.8599	1.8900	1.9879
	X_{2it}	4008.6	4196.6	4063.0	4141.4	4309.5	4418.9	4547.7	4853.5
	X_{3it}	2404.7	2548.7	2630.4	2714.1	2802.6	2891.3	2944.5	3056.9
	X_{4it}	12224.6	12808.5	13292.3	13570.4	13874.0	13988.3	12717.2	13848.1
Scope of variation	Y_{it}	2715207.0	2922567.0	2992489.0	3044304.0	3082154.0	3250765.0	3235160.0	3306634.0
	X_{1it}	2.7094	28247	2.8547	3.0106	3.0099	2.8533	2.8570	3.0479
	X_{2it}	24081.0	26413.0	25577.2	26348.5	26791.0	26865.4	28311.0	29112.0
	X_{3it}	11057.0	10799.0	11283.0	11448.0	11624.0	12062.0	12309.7	12773.6
	X_{4it}	57462.4	57510.2	58835.8	58578.2	59022.1	60229.5	56818.6	63996.9
Standard deviation	Y_{it}	828787.3	847281.3	859048.9	873113.1	891484.2	922825.5	935285.4	959208.8
	X_{1it}	0.7744	0.8626	0.8698	0.8837	0.9098	0.9048	0.9438	0.9814
	X_{2it}	5500.0	5951.6	5793.1	5956.1	6070.0	6122.6	6337.3	6562.8
	X_{3it}	3116.6	3173.4	3281.1	3355.4	3452.8	3579.8	3641.7	3779.1
	X_{4it}	17048.7	17523.9	18159.3	18340.1	18772.1	18903.5	17023.9	18663.4
Variation coefficient	Y_{it}	1.1151	1.1484	1.1637	1.1740	1.1873	1.2092	1.2105	1.2080
	X_{1it}	0.4896	0.5102	0.5009	0.5032	0.5085	0.4864	0.4994	0.4937
	X_{2it}	1.3720	1.4182	1.4258	1.4382	1.4085	1.3856	1.3935	1.3522
	X_{3it}	1.2961	1.2451	1.2474	1.2363	1.2320	1.2381	1.2368	1.2363
	X_{4it}	1.3946	1.3682	1.3661	1.3515	1.3530	1.3514	1.3386	1.3477

Source: calculated based on data from Eurostat (2024)

This is conditioned by the existence of differentiated approaches to policy measures to ensure access to education, coverage of different segments of the population and employment. In 2013-2021, comparable trends of increasing differences among EU countries were recorded for resource productivity, employment of people with higher education, public funding of higher education, and approaches to environmental taxation (Table 1). The growing gaps in the social, financial, and environmental conditions of EU countries suggest the presence of a certain element of competition in achieving the SDGs. Although the EU has defined common SDGs (EU "whole-of-government approach", 2024), key targets and indicators by goal, it is important to consider the current social, environmental, and economic situation in each country.

The following multivariate econometric pooled regression model was obtained (Table 2). The parameters of the regression equation are adequate according to Fisher and Student's criteria, i.e., the selected factor variables of this equation have an impact on the HC of EU countries. From the economic standpoint, this equation (Table 2) explains 97.33% of the impact on the HC in EU countries of such factors as resource productivity, total budget expenditures on higher education, employment of individuals with higher education, and general environmental taxes.

The multivariate regression equation (Table 2) contains a common intercept a_0 for different EU countries, i.e., it does not accommodate individual specific features of HC formation for SD by EU countries. In this multivariate econometric model, the values of the dependent and independent variables for the EU countries are combined into one sample and interpreted as observations of one generalised abstract country. However, the social and economic development of each EU country, environmental conditions and natural resource endowment, and traditions of higher education may have different impacts on the HC. This means that the role of HC in the SD of EU countries may vary.

Table 2. *Multiple regression equations for panel data and estimation results*

Variables	Slope and intercept parameters	Standard error*	*t*-test	*p*-level (*p*<0.05)	Confidence interval, 95%	
					Lower limit	Upper limit
Pooled regression						
Y_{it}-intercept	131066.5934	26344.4106	4.975	0.0001	79090.6	183042.9
X_{1it}	−58141.8516	16653.3105	−3.491	0.0006	−90997.8	−25285.9
X_{2it}	−17.6606	4.2461	−4.159	0.0001	−26.0380	−9.2833
X_{3it}	217.9539	8.2034	26.569	0.0001	201.769	234.139
X_{4it}	15.8218	1.4505	10.908	0.0001	12.9601	18.6835
Regression statistics			**Variance analysis**			
R	0.9866		*df*	*SS*	*MS*	*F*	*p*-level
R^2	0.9733	Regression	4	1.443E+14	3.607E+013	1676.683	0.0000
Normalised R^2	0.9727	Balance	184	3.958E+12	2.151E+10		
Standard error**	146668.5	Total	188	1.482E+014			
Fixed effects (4 variables)						
Y_{it} intercept	429971.6835	55546.6	7.741	0.0001	320293	539650
X_{1it}	−26284.1298	29591.9	−0.888	0.3757	−84714.4	32146.1
X_{2it}	59.4237	15.5437	3.823	0.0002	28.7321	90.1153
X_{3it}	95.3799	22.7225	4.198	0.0001	50.5136	140.246
X_{4it}	−10.8797	3.86419	−2.816	0.0055	−18.5096	−3.2497
Regression statistics			**Variance analysis**			
LSDV R	0.9979		*df*	*SS*	*MS*	*LSDV F*	*p*-level
LSDV R^2	0.9957	Regression	4	3.768E+11	9.421E+10	1596.780	0.0000
Within R^2	0.3737	Balance	184	6.316E+11	3.433E+09		
Standard error**	62060.4	Total	188	1.008E+12			
Y_{it}-intercept	410463.4259	50987.3	8.050	0.0000	309792	511135
Fixed effects (3 variables)						
X_{2it}	55.3429	14.8397	3.729	0.0003	26.0427	84.6432
X_{3it}	92.2241	22.4286	4.112	0.0000	47.9400	136.508
X_{4it}	−10.9427	3.8611	−2.834	0.0052	−18.5662	−3.31924
Regression statistics			**Variance analysis**			
LSDV R	0.9979		*df*	*SS*	*MS*	*LSDV F*	*p*-level

<div align="right">Table 2, Continued</div>

Variables	Slope and intercept parameters	Standard error*	t-test	p-level (p<0.05)	Confidence interval, 95%	
					Lower limit	Upper limit
Regression statistics			**Variance analysis**			
LSDV R^2	0.9957	Regression	3	3.738E+11	9.345E+10	1668.305	0.0000
Within R^2	0.3707	Balance	184	6.347E+11	3.449E+09		
Standard error**	62020.64	Total	187	1.008E+12			

Note: * – slope and intercept parameters; ** – regression
Source: calculated based on data from Eurostat (2024)

Above are the parameters of the fixed-effects econometric model and its estimation (Table 2). With the same values of the model factors, there are differences in the formation of the HC of the EU countries compared to the average level of the regression equation intercept (Table 3). In terms of SD, such differences in fixed effects suggest different capacities of EU countries to develop HC due to variations in social and economic conditions, efficiency of natural resource use, education policies, etc. For instance, it was noted that the EU average conceals considerable differences between European sub-regions and countries, with the average SDG index ranging from over 80% in some Northern European countries to around 60% in some Eastern European countries and 50% in some candidate countries (Lafortune *et al*., 2024). This multivariate regression equation captures the impact of the specified factors on the EU countries' HC quite well. With a probability of 99.57% (Table 2), it can be argued that the development of HC in EU countries depends on resource productivity, total budget expenditures on higher education, employment of individuals with higher education, and general environmental taxes (Eurostat, 2024). For the exogenous variable X_{1it}, the Student's t-test is not fulfilled, i.e., the parameter β_{1it} is not statistically significant.

<div align="center">Table 3. Cross-sectional values (fixed effects) for EU countries</div>

Country	Effect*	Effect**	Country	Effect*	Effect**	Country	Effect*	Effect**
Austria	281252.09	236151.69	France	1284170.77	1302577.86	Lithuania	80675.73	61204.51
Belgium	280745.93	223565.88	Germany	1099686.01	1180944.68	Poland	840497.83	864632.66
Croatia	141077.70	113772.90	Greece	628792.43	604389.77	Portugal	252073.39	229790.13
Czech Republic	232717.17	211821.80	Hungary	170887.38	154987.88	Slovakia	129802.84	100400.06
Denmark	104541.01	70407.81	Ireland	154838.98	90342.76	Slovenia	81062.74	42964.08
Estonia	35016.49	19795.62	Italy	1820533.89	1770151.58	Spain	1189362.37	1171754.22
Finland	53085.24	49019.24	Latvia	75850.66	50689.56	Sweden	92734.72	70367.27

Note: * – for four exogenous variables; ** – for three exogenous variables
Source: calculated based on data from Eurostat (2024)

In the equation (Table 2), the independent variable X_{1it} was removed to construct a multivariate regression equation with fixed effects containing the factors X_{2it}, X_{3it}, and X_{4it}. This resulted in a refined econometric model and its estimates (Table 2, fixed effects with 3 variables). The values of the fixed effects for each EU country (Table 3) suggest that the conditions for HC formation in the respective country are higher or lower than the average value of the intercept of the multivariate regression equation. Given the same values of the factors in this model, HC has a better position in those countries whose fixed effects are higher than the average values of the intercept. In other words, EU countries are developing individualised approaches to policy measures related to the accumulation of HC for SD.

The multivariate regression equation (Table 2) reflects the impact of the identified factors on the HC of the EU countries. Specifically, it can be argued that the formation of HC in the EU countries depends on the amount of total budget expenditures on higher education, employment of individuals with higher education, and general environmental taxes by 99.57% (Eurostat, 2024). The values of *F*- and *t*-statistics are higher than the critical ones, which indicates the adequacy of the built model. According to the identified relationships between the endogenous and exogenous variables of the fixed-effects regression equation (Table 2), improving HC for SD in the EU should accommodate policy measures defined at the EU and country level. Creating favourable conditions for attracting more people in the EU to higher education requires considering the state's budgetary capacity to develop higher education, the situation on the labour market for people with higher education, and the state of the environment in the context of environmental taxation.

A multivariate regression equation was obtained, with its estimates for HC in EU countries with random effects (Table 4). With the same values of the regression equation parameters, HC is influenced by random effects that reflect the uniqueness of the environment of its formation in each EU country, which is invariant over time. For the SD and the completion of its objectives related to the HC in EU countries, this requires the coordination of common policy measures. The multivariate regression equation (Table 4) properly shows the impact of the identified factors on the HC of the EU countries. The Belsley-Kuh-Welsch collinearity test suggests that there is no evidence of excessive collinearity, with the number of condition indices greater than 30 or 10 being zero.

The random-effects model (Table 4) should be tested for the significance of these effects in comparison with the multivariate pooled regression equation and the multivariate fixed-effects model (Table 2). According to the Breusch-Pagan test, the calculated value $\chi^2(1) = 373.333$, which corresponds to the $p_{-value} = 3.520E-83$. The p_{-value} is less than 0.05, the hypothesis is accepted that the parameters of the model with random effects better describe the factors influencing the development of HC in the EU countries. According to the Hausman test, the calculated value $\chi^2(3) = 78.804$, which has a $p_{-value} = 5.540E-17$. This means that the parameters of the multivariate fixed-effects regression equation (Table 2) better specify the factors influencing HC in EU countries.

Table 4. Multiple random effects regression equations for panel data and estimation results

Variables	Slope and intercept parameters	Standard error*	z	p-level (p<0.05)	Confidence interval, 95%	
					Lower limit	Upper limit
Y_{it}-intercept	139999.6421	44815.6	3.124	0.0018	51583.3	228414
X_{2it}	32.5073	10.7614	3.021	0.0025	11.277	53.738
X_{3it}	146.3365	19.2084	7.618	0.0000	108.441	184.232
X_{4it}	5.8199	2.9916	1.945	0.0517	−0.0822	11.722

Note: * – slope and intercept parameters
Source: calculated based on data from Eurostat (2024)

However, the Belsley-Kuh-Welsch collinearity test for the model (Table 2) revealed that the number of state indices greater than 30 is 1, and the number of indices greater than 10 is 3. To eliminate collinearity, the data were standardised by dividing by the standard deviation of the sample. The new parameters of the multivariate fixed-effects regression equation were specified (Table 5). The Belsley-Kuh-Welsch test showed that the number of state indices greater than 30 or 10 is zero.

Table 5. Multiple fixed effects regression equations for standardised panel data and estimation results

Variables	Slope and intercept parameters	Standard error*	t-test	p-level (p<0.05)	Confidence interval, 95%	
					Lower limit	Upper limit
Y_{it}-intercept	753996	4511.34	167.1	0.0001	745088	762903
sX_{2it}	333213	89348.1	3.729	0.0003	156800	509625
sX_{3it}	314385	76457.6	4.112	0.0001	163424	465347
sX_{4it}	−197642	69736.7	−2.834	0.0052	−335333	−59950.5
Regression statistics			**Variance analysis**				
LSDV R	0.9979		df	SS	MS	LSDV F	p-level
LSDV R^2	0.9957	Regression	4	3.738E+11	9.345E+10	1668.305	0.0000
Within R^2	0.3707	Balance	184	6.347E+11	3.449E+09		
Standard error**	62020.64	Total	188	1.008E+12			

Note: * – slope and intercept parameters; ** – regression
Source: calculated based on data from Eurostat (2024)

The multivariate regression equation (Table 5) reflects the influence of the factor attributes on the HC of the EU countries. With a probability of 99.57%, it can be argued that the HC of EU countries depends on the standardised amounts of total budget expenditures on higher education, employment of individuals with higher education, and total environmental taxes (Eurostat, 2024). The economic meaning of the coefficients in the factor characteristics of the multivariate model is that they determine the contribution of exogenous variables to the development of HC in the EU countries.

An assessment of the factual and theoretical values obtained based on the multivariate regression equation (Table 5) showed that this model can be used to predict the key trends in the development of HC in the EU countries. The mean error (ME) is 3.080E-012; root

mean square error (RMSE) is 57949; mean absolute error (MAE) is 30.934; mean percentage error (MPE) is -0.6053; mean absolute percentage error (MAPE) is 6.8136; Theil's U is 0.0249. The ability to identify and measure effects, considering social and economic differences between countries, is being improved to assess the prospects for SD in the EU.

HC is important for the EU's SD because an educated population is turning into a driver of various changes in the economy. However, according to the multivariate regression equation (Table 5), it is important for the HC in the EU to improve their investment approaches by expanding the possibilities of budget financing of higher education. Therewith, the findings obtained may also suggest that increasing employment opportunities for people with higher education is one of the significant factors that stimulates individuals to improve their educational qualifications. In this context, using a non-radial DEA model, M. Cyrek & B. Fura (2019) also pointed to this aspect of employment, arguing that employment in agriculture is one of the factors that slows down SD. Other researchers have emphasised that education to improve HC has a significant impact on the SD and competitiveness of national economies due to the synergistic effect (Aleksejeva, 2016; Sart, 2022). In this way, the quality of labour is improved, and the SDGs focused on decent work are achieved. The findings obtained by the researchers confirm the significance of state measures in the educational sphere for improving the quality of life and achieving the SDGs, complementing the approaches based on the fixed-effects regression equation.

The identified positive effect of employment of people with higher education on labour productivity in the EU countries may also suggest the expediency of creating favourable socio-economic conditions for increasing labour productivity. From this standpoint, the specified dependencies of HC and factor variables in a fixed-effects regression equation complement the findings of M. Conti & G. Sulis (2016) and M.-A. Georgescu & E. Herman (2019) regarding the significance of ensuring high labour productivity and improving the employment structure in national economies for the SD. Therewith, E. Pelinescu *et al*. (2019), using fixed and random effects models, emphasised that in the EU countries, to grow human capital, it is advisable to pay attention to efforts to improve research and development. In this way, EU countries that seek to attract as many people as possible to higher education will be able to ensure sustainable growth of HC. According to S. Vaitkevičius *et al*. (2015) and A.P. Balcerzak (2016), the existence of differences in the development of HC in the EU countries indicates different mechanisms of its formation, which are based on a range of political and institutional factors. This correlates with the fact that in the EU countries, such factors may include the distribution and redistribution of the total budget of each

EU country for higher education, the existing network of higher education institutions (Kichurchak, 2022). Accordingly, deepening the approaches to identifying the links between HC, tertiary employment and labour productivity in the EU could provide a better basis for implementing SD policies.

One of the crucial policy vectors for the EU's SD is to increase the efficiency of using available natural resources. The regression analysis revealed the existence of an inverse relationship between HC and policy measures related to environmental taxation. Accordingly, it is necessary to find a reasonable balance between public investment in forestry and environmental protection. For instance, based on the PMG co-integration analysis, T. Yildiz *et al*. (2022) noted that to increase the impact of HC on the ecological footprint in the EU countries, it is advisable to develop educational infrastructure and accelerate technological development by increasing technological activities. Additionally, it demonstrates the multifaceted and interdependent nature of the interaction between HC and SD in terms of environmental protection, rational use of available natural resources, and policy measures in this area. According to the results of the fixed-effects regression equation, EU countries need to make certain choices in their policies on investment in forestry and environmental taxation. M. Kichurchak (2020) also pointed to the limited financial resources in the SD policy measures in the cultural sector. Considering the multiplicity of factors related to HC and SD, their significance for environmentally oriented economic growth, formation of cultural values and environmental awareness, further research in this area could complement the links of HC in EU countries with environmental taxation and other factors for the development of SD policies.

However, in the EU, the war in Ukraine has created new challenges for HC and SD. For instance, as of 1 February 2024, 4.2 mn Ukrainian citizens were registered as temporary asylum seekers in the EU, of whom only 5% were over the age of 65 (Eurostat, 2024). According to T.V. Yasinska (2022), the events of 2020-2022 are not conducive to the development of HC in Ukraine, especially due to the Russian-Ukrainian war, which made the educational process in many regions of the country impossible for a long time. At the same time, L.M. Zomchak (2023) and O. Hrynevych *et al*. (2023) noted that 2022 saw the deepest recession in the Ukrainian economy, the out-migration of economically active Ukrainians, a considerable reduction in household income, and additional concerns about the environmental consequences of the war. The war in Ukraine is significantly changing approaches to the formation of HC in the EU in the medium and long term, due to the forced migration of economically active and highly educated Ukrainian citizens and the socialisation of their children in recipient countries. According to D. Pudryk *et al*. (2023), the return of forced migrants to Ukraine requires the

implementation of state programmes to stimulate the return migration of HC. For the SD of the EU countries, this also means that it is advisable to continue investigating the factors affecting the HC, considering forced migration and the growing burden on the social sphere of recipient countries, while Ukraine needs to modernise its approaches to the implementation of the SDGs and develop effective policy measures to return the HC to the country after the war.

Conclusions

It was found that the development of HC in the EU countries is a complex and multifactorial process, which is based on the influence of different social, environmental, and political conditions in each country. The multivariate pooled regression model proved that the growth of the HC in the EU countries is sustainable in the period under study (2013-2021), depending on the common policy of the EU countries in the field of highly skilled employment, financial support for higher education, rational use of available natural resources, and their taxation. Based on a comparison of the parameters of the specified multivariate regression models of pooled regression, fixed effects, random effects, describing the dependence of HC in the EU countries on a range of factors, it was found that the best fit for analysis is the regression equation with fixed effects for three variables. Accordingly, the factors that stimulate the development of the HC, which is based on an increase in the number of students pursuing higher education, are the conditions of budget financing of higher education and the situation on the labour market, which is associated with better job opportunities for individuals with higher

education in the EU. On the contrary, the factor that hinders the development of HC in the EU countries is the state's measures in the field of environmental taxation. Furthermore, the specified parameters of the multivariate fixed-effects regression models for HC in the EU countries showed that there are differences in HC formation policies between the EU countries. This suggests not only differences in the social and economic development of the EU countries themselves, but also differentiated approaches to understanding the place and role of HC in ensuring the country's SD. Although the fixed effects contain different cross-sectional coefficients for each EU country, they are not negative. Additionally, this points to the individual capacities of each EU country to increase HC to achieve the SD. Considering the specified factors, the implementation of policies to improve the quality of life in the EU will contribute to the achievement of the SDGs related to decent work, quality education, and reduction of social inequality. Since 24 February 2022, the HC of the EU countries has been considerably affected by the war in Ukraine and the unprecedented increase in the number of forced migrants. At the same time, the assessment of these impacts in the short term has a range of limitations caused by incomplete statistical data. This forms the basis for further research on the significance of HC for the sustainable development of EU countries.

Conflict of Interest

None.

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Людський капітал у сталому розвитку країн ЄС: лонгітюдний аналіз даних

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Анотація. Одним з важливих напрямів, орієнтованих на виявлення головних тенденцій та чинників формування людського капіталу для сталого розвитку в країнах ЄС, є підходи з використанням панельних даних. У статті специфіковано залежність людського капіталу в країнах ЄС від чотирьох факторних ознак, які впливають на його місце і роль у сталому розвитку, за допомогою лонгітюдного аналізу даних. Методологічною основою дослідження був інструментарій економетричного моделювання для побудови багатофакторних регресійних рівнянь трьох видів: об'єднаної регресії, з фіксованими і змінними ефектами. Для визначення параметрів багатофакторних регресійних рівнянь використано статистичні дані Eurostat для 21 країни ЄС за 2013-2021 роки, підґрунтям чого є повнота представлених статистичних показників за результуючими і факторними ознаками та неповнота таких даних для 2022-2024 років. Для трьох видів багатофакторних регресійних рівнянь ендогенною змінною, що описує людський капітал є кількість студентів, які навчаються у вищих навчальних закладах країн ЄС, та чотири екзогенні змінні. Аналіз виявив, що найкраще специфікує вплив на людський капітал країн ЄС економетрична модель, яка описується багатофакторним регресійним рівнянням з фіксованими ефектами. До його складу входять три факторні змінні – загальні державні видатки на вищу освіту, зайнятість з вищою освітою та загальні екологічні податки. З огляду на одержані параметри такого рівняння людський капітал у сталому розвитку країн ЄС залежить від ситуації на ринку праці для високо-кваліфікованих індивідів, державної політики у сфері вищої освіти та екологічного оподаткування. Визначено, що значення фіксованих ефектів для кожної з країн ЄС є додатними, специфікуючи відмінності у даних країнах з формування людського капіталу. Багатофакторне регресійне рівняння людського капіталу країн ЄС допоможе поліпшити розуміння підходів до розбудови партнерських відносин у країнах ЄС щодо реалізації заходів політики сталого розвитку

Ключові слова: вищі навчальні заклади; панельні дані; економетричне моделювання; фіксовані та змінні ефекти; об'єднана регресія; зайнятість
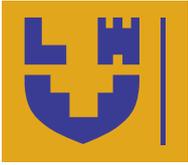
The economic consequences of military conflicts: The Ukrainian context

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Abstract. Conflict, as a unique form of interaction involving the clash of interests between participants in social relations, serves as a necessary condition for the development of civilisation. Contradictions have accompanied humanity throughout its history, finding reflection in the literature, art, and history of various countries and peoples. The emergence and progression of any conflict have economic consequences, stemming from the objective confrontation between opposing forces. The modern economic landscape is increasingly characterised by deepening disparities and a shrinking gap between crises and conflicts. The purpose of this article is to identify the periods that have impacted Ukraine's economy and to analyse the economic consequences of these periods. The author posits that the military period has had a detrimental effect on Ukraine's economy. To achieve this goal, the research employs methods such as scientific abstraction, generalisation, synthesis, analysis, comparison, as well as graphical and tabular methods for data interpretation. This approach has allowed the identification of three main periods of conflict in Ukraine: the brewing conflict in Eastern Ukraine (2013-2014), the pandemic period (beginning in 2019), and the military period (starting in 2022). For each of these stages, the economic development processes in Ukraine were analysed. It is noted that conflicts are inherently dangerous, posing threats not only to the sovereign governance of territories but also to the economy of Ukraine and the global economy at large. Based on the analysis of Ukraine's economic development scenarios without the state of war, the main factors that would contribute to economic recovery in the following areas were highlighted: GDP, unemployment rate, inflation rate, and the NBU's key interest rate. The practical value of this work lies in the identification of three periods of military conflicts in Ukraine and the analysis of their key consequences. This approach helped to demonstrate that the war in Ukraine not only weakens the Ukrainian economy but also affects the economies of neighboring countries. The main economic losses for Ukraine during these conflicts include the loss of human resources and the resulting regional development disparities

Keywords: enterprise; socially responsible business; crisis; losses; relocation of enterprises; social welfare

Introduction

In the context of a sustainable development economy, factors contributing to the growth and formation of socially responsible businesses are of significant importance. Military conflicts, crises, and pandemics have a detrimental impact on these processes. The military conflict in Ukraine has negative consequences not only for the country's economy but also for the economies of neighboring states and the EU as a whole. Therefore, the problems caused by the military conflict in Ukraine and the ongoing war are increasingly relevant and require immediate resolution, as they undermine Europe's economic resilience.

The relevance of this research is further underscored by the assertion made in J.M. Keynes (1920) study that prolonged wars impose significant costs on society and the state. The war in Ukraine can be characterised as a hybrid conflict, beginning in 2013 during the Euromaidan and escalating in 2014 during the Revolution of Dignity.

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The research of Yu. Yurkiv (2022) allows for a generalisation that the two world wars serve as examples of "economic rails". Germany's defeat in First World War was driven by economic problems rather than military failure. In 1918, a resource deficit negatively impacted the economy, leading to the Revolution and the Compiègne Armistice. During Second World War, Britain, Germany, Italy, Japan, and the former USSR were heavily dependent on the supply of raw materials and finished industrial products. The wartime economy becomes focused on meeting military needs, leading to the depreciation of labour, propaganda efforts, and the mobilisation of the population for military and industrial purposes.

L. Cui *et al.* (2023) noted that the Russian-Ukrainian war has heightened the risk of disruptions in the global energy supply chain. The interruption of trade will significantly impact Ukraine's economy, causing a 4.18% decline in its real GDP. However, if the United States and the European Union cease importing energy resources from Russia, the latter's economy will suffer a devastating blow, with a maximum real GDP decline of 5.49%.

The scientists D. Rawtani *et al.* (2022) argue that the Russian-Ukrainian war, extreme weather events, and the COVID-19 pandemic are three catastrophic events currently confronting humanity, and that the war will exacerbate the adverse effects of extreme weather on human society.

W. Boungou & A. Yatié (2022) analysed the impact of the Russian-Ukrainian war on the stock markets of 94 countries and found that the conflict negatively affected stock markets in both countries bordering Russia and Ukraine and those already affected by previous Russian aggression.

I. Liadze *et al.* (2022) employed the global econometric model (NiGEM) to analyse the potential impact of the Russian-Ukrainian war from various perspectives. They confirmed that the negative effects of the war will not only plunge financial markets into turmoil and cause energy and food prices to rise, but also lead to a 1% decline in global GDP and a 1-2% increase in inflation.

M.A.R. Estrada & E. Koutronas (2022) condemn Russia's invasion of Ukraine and evaluate the effectiveness of EU sanctions against Russia. These sanctions have led to reduced liquidity in Ukrainian banks, a temporary devaluation of the ruble, a decline in trade due to the suspension of operations by over 750 international companies in Russia, and a sharp decrease in production caused by shortages of raw materials and limited access to spare parts and supplies. The authors propose a model to assess the economic consequences of military aggression by analysing the impact of trade on the structure of international trade and economic development (trade suppression index and reduced investment as a result of war) and the interdependence of trade and investment (agricultural exports, industrial and manufacturing exports, service exports, and foreign direct investment flows).

N. Stukalo & A. Simakhova (2018) noted that the social dimension of the military conflict in Ukraine affects European stability and the geopolitical situation, particularly in relation to Ukrainian migration. The crisis in Ukraine has generated numerous social challenges, such as loss of human lives, mass migration, rising crime rates, unemployment, and negative impacts on civil society and socialisation processes. These problems also affect European countries. That is why the EU is interested in dialogue and seeks to end the war in Ukraine.

According to V. Sehn *et al.* (2022), the economic consequences of global catastrophes vary significantly across countries. J. Federle *et al.* (2022) also found that the effects of global catastrophes are not evenly distributed worldwide. V. Sehn *et al.* (2022) emphasise that these consequences differ substantially between countries, with geographic proximity to the country at war being a critical factor. The closer a country is geographically to Ukraine, the more pronounced the decline in its stock market around the time the war began.

The author A.C.C.S.M. Esteves (2023) noted, that Russia managed to avert a financial crisis, avoid significant impacts on the real economy, and find alternative import routes, thereby minimising the effects of sanctions. He suggests that this situation can be addressed through the isolation of Russia, the enhancement of multilateral cooperation, and the more effective application of sanctions by closing loopholes and preventing circumvention.

The purpose of this study was to delineate the periods of conflict situations in Ukraine, during which the economy underwent changes, and to highlight the economic consequences of these periods.

The objectives of the article are achieved by addressing the following tasks:

1) differentiating between the concepts of losses and damages resulting from the war;

2) assessing the armed conflict in Ukraine in the Donbas region and the war with Russia in 2022;

3) identifying the periods of conflict escalation in Ukraine, taking into account their timing and specific characteristics.

Materials and Methods

To achieve the objectives of this study and address the tasks set forth, the following research methods were employed: scientific abstraction, critical analysis of literature sources, and generalisation. The method of scientific abstraction was used to identify the essence and structure of the war's consequences, allowing for the development of a methodology to measure them. Generalisation enabled the systematisation of the collected information and the identification of three key periods in the development of Ukraine's economy. For a more detailed analysis of the hybrid war in Donbas from 2013 to 2021, methods of comparison and analysis were applied. These methods allowed for the characterisation

of changes in Ukraine's key macroeconomic indicators during this period. Specifically, the study examined GDP growth rates from 2021 to 2024, the number of people who left Ukraine, and the extent of damage to civilian infrastructure. By using the data extrapolation method, a linear model of GDP growth in Ukraine for 2021-2024 was constructed, which enabled forecasts for future periods. Critical literature analysis and graphical methods were used to identify the negative economic consequences of the third military period in the development of Ukraine's economy. The literature review involved the use of periodic sources, as presented in Table 1.

Table 1. *Analysis of literature sources on data analytics*

Source	Analytical data used for the study
Just about the economy (based on the Inflation Report for January, 2022) (2022)	Analysis of the number of IDPs who do not plan to return home
Relocation program... (2022)	The programme of enterprise relocation is described
The World Bank estimated the financial loss of Ukraine from the Russian invasion at $60 billion (2022)	Analysis of Ukraine's financial losses incurred during the war
D. Schwartz (2022)	Performance of relocated companies during business relocation
Yu. Melnytska (2022)	Companies that have started working under the business relocation programme
O. Polinkevych & R. Kamiński (2018)	An effective model of corporate image of business entities

Source: *developed by the author*

The above sources present the opinions on the events in Ukraine that occurred during the war. The graphical method helped to visualise changes in economic indicators, which helped to clearly understand the extent of the war's impact on the country's economy. An attempt was made to cover the entire period of change, but the focus was on 2013-2022. The material for the study was collected from various sources, including official data published by the State Statistics Service of Ukraine, the Ministry of Finance of Ukraine, the National Bank of Ukraine, and the Centre for Economic Strategies. These data provided a solid basis for analysing macroeconomic indicators and the economic impact of the war. Specifically, the following sources were used:

▣ Official website of the Ministry of Finance of Ukraine (2021);

▣ Official website of the State Statistics Service of Ukraine (2024);

▣ Official website of the Centre for Economic Strategy (2024);

▣ Official website of the National Bank of Ukraine (2024).

Results and Discussion

The consequences of war differ significantly from those of natural disasters. They stem from the destructive and other adverse impacts on the economy, politics, and society as a whole. In other words, the consequences of war affect the socio-economic, political, scientific, technological, and other spheres of activity for individuals, society, businesses, and the state. These areas have undergone changes and have been further strained due to armed conflicts (wars). The consequences of war are measured in terms of losses and damages. Losses are a portion of the consequences that arise from negative changes in key areas of activity (Ivanov, 2015). This term has a broad meaning, referring to various detrimental effects. In a narrower sense, it relates specifically to war casualties, which can be either medical or irreversible. Damage refers to the result of negative changes due to events, phenomena, or actions that compromise the integrity or degrade the properties of an object. These include (Ivanov, 2015):

1) deviation in a person's health from the average level, which can lead to illness or even death;

2) disruption of normal business operations;

3) loss of various types of property or other values, which may be material, cultural, historical, or natural;

4) negative impact on the natural environment or residential areas of people.

The most common definition of damage (harm) is the result of changes in the state of objects that compromise their integrity or deteriorate other properties, leading to actual or anticipated economic and social losses due to military events. Damages can be classified as direct, which are measured in monetary or physical terms, or indirect. Indirect damages include:

▣ disruption of the normal functioning of the country's economic system and businesses;

▣ withdrawal of resources from circulation;

▣ reduction in the ability to meet public needs;

▣ creation of threats to the livelihood of the population.

Figure 1 illustrates the relationship between the concepts of "consequences", "losses", and "damages". These terms are characteristic of war.
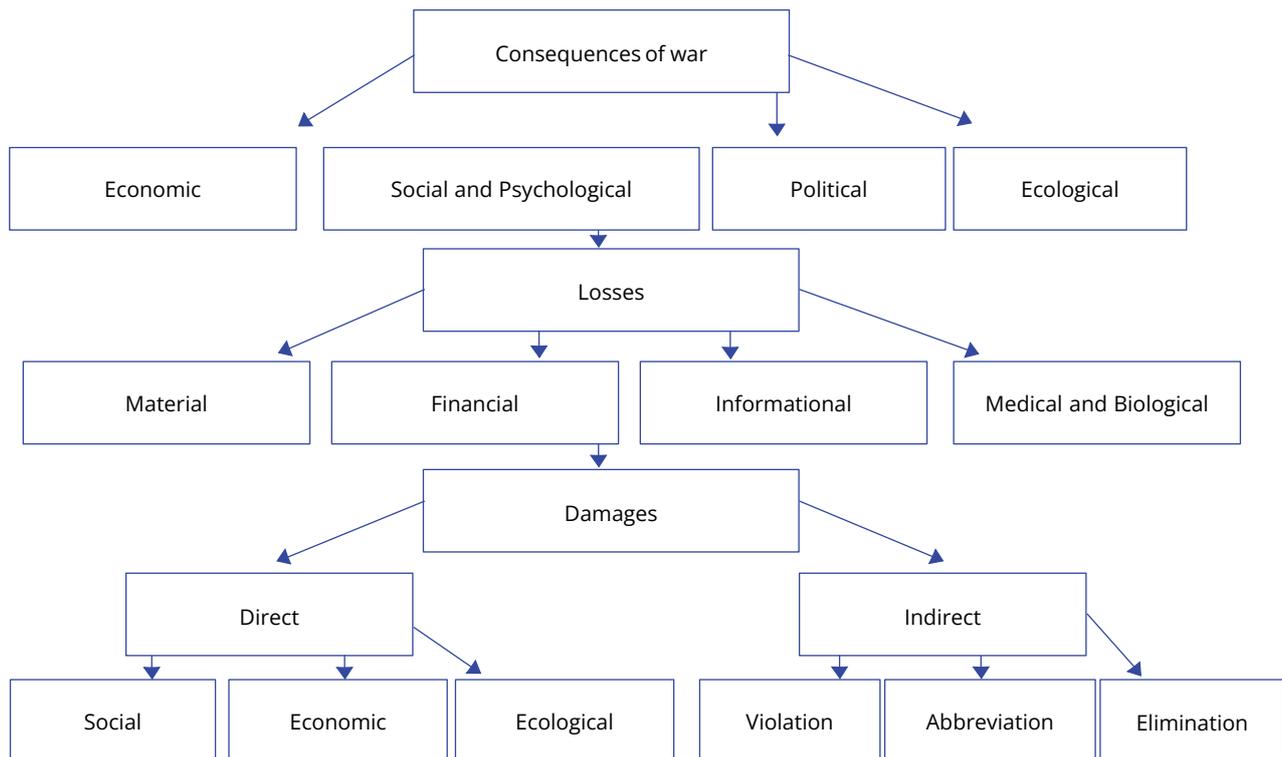
Figure 1. *Correlation between consequences, losses and damages from war*
Source: *summarised by the author according to the research S.V. Ivanov (2015)*

Globally, there is a concerning trend of increasing frequency and severity of armed conflicts, which negatively impact economic efficiency and national security. Direct damage includes losses and harm to all sectors of the national economy within the affected area, leading to irreversible losses of fixed assets and the depletion of natural resources. Consequently, businesses face reduced profits, and the state suffers from lower tax revenues, insurance payouts, and other financial shortfalls.

Damage can be categorised as social, economic, and environmental, and it can be either direct or indirect. Direct economic damage refers to losses that are documented and verifiable. Direct social damage is measured by the number of casualties, injuries, and people affected by the war, and it also has a psychological dimension, linked to the loss of public trust in the government's ability to ensure protection and address social conflicts. Direct environmental damage involves both actual and potential losses that can be quantified and include the costs associated with mitigating the impact on humans, animals, plants, ecosystems, and natural complexes. These negative effects arise from violations of environmental quality standards due to military actions.

Indirect environmental damage refers to the pollution caused by the destruction of enterprises, leading to the release of materials hazardous to public welfare. Indirect damages are the additional costs incurred to compensate for these losses. These expenses arise from

disruptions and changes in economic connections and infrastructure, losses associated with mitigating negative events, and environmental losses. Global changes play a central role in indirect damage across all areas of functioning, which cannot be monetarily quantified for the current generation.

Total damage is the sum of direct and indirect damage, including the costs of mitigating the consequences of war. This damage is calculated at a specific point in time and is not identical to overall damage, which is assessed quantitatively for the future. Damage can be estimated by following these steps (Ivanov, 2015):

▣ determining current prices for goods, work, and services;

▣ reviewing judicial precedents;

▣ considering insurance experience (both personal and property), which has a subjective assessment basis and varied statistics.

Thus, conflicts lead to economic damage and losses. A complex form of warfare is the armed conflict that began in the Donbas region in March 2014 and continues to this day. However, neither side in the conflict has officially declared a state of war. Such conflicts arise from regional struggles with governments and external players. They are dangerous as they pose a threat to sovereign control over territories. Let's examine how the main macroeconomic indicators in Ukraine have changed since the onset of the hybrid war in Donbas and the annexation of Crimea (Fig. 2).
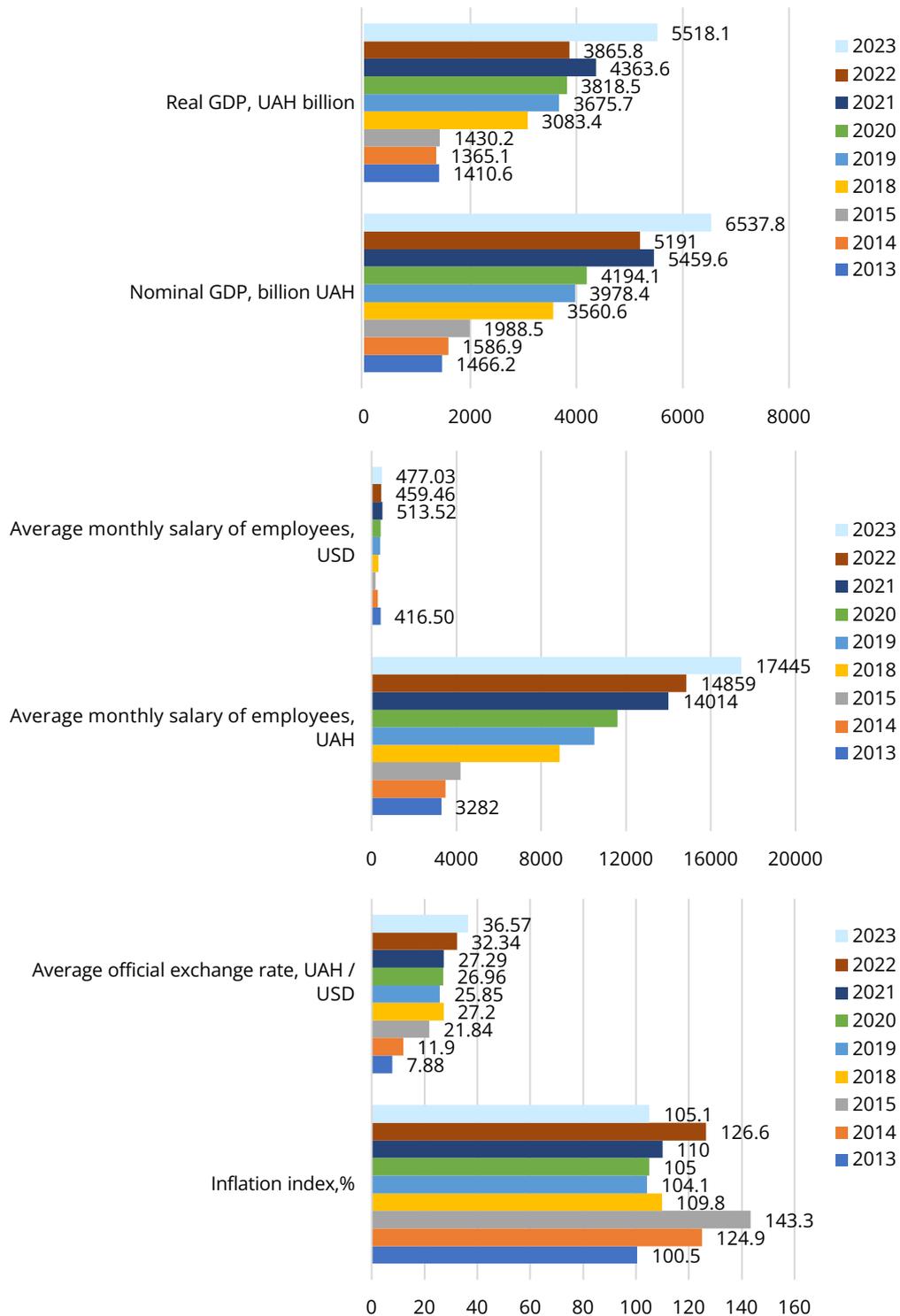
Figure 2. *Changes in the main macroeconomic indicators*
in Ukraine in 2013-2023 since the beginning of the armed conflict in Donbas
Source: *compiled by the author based on the data Official website of the Ministry of Finance of Ukraine (2021); Official website of the State Statistics Service of Ukraine (2024)*

Analysis of the information in Figure 2 suggests that in 2023, compared to 2013, the following indicators increased:
1) nominal GDP by 345%;
2) inflation index by 4.6%;
3) average monthly wages of workers by 14.53%;
4) exchange rate by 364%.

Since the beginning of the military conflict in the East, real GDP has increased by 4107.5 billion UAH, the inflation index has risen by 4.6%, the average exchange

rate has grown to 28.69 UAH/USD, and the wage level has increased by USD 60.

Figure 3 shows the growth rates of inflation, the average official exchange rate, the average monthly salary, and real GDP.
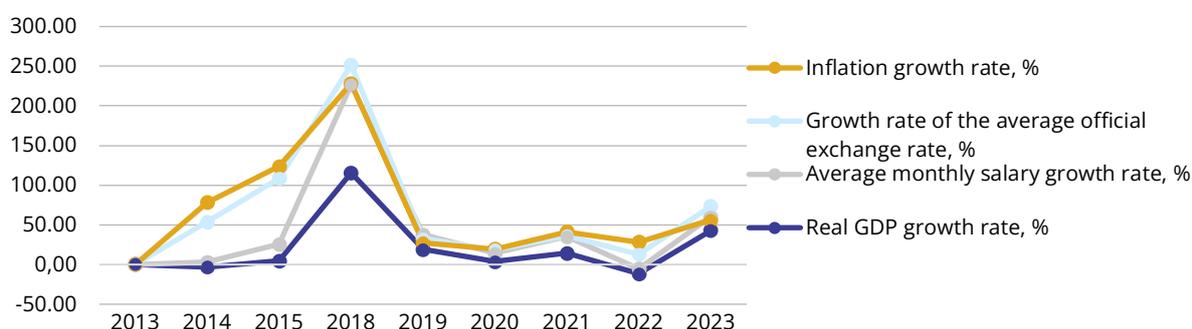
Figure 3. *Growth rates of inflation, Official exchange rate, Real GDP, and average monthly salary in Ukraine from 2013 to 2023 since the onset of the armed conflict in Donbas, as a percentage of the previous year*
Source: *compiled by the author based on the data Official website of the Ministry of Finance of Ukraine (2021); Official website of the State Statistics Service of Ukraine (2024)*

A similar trend was observed following the onset of the COVID-19 pandemic in 2023 compared to 2019:

1) the growth rate of real GDP in 2020 was 3.88%, increased to 14.28% in 2021, slowed down by 11.41% in 2022, and then surged by 42.74% in 2023;

2) the growth rate of the average exchange rate was 4.29% in 2020, 1.22% in 2021, 18.5% in 2022, and 13.08% in 2023;

3) the average monthly wage increased by 10.42% in 2020 compared to 2019, by 20.9% in 2021, by 6.03% in 2022, and by 17.4% in 2023;

4) the inflation rate began to rise sharply, with its growth rate at 0.86% in 2020 compared to 2019, 4.76% in 2021, 15.09% in 2022, and then slowed down by 16.98% in 2023.

Thus, it can be concluded that prior to 2019, there was a gradual and consistent increase in real GDP and average monthly wages, a slowdown in the inflation rate, but a rise in the average exchange rate. The year 2019 resulted in a slowdown in the growth rate of real GDP to 19.21%, in average monthly wages to 18.41%, in the inflation growth rate by 5.19%, and in the average exchange rate by 4.96%. Overall, the study identifies three periods:

Period 1 (2013-2014) – the build-up of conflict in Eastern Ukraine. In 2014, Ukraine faced an economic crisis that deepened and necessitated the reform of key state institutions. The war in the East and problems in Crimea hindered these reform processes. Addressing these challenges required additional resources and renewal of the labour force. The contribution of the Donetsk and Luhansk regions, as well as Crimea, was significant. These territories accounted for 13.5% of Ukraine's total area in 2013 and contributed 18% of the country's GDP. Their importance was further underscored by the fact that they accounted for 25% of industrial production and formed 25% of Ukraine's exports (Ivanov, 2015). Since 2014, the economic significance of Crimea in Ukraine's

GDP has not been reported by the State Statistics Service of Ukraine (Official website of the State Statistics Service of Ukraine, 2024). Donetsk region produced 5.4% of the country's GDP in 2018, 5.15% in 2019, 4.89% in 2020, and 5.19% in 2021. Luhansk region contributed 1% to the country's GDP from 2018 to 2021 (Official website of the State Statistics Service of Ukraine, 2024).

Period 2 (from 2019) – the pandemic period began with the onset of COVID-19, which disrupted the trajectory of development at both the macro and micro levels and established new foundations for changes in society's way of life. These changes affected communication, work, education, and more. Quarantine restrictions in most countries, including Ukraine, led to an unprecedented transformation in the behaviour of economic entities at both the consumption and production levels. Caution became the dominant principle of motivation amid ongoing uncertainty.

Period 3 (from 2022) – the war period, which intensified the negative trends caused by the coronavirus pandemic and the ongoing war across Ukraine. This period saw the rapid destruction of infrastructure, driven by the relocation of businesses from the East to the West. In response, on March 17, 2022, the government developed a business relocation program (Order No. 246-r…, 2022). This program aims to restore the economy by providing assistance to businesses relocating from conflict zones to safer areas in Western Ukraine. Applications are reviewed within 1 to 5 days. The state offers support in selecting relocation sites, transporting and housing employees, finding new staff, providing logistical support, and identifying new markets and suppliers. At the end of March, the total amount of damage inflicted on Ukraine due to Russian aggression exceeded USD 560 billion. The majority of the losses were sustained by Ukrainian infrastructure, accounting for approximately USD 120 billion, while the losses to businesses and organisations

amounted to an additional USD 80 billion. Ukraine launched a zero-interest loan program for businesses during the war, but the loan resources were limited to a sum of UAH 60 million. Currently, an increase in loan interest rates to 5% is anticipated once the military actions cease. A simplified taxation system was introduced for businesses with a turnover of up to UAH 10 billion, applicable to the third group of individual entrepreneurs. The only tax they are required to pay is 2% of their turnover. Additionally, during martial law in Ukraine, business inspections by regulatory authorities have been limited or suspended. From April 1, 2022, businesses received UAH 6500 from the state budget for each employed internally displaced person (Schwartz, 2022). As of March 2, 2023, 800 businesses had been relocated. It is noteworthy that 683 of these have resumed operations in their new locations. The most popular regions for business relocation, where the highest concentrations of relocated businesses are found, include Ternopil (6.3%), Khmelnytskyi (7.3%), Ivano-Frankivsk (8.3%), Chernivtsi (9.8%), Zakarpattia (14.5%), and Lviv (24%) regions (Berezhna, 2023). As of April 13, 2022, the Ministry of Economy had received 1500 applications for the relocation of businesses from combat zones to safer regions, with 300 businesses already relocated, of which 121 were operational (Melnytska, 2022; Relocation program…, 2022). According to World Bank forecasts, Ukraine will spend more than USD 600 billion on reconstruction and recovery (The World Bank estimated the financial loss of Ukraine from the Russian invasion at USD 60 billion, 2022).

In 2023, the Ukrainian economy grew by 5-5.5%, despite a significant decline of 28.8% 2022. In 2021, the economy experienced a 3% growth, whereas in 2020, there was a contraction of 3.8% (Samoilyuk & Levchenko, 2024). The economic recovery in 2023 was supported by several factors:

◾ rising consumer demand: this was driven by an increase in household purchasing power and the necessity to spend savings on goods;

◾ business activity: Ukrainian businesses adapted to the pandemic-related restrictions and ramped up production;

◾ high agricultural yields in 2021.

The recovery in 2021-2023 could have been more faster, but it was hindered by the rapid increase in energy costs due to shortages, the high cost of raw materials, and the emergence of new virus strains that caused the pandemic. These challenges restricted production and disrupted logistics (Just about the economy (based on the Inflation Report for January 2022, 2022). According to the NBU, GDP growth rates were expected to gradually accelerate to 4% (Fig. 4).
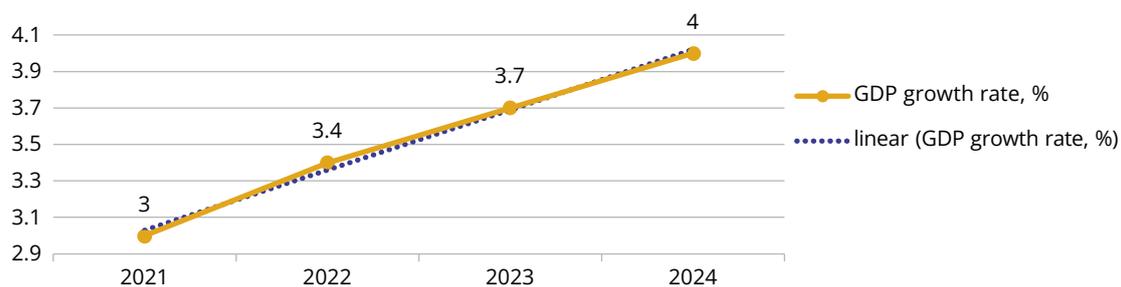
Figure 4. *GDP growth rates in Ukraine in 2021-2024, %*

Source*: developed by the author*

From Figure 4, it can be concluded that 2022 was expected to mark the beginning of GDP growth, with forecasts based on the linear model $y = 0.33x + 2.7$ and a high R^2 coefficient of 0.99, indicating a very strong correlation between the independent and dependent variab les.

It was also predicted that inflation would gradually slow down to 7.7% in 2022 and further to 5% in 2023. In 2021, inflation reached 10% due to rising global food prices, which impacted internal prices as Ukraine both exports and imports many food products, coupled with increased energy costs. Another factor contributing to high inflation was the rise in income levels among Ukrainians. As wages increased, so did production costs, leading to higher prices for goods and services. The planned deceleration of inflation was attributed to (Just about the economy (based on the Inflation Report for January 2022, 2022):

1) a gradual decline in global commodity prices, especially for energy resources and food, starting from their high levels;

2) last year's high agricultural yields in Ukraine, which were expected to mitigate the upward pressure on food prices;

3) The National Bank of Ukraine's plan to gradually raise the key interest rate to encourage citizens to save rather than spend. There is a direct relationship between the NBU's key interest rate and bank rates, making savings in hryvnia more attractive to the public.

The unemployment rate in Ukraine was 9.8% in 2021, 9.1% in 2022, 18.2% in 2023, and 14.2% in 2024, with plans to reduce it to 10-12% in 2025-2026 (Inflation report of the NBU, 2024). However, a decrease in unemployment will only be possible if the pandemic subsides and the economy recovers.

The war in Ukraine has caused a surge in the prices of oil, wheat, and metals, reaching levels higher than during the 2008 financial crisis. This also applies to gas prices in Europe. According to IMF forecasts, economic slowdown in European countries reached 3% by the end of 2022 (compared to an average growth of 5.6-6.7% in 2021) with an inflation rate of 5.5%. The IMF reports that Ukraine's economy contracted by over a third – 35% – in 2022. By April 1, infrastructure damage had amounted to USD 68 billion. The agricultural sector saw a decline in the export of sunflower oil and corn, reaching only 5-10% of last year's volumes (Zanuda, 2022).

The analytical note "Ukraine's wartime economy: An operational assessment, April 2022" (Vyshlinsky *et al*., 2022) indicates that there will be changes in macroeconomic indicators such as GDP, budget, migration, agriculture, and industry. The regions most affected by the war include Donetsk, Zaporizhzhia, Kyiv, Luhansk, Mykolaiv, Sumy, Kharkiv, Kherson, and Chernihiv, which collectively account for 30% of the national GDP. Overall, it is worth noting that GDP in 2022 decreased by 10%. However, when considering the occupied territories, this figure could reach 35-40%. This can be contrasted with a reduction in energy consumption by approximately 35%, though at least 70% of Ukraine's GDP is produced in safe territories.

As of April 8, 2022, total physical damages amounted to USD 80 billion. The majority of these losses were in the transportation infrastructure, accounting for USD 39 billion, and housing, which suffered USD 29 billion in damages. Ukraine's budget deficit was UAH 166.8 billion in 2021, UAH 911.1 billion in 2022, and UAH 1.33 trillion in 2023 (Ilchenko, 2024). This deficit is expected to increase in the future. Approximately 30% (UAH 32.5 billion) of the revenue in the 2022 general budget came from dividend payments by state-owned enterprises, not including UAH 19 billion from the NBU. This source of revenue is no longer available, and there is a trend of sharply declining revenue for the State Budget.

According to UN estimates, as of February 24, 2022, 4.2 million Ukrainians had migrated (Fig. 5). Between February 21 and 23, 2022, 113000 people relocated from the Donetsk and Luhansk regions to Russia. Overall, nearly 6.48 million people have been displaced within Ukraine due to the war. This has led to a significant labor shortage in Ukraine, which will likely slow down the pace of economic recovery in the post-war period. In Ukraine's agriculture sector, arable fields and farms have been the hardest hit by the ongoing war. Approximately 13% of the land has been mined, making it difficult to prepare for spring planting. Due to the prolonged conflict in the Donetsk, Zaporizhzhia, Luhansk, Kharkiv, and Kherson regions, there has been a significant decrease in production: wheat by 23%, corn by 3%, barley by 21%, and sunflower seeds by 20%. Ukraine is a major player in the global market, supplying 44% of

China's wheat flour imports, 55% of its corn, and 59% of its sunflower oil (Vyshlinsky *et al.*, 2022).
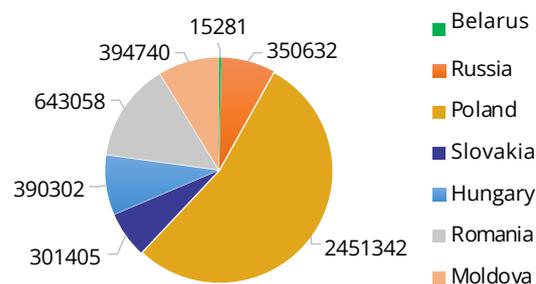
Figure 5. *Population left Ukraine as of April 3, 2022, male*
Source: *summarised by the author for H. Vyshlinsky et al. (2022)*

Industrial losses in 2022 amounted to USD 6.7 billion. Around 100 industrial enterprises have been damaged or destroyed. The metallurgy sector lost 30% of its assets due to the destruction of major plants such as "Azovstal", "MMK Ilyich", the Avdiivka Coke Plant, "ArcelorMittal Kryvyi Rih", "Zaporizhstal", and "Kametstal", which were among Ukraine's largest metallurgical plants. Ukraine's residential complexes have been damaged similarly to educational institutions and hospitals. As of March 22, 2022, almost all regions have experienced destruction, with the exception of Volyn, Lviv, Zakarpattia, Ivano-Frankivsk, Chernivtsi, Ternopil, and Poltava regions (Fig. 6).
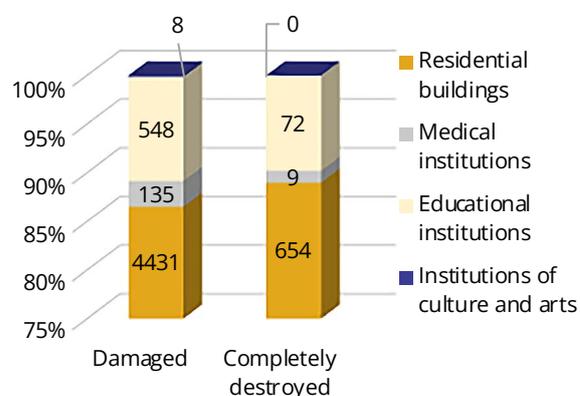
Figure 6. *The number of destroyed objects of civil infrastructure in Ukraine as of March 22, 2022, units*
Source: *created by the author based on H. Vyshlinsky et al. (2022)*

In 2020, research conducted by the International Organization for Migration revealed that 40% of individuals displaced after six years of war, whether relocated to other areas or abroad, did not consider returning to Donbas (Almost 40% of displaced people do not plan to return home after the end of the war – survey, 2020). In April 2022, 10% of Ukrainians who left the country through the Zakarpattia region had no intention of

returning, while 11% were still considering it (Ukrainian refugees: Attitudes and assessments, 2022).

Ukraine faces the challenge of a labour shortage and a slowdown in post-war recovery due to significant human and resource losses. These factors will negatively affect the level of development in both regions of Ukraine, potentially leading to significant deviations in economic growth indicators. According to the 2023 United for Ukraine study "Willingness of Ukrainians to Return Home", 28% of respondents plan to return to Ukraine, while another 62% will return after the war ends (Official website United for Ukraine, 2024).

A survey conducted by the UN Refugee Agency between April and May 2023 showed that around 60% of people expressed a desire to return to Ukraine. By December 2023, more than 6 million internally displaced persons (IDPs) from Ukraine had been registered worldwide (Regional Intent Report No. 4, 2023).

The government is making significant efforts and developing business renovation packages aimed at revitalising the economy. Among them are the following initiatives (Vyshlinsky *et al.*, 2022):

1) the initial increase of the annual income limit for the 3rd group of enterprises under the simplified taxation system from 7.5 million to UAH 10 billion. Subsequently, a second assistance package was developed that eliminated income limits;

2) reduction of the single tax rate from 5% to 2%;

3) removal of restrictions on all types of economic activities, with the exception of excisable goods and the gambling business;

4) granting businesses under the general taxation system the choice between a 2% turnover tax and the simultaneous payment of VAT (20%) and profit tax (18%);

5) establishment of preferences for taxpayers in the 1st and 2nd groups under the simplified taxation system. Specifically, they were exempted from paying taxes, as well as environmental and land taxes on objects located in combat zones, and paid zero excise and 7% VAT on gasoline instead of 20%. They also had the right to declare tax credits on goods based on initial (accounting) documents;

6) expansion of the "5-7-9%" program, allowing Ukrainian businesses to obtain up to UAH 60 million in loans without interest payments. After the war, the interest rate will rise to 5%. Loan terms are up to 5 years for investment needs and up to 3 years for financing working capital;

7) the state partially guarantees loans issued by Ukrainian banks to small and medium-sized enterprises (up to 80% of the total loan amount);

8) small and medium-sized agricultural businesses with an annual turnover of up to EUR 20 million can apply for interest rate compensation on loans (up to UAH 50 million) during the sowing campaign;

9) the Export Credit Agency provides financing to Ukrainian exporters, which helps reduce the cost of financing;

10) The National Bank of Ukraine has introduced unlimited blank refinancing loans to support the liquidity of Ukrainian banks.

All these measures will contribute to the recovery of Ukraine's economy in the near future, especially in regions not experiencing active military conflict. The war has affected not only the nine regions where intense fighting is ongoing but also other Ukrainian regions. The discussed GDP losses are the lowest possible estimates resulting from the war in Ukraine. The economic crisis has been exacerbated by earlier events, specifically the conflict in Eastern Ukraine since 2013 and the pandemic starting in 2019.

The war in Ukraine, which began on February 24, 2022, marks the third asymmetric shock to the EU between 2000 and 2020, following the 2008 financial and economic crisis, the Eurozone crisis, and the COVID-19 pandemic. As B. Fontelles (2021) rightly stated, an asymmetric shock refers to sudden changes in economic conditions that disproportionately affect certain EU countries. The war in Ukraine impacts neighboring countries through a growing refugee crisis and high dependence on Russian natural gas supplies. To prevent the EU from weakening due to this asymmetric shock, it is necessary to strengthen solidarity with the most affected countries.

The conflict between Russia and Ukraine has escalated into a full-scale war, triggering a humanitarian crisis that negatively impacts millions of people. This has led to an economic shock, the duration and scale of which remain uncertain. The conflict has caused significant economic losses and heightened uncertainty, which has been further aggravated by rising inflation and an imbalanced recovery from the pandemic. This perspective is supported by G. Zhyla (2023).

Conflict is an objective social phenomenon. This conclusion was reached based on the analysis of research by P.M. Baltadzhy & L.G. Matveeva (2022). It is impossible to avoid contradictions and disputes in social relations, and effective means of resolving them must be found. These means can include both conflict-based and consensus-based (alternative) interactions. Society cannot function without conflicts and contradictions, and it strives to resolve them. One alternative way of resolving political conflicts is through dialogue and international mediation.

Conflicts have been inherent to all countries and periods. The first major military conflict in Europe since Second World War is described in the studies of A. Soliman & E. LeSaout (2024). They were the first to address the issue of the impact of the onset of the Russian-Ukrainian war on the dynamics of idiosyncratic volatility and market risk in Europe. The conflict altered the relationship between idiosyncratic volatility and market portfolio volatility even before it escalated. The connection between aggregate idiosyncratic risk and market risk is being reshaped by the military conflict in Ukraine.

The trade consequences of the Russian-Ukrainian war are primarily seen through adjustments in import

prices. This conclusion is supported by the research of S. Steinbach (2023), who conducted an empirical analysis of the effects of the global trade redistribution caused by the Russian-Ukrainian war, using detailed trade data and empirically grounded models aligned with trade theory to quantify the extent of trade destruction and diversion resulting from Russia's invasion of Ukraine.

Conclusions

The economic consequences of the war for Ukraine are extremely negative. This is linked to the impact of the COVID-19 pandemic, which had already undermined the country's growth. The military actions have only worsened the negative imbalances in regional development, delaying the process of Ukraine's economic recovery and reconstruction by decades. Without government intervention and global support, Ukraine will not be able to overcome the war's negative consequences. The economic impacts of the conflicts, based on the proposed periodisation, can be divided into three groups:

1) Economic consequences of the armed confrontations in 2013-2014 due to the conflict in Eastern Ukraine: The real GDP of the country declined, inflation rose sharply, and the official exchange rate increased by 4.02 UAH in 2014 and 13.96 UAH in 2015. This situation negatively affected the social well-being of the population, as the average monthly salary of workers plummeted from USD 416.5 in 2013 to USD 292.44 in 2014 and USD 192.08 in 2015. Consequently, nominal GDP dropped from USD 186.07 billion in 2013 to USD 133.35 billion in 2014 and USD 91.05 billion in 2015. Unemployment stood at 7.7% in 2013 but increased to 9.7% in 2014. Research shows that the military conflict in Eastern Ukraine negatively affected not only the economic development of the state but also worsened social welfare and reduced consumer demand.

2) During the pandemic period, the philosophy of business changed: business shifted from offline to online formats. Many establishments were forced to repurpose and establish remote operations, leading to significant workforce reductions. However, the unemployment rate was 9.1% in 2018 and 8.6% in 2019. The economy reacted more slowly to the pandemic's consequences. By 2020, the unemployment rate had surged to 9.9% and 10.3% in 2021. Meanwhile, average monthly wages increased rapidly: from USD 325.92 in 2018 to USD 406.07 in 2019, USD 429.93 in 2020, and USD 513.52 in 2021. Yet, the growth rate of average monthly wages slowed – from 111.32% in 2018 to 18.41% in 2019 and 10.42% in 2020. A similar trend was observed in real GDP growth: it was 115.59% in 2018, 19.21% in 2019, and 3.88% in 2020. Thus, the pandemic negatively impacted the country's economic development and the social well-being of its citizens.

3) During the wartime period, there was a decline in both nominal and real GDP in 2022, a sharp rise in inflation to 126.6%, an increase in the average official exchange rate by UAH 5.05 per dollar, and a drop in the average monthly salary of workers by USD 54.06. The growth rate of average monthly wages was the lowest in 2022 compared to 2018-2021, standing at just 6.03%, while real GDP fell by 11.41%. However, this period also saw a rise in the average official exchange rate by 18.5% and inflation by 15.09%. In 2023, the situation somewhat stabilised, marked by a 42.74% increase in real GDP, a 17.4% rise in the average monthly salary, and a 16.98% decrease in the inflation index. During this period, the average official exchange rate increased by 13.08%. This situation demonstrates that the war in Ukraine has had the most negative economic consequences of the periods considered.

Further research should focus on developing measures to mitigate the negative economic impacts of conflicts.

Conflict of Interest

None.

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Економічні наслідки військових конфліктів: український контекст

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Анотація. Конфлікт, як унікальний вид взаємодії, що полягає в зіткненні інтересів суб'єктів суспільних відносин, становить необхідну умову для розвитку цивілізації. Протиріччя супроводжували людство протягом усієї історії та знаходили відображення у літературі, мистецтві та історії різних країн і народів. На виникнення і розвиток будь-якого конфлікту впливають економічні наслідки, які виникають через об'єктивне протистояння між протилежними силами. Сучасний економічний простір поглиблюється диспропорціями та характеризується зменшенням лагу між кризами та конфліктами. Метою статті було виділення періодів, які впливають на економіку України та аналіз економічних наслідків від них. Автором розроблено тезу про те, що військовий період негативно вплинув на економіку України. Досягненню мети сприяють такі методи дослідження: наукова абстракція, узагальнення, синтез, аналіз, метод порівняння, графічний та табличний методи для інтерпретації даних. Це дозволило виділити три основних періоди виникнення конфліктів в Україні: назрівання конфлікту на Сході України (2013-2014 роки), пандемічний період (з 2019 року), військовий період (з 2022 року). За кожним із цих етапів проведено аналіз процесів розвитку економіки України. Зазначено, що будь-які конфлікти є небезпечними, оскільки несуть загрозу для суверенної влади щодо управління територіями, несуть загрозу не лише економіці України, але й всьому світу. На основі аналізу сценаріїв розвитку економіки України без стану війни виділено основні фактори, які б сприяли відновленню економіки за такими напрямами: ВВП, рівень безробіття, рівень інфляції, облікова ставка НБУ. Практичною цінністю роботи є те, що автором виділено три періоди військових конфліктів в Україні та проаналізовано основні наслідки їх. Такий підхід допоміг довести, що війна в Україні не лише послаблює українську економіку, але й економіку сусідніх держав; головною економічною втратою України в процесі конфліктів є втрата трудових ресурсів та диспропорції у розвитку регіонів

Ключові слова: підприємство; соціально-відповідальний бізнес; криза; втрати; релокація підприємств; соціальний добробут
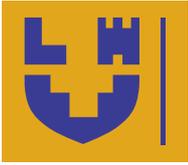
Development of lottery business and economic justification of its monopolisation by the state

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Abstract. The research relevance is determined by the fact that, despite the emergence of more modern gambling, millions of people around the world participate in lotteries every year, and this number is steadily growing. The study aims to assess the prospects for the development of the lottery business in the context of the state monopoly on this industry, as well as to consider possible risks for the economy. The structural-functional method was used as a basis for studying the place of the lottery business in the economic system on the example of different countries; the historical method addressed the peculiarities of the origin of lotteries in the world. The study conducted a comprehensive study of the stages of formation of modern models of lottery activity in the leading countries of the world, such as the USA, Great Britain and China. The reasons for the emergence of lotteries, their advantages and disadvantages, as well as the role of government agencies in regulating this activity were investigated. In particular, the study analysed the models of a complete ban, a free market and a state monopoly, as well as the impact of lotteries on the economy and society. The study showed that the high level of profitability of the lottery business allows organisers to make stable contributions to the state budget and charitable organisations, solving social and humanitarian problems. The results of the study determined the optimal model of the lottery business, formulated the prospects for the development of this type of activity at the present stage, and assessed the role of the state authorities in this process. The study materials can be used by public authorities engaged in reforming the legislative framework in the field of gambling

Keywords: gambling business; gambling; legislation; budget; financing

Introduction

The lottery business is a large and dynamically developing industry that not only generates profits for organisers but also provides significant revenues to the state treasury and various charitable foundations. They have become a significant part of daily lives for many and are important in the global economy.

Most developed countries have chosen the vector of lottery business development, which is the transfer of lotteries under state control. This approach guarantees strict compliance with the law when organising and conducting lotteries. It also contributes to budget revenues that are subsequently used to finance a wide range of government programmes and projects (Clotfelter, 2023). However, the state policy of different countries of the world on regulating the lottery market and legislation in this area is gradually changing, which necessitates thorough scientific research on this issue. The relevance of this work is that lotteries continue to occupy one of the dominant places in the structure of gambling. At the same time, most countries in the world rely on strict state regulation of the lottery business, which raises many questions for analysis and reflection.

Ukrainian, Western European, American and Kyrgyz historiography has no studies devoted to this topic. Most researchers address various aspects of the impact of gambling on the economy and society and consider

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the situation with the lottery business not in a general way, but analysis of the experience of individual countries or regions in the historical perspective and at the present stage.

E. Ulvidienė *et al.* (2023) studied the relationship between Lithuanian gross domestic product (GDP) and tax revenues from the gambling and lottery market. Using data from 2004 to 2021, the study showed that GDP growth had a direct impact on tax revenues without delay, while budget revenues from gambling and lotteries showed significant inertia. T. Roukka & A.H. Salonen (2020) studied the tax burden of gambling in Finland. The study analysed the distribution of tax liabilities between winners and losers and addressed how tax policy affected gamblers and the financial state of the state. V. Marionneau *et al.* (2021) identified two models of gambling business functioning: the state monopoly model and the market-licensed model. In their study, the authors determined that in countries with the first type, the harm from gambling is less than in the second.

The authors S.A.U. Agha *et al.* (2021) analysed the legal nature of lotteries from the perspective of Shariah and Islamic jurisprudence. The results showed that modern lotteries, including prize bonds, require careful analysis to ensure their compliance with Islamic norms and protection against gambling and usury. The potential advantages and disadvantages of running a lottery business in a monopoly or competitive market were studied by Bulgarian scientist K. Ivanov (2021). The author argued that the creation of the National Lottery in Bulgaria was financially motivated. The authorities recognised an opportunity to replenish the state budget with additional funds and direct them to the implementation of various programmes.

A. Díaz & L. Pérez (2021) addressed the reasons for the decline in lottery revenues. Moreover, the authors analysed reforms in the lottery business to increase the number of participants and generate more profit. An interesting study was conducted by L. Del Viva *et al.* (2021), which analysed the behaviour of banks in the lottery context after the government bailout under the Troubled Asset Relief Programme (TARP), a US programme aimed at stabilising the financial sector, restoring confidence in financial institutions and preventing further economic decline in 2008. The study results show that banks have changed their strategies in response to the bailout, which has affected their behaviour in terms of risky investment decisions and asset management.

Despite a significant number of existing studies in the field of lottery business, areas such as the dynamics of its development and the economic justification for the state monopolisation of this sector remain insufficiently researched. In particular, the impact of different regulatory models on the economic efficiency and social consequences of the lottery business requires further analysis.

The study aims to assess the prospects for the development of the lottery business in conditions where the state has a monopoly in this area and is looking for economic benefits in the form of attracting additional funds to the budget.

Materials and Methods

In the first stage of the research, the authors examined the stages of development of lottery activities in the world and identified the countries where they were most successful. In particular, the experience of China, Belgium, France, England and the United States in this regard is studied. The author formulates the prerequisites and reasons for the emergence of the first lotteries and highlights their advantages. In the second stage, the authors analysed the models of lottery business functioning at the current stage, such as the model of a complete ban, the free-market model and the state monopoly model. The United States, the United Kingdom, and China are examples. The study notes the role of state authorities in regulating lottery activities in each country and assesses the pros and cons of each model. In addition, the author formulated the main advantages of state lotteries. In addition, special methods such as historical, comparative, political and legal analysis, systemic, structural and functional, and forecasting methods were used.

This study is based on the structural-functional method. It was used to address the place of lottery activities in the economic system of the United States, the United Kingdom and China, and the role of government agencies in regulating the organisation and conduct of gambling. The historical method was used to study the global experience and history of one of the oldest gambling games, identify the main stages and patterns of lottery development, and outline the causes and consequences of the first lotteries in Belgium, China, France, the UK, and the USA. In addition, the areas where the initial income was channelled were outlined.

The economic and statistical method was used to estimate revenues in the global online lottery market and the number of users. This method was used to analyse market trends in detail and forecast their dynamics for the period from 2024 to 2029. The ranking of the US states with the highest level of lottery sales was also made using this method, which was used to identify the most successful states in the context of lottery sales and their contribution to the state budget. The Wilcoxon test, a non-parametric test, was used to compare the distribution of lottery revenues between different regions and demographic groups. This method was used to assess the significance of differences in income distribution and identify statistically significant differences between groups, necessary for the determination of the social and economic impact of lottery activities.

The comparative method compares the models of lottery business functioning in different countries at the present stage, addressing the experience of the United States, the United Kingdom and China. The main advantages and disadvantages of this or that model in terms

of filling the state budget and spending funds were outlined. The forecasting method was used to identify the main and ways of developing lottery activities in the US, UK and China, and to highlight trends and patterns of change in this area. The systematic method was used to address lottery activities as an effective tool for solving public problems, such as financing of charitable foundations, and ensuring the implementation of sports, cultural, social and educational programmes.

Results

One of the first lottery formulas close to the modern one appeared in ancient China. In 206-195 BC, the country was ruled by Emperor Gao Tzu, who initiated a lottery to provide for his military. The idea was to divide 120 characters into categories and place them on special cards. People bought cards with hieroglyphs, and the emperor drew a few coins among them. The emperor's lottery took place every day in the morning and evening. The emperor drew cards at random, and heralds in the main square of the capital announced the cards with which characters he had drawn (Willmann, 1999). It is worth noting that the funds received from the lottery allowed the treasury not only to maintain a huge army for those times but also to allocate funds for the construction of the Great Wall.

As early as the 15th century, lotteries appeared in Europe, including as a way to fill the state budget. For instance, the widow of the Flemish artist Jan Van Eyck organised a lottery to mark the 25th anniversary of his death. This was the first mention of a lottery in Europe. The lottery took place in Bruges (modern Belgium) in February 1466. Anyone could participate in the lottery and receive a cash prize. The money raised from ticket sales was spent to support low-income citizens. After that, lotteries were held in Belgium regularly, which helped to build chapels, ports, water canals and other socially important facilities.

In England, lotteries were introduced during the reign of Queen Elizabeth I, who came to the throne in 1559. At that moment the country was in economic difficulties. The queen's entourage favoured the monarch's marriage to a strong foreign ruler as a way to resolve the situation. However, Elizabeth I refused such a step and said that she knew how to solve these economic problems. As a result, the monarch suggested organising a lottery. In January 1559, tens of thousands of lottery tickets were put up for sale, and the winners were rewarded with tapestries, gold and money. The proceeds from the sale of lottery tickets were spent on harbour improvements and other public needs (Díaz & Pérez, 2021). From then on, state lotteries in England were held regularly. However, in 1825, this tradition was interrupted by the government under pressure from opposition forces in Parliament. But it should be noted that for two centuries the London Aqueduct, the British Museum and many other architectural objects were built on "lottery" funds.

The lottery was brought to America by European settlers. In the United States, the emergence of the lottery relates to the construction of the first British colony in the New World. In 1612, King James I of England ordered the Virginia Joint Stock Company of London (which had previously obtained a licence to build the colony) to hold a lottery to finance the construction of the facility. The lottery was held regularly for several years, raising about 8000 pounds annually for the development of the colony. This played an important role in the creation of the first permanent English settlement in the United States, which was named Jamestown (Virginia) (Fu *et al.*, 2021).

Since the 17th century, lottery activities in the United States have been actively developing. The lottery has become an effective tool for financing military and social programmes. By 1860, the profits from the sale of lottery tickets accounted for most funding for social projects in 24 US states. For a little over 250 years, 200 churches, more than 350 educational institutions, dozens of medical facilities, orphanages and libraries were built in the US with lottery money. However, the American lottery activity had its drawbacks. By 1778, there were serious scandals in the country since lotteries were in private hands. Moreover, lottery activities were poorly regulated and exposed to corruption, which subsequently led to public discontent and caused its restriction.

At the end of the 19th century, a constitutional law banned lotteries in most states. In July 1890, US President B. Harrison sent a message to Congress demanding the adoption of a law banning lottery activities across the country. As a result, Congress approved a legal act that vetoed the sale of lottery tickets. In 1900, the lottery business was banned in the country and allowed only decades later (Walker, 2024). There are three main models of public gambling management (Fig. 1).

Models of public gambling management		
Total ban – an absolute prohibition of all forms of gambling in the territory, which aims to prevent their negative social and economic consequences	Free market – implies the absence of state restrictions and regulation, allowing private companies to freely offer and organise gambling in accordance with market conditions	State monopoly – all forms of gambling are organised and controlled exclusively by the state, which allows it to regulate the market, generate tax revenues and minimise negative consequences

Figure 1. *Models of public gambling management*
Source: *compiled by the author based on M. Pohoretskyi et al. (2022)*

The first group includes Azerbaijan, Thailand, Pakistan, Saudi Arabia, and Brazil, the second includes Monaco, Malta, and Gibraltar, and the third includes all countries of the European Union, the United States, and Canada (Pohoretskyi *et al.*, 2022). The lottery segment accounts for almost half of the gambling industry's revenues, which is why many states keep them under control through monopolies. To determine how the lottery business works and why lotteries are held at all, it is necessary to highlight who organises them and where the income is channelled. Revenues in the online lottery market are projected to reach 16.94 billion USD in 2024. The market is also expected to grow at a CAGR of 5.51% from 2024 to 2029, leading to a market size of 22.15 billion USD by 2029. The number of users in the online lottery market is projected to reach 42.5 million by 2029 (Fig. 2).
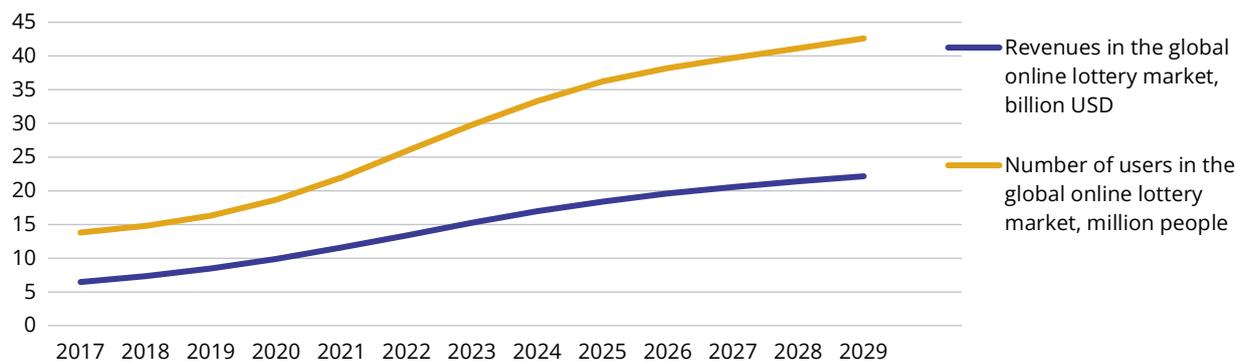
Figure 2. *Revenues in the global online lottery market (USD billion) and the number of users (million)*
Source*: compiled by the author based on Statista (2024b)*

Thus, as can be seen from the graph in Figure 2, the online lottery market is showing steady growth in terms of both revenue and the number of users. From 2017 to 2023, revenues increased from 6.46 billion USD to 15.24 billion USD and the number of users increased from 13.8 m to 29.8 m. The forecast from 2024 to 2029 also shows continued growth, with revenues expected to reach 22.15 bn USD and the number of users to reach 42.6 m by 2029. The data presented indicates a significant interest in online lotteries and suggests that this sector will remain one of the mainstays of the gambling industry, continuing to attract more users and generating significant revenues.

In the leading countries of the world, the lottery business has become an alternative source of financing social expenditures and humanitarian projects. For example, in the United States, each state independently regulates this area. The authorities of administrative and political units prescribe the rules of conduct, the way of distributing proceeds, the prize pool, and other details. Figure 3 shows the ranking of US states with the highest level of lottery sales.
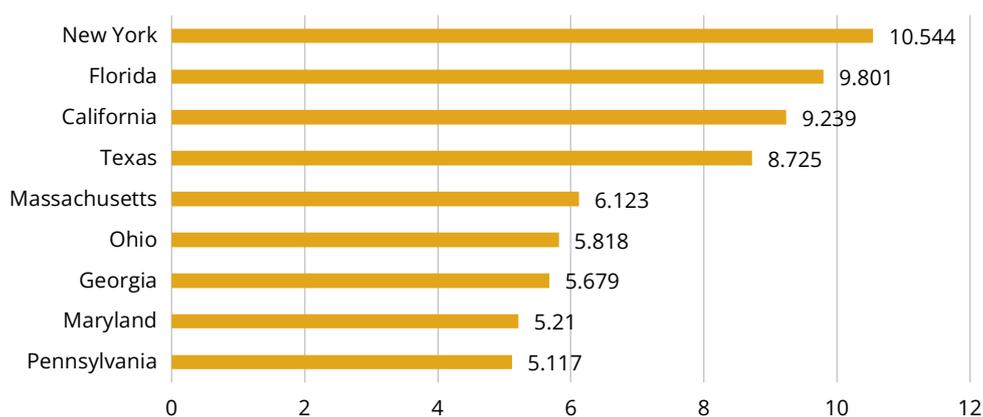
Figure 3. *Ranking of US states with the highest level of lottery sales, in millions USD*
Source*: compiled by the author based on Statista (2024a)*

It is also worth noting that, for instance, according to the Kansas statute, part of the proceeds from lottery ticket sales goes to the state gambling revenue fund and the general fund for the economic development of the state, while in Idaho, a share of the ticket sales revenue is used to build schools. In the state of Georgia, four educational programmes funded by lottery proceeds were created in the early 90s. In this way, the

authorities managed to attract an interested group of parents of children to participate in lotteries (McCrary & Condrey, 2003).

There are no restrictions on the organisation of lotteries in the UK. Lotteries can be conducted by government agencies, individuals, and businesses. To do this, it is necessary to obtain a licence from the Gambling Commission every few years. At the same time, the UK National Lottery with sales of up to 10 billion USD per year is recognised as one of the most popular. USD per year is recognised as one of the most effective. It attracts more money to the government and charities than any other lottery in the world. Winnings are tax-free and paid out immediately (Fig. 4).
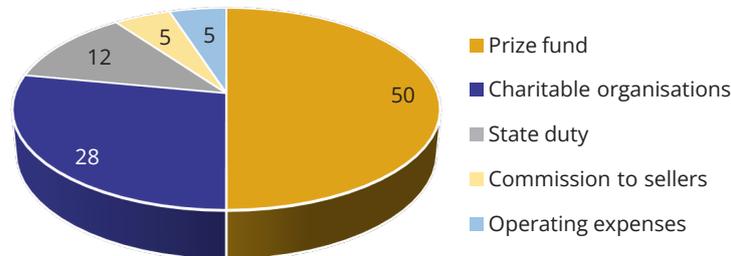
Figure 4. *Distribution of the UK National Lottery, %*
Source: *compiled by the author based on Camelot Group (2023)*

The example of the UK shows that, despite the existence of a free market for the lottery business, it is the national lottery that is most successful in the country. This is because citizens trust state institutions more than private ones. This suggests that the trend towards state monopolisation of the lottery business will continue in the coming years.

Meanwhile, China has a state monopoly on lottery activities. Currently, the only permitted form of gambling in China is lottery. There are two types of lotteries: sports and charity. The Ministry of Civil Affairs and the General Administration of Sport are responsible for issuing lottery tickets and developing and implementing rules (Yuan & Gao, 2015). Lotteries in China are strictly regulated. According to the adopted rules, the money raised is used not only to cover organisation costs and the prize fund but also to implement socially important tasks and programmes aimed at improving the lives of Chinese people. The distribution of lottery revenue in China is carried out at two levels. The first level is the distribution of revenue from ticket sales shown in Figure 5. The second level is the distribution of funds from the public welfare fund.
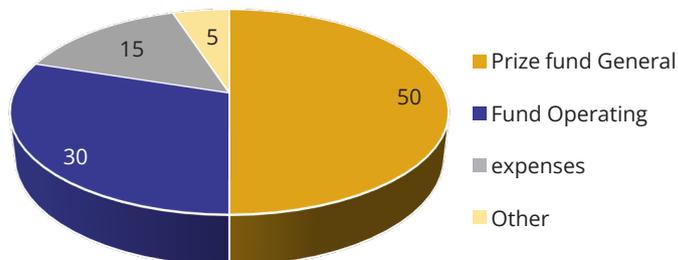
Figure 5. *The first level of lottery revenue distribution in China, %*
Source: *compiled by the author based on J. Yuan & J.Z. Gao (2015)*

Public welfare funds are distributed 50% between the central government and local governments. The government's funds are then divided into 60%, 30%, 5% and 5% to the social security funds, special public welfare funds, the Ministry of Civil Affairs and the General Administration of Sports. The use of funds allocated to local governments is consistent with the purpose of the lottery, and the principles of distribution are studied and determined jointly by the Ministry of Finance, the Ministry of Civil Affairs and the General Administration of Sports. In 2012, the PRC established a special research institute to study gambling. The main focus of the organisation is on optimisation of lotteries so that they have a greater effect on the state economy. In addition, experts develop lottery methods considering the national peculiarities and mentality of Chinese citizens (Zhang, 2024).

The experience of developed countries demonstrates that the development of the lottery business with the participation of the state is the right principle of market functioning. This is caused by the advantages of using national lotteries (Table 1).

Table 1. *Advantages and disadvantages of using national lotteries*

No.	Advantages	Disadvantages
1	Official winnings (taxes are paid automatically, guaranteed receipt of funds)	Limited probability of winning (the odds may be small)
2	Low cost (ticket price is usually low)	Limited number of prizes (many participants may not win)
3	Simple rules (takes a few minutes to learn)	Small amounts of winnings (compared to large private lotteries)
4	No possibility of becoming addicted (frequency of lotteries)	Possible lack of flexibility in terms and conditions (e.g., limited ways to participate)
5	High level of trust and legitimacy (state control)	Risk of fraud in informal lotteries if controls are insufficient
6	Transparency and reliability of lotteries (guaranteed honesty and security)	Need to register and follow certain rules to participate
7	Support for social and charitable programmes (often funds are donated to charity)	Less dynamic and diverse compared to private lotteries
8	Widespread and accessible (lotteries are often available in different regions)	Less attractive for players who prefer larger prizes
9	Government regulation and control (consumer protection)	Lower frequency of lotteries (could less interesting for players)

Source: *compiled by the author based on D. van Wyk & A. van der Merwe (2022), B. Bolkvadze (2023), C.T. Clotfelter (2023)*

In summary, national lotteries provide important financial resources for public projects and have attractive aspects for participants, but their social and economic impacts, as well as the need for strict regulation and transparency, require careful analysis and control. Table 2 summarises examples from different countries that illustrate how state authorities regulate and use national lotteries for different purposes.

Table 2. *Examples from different countries showing how public authorities regulate and use national lotteries for different purposes*

Country	National Lottery	Regulatory body	Purpose of income use	Examples of income use
USA	Powerball, Mega Millions	State commissions	Financing education	Funds are used to finance schools, colleges and universities
United Kingdom	National Lottery	National Lottery Commission	Charity and sport	The funds are used to support charities, sports and cultural projects
France	La Française des Jeux	Ministry of Economy and Finance	Social programmes	The proceeds are used for social programmes, support for pensioners and the disabled
Canada	Lotto 6/49, Lotto Max	Provincial Lottery Corporations	Healthcare and education	Financing of medical institutions and educational programmes
Italy	SuperEnalotto	Agenzia delle Dogane e dei Monopoli	Social and cultural projects	Funds are used to restore cultural monuments and support the social sector
Spain	El Gordo	Loterías and Apuestas del Estado	Charity and education	Financing of charitable organisations and educational institutions

Source: *compiled by the author*

Thus, the distribution of revenues from national lotteries has a significant impact on the financing of public projects, increasing public confidence in the activities of public authorities. Examples from around the world demonstrate that funds allocated to education, and social and cultural programmes help to improve the quality of life and provide additional funding for important public initiatives.

Discussion

To determine the trends in the development of the lottery business at the current stage, it is necessary to look at the origin of the first lotteries. In Ukrainian science, this topic was studied by M. Lyskov (2017). The author addressed the genesis of the formation and development of the lottery sector in China, Belgium, England, Holland, France, the USA and Russia. The author noted that at the initial stage of the lottery business development, this sector was based on the principles of strict control by the state, which was also the organiser and the main beneficiary. The main goal of lotteries in this period was patronage initiated by the same state.

The relationship between the socioeconomic status of a person and propensity for participation in lotteries was studied by H.-N. Fu *et al.* (2021). The researchers examined how age, education, employment, and income influence the frequency of participation in lotteries in the largest cities of Canada. The researchers also

determined that lottery ticket sales are higher in areas with lower socioeconomic status than in high-income areas.

J. Beckert & M. Lutter (2013) also addressed this issue. The authors explained why people with lower levels of education and income spend more on lotteries than the rich and educated. The authors, referring to survey data, found that on average, households in the United States spend about 162 USD annually on lottery tickets. At the same time, low-income households spend about 289 USD for this purpose. The researchers theorise that participation in lotteries serves to compensate for and relieve tension arising from feelings of social inequality. At the same time, they noted that lottery players systematically overestimate the extremely low probability of winning and have overly optimistic estimates of their chances of winning.

K. Ivanov (2020) suggested that in Bulgaria, the tourism industry plays an important role in the country's economy. Gambling, in turn, as a need of a modern person, has its place in the regional tourism and entertainment sector along with other countries. The collection of taxes and fees is the main way for states to replenish their budgets, and the Bulgarian gambling sector is no exception to the rule. The researcher compared the practice of the leading European lottery markets with the conditions that have developed in Bulgaria in recent years. The author also analysed some of the economic and financial difficulties facing the industry now and the issue of reforming Bulgarian legislation in the field of gambling business organisation to increase state budget revenues. The author believes that the funds received by the treasury from gambling should be used to develop healthcare, education and sports, environmental protection, charity events and the restoration of cultural sites.

This is confirmed in the study by T. Roukka & A.H. Salonen (2020). The authors investigated how socio-demographic factors influence gambling participation and how tax policy distributes the financial burden among different population groups. The results showed that socio-economic conditions such as low income, low education level and living in rural areas have a significant impact on how people participate in gambling and how they become "losers" in the context of the Finnish gambling tax system. In particular, the most vulnerable segments of the population often bear a heavier tax burden, which can exacerbate their financial situation.

Following A. Díaz & L. Pérez (2021), the choice often falls on lotteries and other games of chance. The lottery fee is considered another state tax. Therefore, the allocation of a part of the lottery revenues to charity and social or humanitarian programmes can be considered quite understandable. The advantage of such a specific type of tax over the usual one is that the taxation process is not so significant, and it also brings benefits to the citizen in the form of the opportunity to win a cash prize. Based on the above arguments, the authors conclude that lotteries are an effective tool for countries to increase funding for public services. However, the authors also emphasise that lottery activities need to be carefully regulated and controlled to minimise the negative social and economic consequences associated with gambling.

V. Cornea & A.-E. Matic (2021) presents the lottery as a real business focused on maximising profits. The authors suggested that where lotteries are under the control of the state, the important goal is to collect as much money as possible for the state treasury. The scientists analysed the charitable purpose of lottery activities in the public administration system using the example of Romania. In addition, they noted that few players are aware of the fact that the lottery institution is largely determined by the income generated by lottery games and that the element of risk inherent in this activity does not exclude its economic nature.

Z. Metzker & J. Streimikis (2020) investigated how state lotteries in Europe benefit the government, the private sector, and civil society. The authors believe that lotteries are a form of gambling in which European governments have taken on the greatest degree of d irect ownership and management. The researcher also emphasises that lotteries are also the most massive form of gambling. That is why the proceeds from lottery activities should be allocated to socially important projects.

When studying lottery activities, it is necessary to note the physiological component of the game. Several studies examine the relationship between a person's participation in the lottery and happiness, as well as what emotions a loss causes. M. Burger *et al.* (2020) focused on the emotional aspect of playing the lottery in their study. The authors used the example of the UK National Lottery to examine the goals of citizens participating in lotteries. Researchers determined that people who participate in lotteries for fun become happier. Therefore, lotteries have a positive effect on emotional state. This is also confirmed by S. Kim & A.J. Oswald (2022) and Y. Ji *et al.* (2024), who believed that it is necessary to regulate the development of the lottery industry by expanding entertainment and cultural activities, expanding economic opportunities, increasing awareness of laws, and improving the business model of the public welfare lottery. W. Nirantechaphat & A. Nedpogaeo (2023) noted that bargaining power with underground lottery players is driven by two objectives: preserving honour and dignity, as well as supporting the underground lotto business network.

J.D. Cohen (2022) addressed the American lottery market. Statistics have shown that every year, US residents spend more on lottery tickets than on books, cinema, and concerts combined. The author explains that Americans perceive the lottery as a chance to drastically change their lives. The researcher also addressed the US national lottery, which has been popular among the population since the second half of the 20th century. The analysis determined how the lottery market was formed and how the political forces involved influenced this

process. Ya. Peng *et al.* (2015) outline the directions and goals of China's lottery management and reform system and put forward proposals for improving the lottery management system.

It is possible to conclude that lottery activities have an ancient history. In the very beginning, lotteries were used to fill the treasury and to build social facilities. Over time, the forms and types of gambling have changed significantly. The leading countries identified the best models of gambling regulation and created the appropriate legal framework. Some of them relied on the monopolisation of gambling activities. However, despite the choice of the gambling regulation model, in many countries, lottery revenues continue to be used to implement humanitarian, social and sports programmes.

Conclusions

The high level of profitability of the lottery business allows organisers to make stable contributions to the state budget and to various charitable organisations to solve social and humanitarian problems.

In many developed countries, the lottery industry is well established and generates revenue for the state. Therefore, the classic monopoly ownership of lottery activities helps to significantly increase the revenue item in this industry. This allows countries to restrain tax increases and implement social projects. This model of lottery business operation demonstrates its effectiveness in the modern world, as it has several advantages over private organisers. For example, China has a complete state monopoly on the lottery business. In China, analysts record a significant increase in lottery turnover every year. In their opinion, citizens trust national lotteries more, as they have several advantages, such as low-ticket prices, official winnings, and simple rules.

The study generated data that led to several important conclusions. Firstly, the use of the econometric-statistical method showed that revenues in the global online lotteries market are growing steadily, from 6.46 billion USD in 2017 to a projected 22.15 billion USD by 2029. This is further supported by the growing number of users, which has increased from 13.8 million in 2017 to a projected 42.6 million in 2029. In the ranking of US states with the highest lottery sales, the most successful states were those that actively use lottery revenues to fund educational programmes and other community projects. In the UK, according to the results of the analysis, the distribution of National Lottery revenues shows high efficiency in supporting charitable and sporting events, which increases public trust in government bodies. In China, lottery revenues were allocated to social programmes, such as assistance to pensioners and the disabled, under the strict control of the Ministry of Economy and Finance.

Collectively, the results of the study highlighted the importance of lotteries as a tool for additional funding of government programmes and social initiatives, as well as the need for careful control and regulation of their use for maximum public benefit. But an exception can be highlighted here. In the example of Great Britain, where there are no restrictions on the organisation of lotteries, it can be traced that the most successful in terms of sales is also the national lottery. Citizens choose it because the proceeds from ticket sales are used for sports programmes, museum renovation, restoration of works of art and other humanitarian needs.

Further scientific research should address the experience of other countries in the functioning of lottery activities. Those countries that have a free market for public gambling are of interest to researchers.

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Conflict of Interest

None.

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Розвиток лотерейного бізнесу та економічне обґрунтування його монополізації державою

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Анотація. Актуальність науково-дослідницької роботи полягає в тому, що, незважаючи на появу більш сучасних азартних ігор, у лотереях щорічно беруть участь мільйони людей по всьому світу, і це число неухильно зростає. Мета дослідження – оцінити перспективи розвитку лотерейного бізнесу в умовах існування державної монополії на цю галузь, а також розглянути можливі ризики для економіки. Структурно-функціональний метод став основою для вивчення місця лотерейного бізнесу в економічній системі на прикладі різних країн; історичний метод допоміг вивчити особливості зародження лотерей у світі. У даній роботі проведено комплексне дослідження етапів становлення сучасних моделей функціонування лотерейної діяльності у провідних країнах світу, таких як США, Великобританія та Китай. Досліджено причини виникнення лотерей, їхні переваги та недоліки, а також роль державних органів у регулюванні цієї діяльності. Зокрема, аналізувалися моделі повної заборони, вільного ринку та державної монополії, а також вплив лотерей на економіку та суспільство. Дослідження показало, що високий рівень рентабельності лотерейного бізнесу дає змогу організаторам здійснювати стабільні відрахування до державного бюджету та благодійних організацій, розв'язуючи соціальні та гуманітарні проблеми. Результати дослідження полягають у визначенні оптимальної моделі функціонування лотерейного бізнесу, формулюванні перспектив розвитку цього виду діяльності на сучасному етапі, а також в оцінці ролі державної влади в цьому процесі. Матеріали можуть використовувати у своїй роботі органи державної влади, які займаються реформуванням законодавчої бази у сфері грального бізнесу

Ключові слова: гральний бізнес; азартні ігри; законодавство; бюджет; фінансування
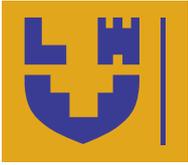
Application of forecasting methods in harmonising strategic planning for sustainable development of the state

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Abstract. Successful implementation of the global concept of sustainable development requires harmonising the strategic planning of sustainable development of the state to ensure effective monitoring of the progress of states in achieving the Sustainable Development Goals. The purpose of the research is to actualise the problem of applying forecasting methods in the process of harmonising the strategic planning of the sustainable development of the state and to develop methodological tools for its solution. In the course of the study, based on the application of such methods as: literature review, hypothetical-deductive method, comparison method, empirical method and logical analysis, the expediency is substantiated, methodological tools are developed and the method of triple exponential Holt-Winters smoothing based on a long time series is tested using the Forecast Sheet in Microsoft Excel 2016. Within the framework of a harmonised approach to strategic planning for sustainable development, to assess the country's progress in sustainable development, the indicators of decoupling of environmental pressure from economic growth are used, as they are simple, measurable and flexible. Based on the Tapio's methodology, a norm of non-renewable resource decoupling and environmental impact decoupling indicators is determined as a benchmark for the development and analysis of the effectiveness of the national sustainable development strategy, and a forecast of the dynamics of these indicators in the EU as a whole until 2026 is made, as a leader in the greening of the economy. The findings allowed us to identify the main trends in the EU's sustainable development, basing on the classification of the decoupling status. The results obtained contribute to the harmonisation of national strategies to ensure the successful implementation of the global concept of sustainable development, can be used at such a stage of strategic planning as the formation of a goal tree, which makes it possible to set both attainable and relevant goals, as well as in assessing the effectiveness of strategies in achieving the Sustainable Development Goals

Keywords: Sustainable Development Goals; exponential smoothing; decoupling; harmonised approach; national strategy; unification

Introduction

The escalation of global problems has led to the emergence of the sustainable development concept, aiming to ensure a harmonious relationship between humans and nature with sustainable economic growth. Its global nature requires unified approaches and standardised methods for developing national sustainable development strategies. Since 2015, achieving the Sustainable Development Goals (SDGs) has been on the agenda of all 189 countries participating in the 70th session of the UN General Assembly, where the document "Transforming Our World: The 2030 Agenda for Sustainable Development" was adopted (ENAT, 2020). This declared the ambitious global goal of achieving sustainable development in economic, social, and environmental dimensions by 2030, becoming a strategic goal for all national economies.

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The SDGs are global and universal but respect national characteristics, economic differences, capabilities, policies, and interests. Each government chooses how to incorporate the SDGs into national strategic planning, determine links between sustainable development and current economic, social, and environmental processes, and develop progress measures. Each state, within its national strategy, forms its own goals, tools, and indicators, without a standardised approach to interpreting the results.

According to the 2019 Sustainable Development Solutions Network survey, there is no single approach to monitoring the achievement of the SDGs among countries around the world. For example, the EU assesses its success in ensuring sustainable development using 100 indicators, Canada – 244, Belgium – 34 (Sachs *et al.*, 2019). Such a variety of indicators intensifies research activities but creates difficulties and delays in interpreting the results of national sustainable development strategies. This hinders prompt intervention to improve the strategy and the development of useful proposals for forming a successor strategy based on past experience. In addition, there is the problem of international comparison of the levels of countries' progress in ensuring sustainable development in the absence of generally accepted standards for assessing the effectiveness of the implementation of national sustainable development strategies.

Thus, M. Olievska (2019) in research highlights the problem of comparability of indicators due to the use of different methodologies for assessing sustainable development, which is why countries should unify reporting metadata, adapt the SDGs and indicators for their achievement. P. Gennaria & M. D'Oraziob (2020) rightly point out that even leading international organisations do not agree on methods for assessing sustainable development, which can lead to discrepancies in results and, consequently, confusion among decision-makers who will have to base their policy decisions on unreliable and inconsistent assessments. The potential methodological difficulties in auditing national strategies for the effectiveness of achieving the SDGs within the framework of the International Organization of Supreme Audit Institutions (INTOSAI) are emphasised by V. Hanushchak (2023), which the author assumes to exist due to the relative novelty and subjectivity of the methods that can be used. In turn, T.I. Iefymenko (2019) raises the problem of the threat of information asymmetry in the field of sustainable development, to offset which it is necessary to develop common methodological approaches to the formation of a system of indicators at the global and national levels, which will allow to adequately assess the degree of achievement of the SDGs. As noted by J.W. McArthur & K. Rassmusen (2019), differences in concepts, programs, and implemented sustainable development strategies between different institutions only intensify the parallel development of alternative and parallel indicators, while it is a harmonised methodology that can translate the SDGs into an empirical framework that meets the challenges of each country.

Globalisation necessitates studying methods to harmonise strategic planning for sustainable development. This aims to unify approaches for assessing national strategies' effectiveness in achieving the SDGs. These methods should be relevant to strategic management, promote planning harmonisation, and be accessible. Початок формиКінець форми In this case, forecasting methods deserve attention, as according to D. Spokojny (2022), forecasts play an important role in the broader decision-making process, namely strategic planning. Forecasting is considered the basis of strategic planning, as it makes it possible, taking into account the overall dynamics of the system and global trends, to predict its desired future state and form an effective set of tools to achieve it.

The expediency of using forecasting methods in harmonising the strategic planning of the state's sustainable development is due to the fact that they allow to assess future developments based on past and present data (Petropoulos *et al.*, 2022) and to make sure that the decision is correct, or to receive a signal about the ineffectiveness of the strategy in achieving the goals and take appropriate measures. The long-term nature of national strategies requires that a certain level of progress in achieving sustainable development by the state be foreseen in the future. Also, M. Balan (2019) believes that the use of a forecasting system in strategic planning involves the introduction of a system of adequate indicators, the unification of which will allow an objective assessment of the effectiveness of the implementation of national strategies in the context of achieving the SDGs.

The purpose of the research is to actualise the problem of application of forecasting methods in harmonising strategic planning for sustainable development of the state; to suggest methodical tools for solving the problem. Achieving this goal involves the following tasks: to study the forecasting methods used in the strategic planning of sustainable development of the state; to select indicators for forecasting sustainable development in harmonising strategic planning and substantiate their norms; to choose an effective forecasting method in the process of harmonisation of strategic planning of sustainable development of the state and make a forecast.

Scientific novelty of the paper: for the first time the problem of applying forecasting methods within the framework of a harmonised approach to strategic planning of sustainable development of the state is raised; the study of forecasting methods in strategic planning of sustainable development has been further developed, methodical tools for harmonising strategic planning of sustainable development of the state are proposed.

Literature Review

In the framework of the study, it is important to investigate the Sustainable Development at the state level, which will give a basis for choosing such methods to

harmonise strategic planning for sustainable development of the state. Thus, Z.M. Buryk (2017) focuses on the study of theoretical and practical foundations for assessing the effectiveness of state regulation and forecasting indicators of sustainable development of Ukraine and uses the extrapolation method to predict the dynamics of integrated indicators of economic, environmental, social and institutional development of the country. As a result, the author forecasts the achievability of sustainable development indicators of Ukraine in accordance with the Sustainable Development Strategy "Ukraine-2020". A. Bidarbakht-Nia (2017) proposed to select an individual extrapolation method to forecast changes in the values of each of the selected 77 indicators of the SDGs, which, of course, complicates the forecasting procedure, but provides a more reliable result. J. Friedman *et al.* (2020) also used the method of extrapolation in the study of progress in achieving the SDGs, namely a cohort extrapolation model to predict progress in achieving the education-related SDGs.

In turn, I.O. Pyshnograiev & I.O. Tkachenko (2022) built an approximation model using MS Excel and RStudio applications to predict the level of sustainable development in the European context, based on 10 indicators from three dimensions of human life (economic, social and environmental) that had the highest correlation coefficient with the sustainable development index.

The authors A.L. Pomaza-Ponomarenko *et al.* (2021) argue, that forecasting the consequences of state policy to ensure sustainable development can be based on the use of a simulation model of the development of socio-ecological and economic systems with the obligatory correction of the defining parameters of sustainable development.

Scientists D. Firoiu *et al.* (2022) used the ARIMA modeling methodology based on SPSS software to study the country's potential to achieve the SDGs by 2030. The indicators for such a study were selected from 120 indicators for 17 Sustainable Development Goals defined within the EU SDG Indicator set 2021.

L. Hrytsenko *et al.* (2024), exploring the concept of sustainable smart urban development as a fundamental component of the national sustainable development strategy, built additive forecasting models obtained by the simple exponential smoothing method using the Google Trends tool, being convinced that in developing any strategies it is important to find out the level of public interest in this issue, to determine the level of awareness and readiness of citizens to perceive new information.

W. Qu *et al.* (2020) used the method of building scenarios based on the Threshold 21 Integrated Model to develop a national sustainable development strategy, which made it possible to analyse a number of strategic alternatives for the sustainable development of the state by indicators characterising the economic, social and environmental spheres of the state.

The literature review shows a keen interest of scientists in the issue of forecasting the sustainable development of the state, with a variety of forecasting methods and assessment indicators. However, in terms of harmonising strategic planning for sustainable development at the national level, it is important to ensure a unified approach to the selection of indicators and forecasting methods. According to the Ministry of Economy of Ukraine (2017), sustainable development indicators should be objective and suitable for international comparisons and in accordance with the capabilities of national statistical systems. In turn, forecasting methods should be chosen to ensure not only the validity and objectivity of the forecasted data, but also the possibility of comparing the level of achievement of the selected indicators with the norm.

Materials and Methods

This research was carried out in stages in accordance with the tasks set. A literature review was conducted to examine forecasting methods that are already used in strategic planning for sustainable development of the state and have proven their practical significance in this area, which was helpful in choosing such a method for harmonising strategic planning. As forecasting involves predicting the future state of the research object based on an assessment of its current state, it is necessary to select objective indicators for this purpose. The application of the hypothetical-deductive method made it possible to define such an indicator as decoupling of environmental pressure from economic growth, which is defined as a state of the economic system in which its economic growth prevails over its environmental damage on the ecosystem through two groups of factors: resource and environmental impact factors with the prospect of increasing such a gap in the future (Korolchuk, 2021).

The application of the method of comparing the decoupling of environmental pressure from economic growth with the system of sustainable development indicators proposed by the United Nations Commission on Sustainable Development (CSD) and the Organization for Economic Cooperation and Development (OECD), which includes a large number of indicators for which, according to K.Y. Redko & V.R. Miroshnychenko (2022), national statistical reports may lack the necessary information to assess the level of achievement of the SDGs, and some of them cover several areas at once, which greatly complicates the process of harmonising strategic planning, as well as with the sustainable development indices, which are complex indicators and involve multilateral complicated calculations, made it possible to identify the following arguments for using the decoupling indicator as part of a harmonised approach to developing a national sustainable development strategy:

▪ decoupling is a simple indicator, as it expresses the ratio of two groups of factors;

decoupling measures the environmental impact of economic growth, that is, how great is the sacrifice of nature in favour of economic development and raising human living standards, how much anthropogenic factor is harmful to the environment, whether harmony is ensured between the existence of nature, society and economy. Thus, it reflects the three-dimensionality of sustainable development, and thus the objectivity of the assessment;

the indicators for calculating the decoupling index are available within the international, pan-European and national statistical systems, which simplifies the study and increases the validity of its results, as it ensures the consistency and continuity of dynamic series;

decoupling is a flexible indicator suitable for sustainable development studies at all levels: regional, national, (pan-European) international. It simplifies comparisons and international benchmarking, and helps to define an indicative norm for the level of achievement of selected indicators;

decoupling itself is defined as one of the main goals of the OECD Environmental Strategy.

In order to analyse decoupling of environmental pressure from economic growth and assess the efficiency of implementing the sustainable development concept, the decoupling index is used. The main approaches to determining the decoupling index are the methodology proposed by OCED (2002) and the P. Tapio (2005) methodology. The P. Tapio's one is the most common practice used in scientific studies by Ukrainian and foreign scientists, as it objectively allows for a more accurate analysis of decoupling, increasing the information content and validity of research results.

Therefore, the decoupling index is calculated using the following formula:

$$DI = (\Delta EP / EP_o) / (\Delta DF / DF_o); \qquad (1)$$

$$\Delta EP = EP_t - EP_o; \qquad (2)$$

$$\Delta DF = DF_t - DF_o, \qquad (3)$$

where EP – environmental pressure, DF – driving force, t – target year, o – base year. The driving force reflects economic growth in the country and is usually described at the national level by the GDP indicator (at the regional and local levels, as well as at the level of the economy sector, appropriate indicators are selected). The use of GDP rather than GNP increases the objectivity of the indicator, as it eliminates the factor of relocation of industrial production to third countries within the TNCs, in which case there will be economic growth in the country of origin, and environmental damage will not be reflected.

At the next stage of the study, the norm of the selected indicator for forecasting was determined, which should be used to guide the development and analysis of the effectiveness of the national strategy, which is a critical element of strategic planning for sustainable development, as it provides basic benchmarks, increases forecasting accuracy, supports alignment with global goals, promotes effective resource and risk management, and thus helps to create sustainable and successful strategies. In the context of harmonising strategic planning, the indicator was chosen based on the best practices of implementing the sustainable development concept in the world, as well as on the norms and standards of developed countries. The EU was chosen as the best example of a sustainable development economy due to the comparative analysis, based on the decoupling index, which was used to determine the norm of this indicator.

To interpret the results, P. Tapio's (2005) classification of the decoupling status was used, which, according to M. Yaremova & A. Mytrofanova (2022), introduces decoupling flexibility into the traditional decoupling model, which can further decompose the coupling state. This classification is presented in Table 1.

***Table 1.** Classification of the decoupling status*

$\Delta EP/EP_o$	$\Delta DF/DF_o$	Decoupling index	Decoupling status	
> 0	< 0	DI < 0	**Negative decoupling**	Strong Negative Decoupling (SND)
< 0	< 0	0 ≤ DI < 0.8		Weak Negative Decoupling (WND)
> 0	> 0	DI > 1.2		Expansive Negative Decoupling (END)
< 0	> 0	DI < 0	**Decoupling**	Strong Decoupling (SD)
> 0	> 0	0 ≤ DI < 0.8		Weak Decoupling (WD)
< 0	< 0	DI > 1.2		Recessive Decoupling (RD)
> 0	> 0	0.8 ≤ DI ≤ 1.2	**Coupling**	Expansive Coupling (EC)
< 0	< 0	0.8 ≤ DI ≤ 1.2		Recessive Coupling (RC)

Source: *developed by the author on the basis of P. Tapio (2005), Q. Wang et al. (2022)*

The decoupling index was calculated for the EU-28 and the EU-27 from 2020 for the period from 2015 (since the declaration of the Sustainable Development Goals at the UN General Assembly and, therefore, since their integration into national socio-economic development strategies) to 2023 (the latest year for which Eurostat statistical reporting was available at the time of the study). The study used data from the websites of the

Eurostat (Official website of Eurostat, 2019, 2024a), GMK's analytical and consulting centre (Yermolenko, 2023) and the global data and business intelligence platform Official website of Statista (2024).

At the next stage, using logical analysis, the most appropriate forecasting methods were selected in the process of harmonising the strategic planning of the state's sustainable development. Quantitative methods are preferred over qualitative ones, since statistical support for decoupling of environmental pressure from economic growth makes it possible to obtain sufficiently long, continuous dynamic data series, which, according to J.G. De Gooijer & R.J. Hyndman (2006), in cases where sufficient numerical data are available, quantitative methods are preferred, while in the absence of such data, judgmental approaches are preferred. It is proposed to apply the extrapolation method, which is designed to study the stable trends of socio-economic development formed in the past and present and transfer them to the future (International Labor Organization, 2023; GeeksforGeeks, 2024).

The forecast was made in Microsoft Excel 2016 with the use of such a tool as the Forecast Sheet, using the exponential smoothing method, which is characterised by simplicity, computational efficiency, ease of adjusting the response to changes in the forecasting process, and sufficient accuracy (Khomyak *et al.*, 2019; Lande, 2021).

In Microsoft Excel 2016, the Forecast Sheet employs the Holt-Winters Triple Exponential Smoothing (ETS) method with automatic determination of smoothing parameters for level, trend, and seasonality based on the data (Hyndman & Athanasopoulos, 2024). The general equation for forecasting using this method depends on the nature of the seasonality: additive or multiplicative, which Excel selects automatically based on data analysis.

In the additive model of the Holt-Winters method, the forecast for h periods ahead is determined as follows:

$$\hat{Y}_{t+h/t} = \ell_t + hb_t + S_{t+h-m(k+1)}, \qquad (4)$$

where $\hat{Y}_{t+h/t}$ – is the forecasted value for the t+h period; ℓ_t – is the current level; b_t – is the current trend; $S_{t+h-m(k+1)}$ – is the seasonality at t+h, which corresponds to the seasonality at time t+h-m(k+1).

The forecast equation in the multiplicative model for h periods ahead is as follows:

$$\hat{Y}_{t+h/t} = (\ell_t + hb_t)S_{t+h-m(k+1)}. \qquad (5)$$

This approach made it possible to obtain a reliable forecast based on time series with both stable and abrupt changes, adapting to newer data, which, compared to the data at the beginning of the time series, have a greater impact on the forecast results (Vocaire, 2022; Simplilearn, 2023). The priority of the method that gives more weight to the latest data in forecasting was given in the context of the subject of the study. Since all dimensions of sustainable development are dynamic systems, effective strategies in this case require taking into account the latest trends:

◾ in the economic dimension, the introduction of new technologies, policy changes, or global crises (financial crises, pandemics) rapidly change conditions, so taking into account the latest data in forecasting helps to more effectively adapt national sustainable development strategies to such changes;

◾ in the social dimension, public attitudes and behavior in the country, as well as demographic indicators, are not stable. Taking the latter into account helps to predict changes in the social sphere and plan appropriate actions to support sustainable development;

◾ unpredictable metamorphoses occur in the environmental dimension as a short- or long-term consequence of anthropogenic factors. Climate change, changing levels of pollution, destruction of ecosystems as a result of armed conflicts, speak in favour of using forecasting methods in strategic planning for sustainable development that take more account of the latest data and help set relevant goals.

The forecast was made for 3 years in accordance with the length of the original dynamic series, since the length of a reliable medium-term forecast should be no more than 30% of the length of such a series according to O.V. Kozyrieva (2021). In addition, I.Y. Kondrat (2000) and E. Ostertagova & O. Ostertag (2012) believe that the exponential smoothing method is effective for forecasting the near future.

Results and Disscusion

Environmental pressure can be measured by two factors: resource and environmental impact, hence the two different types of decoupling – non-renewable resource decoupling and environmental impact decoupling. Since non-renewable resource decoupling implies a disconnect between economic growth and the use of non-renewable resources in social and production processes, the pressure on the environment can be measured by indicators of natural resource consumption, such as FEC (final energy consumption), which is appropriate at the national level. In turn, the environmental burden, which reflects the gap between economic growth and ecosystem pollution by harmful emissions, is measured by the volume of emissions of economic waste into the atmosphere, among which the GHG (Greenhouse Gases) indicator is widely used for a valid assessment. The choice of indicators depends on the object and subject of the study.

Based on the results of Decoupling Index (DI) resource calculations in the EU, based on the methodology of P. Tapio (2005), which are presented in Table 2, the following conclusion is made: the dominant status of DI resource in the EU is weak decoupling, which indicates a slight increase in the consumption of non-renewable natural resources with insignificant economic growth,

that is, DI ≥ 0, but DI < 0.8 (Table 2). This means that the EU is introducing energy-saving technologies, developing alternative energy, promoting economical use of energy by households, but not to the extent required.

Table 2. *DI resource in the EU as a whole for the period 2015-2023*

Periods	ΔEP/EPo	ΔDF/DFo	DI	SND	WND	END	SD	WD	RD	EC	RC
2014-2015	0.021	0.037	0.58					+			
2015-2016	0.020	0.027	0.73					+			
2016-2017	0.012	0.042	0.29					+			
2017-2018	0.003	0.035	0.09					+			
2018-2019	-0.006	0.036	-0.17				+				
2019-2020	-0.082	-0.039	2.09						+		
2020-2021	0.067	0.087	0.78					+			
2021-2022	-0.014	0.086	-0.17				+				
2022-2023	-0.008*	0.007	-1.14				+				

Note: * calculated on the basis of the forecast indicator for 2023
Source: developed by the author on the basis of Official website of Eurostat (2024a; 2024b), H. Yermolenko (2023)

The results shown in Table 2 may indicate, on the one hand, the ability of the EU economy to maintain a stable level of production and income without significantly increasing the use of limited resources, and, on the other hand, a possible dependence on imports of limited resources. In order to offset potential negative trends, such as increased foreign economic dependence and environmental problems due to the inability to significantly reduce resource use, and to strengthen the already existing positive achievements in achieving the SDGs, it is necessary to implement innovative sustainable development strategies focused on integrating the latest technologies into all spheres of social and economic life to green them and increase the weight of renewable resources.

According to the results of DI impact calculations in the EU, based on the methodology of Tapio (2005), which are presented in Table 3, the following conclusion is made: the dominant status of DI impact in the EU is strong decoupling, which means reducing ecosystem pollution by harmful emissions while ensuring economic growth, that is, DI < 0 (Table 3). It is the achievement of strong decoupling, or absolute decoupling, that is the fundamental goal of the sustainable development concept, as it is ensured by adherence to the principles of the circular economy: energy and resource efficiency, eco-innovation, zero waste, economic stability, reasonable consumption, etc. Strong environmental impact decoupling means that the EU has been very successful in introducing environmentally friendly production technologies.

Table 3. *DI impact in the EU as a whole for the period 2015-2023*

Periods	ΔEP/EPo	ΔDF/DFo	DI	SND	WND	END	SD	WD	RD	EC	RC
2014-2015	0.009	0.037	0.23					+			
2015-2016	0.029	0.027	1.08							+	
2016-2017	-0.019	0.042	-0.46				+				
2017-2018	-0.016	0.035	-0.45				+				
2018-2019	-0.054	0.036	-1.51				+				
2019-2020	-0.052	-0.039	1.34						+		
2020-2021	0.038	0.087	0.44					+			
2021-2022	-0.040	0.086	-0.46				+				
2022-2023	-0.071	0.007	-10.12*				+				

Note: * calculated based on data for the third quarter of 2022 and 2023
Source: developed by the author on the basis of Official website of Eurostat (2024a; 2024b)

The results presented in Table 3 show that the EU economy is capable of cutting greenhouse gas emissions and thus preserving clean air, water, and soil while ensuring a decent standard of living for its citizens. In such circumstances, strategies to stimulate the development of green infrastructure, sustainable education, and investment in clean technologies will be effective in bridging the gap between economic growth and negative environmental impact.

Thus, the norm of non-renewable resource decoupling is weak decoupling status, and the norm of environmental impact decoupling is strong decoupling status. Forecasting the dynamics of DI resource and DI impact in the EU, the results of which are shown in Figures 1 and 2, reveals a positive trend in the indicators. The general trend is visually demonstrated by a tool in Microsoft Excel 2016 called the Trend Line, which clearly predicts a change in the values of indicators in the

direction below zero. In addition, it can be seen that the norm of non-renewable resource decoupling has a tendency to change from weak decoupling status to strong decoupling one by 2026 (Fig. 1). In contrast, the DI impact will remain within the strong decoupling status within the forecast period (Fig. 2).
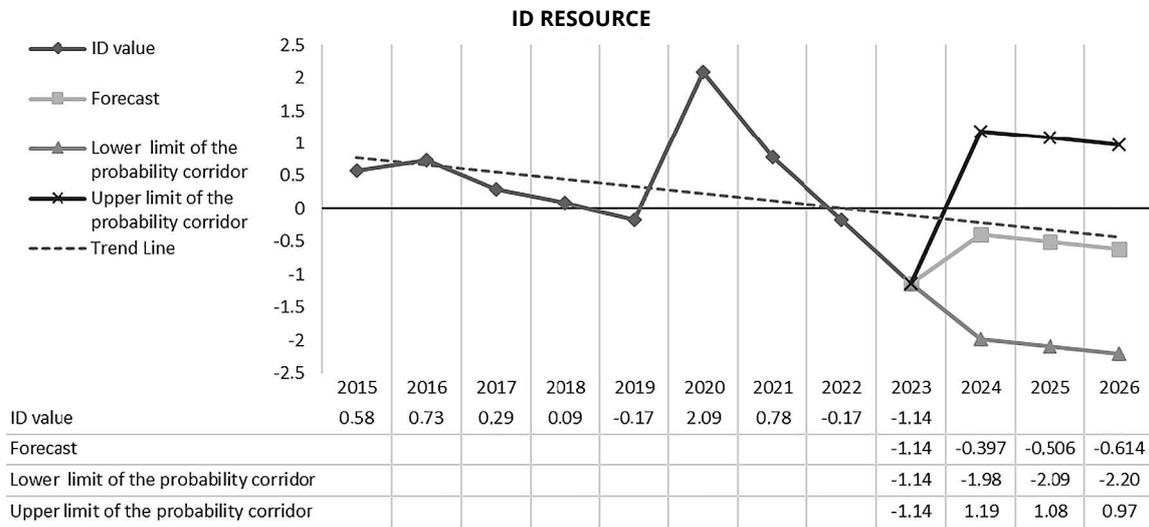
ID RESOURCE

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
ID value	0.58	0.73	0.29	0.09	-0.17	2.09	0.78	-0.17	-1.14			
Forecast									-1.14	-0.397	-0,506	-0.614
Lower limit of the probability corridor									-1.14	-1.98	-2.09	-2.20
Upper limit of the probability corridor									-1.14	1.19	1.08	0.97

Figure 1. *Forecasting the dynamics of DI resource in the EU as a whole until 2026 with the use of Microsoft Excel 2016*
Source: *developed by the author on the basis of R.J. Hyndman & G. Athanasopoulos (2024) and the data of Table 2*

ID IMPACT

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
ID value	0.23	1.08	-0.46	-0.45	-1.51	1.34	0.44	-0.46	-10.12			
Forecast									-10.12	-5.207	-5.905	-6.604
Lower limit of the probability corridor									-10.12	-11.18	-11.91	-12.64
Upper limit of the probability corridor									-10.12	0.77	0.10	-0.56

Figure 2. *Forecasting the dynamics of DI impact in the EU as a whole until 2026 with the use of Microsoft Excel 2016*
Source: *developed by the author on the basis of R.J. Hyndman & G. Athanasopoulos (2024) and the data of Table 3*
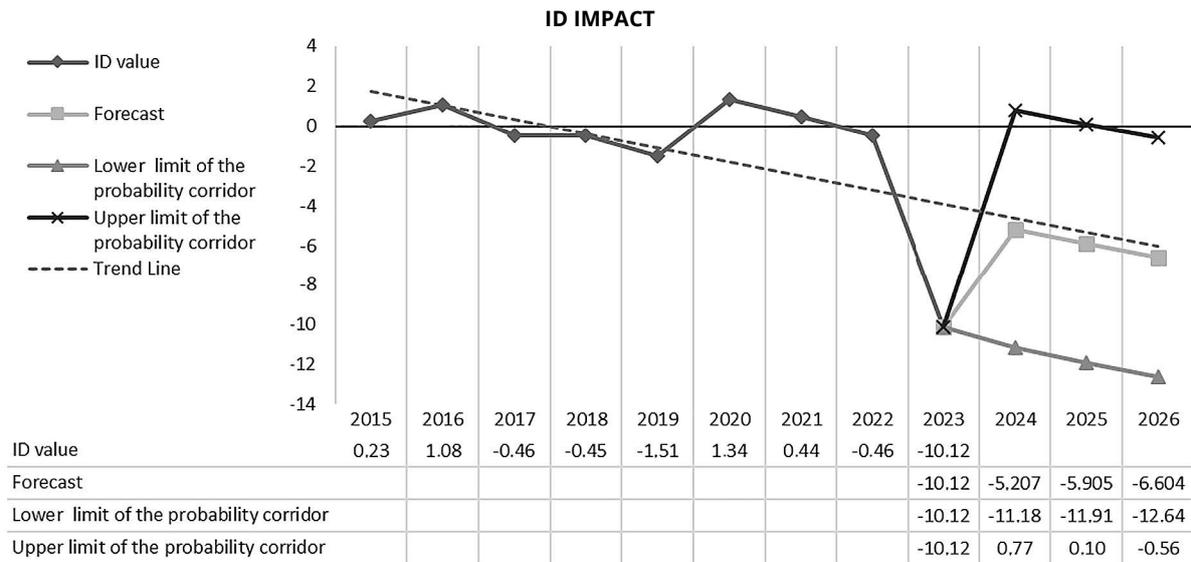
The graphs also show prediction interval in the values of the indicators, which helps to plan the best and worst possible limits when developing the strategy, allowing to maintain flexibility in responding to unforeseen changes in the internal and external environment of the socio-economic system, and to adapt to such challenges without significantly revising the strategy. As shown in Figure 1, the probability corridor of the forecast data allows taking into account such possible variations in the future values of DI resource as Strong Decoupling and

Coupling, which can be taken into account in risk management when making strategic decisions.

By analysing the range of fluctuations in the forecasted values of DI impact in Figure 2, the Forecast Sheet also provides additional information about the future dynamics of the indicator, such as its lowest and highest values, which range from Strong Decoupling to Weak Decoupling with a trend towards Strong one.

The practical value of this forecast is the possibility of raising awareness of the competent public authorities,

public organisations, researcher about the norm of decoupling of environmental pressure from economic growth and the prospects for sustainable development of the EU. The norm of the indicator should be used to harmonise national sustainable development strategies in terms of analysing the effectiveness of their implementation as of 2023 through international comparisons, and the data of the future dynamics of DI resource and DI impact in the EU should be used at such a stage of strategic planning as setting short- and medium-term goals when forming a goal tree as part of the development of new sustainable development strategies or adjusting existing ones, as forecasts, according to Z.E. Shershneva (2004), are the tools for setting goals which, by J.S. Armstrong (2000), are used as inputs to the planning process.

The expediency of applying the triple exponential smoothing method for forecasting sustainable development is supported by the existing experience in the research of scientists in this area. For example, D. Firoiu *et al*. (2019) and A. Boto-Álvarez & R. García-Fernández (2020), studying the progress in achieving the SDGs by European countries such as Spain and Romania, used the Forecast Sheet in Microsoft Excel 2016 based on time series of 10 time periods and 11 time periods, respectively. The indicators were used the EU Sustainable Development Goals indicator set (OECD, 2002) and a special statistical database of Eurostat. As a result, forecasts were made to determine to what extent the studied countries could achieve the SDGs by 2030.

Instead, in this article, a forecast of the sustainable development progress of the EU as a whole is made also using the Forecast Sheet, but on the basis of an indicator that is available for processing in the statistical systems of all countries, not only Eurostat, since in the context of the study subject, harmonisation of strategic planning requires unification of indicators for assessing the state's progress in sustainable development, that is, that all civilised countries use the same indicator, which, accordingly, should be reliably provided by national statistical databases, not only by Eurostat. In turn, the use of a large number of indicators (100 indicators) in the assessment process complicates international comparisons of results in terms of their comprehensive interpretation.

In addition, research results differ in the length of the forecast: the authors made a long-term forecast until 2030, which is 130% and 118% of the length of the time series (Firoiu *et al.*, 2019; Boto-Álvarez & García-Fernández, 2020), while the forecast in this article – 30%, according to the recommendations on O.V. Kozyrieva (2021). This may indicate the suitability of the used method also for long-term forecasts.

By comparing the results of the study obtained by applying the triple exponential smoothing method in Microsoft Excel 2016, it was found that all of them, as well as in this article, can be used in strategic planning for the sustainable development of the state. Thus, D. Firoiu *et*

al. (2019) hope that the data obtained in the course of the study will become a "starting point" for the relevant Romanian authorities to formulate an effective policy for the successful achievement of sustainable development goals, as well as to draw up effective plans. For their part, A. Boto-Álvarez & R. García-Fernández (2020) suggest that the conclusions reached in the research paper will help public authorities to realise the real state of affairs in the field of sustainable development in Spain and adopt relevant laws, develop policies that will allow for timely reorientation. This indicates the correct choice of the forecasting method in the context of the subject of the current study.

In turn, K. Chenary *et al.* (2024) made a forecast of the progress in achieving the SDGs for global regions by 2030 using smoothing by Holt-Winters' multiplicative technique to improve the accuracy of the moving average autoregressive model ARIMAX, which is an extended version of ARIMA, which, unlike its predecessor, takes into account external factors that affect the selected time period. The database was provided by The Sustainable Development Report, published by Dublin University Press, which uses official SDG indicators (232) endorsed by the UN Statistical Commission. The object of the study was geographic regions defined under the Area Codes for Statistical Use by the UN Statistics Division. To improve the model's performance, the predictors that are most likely to be influenced by artificial intelligence in the future were integrated into the forecast model by selecting filters. As a result of the study, a forecast of progress in achieving the SDGs for geographical regions of the world by 2030 was made. It uses exponential smoothing for long time series (2000-2022), resulting in a long-term forecast to 2030 which is 36% of the length of the time series, closely matching the forecast made in this paper.

The results of the study were obtained using Python programming in Google Colab, rather than Microsoft Excel 2016, which, in turn, is more accessible in use, as it supports traditional analytical tools, which is a key aspect in the harmonisation process. In addition, the authors' attention is focused on regions rather than countries, as they took into account the lack of data within the proposed methodology for individual countries (Chenary *et al.*, 2024). Thus, the database is well-stocked, but not applicable in the context of this study, as strategic planning for sustainable development implies the presence of subjectivity, which geographical regions do not possess. Moreover, among the shortcomings of the selected indicators, it is noted by the authors themselves that the SDGs are interconnected, a wide range of which, although leveled by the use of predictors, the latter, focusing only on the artificial intelligence factor, contribute to a decrease in the objectivity of the results. This confirms the expediency of choosing only one indicator to predict the sustainable development of the state.

The results of the study by K. Chenary *et al.* (2024), according to the authors, are intended to help governments and international organisations effectively allocate resources and prioritise their policies, to strengthen the consolidation of international economic actors around the achievement of the SDGs, and to effectively implement sustainable development strategies. This proves the practical feasibility of using the applied method in the field of strategic planning for sustainable development.

In turn, no examples of using the decoupling index as an indicator for forecasting the sustainable development of the state have been found. However, a number of scholars use it to develop regional development forecasts (Dong & Li, 2022; Yan *et al*., 2023; Liu *et al*., 2023). The method of building scenarios using analytical models is applied. As in the article, the P. Tapio (2005) methodology is employed to calculate the DI impact based on different groups of factors. The object of the study is both regions and industries, which makes the results significant for improving strategic planning for sustainable regional development and coordinating sectoral policies implemented in the regions. Such research experience can also be used in strategic planning for the sustainable development of the state to ensure balanced development and effective management of resources and potential of each region. This testifies in favour of the universality of the decoupling index as an indicator for assessing progress in achieving the SDGs, which is a significant characteristic in the context of unification of indicators for assessing the progress of sustainable development of the world's states as the most effective way to promote harmonisation of strategic planning for sustainable development of the state.

Conclusions

As a result of the study of the problem of application of forecasting methods in the process of harmonisation of strategic planning for sustainable development of the state, the most appropriate forecasting method has been identified and tested. The results are of particular importance at such a stage of strategic planning as goal setting. On the one hand, the proposed indicators and

method can be used by countries planning sustainable development at the national level to study the current state of sustainable development and identify future trends, which will allow setting realistic achievable goals; and on the other hand, the possibility of studying foreign experience and international comparison of indicators will allow setting relevant goals, which will contribute to the harmonisation process.

A harmonised approach to strategic planning of the state's sustainable development is crucial in terms of ensuring the coherence of national sustainable development policies. The use of forecasting methods in the harmonisation process allows for the development of strategies that take into account both current needs and future challenges based on international standards and unified methodological tools; it provides for the creation of effective monitoring and evaluation systems to track progress towards the SDGs, and thus makes it possible to identify problems in a timely manner and adjust strategies to improve their effectiveness.

Problem is a promising area of scientific research to ensure the effective implementation of the global concept of sustainable development. The obtained results provide the basis for further research on the problem of applying forecasting methods in the context of harmonising the strategic planning of sustainable development of the state. The fast development of the latest technologies provokes ongoing research to find optimal methods for forecasting sustainable development in the context of rapidly changing technological generations.

The results of the study contribute to the further discussion on the feasibility of finding universal indicators of progress in achieving the SDGs, which would be ensured by the statistical bases of all countries, as well as on ways to improve approaches to evaluating and monitoring the effectiveness of national sustainable development strategies.

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Застосування методів прогнозування в гармонізації стратегічного планування сталого розвитку держави

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Анотація. Успішна реалізація глобальної концепції сталого розвитку вимагає гармонізації стратегічного планування сталого розвитку держави для забезпечення ефективного моніторингу прогресу держав у досягненні Цілей сталого розвитку. Метою дослідження є актуалізація проблеми застосування методів прогнозування в процесі гармонізації стратегічного планування сталого розвитку держави та розробка методичного інструментарію для її вирішення. У ході дослідження на основі застосування таких методів, як: огляд літератури, гіпотетико-дедуктивний метод, метод порівняння, емпіричний метод та логічний аналіз, обґрунтовано доцільність, розроблено методичний інструментарій та апробовано метод потрійного експоненціального згладжування Холта-Вінтерса на основі довготривалого часового ряду з використанням «Листа прогнозу» в Microsoft Excel 2016. В рамках гармонізованого підходу до стратегічного планування сталого розвитку для оцінки прогресу країни у сфері сталого розвитку використовувалися індикатори відокремлення екологічного тиску від економічного зростання, оскільки вони є простими, вимірюваними та гнучкими. На основі методології Тапіо визначено норматив показників декаплінгу невідновлюваних ресурсів та декаплінгу впливу на довкілля як орієнтир для розробки та аналізу ефективності національної стратегії сталого розвитку, а також зроблено прогноз динаміки цих показників в цілому по ЄС до 2026 року, як лідера в озелененні економіки. Отримані результати дозволили виявити основні тенденції сталого розвитку ЄС на основі класифікації статусу декаплінгу. Отримані результати сприяють гармонізації національних стратегій для забезпечення успішної реалізації глобальної концепції сталого розвитку, можуть бути використані на такому етапі стратегічного планування, як формування дерева цілей, що дає можливість ставити як досяжні, так і релевантні цілі, а також при оцінці ефективності стратегій у досягненні Цілей сталого розвитку

Ключові слова: цілі сталого розвитку; експоненціальне згладжування; декаплінг; гармонізований підхід; національна стратегія; уніфікація
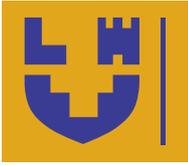
Tools for financing local economic development of local communities

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Abstract. The study examined the specific features of using the instruments of financing the economic development of territorial communities on the example of Ukraine. Economic and statistical analysis methods were used to process the data, including the Wilcoxon signed-rank test for comparing growth trends. The study identified the most common sources and tools for financing the economic development of local communities, in particular tax revenues, grants, loans, public-private partnerships. The financial instruments of local economic development in the UK, Denmark, and Slovenia were analysed, focusing on their flexibility, adaptability, and efficiency. The importance of integrating the best practices of these countries into the strategic financial management of territorial communities of Ukraine is substantiated. Specific recommendations for implementing successful international experience are proposed. It is recommended that Ukraine introduce monitoring and control systems similar to the British ones to ensure strict control over local budget expenditures, which is important for the stability and transparency of financial governance; consolidate or redistribute competencies in favour of larger communities, increase the share of local taxes, and introduce financial equalisation mechanisms to reduce financial inequality and ensure equal opportunities for all communities, as the Danish experience has shown. According to the Slovenian experience, it is necessary to develop clear standards for the provision of services, create independent supervisory authorities to monitor the effectiveness of local budgets, introduce fiscal decentralisation, and increase the share of local taxes to increase the autonomy of local authorities and reduce the disparity in the level of services between regions. The results obtained emphasised the importance of using an integrated and integrative approach to the development and management of financing tools for the local economic development of territorial communities. The practical significance of the study's findings is manifested in the provision of specific recommendations on the use of various financing instruments, such as local guarantees, municipal bonds, and loans from international financial institutions and grants from international donors. These recommendations can help determine investment priorities and improve investment planning and management processes, which is important for the development of territorial communities

Keywords: regional public administration; tax revenues; grants; subventions and subsidies; public-private partnership; state budget; local budget

Introduction

The development of territorial and local communities is one of the priority tasks of both legislative and executive authorities of any country. This task is carried out within the framework of the implementation of the goals of budget and financial decentralisation, which are aimed at improving the efficiency of redistributing budget funds received from taxpayers. As noted by S. Tulumello *et al.* (2019), local communities should become not only passive recipients of state resources, but also active and responsible participants in the development of their territories.

In the context of decentralisation, communities receive more powers and resources to independently solve local problems, which means that they must not only accept state subventions, but also actively attract

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various financial instruments for the implementation of economic development projects. It is financial instruments that can provide the necessary level of financial support for the implementation of ambitious projects aimed at improving infrastructure, improving the standard of living of residents and the overall economic development of territories (Antunes Jr. *et al.*, 2021).

The use of financial instruments requires communities not only to be proactive, but also to have a high level of financial literacy and the ability to manage debt obligations (Putra & Iswanto, 2024). Unlike grants, financial instruments provide for a return on invested funds, which imposes additional responsibility on communities for the efficient use of these resources. Therefore, for the successful implementation of development projects, it is necessary not only to receive funding, but also to ensure effective planning and management of financial resources.

Different countries have their own unique experience in using tools to finance local economic development, which reflects the specifics of their economic, political, and social conditions. In the UK, the application of local taxes and investment strategies has effectively ensured financial stability and support for regional development. In a Scandinavian country such as Denmark, high efficiency in managing the financial resources of local governments has been achieved through decentralisation and cost optimisation, which has contributed to economic growth and social equality (Kjaer, 2021). In Slovenia, the emphasis on fiscal instruments to support sustainable regional development has helped to reduce social and economic inequality by ensuring sustainable growth of local communities (Ministry of Finance of the Republic of Slovenia, 2024). Thus, these examples demonstrate the diversity of approaches to the use of local development financing instruments, emphasising the importance of adapting financial instruments to local conditions and needs. The use of international experience requires consideration of the characteristics and capabilities of each country, which allows creating more effective and sustainable models for managing local finances.

As noted by Y. Guan *et al.* (2024), despite the existing experience of using financial instruments to stimulate the development of local communities, state executive bodies and local governments still face many difficulties in its understanding and effective use. Consequently, financial instruments remain an important element in the implementation of various local community development projects. The analysis of publications in the field of financing the economic development of local communities revealed a number of main areas. Local communities as subjects of local self-government. V. Radich & O. Bryginets (2020) explored the role of territorial communities as primary subjects of local self-government, where they emphasise the importance of communities as the main participants in local self-government processes, which is important for

understanding their financial autonomy and ability to implement economic development.

V. Morretta (2021) considered the concept of territorial capital as an important element of endogenous economic development, and also emphasised the role of local resources and institutional opportunities in stimulating economic growth at the level of local communities. O.I. Laiko *et al.* (2023) analysed the organisational and economic principles that ensure the preservation and sustainable development of territorial communities on the example of Kuialnyk Estuary. The study highlighted the importance of sustainable development and conservation of natural resources in the context of local economies.

R. Kostyukevich *et al.* (2020) analysed the impact of European integration processes on the investment potential and institutional maturity of rural communities. An important aspect of the study was the impact of international integration on the development of local economies and improving the investment climate. A. Afonso & A. Venâncio (2019) examined the impact of local government reforms on the effectiveness of regional spending. The researchers found out how changes in the structure of local self-government can increase the efficiency of using budget funds. This study provided insight into how local government reforms can affect financial performance at the local level. K. Akapelwa & A. Mwange (2023) conducted a review of local government funding theories, which is important for understanding different approaches to ensuring the financial sustainability of communities.

Gaps in the research of financial support and management of territorial communities are manifested in the insufficient adaptation of theoretical models of financing to real conditions and dynamic changes in the financial environment, supplemented with specific examples of the application of fiscal instruments and methodologies in various regional contexts. In addition, specific strategies for managing the development of local communities remain insufficiently investigated, which indicates the need to integrate new approaches and consider local realities in their implementation.

The purpose of the study was to highlight the specific features of using financing technologies in the system of socio-economic development of territorial communities in Ukraine. To achieve this goal, the following tasks were set:

1. To identify the most common sources and tools for financing the economic development of local communities.

2. To analyse tools for financing local economic development of local communities in the UK, Denmark, and Slovenia.

3. To develop recommendations for implementing the successful experience of countries in improving the use of tools for financing local economic development of territorial communities for Ukraine.

Materials and Methods

The study systematised information about available financial instruments that are most often used in the practice of territorial or local communities. The United Kingdom, Denmark, and Slovenia were chosen to examine the economic development of local communities for the following reasons. The UK is characterised by a long history of decentralised governance and extensive use of financial instruments to support local communities. Denmark demonstrates a successful model of a social state and a high level of local autonomy, which ensures the effective use of financial instruments for economic development. Slovenia is represented as a central and Eastern European country that has implemented significant local government reforms since joining the European Union.

To investigate the financial instruments of local communities in the UK, statistics on local community income for 2017-2022 were collected (Department of Levelling Up, Housing and Communities, 2023). This data included information on grant income and local communities' own income, expressed in millions of pounds. Data collection was carried out from official sources such as government reports, national statistical services and financial reports of local councils, in particular, Worldwide Tax Summaries (2024); Ministry of Finance of the Republic of Slovenia (2024); Organisation for Economic Co-operation and Development (2021). The sources of the Department of Levelling Up, Housing and Communities (2023) and the data of the Decentralisation Reform (2014) by the Government Portal of Ukraine were also considered. The data was ordered and systematised for further analysis. An economic and statistical analysis was carried out using the Wilcoxon signed-rank test, which was used to compare income levels and analyse their changes over time, which helped to determine trends and patterns in the financing of local communities. Next, graphical models were built that illustrated changes in grant revenues and local communities' own incomes for 2017-2022. In addition, a correlation analysis was carried out to determine the relationships between different sources of income of local communities and their impact on the overall level of economic development.

Further, the tools for financing the economic development of local self-government were studied on the example of Denmark. For this purpose, statistical data on the number of local communities were collected and a map was built that allowed visualising the results of the reforms carried out in Denmark and reflected changes in the administrative and territorial structure of the country caused by reforms aimed at optimising and enlarging communities.

To analyse the sources of funding for local communities in Slovenia for the period 2018-2023, the time series analysis method was used, which allowed studying the dynamics of changes in financial revenues, identifying seasonal fluctuations and trends, and predicting future values based on available data. Data for analysis were collected from official sources, such as national statistical services and local council financial reports (Ministry of Finance of the Republic of Slovenia, 2024). The statistics included information on local taxes, government subsidies, grants from the European Union, and other financial revenues expressed in millions of EUR. At the final stage, the structure of local budget revenues of Ukraine for the period from January 1, 2024 to April 4, 2024 was analysed (Decentralisation, 2024). Based on the results of research on the experience of Great Britain, Denmark, and Slovenia, a number of recommendations were created for implementing their experience in the practice of Ukrainian territorial communities.

Results

Sources and instruments for financing the economic development of local communities

The main instruments and sources of financing are tax revenues, which include local taxes such as property tax, corporate income tax, and land tax. It is worth noting that such tax revenues provide the main financial resource for the implementation of local projects and cover the costs of social services and infrastructure. Non-tax revenues, such as service fees, fines, and rental income from public property, while less significant, are also important for the financial stability of the community.

Capital revenues generated from the sale or lease of capital assets can be used to finance large infrastructure projects or replenish reserve funds. Communities also often receive financial assistance in the form of grants and donations from national and international organisations, which contributes to the implementation of specific development projects. Transfer revenues, including subsidies and subventions from the state budget, help equalise financial opportunities between territories and cover local budget deficits.

It is also worth adding that local communities can attract loans and borrowings from commercial banks or through bond issues to finance large projects, but this requires careful debt management. Public-private partnerships allow the private sector to be involved in the implementation of infrastructure projects, which reduces the financial burden on local budgets. Investment funds can provide capital for long-term development projects, while crowdfunding and local initiatives allow attracting resources from residents and businesses to finance local projects.

In general, the effective use of these sources and instruments of financing is important for ensuring the sustainable economic development of local communities. The development and implementation of new financial instruments, such as public-private partnerships and crowdfunding, can significantly improve and innovate the financial situation and contribute to the implementation of important initiatives.

Features of financing local economic development of local communities: international experience
Successful financing of the economic development of territorial communities is a significant factor for ensuring their sustainable growth and improving the quality of life of the population. International experience demonstrates a variety of approaches and strategies that can provide valuable lessons for improving financial mechanisms at the local level.

The UK has a complex three-tier system of local government that includes counties and districts. Regions have very limited functions and are not considered local governments for funding purposes. The main levels of local government are counties and districts. There are 89 counties that are divided into several types, each of which has its own characteristics. London has a unique governance system – the Greater London Authority (GLA), which includes the elected London Assembly and the Mayor of London. London is divided into 32 parts and a separate unit – the City of London. Other counties in England include metropolitan counties, where administrative units cover major cities and provide services through districts, unified administrative bodies that combine the functions of counties and districts, and two-tier non-conglomerate counties, where counties provide basic services and districts have a limited role (Herczyński, 2019).

Local governments in the UK receive income mainly from two sources: grants and their own income. Grants are divided into several categories. An Income Support Grant is an equalisation grant used for general expenses, and its distribution is determined by a formula that takes into account local income, service costs, and demographic data. This grant is adjusted annually depending on financial calculations. Targeted grants under organised external funding include a number of specialised grants, such as an Education Grant (72% of the AEF) and a Health Grant (9%). There is also a Police Support Grant, which is used to fund local police forces and is partially supplemented by council tax revenue. Aggregate External Finance (AEF) is an aggregate indicator used in the local government financing system in England. It includes all forms of grant revenue from the central government that are not part of regular transfers and that local authorities can use to finance their expenses. It is worth noting that the AEF in England covers several types of grants, in particular: a grant aimed at financing education, a grant to finance public health, a grant to support students from low-income families, a grant provided to encourage the construction of new housing units (Organisation for Economic Co-operation and Development, 2021).

Table 1 demonstrates the dynamics of local community incomes in the UK for 2017-2022, divided into grant and own revenues. Grant revenues were marked by fluctuations, with the highest rates during the COVID-19 pandemic due to additional grants, but generally showed a downward trend. Communities' own revenues also changed, with some growth at the beginning of the period and a subsequent slight decrease.

Table 1. *Income of local communities in the UK for 2017-2022, million GBP*

Income category	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
Grants					
Revenue Support Grant	4.383	1.493	700	1.657	1.629
Police Support Grant	7.838	7.713	7.669	7.987	8.228
AEF	43.333	42.81	42.656	51.215	50.333
Grant to support local services	39	24	30	22	28
COVID-19 general and revenue grants	-	-	-	6.622	2.871
Grants outside the AEF	22.562	20.704	18.007	16.879	15.293
Grants to the housing income account	159	207	191	236	198
Capital expenditure grants	8.934	9.867	8.702	9.262	10.195
Total grant revenue	87.249	82.817	77.955	93.879	88.775
Own revenue					
Municipal tax	30.454	32.001	33.183	34.04	34.434
Revenue from the bid retention scheme	16.707	19.454	18.163	17.323	17.695
External interest income	1.288	1.631	1.781	1.522	1.611
Capital receipts	3.051	3.421	2.358	2.105	2.364
Sales, fees, and charges	14.028	14.268	14.056	11.426	13.832
Rent of councils	7.724	7.744	7.543	7.426	7.087
Other income and adjustments	20.911	20.648	20.925	21.321	21.238
Total own income	73.252	78.52	77.084	73.842	77.023
Total revenue	181.411	181.985	175.964	189.042	187.036

Source: *compiled by the author based on Department of Levelling Up, Housing and Communities (2023)*

The UK's own income includes revenues from local taxes, in particular the commercial real estate tax, part of which remains in local budgets. In addition, there are grants outside the AEF that target the management of specific services, such as housing assistance, which is administered by third-party organisations through subsidies from the Ministry of Labour and Pensions (Fig. 1).
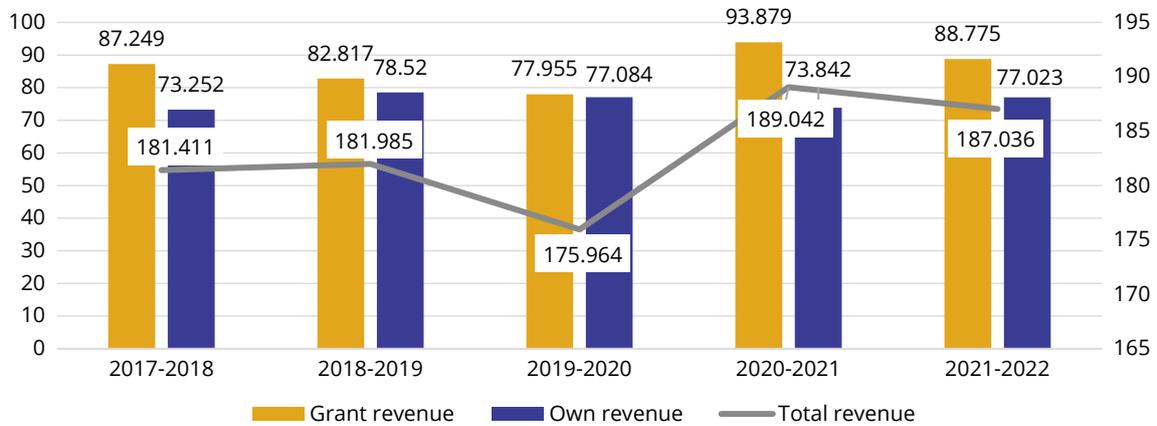

Figure 1. *Grant revenue and own revenue of local communities in the UK, million GBP for 2017-2022*
Source: *compiled by the author based on Department of Levelling Up, Housing and Communities (2023)*

The table of local community incomes for 2017-2022 showed important trends in financing. Total grant income has certain fluctuations, with a decrease in the period in 2019-2020 and an increase in 2020-2021. AEF grants showed steady growth from 49.66% in 2017-2018 to 56.85% in 2021-2022, indicating that local governments are increasingly relying on these grants to finance their needs, which can be both positive (increased resources for important projects) and negative (dependence on unstable sources of funding). Own revenues also showed interesting trends. The municipal tax increased throughout the period, from 16.78% to 18.43%, which indicates a stable level of tax revenues. On the other hand, income from capital revenues and sales declined, which may indicate a decrease in assets or a change in the economic situation in the region. It is worth noting that since the UK is an economically developed country, the government can easily delegate some of its financial obligations to local authorities. This obliges local governments to look for new sources of income to cover their expenses and fulfil their existing responsibilities.

Denmark's local government system has a long history of creating parishes that deal with local affairs and provide services to residents within walking distance of the church. After the Reformation, these parishes partially merged, but remained quite small. Since the beginning of the 19th century, the development of a modern fiscal system of local self-government began, when the state delegated some of the powers to local authorities, including road maintenance, social assistance and primary schools, which were financed through co-financing from the state budget until 1970. Major local government reforms in Denmark took place in 1974, when more than 1300 local administrative divisions were merged into 277 municipalities and 14 counties. These reforms coincided with the national welfare state development programme, which required new, larger municipalities to provide basic social services such as child care, education, and care for the elderly, leading to higher tax rates that rose from 15% in 1975 to 25% in 2013. In 2007, there was a second wave of reforms, which included the subsequent merger of municipalities to 98 units and counties to 5 regions, the redistribution of competencies and funding reform, which included a new block grant and equalisation scheme (Kjaer, 2021). Figure 2 shows a map of Denmark, taking into consideration the implementation of structural reform.
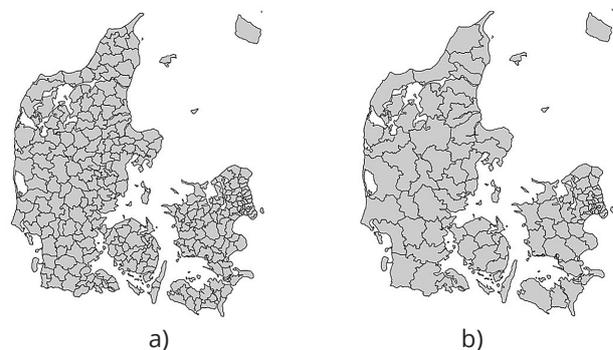

a)   b)

Figure 2. *Map of Denmark taking into consideration the implementation of structural reform (a) before 2007 and (b) after 2007*
Source: *compiled by the author based on U. Kjaer (2021)*

Funding for local communities in Denmark is provided through several main sources, including tax revenues and inter-budget transfers. The main sources of funding include tax revenues and inter-budget transfers. Tax revenues consist of personal income tax, which is the main source of income for municipalities, and property tax, which includes taxes on residential and commercial real estate. Inter-budget transfers include block grants from the state budget, which help equalise financial opportunities between different municipalities and amounted to approximately DKK 40 billion in 2020 (Worldwide Tax Summaries, 2024), and equalisation grants that compensate for financial inequalities between municipalities. In addition, municipalities receive capital revenues from the sale of assets and other sources. Table 2 shows the rates of some local taxes, which are a source of funding for local communities in Denmark, as of 2024.

Table 2. *Rates of some local taxes, which are a source of funding for local communities in Denmark, as of 2024*

Local taxes	Rate, %
Municipal tax	25.067
Church tax	0.65
Labour market tax	8
Land tax	2.8

Source: *compiled by the author based on Worldwide Tax Summaries (2024)*

Since the 2007 reform, local communities in Denmark do not have the right to collect taxes (previously, the second level of local self-government collected taxes, but most of these powers were transferred to municipalities). Revenues of Danish municipalities include block grants from the national budget and contributions from municipalities in the form of co-financing of services. Health funding includes a block grant from the national budget and co-financing of hospitals by municipalities, which accounts for more than 90% of all county revenues. Regional development is financed by block grants from the national budget and co-financing from municipalities. Social services and special education are funded by municipalities on a fixed basis (on a paid basis). The system of financing local communities in Slovenia provides for uniform rules for all municipalities, regardless of their size or specifics. The main goal of this system is to ensure equal opportunities to meet the needs and interests of citizens in all municipalities. Funding for municipalities in Slovenia comes from three main sources (Table 3). Figure 3 shows the sources of funding for local communities in Slovenia for 2018-2023 in millions of EUR.

Table 3. *Tools and sources of funding for local communities in Slovenia*

No.	Tools and sources	Explanation
1	Own resources	Municipalities independently generate more than 90% of their resources. Own resources include: income tax (54% of tax realised in the year before), land and real estate use tax, water transport tax, real estate turnover tax, inheritance and gift tax, tax on winnings from traditional gambling, tourist tax, municipal taxes, administrative fees and charges, environmental taxes, fines, property income (rent, concession fees), municipal contribution, contributions from citizens and surcharges for certain programmes, self-taxation, capital gains and donations.
2	Transfers from the state budget and EU funds	These are additional funds that municipalities receive to support their activities and infrastructure development, which help to ensure the financial stability of local communities and equalise their capabilities.
3	Borrowing	Local territorial communities also have the right to take out loans to finance their projects and initiatives. Local communities in Slovenia can borrow from the state budget, from Slovenian banks or savings banks authorised by the Bank of Slovenia to provide banking services, and from state funds that provide loans. These borrowings are used for the implementation of the municipal budget in the current year, investment and debt management of the municipal budget. Municipalities included in the unified treasury account system of the state or municipality may also take debts from the asset manager of the unified treasury account system. For projects that are co-financed from the EU budget, they can take out debts in the amount of approved funds and for the period until they receive these funds. The amount of borrowing for the implementation of the municipal budget and debt management is determined by the decision on the adoption of the budget, and to ensure liquidity, borrowing can amount to up to 5% of the total amount of expenditures of the last adopted budget. The Municipal Finance Act regulates the maximum amount of borrowing.

Source: *compiled by the author based on Ministry of Finance of the Republic of Slovenia (2024)*
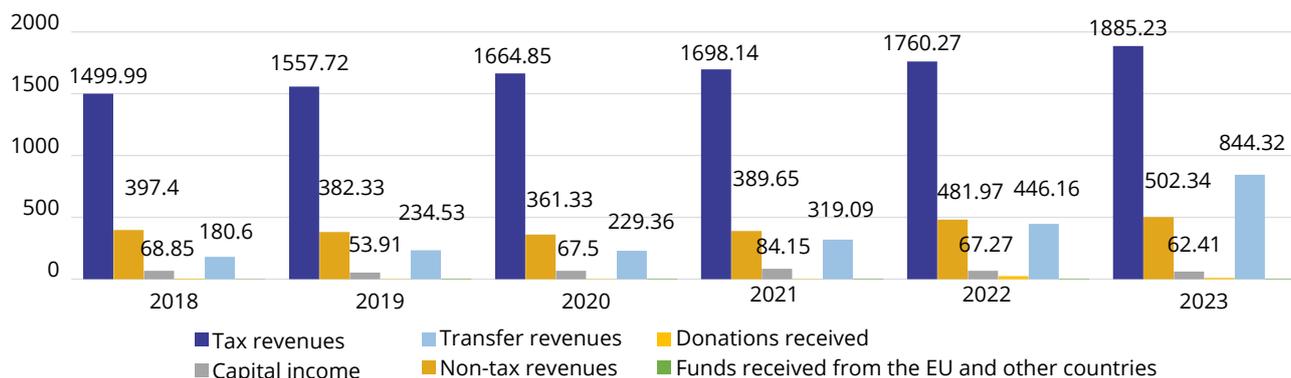
Figure 3. *Sources of funding for local communities in Slovenia for 2018-2023, million EUR*
Source: *compiled by the author based on Ministry of Finance of the Republic of Slovenia (2024)*

It is also worth noting that the law on municipal financing regulates the financing system equally for all municipalities and defines the tax base, tax rates, taxpayers, and grounds for granting benefits. In addition, municipalities independently set compensation rates for the use of land plots for construction through their regulations. Such a system is aimed at ensuring the financial independence and stability of local communities in Slovenia, allowing them to effectively perform their functions and meet the needs of citizens.

Financing of municipalities in Slovenia is carried out based on the *primerna poraba* (appropriate costs) system, which ensures equal financial opportunities for all municipalities to perform mandatory tasks. This procedure begins with the calculation of the average cost per inhabitant (povprečnina). The calculation methodology is determined by the government using data from the last four years. The Ministry of Finance prepares the estimates and sends them to representative associations of municipalities for their opinions. Based on the calculated povprečnina, a credit amount is determined for each municipality to complete mandatory tasks. If the share of income tax revenues does not cover these expenses, the state provides the necessary funds through financial equalisation (Ministry of Finance of the Republic of Slovenia, 2024).

The development of municipalities is assessed based on economic development (gross value added per employee, income tax base per resident, number of jobs). This systematisation of financing helps to ensure the stable development of municipalities and their financial autonomy.

Features of financing local economic development of territorial communities of Ukraine and recommendations for implementing the successful experience of countries in improving it
Financing of territorial communities in Ukraine is based

on several main sources. The main ones are local taxes and fees, such as property and land taxes, and a single tax for entrepreneurs. In addition, a significant part of the budget is formed by state transfers in the form of subventions and subsidies that are directed to education, healthcare, and other social needs. Territorial communities also receive grants and funding through international programmes and national initiatives that support infrastructure projects and the development of local initiatives. In addition to traditional sources of financing, communities have the opportunity to attract loans and borrowings for the implementation of large projects. Investment projects and public-private partnerships also play an important role in financing, allowing the private sector to be involved in infrastructure development. Support for local entrepreneurship through consulting services, soft loans, and other tools contributes to economic growth and improves the quality of life in communities.

After the start of the reform in 2014, the united territorial communities received the same powers and resources as cities of regional significance, including the transfer of 60% of personal income tax to their local budget (Decentralisation Reform, 2014; Decentralisation, 2024). In addition, they fully retain local revenues from the single tax, corporate income tax and financial institutions of communal property, and property tax. This allows communities to independently solve issues, such as road repairs or the construction of new schools, without waiting for funding from the region. In addition, they can use additional revenues to attract investment and develop local businesses, which will help to create new jobs and increase the economic potential of the community. Figure 4 shows the structure of local budget revenues for the period 01.01.2024-04.04.2024. Based on the processed information, Table 4 systematises the main problems in financing the economic development of territorial communities of Ukraine as of 2024.
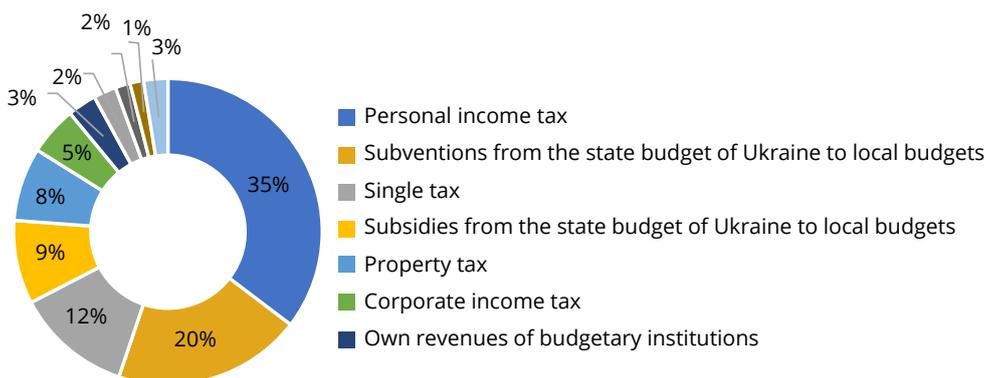
Figure 4. *Structure of local budget revenuesfor 4 months of 2024 (01.01.2024-04.04.2024)*
Source: *compiled by the author based on Decentralisation (2024)*

Table 4. *Main problems in financing the economic development of territorial communities in Ukraine as of 2024*

No.	Problems	Explanation	Author's comment
1	Instability and insufficient budget revenues	Local budgets often face instability and insufficient revenue from taxes and fees due to the economic difficulties associated with the war. For example, declining economic activity and the destruction of businesses in a war zone reduce tax revenues.	The instability of tax revenues, combined with the war, creates serious challenges for financing vital services and infrastructure.
2	Imbalance between income and expenses	The imbalance between income and spending is exacerbated by increased spending on defence and social needs, which leads to local budget deficits. The war also affects the increased cost of restoring infrastructure.	To avoid budget deficits, effective methods should be developed to reduce costs and manage resources, especially in the context of restoring destroyed facilities.
3	Unsatisfactory access to government transfers	The distribution of transfers may be inefficient or delayed due to administrative difficulties. For example, delays in allocating funds for the restoration of infrastructure in a war zone.	It requires improving the transfer distribution system and reducing bureaucratic barriers to speed up the financing of critical projects.
4	Difficulties with access to loans and borrowings	Local communities face problems accessing loans and borrowings due to increased risks, high rates, or limited availability of funding in times of war. Many financial institutions may be more careful when issuing loans.	It is important to establish mechanisms to support local budgets to ensure access to funding, possibly through government guarantees or special programmes.
5	Insufficient effectiveness of public-private partnerships	Public-private partnerships are often difficult due to the uncertainty and risks associated with war. Private investors may be less likely to invest in projects in conflict zones or high-risk environments.	There is a need to develop new and more relevant methods of attracting investors and to ensure greater transparency and credible safeguards to enhance cooperation.
6	Limited opportunities for investment in local entrepreneurship	The war leads to a decrease in investment in local entrepreneurship due to high risks and economic instability. Local entrepreneurs may face problems accessing funding and resources.	It is necessary to provide support for entrepreneurs, including soft loans and grants, to stimulate economic activity and recovery.

Source: *compiled by the author based on T. Vasyltsiv et al. (2021), M. Bondarchuk et al. (2022), M. Patynska-Popeta & T. Zinchuk (2022)*

The analysis of the problems of financing the economic development of territorial communities in Ukraine in the context of a long war highlights a number of existing problems faced by local budgets. The instability of tax revenues, the imbalance between income and expenditure, problems with access to credit and loans, corruption and inefficient management mechanisms pose serious challenges to ensuring sustainable regional development. To overcome these problems, Ukraine should pay attention to the successful experience of other countries that demonstrate effective models for financing local development. The study and adaptation of best practices, such as transparent mechanisms for the distribution of public transfers, support for public-private partnerships and effective use of international funding, can significantly improve the situation. The recommendations include the introduction of new financial instruments, reforms in the field of public administration, and the development of mechanisms to support local entrepreneurship, which can provide more stable

and effective financing for the economic development of territorial communities.

Based on the experience of Great Britain, several areas of implementation of the English successful experience in the practice of territorial communities of Ukraine can be distinguished. Ukraine should introduce a system of high level of trust in local authorities. In the UK, local authorities enjoy significant autonomy, including delegating certain functions, such as school management, without the direct involvement of municipalities. This is possible due to the high trust in local institutions. Ukraine should consider mechanisms that promote such trust, ensuring the autonomy of local authorities while adhering to clear standards of control and monitoring. It is also necessary to adapt systems for monitoring and controlling local finances. The UK has a centralised structure, such as the National Audit Service, which provides strict control over local budget expenditures. Ukraine should introduce effective monitoring mechanisms, including regular reports on the financial stability of local budgets, in particular, for small and financially weak territorial communities.

It is worth considering the experience of the UK in using grants to equalise financial opportunities. England uses income support grants to help offset differences in income and spending between different regions. Ukraine should introduce such equalisation tools, which will reduce financial imbalances between territorial communities and ensure equal access to social services. In addition, attention should be paid to the importance of property taxes as an important source of income. In the UK, property taxes (municipal tax) are a significant source of local income. Ukraine needs to consider increasing the role of real estate taxes and introducing new types of taxes to increase the financial resources of local authorities. In general, the implementation of the English experience in Ukraine should consider local conditions and specifics, but the basic principles of trust in local authorities, effective control, financial equalisation and use of taxes can significantly improve the financial stability and effectiveness of local government in Ukraine.

According to Denmark, Ukraine should consider reducing the number of local communities and increasing their size to increase financial and managerial capacity, which will provide better access to experts, increase fiscal capacity, and manage its own affairs more effectively. In cases where consolidation is politically impossible, it is necessary to consider reallocating some competencies in favour of larger and financially stronger neighbouring communities, which will contribute to the financial sustainability of smaller communities. The second important area is to increase the financial autonomy of local communities by increasing the share of local taxes. The use of block grants and financial equalisation mechanisms similar to those in Denmark can help reduce financial inequality between communities and ensure equal opportunities for all citizens.

Another important area of implementation of the Danish experience is the introduction of effective monitoring mechanisms and sanctions by the central government. Denmark has shown a high level of trust in local governments, but it also has strict control mechanisms and the ability of the central government to intervene in cases of financial turmoil. Ukraine should develop and implement similar mechanisms to ensure compliance with the principles of governance, including preparation for decisive action by the central government in cases of failure to comply with the law by local communities, which will help to avoid a financial crisis and ensure stable development.

The implementation of Slovenia's experience in the practice of territorial communities in Ukraine can significantly increase the effectiveness of local self-government in a number of main areas. It is important to develop clear standards for the delivery of services that include education, health, utilities, and other basic goods. Slovenia, for example, defines a minimum set of services that should be available in communities with at least 5000 inhabitants. Ukraine can take a similar approach by setting requirements for the provision of basic social services to avoid inequality in accessibility between large cities and smaller localities. It is necessary to implement the practice of creating a supervisory board, as is done in Slovenia, to monitor the effectiveness and transparency of local budgets. The supervisory board should act as an independent auditor, monitoring the use of budget funds and evaluating the effectiveness of local responsibilities. Such a mechanism can significantly reduce the risks of corruption and inefficiency in financial management. In addition, Ukraine should introduce gradual fiscal decentralisation, in particular, by increasing the share of local taxes in community budgets and developing financial equalisation mechanisms to ensure the uniform development of all territories. This approach, similar to the Slovenian one, will increase the autonomy of local authorities and reduce the disparity in the level of services between different regions.

Discussion

The results of the study highlighted the importance of territorial reforms and fiscal decentralisation, which allows allocating resources more efficiently and stimulating economic growth. In addition, the role of local taxes and subsidies in maintaining financial stability and development of territories is important. Of particular importance is the development of infrastructure and improving the effectiveness of management at the local level, which includes not only financial, but also organisational tools. It is also necessary to consider social aspects and the involvement of citizens in the decision-making process, which will contribute to a more transparent and efficient use of resources, which was also indicated in the study by K. Akapelwa & A. Mwange (2023). In this study, it was found that the success of the system of financing local community development in different countries is due

to a number of specific factors. A well-designed three-tier system of local government, such as in the UK, clearly differentiates powers and responsibilities between different levels of government, which contributes to a more efficient and targeted use of financial resources. Localities and districts with well-defined functions can better respond to the specific needs of local communities. Such conclusions coincide with the results of D. Sharma (2021).

The flexibility and adaptability of the funding system, such as in the UK, Denmark, and Slovenia, allows local authorities to respond quickly to changes in the economic and political environment. Regular adjustments to grants and financial resource allocation mechanisms ensure stable funding even in conditions of economic instability. M. La Torre *et al.* (2023) focused on the importance of adaptive financial strategies that enable local communities to effectively manage their resources and minimise risks associated with external factors. This highlights the importance of an integrated approach to financial management, which includes strategic planning and continuous monitoring of the economic situation, to ensure sustainable development and economic stability of communities. It was found that financial instruments such as attracting various financial institutions contribute to the development of territorial communities. This is also consistent with the conclusions of M. Bondarchuk *et al.* (2022), who also stressed the importance of financial and credit institutions' participation in financial cooperation and joint investment. The main argument is that these institutions accumulate monetary capital, and therefore, the strategic areas of financial activities of communities should include actions to introduce new technologies, effective management, marketing, and logistics.

It was found out that the strategic areas of financial activities of territorial communities provide for the active use of external financing, in particular, public debt and public-private partnership, to overcome budget constraints. Such conclusions can also be found in the paper by Y. Liu & Y. Zhou (2021), who also emphasised the importance of these tools for local governments. The researchers found that the financial strategies of Chinese local governments correspond to the hierarchy theory, where priority is given to internal financing over debt obligations, followed by public-private partnerships. These findings are consistent with current research, which also highlights the importance of an integrated approach to financing local economic development. It is also worth agreeing with the opinion of K. Horbova *et al.* (2023) that cross-border cooperation programmes and EU initiatives also open up additional opportunities for the development of local communities, including joint projects with border regions of neighbouring countries, because this not only encourages local development, but also expands international cooperation, which is important for long-term socio-economic growth. In general, an integrated approach to investment activities, including

strategic planning, sound resource management, and active involvement of international support, should be used to ensure the sustainable development of communities. Such measures allow communities to realise their investment potential responsibly and purposefully.

In the course of the study, the analysis of problems of financing the economic development of territorial communities in Ukraine in the conditions caused by a long war revealed significant challenges that require adequate and correct solutions. The instability of tax revenues, the imbalance between income and expenditure, and difficulties in accessing loans and borrowings, combined with corruption and inefficient management mechanisms, significantly complicate the sustainable development of territorial communities. Prospects for solving these problems are opened up by applying the successful experience of other countries. In particular, the introduction of transparent mechanisms for the distribution of public transfers, support for public-private partnerships and effective use of international funding can significantly improve the situation. The UK example demonstrated the importance of a high level of trust in local authorities, which ensures better resource management. Monitoring and control systems similar to the British ones can help ensure strict control over local budget expenditures, which is important for the stability and transparency of financial management. This conclusion was also reached by V.A. Bruno & A. Cozzolino (2023), who examined the role of trust in the functioning of local authorities and stressed that the presence of transparent control mechanisms significantly increases the efficiency of budget allocation. They noted that the introduction of a surveillance system minimises the risks of misuse of resources and ensures financial stability at the local level.

Denmark's experience, in particular, has shown that reducing the number of local communities and increasing their size can increase financial and managerial capacity. This can be achieved by consolidating or reallocating competencies in favour of larger communities. Raising the share of local taxes and introducing financial equalisation mechanisms can reduce financial inequality and provide equal opportunities for all communities. Y. Liu & Y. Zhou (2021) also emphasises that the concentration of resources and the strengthening of management structures have a positive impact on the economic development and social stability of local communities. Slovenia's experience has highlighted the importance of developing clear standards for service delivery and establishing independent oversight bodies to monitor the effectiveness of local budgets. The introduction of gradual fiscal decentralisation, an increase in the share of local taxes, and the development of financial equalisation mechanisms can significantly increase the autonomy of local authorities and reduce the disparity in the level of services between different regions. S. Qin & W. Luo (2021) also emphasised in their research that the introduction

of fiscal decentralisation is a necessary element in increasing the financial independence of local authorities. They stressed that the development of clear standards for the provision of services, and the creation of independent bodies that monitor the efficiency of using local budgets, can significantly improve the quality of management and ensure uniform development of regions.

B. Louman *et al.* (2022) explored access to finance, a key element of sustainable and inclusive landscapes. They also noted that the most common problems are the types of available financial products, the lack of assets for the existence of recipients. I. Otamendi-Irizar *et al.* (2022) identified the characteristics of Local Energy Communities and what is necessary for them to act as a driving force for local sustainability and social innovation. Q. Ruan *et al.* (2024), using the example of data from Chinese municipal corporate bonds, investigated the impact of high-speed railways on local government financing costs. Among Ukrainian researchers, in the practice of implementing territorial reforms, O.V. Nieizviestna *et al.* (2023) considered the financial aspects of territory branding. I. Popova & N. Demchenko (2020) investigated tools for implementing integrated territorial communities that require adaptation to Ukrainian realities.

This study offered a comprehensive approach to the analysis of financial instruments used for the development of territorial communities, allowing not only to identify the main financing mechanisms, but also to assess their integration into strategic management. It is this approach that provides the basis for practical recommendations and policy decisions, which is important for developing effective financing strategies at the local level. However, it is worth noting that the study has its drawbacks. The lack of contextual and local aspects can reduce the accuracy of applying results in different regions. In addition, underestimating the impact of economic and political changes, social and cultural factors can lead to a lack of adaptability of recommendations to real-world conditions. An expanded study that takes these aspects into consideration can improve the practical value and effectiveness of the proposed strategies.

Conclusions

As a result of the study, the main sources and tools for financing the economic development of local communities were identified, among which local budgets and state transfers play an important role. International grants and funding from donor organisations complement these sources by providing additional resources for specialised projects that contribute to economic and social development. Public-private partnerships are another important tool that allows mobilising additional investment from the private sector for the implementation of infrastructure

and social projects, ensuring an effective distribution of risks and resources. The combination of these sources and tools serves as the basis for ensuring an integrated and balanced approach to financing the economic development of local communities. The analysis of local economic development financing tools in the UK, Denmark, and Slovenia identified the main areas that contribute to the effectiveness of local economic development management, in particular a high level of trust in local authorities, optimising the number of local communities to increase their capacity and developing clear standards for the provision of services. Based on this experience, it is recommended for Ukraine to implement monitoring and control systems that will ensure transparency of local budget expenditures; to consolidate communities to increase managerial capacity; to introduce financial equalisation mechanisms to reduce financial imbalances. In addition, it is important to adapt service delivery standards and create independent oversight bodies that ensure the efficiency and transparency of local finances.

The inclusion of comparative analysis with the experience of other countries, such as the UK, Denmark, and Slovenia, adds additional value to the study, allowing for the adaptation of best practices to the Ukrainian environment, providing a deeper understanding of financial strategies and approaches that can be applied to improve local economic development. Although the study makes a significant contribution to understanding financial instruments for the development of local communities, there are certain limitations. One limitation is the lack of detailed analysis of specific cases or local features, which may limit the universality of the proposed recommendations. For example, different regions may have specific needs or limitations that are not taken into account in the overall research approach. In addition, the study may not sufficiently consider the impact of unpredictable economic or political changes, such as economic crises or political instability, which may affect the effectiveness of proposed financial instruments. The inclusion of scenario analysis of these factors can make the conclusions more flexible and adaptive to the conditions.

Further research may focus on a more detailed analysis of the impact of implemented financial instruments on the real economic performance of territorial communities. In addition, it is possible to investigate the effectiveness of adapting international experience in the context of specific features of local government in Ukraine.

Conflict of Interest

None.

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Інструменти фінансування місцевого економічного розвитку територіальних громад

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Анотація. Дослідження спрямоване на висвітлення особливостей використання інструментів фінансування економічного розвитку територіальних громад на прикладі України. Для обробки даних використовувалися методи економіко-статистичного аналізу, включаючи статистичний метод Вілкоксона для порівняння тенденцій зростання. В процесі дослідження визначено найпоширеніші джерела й інструменти фінансування економічного розвитку територіальних громад, зокрема податкові надходження, гранти, кредити, публічно-приватні партнерства. Проведено аналіз фінансових інструментів місцевого економічного розвитку у Великобританії, Данії та Словенії, акцентуючи увагу на їхній гнучкості, адаптивності, та ефективності. Обґрунтовано важливість інтеграції найкращих практик цих країн у стратегічне управління фінансами територіальних громад України. Запропоновано конкретні рекомендації щодо імплементації успішного міжнародного досвіду. Рекомендовано для України запровадити системи моніторингу та контролю, схожі на британські з метою забезпечення жорсткого контролю за витратами місцевих бюджетів, що є важливим для стабільності й прозорості фінансового управління; здійснити консолідацію або перерозподіл компетенцій на користь більших громад, підвищити частку місцевих податків і запровадити механізми фінансового вирівнювання, щоб зменшити фінансові нерівності й забезпечити рівні можливості для всіх громад, як показав досвід Данії. Згідно зі словенським досвідом, необхідно розробити чіткі стандарти для надання послуг, створити незалежні наглядові органи для моніторингу ефективності місцевих бюджетів, впровадити фіскальну децентралізацію і збільшити частку місцевих податків з метою підвищення автономії місцевих органів влади й зменшення диспропорції в рівні послуг між регіонами. Отримані результати підкреслили важливість використання комплексного та інтеграційного підходу щодо формування та управління інструментами фінансування місцевим економічним розвитком територіальних громад. Практичне значення результатів дослідження проявляється у наданні конкретних рекомендацій щодо використання різних інструментів фінансування, таких як місцеві гарантії, муніципальні облігації, кредити від міжнародних фінансових установ та гранти від міжнародних донорів. Ці рекомендації в змозі допомогти визначити пріоритети інвестиційних напрямів і вдосконалити процеси планування й управління інвестиціями, що є важливим для розвитку територіальних громад

Ключові слова: регіональне публічне управління; податкові надходження; гранти; субвенції та дотації; публічно-приватне партнерство; державний бюджет; місцевий бюджет