ISSN: 1683-1942
E-ISSN: 2304-6155

Харківський національний економічний університет імені Семена Кузнеця

ЕКОНОМІКА РОЗВИТКУ

Міжнародний економічний журнал

Заснований у 2002 році
Періодичність випуску: 4 рази на рік

Том 23, № 2

Харків – 2024

ISSN:1683-1942
E-ISSN: 2304-6155

Засновник:
Харківський національний економічний університет імені Семена Кузнеця,
ТОВ «Наукові журнали»

Рік заснування: 2002

Рекомендовано до друку та поширення
через мережу Інтернет Вченою радою
Харківського національного економічного університету імені Семена Кузнеця
(протокол №8 від 27 червня 2024 р.)

Ідентифікатор медіа: R30-02690
(Рішення Національної ради України
з питань телебачення і радіомовлення
№ 177, протокол № 3 від 25 січня 2024 року)

Журнал входить до переліку наукових фахових видань України
Категорія «Б». Спеціальності: 051 «Економіка», 071 «Облік і оподаткування»,
072 «Фінанси, банківська справа та страхування», 075 «Маркетинг»,
076 «Підприємництво, торгівля та біржова діяльність», 292 «Міжнародні економічні відносини»
(Наказ Міністерства освіти і науки України № 1643 від 28 грудня 2019 р.)

Журнал представлено у міжнародних наукометричних базах даних, репозитаріях та пошукових системах:
Index Copernicus International, Фахові видання України,
Національна бібліотека України імені В. І. Вернадського, Crossref,
Polska Bibliografia Naukowa, Universitäts Bibliothek Leipzig, BASE,
DOAJ: Directory of Open Access Journals, EconBiz, WorldCat, Ulrichsweb Global Serials Directory, UCSB Library, Dimensions, German Union Catalogue of Serials (ZDB), ERIH PLUS, University of Oslo Library, University of Hull Library, Search Oxford Libraries Online (SOLO),
European University Institute (EUI), Cambridge University Library, ZENDY,
Open Ukrainian Citation Index (OUCI), Asian Science Citation Index (ASCI)

Економіка розвитку : міжнар. екон. журн. / [редкол.: Т. В. Шталь (голов. ред.) та ін.]. – Харків : Харківський національний економічний університет імені Семена Кузнеця, 2024. – Т. 23, № 2. – 92 с.

Адреса редакції:
Харківський національний економічний університет імені Семена Кузнеця
61166, пров. Інженерний, 1-А, м. Харків, Україна
Тел. +380 (57) 702-03-04
E-mail: info@ecdev.com.ua
https://ecdev.com.ua/uk

ISSN: 1683-1942
E-ISSN: 2304-6155

Simon Kuznets Kharkiv National University of Economics

ECONOMICS OF DEVELOPMENT

International Economic Journal

Founded in 2002
Frequency of issue: Four times per year

Volume 23, No. 2

Kharkiv – 2024

ISSN: 1683-1942
E-ISSN: 2304-6155

Founder:
Simon Kuznets Kharkiv National University of Economics,
LLC "Scientific Journals"

Year of foundation: 2002

Recommended for printing and distribution
via the Internet by the Academic Council
of Simon Kuznets Kharkiv National University of Economics
(Minutes No. 8 of June 27, 2024)

Media identifier: R30-02690
(Decision of the National Council
of Television and Radio Broadcasting of Ukraine
No. 177, Minutes No. 3 of January 25, 2024)

The journal is included in the list of scientific professional publications of Ukraine
Category "B". Specialties: 051 "Economics", 071 "Accounting and Taxation",
072 "Finance, Banking and Insurance", 075 "Marketing",
076 "Entrepreneurship, Trade and Stock Market Activity", 292 "International Economic Relations"
(Order of the Ministry of Education and Science of Ukraine No. 1643 of December 28, 2019)

The journal is presented international scientometric databases, repositories and scientific systems:
Index Copernicus International, Professional publications of Ukraine,
Vernadsky National Library of Ukraine, Crossref,
Polska Bibliografia Naukowa, Universitäts Bibliothek Leipzig, BASE,
DOAJ: Directory of Open Access Journals, EconBiz, WorldCat, Ulrichsweb Global Serials Directory,
UCSB Library, Dimensions, German Union Catalogue of Serials (ZDB), ERIH PLUS, University of Oslo Library,
University of Hull Library, Search Oxford Libraries Online (SOLO), European University Institute (EUI),
Cambridge University Library, ZENDY, Open Ukrainian Citation Index (OUCI),
Asian Science Citation Index (ASCI)

Economics of Development / Ed. by T. Shtal (Editor-in-Chief) et al. Kharkiv: Simon Kuznets Kharkiv National University of Economics, 2024. Vol. 23, No. 2. 92 p.

Editors office address:
Simon Kuznets Kharkiv National University of Economics
61166, 1-A Inzhenerny Ln., Kharkiv, Ukraine
Tel. +380 (57) 702-03-04
E-mail: info@ecdev.com.ua
https://ecdev.com.ua/en

ЕКОНОМІКА РОЗВИТКУ

Том 23, № 2

Редакційна колегія

ECONOMICS OF DEVELOPMENT Volume 23, No. 2

Editorial Board

ЗМІСТ / CONTENTS

Л. Малярець, О. Ястремська, І. Бараннік, О. Ястремська, К. Ларіна
Оцінка структурних змін стійкого розвитку країни 8
L. Malyarets, O. Iastremska, I. Barannik, O. Iastremska, K. Larina
Assessment of structural changes in stable development of the country 8

Е. Ногоїбаєва, Н. Маматова, С. Деркенбаєва, У. Омурзакова
Інтегрований підхід до аналізу ризиків
у фінансовій звітності для забезпечення економічної безпеки підприємства 17
E. Nogoibaeva, N. Mamatova, S. Derkenbaeva, U. Omurzakova
Integrated approach to risk analysis in financial statements to ensure economic security of the enterprise 17

М. Бердар, Л. Кот, Л. Мартинюк, О. Євтушевська, Ю. Сапачук
Виклики та перспективи інноваційно-інвестиційного розвитку підприємств у післявоєнний період 27
M. Berdar, L. Kot, L. Martyniuk, O. Yevtushevska, Yu. Sapachuk
Challenges and prospects of innovation and investment development of enterprises in the post-war period 27

Л. Піддубна, І. Дибач, В. Красовський, К. Плєханов, Р. Могилевський
Аналіз впливу цифрового розвитку на економічне зростання країни 38
L. Piddubna, I. Dybach, V. Krasovskiy, K. Pliekhanov, R. Mogylevskyi
Analysis of the impact of digital development on a country's economic growth 38

Е. Джафаров, Н. Бабаєв
Проблеми підготовки фінансової звітності бізнесу за міжнародними стандартами 47
E. Jafarov, N. Babayev
Problems of preparing business financial statements according to international standards 47

С. Левицька, Н. Остап'юк, О. Цятковська, М. Реслер, О. Михальська
Стратегія розвитку аудиту нефінансових активів державних установ 57
S. Levytska, N. Ostapiuk, O. Tsiatkovska, M. Resler, O. Mykhalska
State institution non-financial asset audit strategy development 57

Н. Шведа, О. Гарматюк, Т. Кужда, Г. Машлій, Н. Юрик
Цифрова трансформація як імператив інноваційного розвитку бізнес-процесів
в умовах воєнного стану (досвід України) 69
N. Shveda, O. Garmatiuk, T. Kuzhda, H. Mashliy, N. Yuryk
Digital transformation as an imperative for innovative development
of business processes under martial law (Ukrainian experience) 69

Н. Гавкалова, Д. Мартін, Г. Шумська, К. Бабенко
Ландшафт і циркулярна економіка
як механізм сталого розвитку в умовах глобалізації та цифровізації світової економіки 80
N. Gavkalova, J. Martin, H. Shumska, K. Babenko
Landscape and circular economy as a mechanism
of sustainable development in globalisation and digitalisation of the world economy 80

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2
2024

UDC 338.1; 330.1
DOI: 10.57111/econ/2.2024.08

Lyudmyla Malyarets*
Doctor of Economics, Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0002-1684-9805

Olena Iastremska
Doctor of Economics, Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0002-5653-6301

Igor Barannik
PhD in Economics, Doctoral Student
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0001-6364-4768

Olesia Iastremska
PhD in Economics, Associated Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0003-1865-0282

Kateryna Larina
PhD in Economics, Associated Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0009-0008-0009-9270

Assessment of structural changes in stable development of the country

Abstract. The issue of structural changes is poorly researched and unresolved in the assessment of sustainable development in the countries of the world and remains relevant for many years. The purpose of the article was to clarify the content of the issue of structural changes and justify the method of assessing the structural dynamics of the country's stable development to ensure its objectivity and reliability. To achieve the goal, an abstract-logical method was used to determine the degree of solving the problem of assessing structural changes in the stable development of countries and to develop a structural dynamic benchmark. The method of constructing an integral key figure of structural dynamics was used to determine the level of a country's stable development using the example of Ukraine. The regression analysis was used to determine the dependence of the structural dynamics of stable development on main factors. It was found that the results of the structural dynamics assessment of the stable development depend on the structural dynamic

Article's History: Received: 10.01.2024; Revised: 18.04.2024; Accepted: 27.06.2024

Suggested Citation:
Malyarets, L., Iastremska, O., Barannik, I., Iastremska, O., & Larina, K. (2024). Assessment of structural changes in stable development of the country. *Economics of Development,* 23(2), 8-16. doi: 10.57111/econ/2.2024.08.

*Corresponding author

benchmark, as the state is compared with it. This structural dynamic benchmark of the stable development of countries is the main assessment tool. The new structural dynamic benchmark for the stable development of developing countries is substantiated. In the calculation of the integral key figure of the structural dynamics of stable development, the base rates of macroeconomic key figures that reflect this development were used. It is proposed to determine the factors influencing the integral key figure of the structural dynamics of stable development. The range of [0.28; 0.35] represents the low level of structural dynamics in Ukraine's stable development. The practical value of the proposed approach to structural change assessment in the country's stable development lies in the possibility of rapid diagnosis and monitoring of these changes for early correction of the negative consequences of phenomena that slow down development

Keywords: sustainable development; structural dynamic benchmark; macroeconomic key figures; integral key figure; determination of influencing factors

INTRODUCTION

The main programme of human development formulated by the United Nations is sustainable development. In the concept of sustainable development, economic growth, material production, and consumption in a healthy environment are connected with the possibility of economic system self-renewal without harming people's livelihoods in the future. It was clearly defined by the Brundtland Commission that sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (World economic situation..., 2024). Therefore, the problems of sustainable development remain relevant, and methods of solving them need to be improved. The latest publications for 2023 and 2024, which explore various issues of sustainable development that continue classical views and approaches to considering this phenomenon, are as follows.

The Y. Kharazishvili *et al*. (2023) research analysed and suggested using traditional macroeconomic key figures of aggregate demand and aggregate supply for the formation of institutional measures of market equilibrium to achieve stable development of macroeconomic processes, taking into account the phenomena of corruption, the increase in the activity of innovative processes, a decrease in imports, and an increase in exports and investments. The positive conclusion of the authors is the provided models of sustainable development of the economy at the macroeconomic level for European Community member states. Since sustainable development is a complex and compound phenomenon that requires monitoring of influencing factors, P. Paridhi & R. Ritika (2024) consider issues that hinder the transparency of the perception of its reporting. They emphasise that the measurement of key figures provides useful quantitative information for assessing the risks accompanying sustainable development at the macroeconomic level. However, the article does not provide algorithms for evaluating development results and adequate mathematical models.

Sustainable development at the macroeconomic level is possible on the basis of achieving economic security, which in the context of sustainable development is discussed in the article by G. Mazhara *et al*. (2023), which provides results of forecasting macroeconomic key figures of the functioning of the Ukrainian economy in the conditions of war according to the scenario approach. At the same time, none of the developed forecasts characterises the state of the macroeconomic security level as optimal, taking into account the structural changes in the branches of the Ukrainian economy, which are inherent in the modern complex war-time conditions of business entities and industries' activity.

While previous authors considered sustainable development at the macroeconomic level as a holistic phenomenon, many researchers analyse and develop proposals considering its individual features, taking into account the business conduct in certain countries and certain functional aspects. An important aspect of development in modern conditions is its financing, proposals for which are outlined, for example, in a study by C.E. Anton *et al*. (2024). This scientific work provides an in-depth analysis of financing sources and access to them in the context of sustainable development and analyses the prospects and intentions of entrepreneurs regarding the use of such sources in the future. It would be expedient to substantiate proposals for financing structural shifts between economic sectors.

Summarising the above publications on the problem of sustainable economic development, it can be concluded that, in general, this phenomenon arouses the increased interest of researchers in the general definition of analytical methods, tools, and specific aspects of its components, functional directions, and features of manifestation in certain parts of the world and countries. However, what remains unresolved is the issue of the composition of the key figure system for measuring development as not only stable but also sustainable, which differs by taking into account structural economic shifts, for which it is necessary to justify the system of key figures, the benchmark of their measurement. Therefore, the purpose of the conducted research was to formulate and solve the issue of structural dynamics of the stable development of countries, to develop a method of its assessment, and to substantiate the structural dynamic benchmark of the stable development of developing countries.

MATERIALS AND METHODS

In order to carry out the choice of methods and justification of tools, it should be borne in mind that sustainable development is defined as systematically managed development and is carried out according to 17 goals. Monitoring of the implementation of sustainable development goals is carried out according to 183 national indicators. It should be noted that a large number of indicators cause many problems, namely: it is difficult to organise an information collection system; an unambiguous definition of individual indicators; problems in aggregating indicators that are structured by components; lack of assessment of

the structural dynamics of stable development. It should also be noted that stability is a defining characteristic of sustainable development, but this development is not the same as stable development. Stable development is manifested in the adaptation to various force majeure circumstances, the resistance of the socio-economic-ecological system to destabilising factors, and the ability to dynamically change structurally to achieve set development goals. In view of these issues, for the objectivity of the comparative assessment of the stable development of countries, it is advisable to limit the number of indicators for each of the components and use a method that complements the quantitative assessment obtained on the basis of the aggregation of indicator values. This method reflects not only the increase in the size of the components, but also the change in their qualitative content, the dynamics of structural changes. The method of assessing the dynamics of structural changes in a stable development involves the analysis of a dynamic series of key figures reflecting its elemental state and the substantiation of the reference ratio of the order of rates of their changes. The need to assess the structural dynamics of stable development is explained by the fact that this development is ensured not only by the growth of components but also by a change in their qualitative content, the dynamics of structural changes.

To determine the assessment of the dynamics of structural changes in stable development, one should analyse the dynamic series of key figures that reflect its elemental state and justify the reference ratio of the order of rates of their changes. By comparing two rankings – actual and benchmark – consistency in the structural dynamics of stable development can be achieved. The integral coefficient is calculated based on the Spearman and Kendell rank correlation coefficients. Spearman's rank correlation coefficient is based on deviations or rank differences, and Kendall's coefficient is based on rank inversions. It is believed that the evaluation based on deviations characterises the volumetric side of the movement, and the evaluation based on inversions reflects structural dynamics (Malyarets *et al.*, 2019). Therefore, the method for assessing the dynamics of structural changes in stable development was implemented according to the algorithm presented in Table 1.

Table 1. An algorithm of the method for assessing the dynamics of structural changes in stable development of the country

No.	Stage name	Stage contents
1	Formation of a partial key figure system for the assessment of stable development.	Theoretical and economic analysis. Matrix formation: $X = (x_{ij})_{m\times n}$, (1) where X – matrix of key figure values of economic stability for the corresponding period of time; x_{ij} – the value of the i-th key figure in j-th time period; m – the number of key figures reflecting the structure of the export-import potential; n – the number of periods during which the analysis is carried out.
2	Justification of the dynamic structural benchmark.	Theoretical and economic analysis.
3	Calculation of basis rates in changes of key figure values in the system.	$IX = (ix_{ij})_{m\times(n-1)}$, (2) where IX – the matrix of basis rates of key figure values; ix_{ij} – basis rates of the i-th key figure.
4	Setting the ranks of key figures in each time period according to the change rate of key figure values in the system.	$P = (p_{ij})_{m\times(n-1)}$, (3) where P – the rank matrix of basis rates of key figures; p_{ij} – key figure rank.
5	Calculation of paired rank correlation coefficients.	Spearman's coefficient: $r_{c\,j}(r_{c\,j} = 1 - \frac{6\sum_{i=1}^{n} d_{ij}}{m(m^2-1)}$, where $d_{ij} = p_{ij} - e_i)$, (4) where e_i – the rank of the i-th key figure in a benchmark. Kendell's coefficient: $r_{\tau\,j}\,(r_{\tau\,j} = 1 - \frac{4\sum_{i=1}^{n} s_{ij}}{m(m-1)})$, (5) where s_{ij} – the number of inversions for the i-th key figure of the real state of the key figure system with its dynamic structural benchmark.
6	Calculation of an integral key figure of the structural dynamics of stable development.	$I_{s\,j} = \frac{(1+r_{c\,j})(1+r_{\tau\,j})}{4}$, (6) where I_{sj} – is the value of the integral indicator of the structural dynamics of sustainable development in the j-th period of time.
7	Determining the consistency of change rates for key figures using the concordance coefficient according to the formula.	$W = \frac{12\times S}{n^2(m^3-m)}$, (7) where W – the concordance coefficient value; $S = \sum_{i=1}^{m}\left(\sum_{j=1}^{n} p_{ij} - n\times\frac{m+1}{2}\right)$.
8	Determining the influence of factors on the structural dynamics of stable development.	Paired regression dependencies.

Source: the authors' improvement of the method described in L.M. Malyarets *et al.* (2019)

The value of the integral key figure of structural changes in the country's stable development belongs to the interval [0,1] and is interpreted as follows: the closer the calculated key figure value is to 1, the more the structure of the country's stable development in the *j*-th time period corresponds to the benchmark.

RESULTS

A great contribution to the formation of sustainable development theory was made by such famous development researchers as J. Butlin (1989), H.E. Daly (1991), N. Georgescu-Roegen (2011) and many others. Depending on professional interests, researchers pay attention to the development of narrow issues for explaining the results of its implementation. Thus, academic economists in their research paid more attention to well-being, profit, and capital accumulation. Ecologists mostly focused their attention on environmental assessment. Scientific geographers studied sustainable development in land use planning. But many scientific problems in the study of sustainable development, such as structural shifts in the branches of the country's economy and global economic relations, remained outside the attention of scientists. According to the United Nations, there are about 1,348 publications dedicated to the discussion of sustainable development issues (The 17 goals, n.d.).

It should be noted that the substantiation of the dynamic structural benchmark of stable development is an important stage on which all other stages depend (Kolodiziev *et al.*, 2017). The dynamic structural benchmark of stable development is a management tool for evaluation, as the state of this development is compared with it. The results depend on this tool in the method of assessing the dynamics of structural changes in stable development. This benchmark is proposed to be formed on the basis of the theoretical and logical analysis of scientists' research and to take into account the existing legislative documents. To justify the dynamic structural standard of stable development, one should use both the rating of the components of sustainable development, defined by the UN, and the existing laws in the economy regarding the relationship between change rates of key figures. However, regarding the relationship between key figure change rates in the system, A.O. Melnyk (2014) believes that there should be such a subordination: the change rate of the average salary (T_{as}) should be less than the change rate of the volume of industrial products sold (T_{is}) and, accordingly, the change rate of nominal GDP (T_{NGDP}). Only under such conditions will there be an increase in the change rate of direct investment in Ukraine (T_i) (Bogolyubov *et al.*, 2018):

$$T_i > T_{NGDP} > T_{is} > T_{as} > 100\%. \quad (8)$$

It should be noted that many scientists studying development issues recommend the relationship between change rates of economic indicators, which reflects the dynamics of structural changes. Scientist A.S. Galchynskyi (2009) also investigated the relationship between key figure change rates, considering the causes of world development crises. He believes that the low change rates in the volume of sold products affect the decrease in the export of goods and services and the increase in imports, and recommends increasing change rates in the volume of sold products (T_{ri}) over change rates in exports (T_e) and imports of goods and services (T_{igs}) and change rates of a country's public debt (T_{crp}):

$$T_{ri} > T_{crp} > T_e > T_{igs} > 100\%. \quad (9)$$

The famous scientist S.K. Ramazanov *et al.* (2012) claims that the appropriate ratio of key figure change rates for the development of the country is as follows:

$$T_i > T_{NGDP} > T_{ip} > T_{cpd} > 100\%, \quad (10)$$

where T_i – change rates of direct investments; T_{NGDP} – change rates of the nominal GDP; T_{ip} – change rates of the volume of sold industrial products; T_{cpd} – change rates of a country's public debt. There are well-known justifications for the economic stability benchmark of the macroeconomic system, where the following benchmark of the ratio between key figure change rates is proposed (Malyarets *et al.*, 2019):

$$Q_i > Q_{NGDP} > Q_{sip} > Q_{cg} > Q_{cpd} > Q_e > Q_{im} > Q_{as} > Q_{sa} > Q_{ul}, \quad (11)$$

where Q_i – growth rate of direct investments; Q_{NGDP} – growth rate of the nominal GDP; Q_{sip} – growth rate of the volume of industrial products sold; Q_{cg} – growth rates of a country's gold and foreign currency reserves; Q_{cpd} – growth rates of a country's public debt; Q_e – growth rates of goods and services exported; Q_{im} – growth rates of goods and services imported; Q_{as} – growth rates of the average salary; Q_{sa} – growth rates of salary arrears; Q_{ul} – growth rates of the unemployment level. One can continue citing the opinions of scientists regarding the key figure change rate relation in the economy, but when summarising them, it is recommended to use the structural dynamic benchmark of the country's stable development, which is provided in Table 2. The method of assessing the dynamics of structural changes in stable development involves the calculation of an integral key figure that uses the basis rates of partial key figures (Fig. 1).

Table 2. Structural dynamic benchmark of country's stable development

No.	Growth rates of macroeconomic key figures	The rank of the key figure basis rate in the benchmark
1	Growth rates of Nominal GDP of Ukraine per capita, USD (IX1)	1
2	Growth rates of Gross foreign debt, million USD (IX2)	2
3	Growth rates of Average salary per full-time employee, UAH (IX3)	3
4	Growth rates of Current expenses for environmental protection, thousand UAH (IX4)	4
5	Growth rates of Economically active population aged 15-70, in total, thousand persons (IX5)	5
6	Growth rates of Registered unemployed, thousand persons (IX6)	6
7	Growth rates of Volume of sold industrial products (goods, services), million UAH (IX7)	7
8	Growth rates of Export of goods, million USD (IX8)	8

Table 2. Continued

No.	Growth rates of macroeconomic key figures	The rank of the key figure basis rate in the benchmark
9	Growth rates of Import of goods, million USD (IX9)	9
10	Growth rates of Net international investment position, million USD (IX10)	10

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

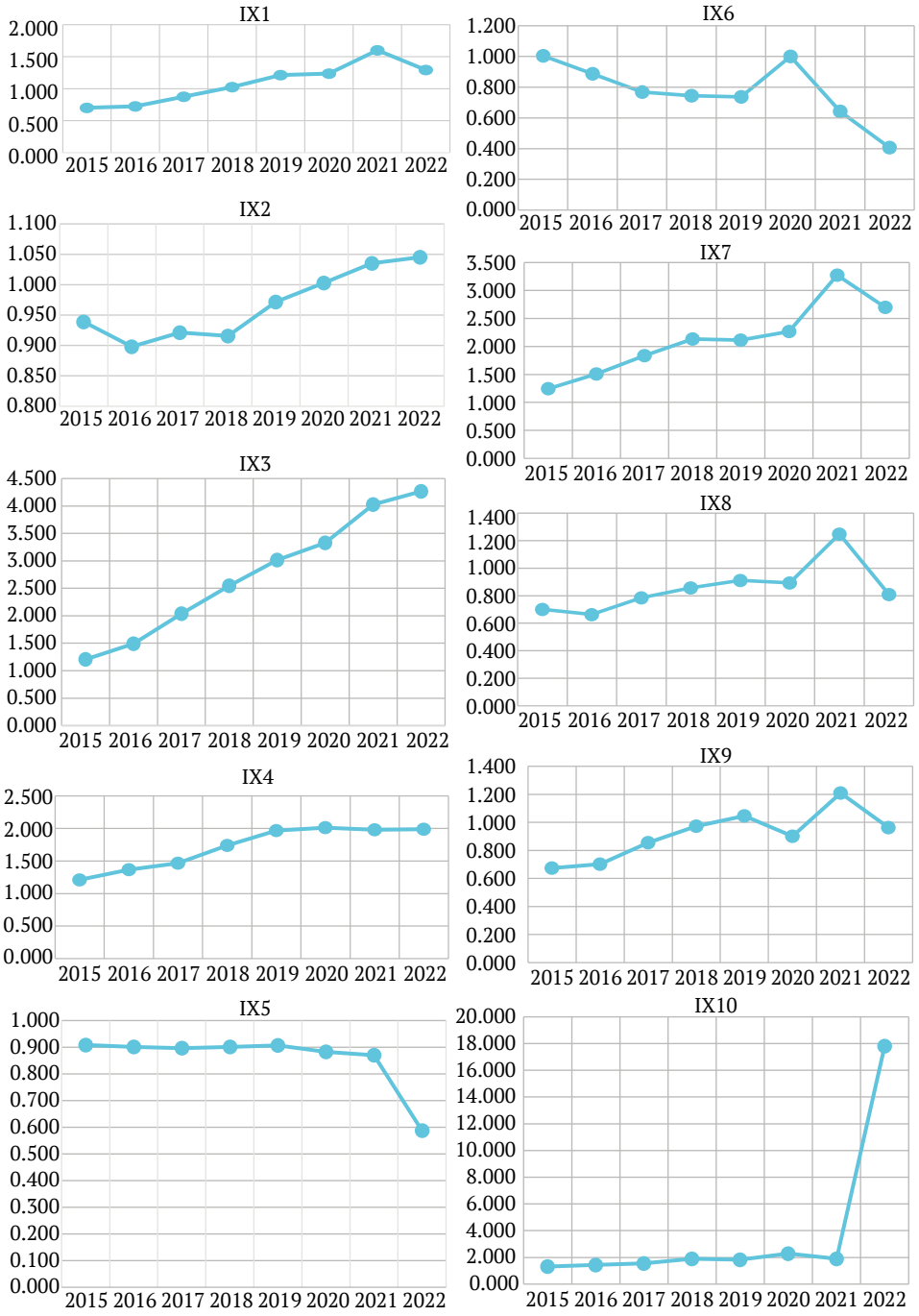

Figure 1. Key figure basis rates of the structural dynamic benchmark of stable development of Ukraine

Note: IX1 – the basis rate of the nominal GDP of Ukraine per capita; IX2 – the basis rate of the gross foreign debt; IX3 – the basis rate of the average salary per full-time employee; IX4 – the basis rate of the current expenses for environmental protection; IX5 – the basis rate of the economically active population aged 15-70; IX6 – the basis rate of the registered unemployed persons; IX7 – the basis rate of the volume of sold industrial products (goods, services); IX8 – the basis rate of the export of goods; IX9 – the basis rate of the import of goods; IX10 – the basis rate of the net international investment position

Source: made by the authors based on Macroeconomic indicators (n.d.)

The analysis of Figure 1 shows that there is a different trend in the key figure basis rates of the structural dynamic benchmark of stable development. As a result of the implementation of the proposed algorithm for the method of assessing the dynamics of structural changes in the country's stable development, the value of the integral key figure was obtained, the dynamics of which are shown in Figure 2.

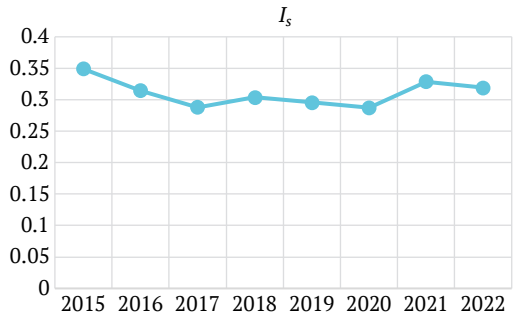

Figure 2. The value of the integral key figure of the structural dynamics of stable development of Ukraine
Note: I_s – integral key figure value of the stable development structural dynamics
Source: made by the authors

As shown in Figure 2, the levels of structural dynamics are not high; therefore, the ratio of key figure change rates for stable development in Ukraine should be managed. At the same time, the concordance coefficient is equal to 0.4423, which also indicates a low level of consistency of key figure change rates in the system. An integral key figure value of the structural dynamics of the stable development of Ukraine varies from 0.287 to 0.349, that is, in the interval [0.28; 0.35], which is low and requires urgent development of management measures to correct this situation. To determine directions of influence on the ratio of key figure change rates of stable development, it is recommended to calculate the dependence of the integral key figure of structural dynamics on the specified partial key figures. At the same time, R^2 coefficients of determination were calculated:

$$I_s = \sqrt{0.083 + \frac{0.014}{IX1}}, R^2 = 0.892;$$

$$I_s = \sqrt{0.123 - \frac{0.025}{IX2}}, R^2 = 0.012;$$

$$I_s = \sqrt{0.084 + \frac{0.03}{IX3}}, R^2 = 0.619;$$

$$I_s = \sqrt{0.067 + \frac{0.05}{IX4}}, R^2 = 0.719;$$

$$I_s = \frac{1}{3.455 - \frac{0.187}{IX5}}, R^2 = 0.037;$$

$$I_s = \frac{1}{3.327 - \frac{0.068}{IX6}}, R^2 = 0.0217;$$

$$I_s = \sqrt{0.081 + \frac{0.03}{IX7}}, R^2 = 0.137;$$

$$I_s = \sqrt{0.085 + \frac{0.009}{IX8}}, R^2 = 0.723;$$

$$I_s = \sqrt{0.073 + \frac{0.021}{IX9}}, R^2 = 0.117;$$

$$I_s = \sqrt{0.092 + \frac{0.01}{IX10}}, R^2 = 0.024.$$

The equation of the dependence of the integral key figure of structural dynamics on the specified partial key figures, which are accompanied by a coefficient of determination greater than 0.6, indicates an effective way to change the structure of stable development and increase its overall level. In these studies, the level of structural dynamics of Ukraine's stable development is influenced by Ukraine's nominal GDP per capita, the average salary per full-time employee, current costs for environmental protection, and the export of goods. Changing the rate of determined influencing factors will have an effective influence on structural changes and, as a result, will affect the increase in the level of stable development in the country.

Thus, the country's stable development is conditioned by the appropriate structural dynamics, the benchmark of which should be justified on the basis of current national conditions and taking into account the global Stable Development Program. In assessing structural changes in the country's stable development, it is necessary to rely on its 17 goals, which are determined by the appropriate system of indicators. To carry out the assessment, it is advisable to use the proposed algorithm for assessing structural changes in the stable development of the country. It is recommended to substantiate the structural dynamic benchmark of a country's stable development, taking into account the rating of goals and recommendations of leading scientists and practitioners regarding the ratio of change rates in macroeconomic key figures.

DISCUSSION

The proposed approach is of great importance in practical activities as it allows for the express diagnosis and monitoring of structural changes in stable development over time. The assessment of structural changes in the country's stable development, which is carried out on the proposed basis, differs in objectivity, reliability, and scientific reasonableness. The results of the conducted research are significantly different from the existing ones, despite the existing positive achievements in solving this issue.

The need to improve individual development measurement indicators is evidenced by X. Zhao *et al.* (2024), who examined the impact of natural resource extraction on the ecological state of the environment and population health using the example of the United States of America for 32 consecutive years until 2022. The authors suggest creating green and blue natural centres and reducing the greenhouse effect in order to achieve sustainable economic development. The authors' proposals are correct, but it would be advisable to more clearly indicate the composition of the indicator system for measuring stable and sustainable development by taking into account the proposed factors. Proposals for combining several important indicators for assessing sustainable development at the macroeconomic level are outlined in the article by D. Weng & Q. Xia (2023), where the authors continue the theme of preserving natural resources, promoting the development of human resources,

and using financial sources for these purposes. The appropriate proposal of the authors is the use of inclusive financial resources to achieve the specified goals. However, it would be advisable to more clearly indicate the key figures that the authors propose to measure the level of stable and sustainable economic development at the macroeconomic level.

The issues of analytical support, analytical tools in the study of sustainable development processes are given attention in a study by S. Proença & E. Soukiazis (2023), where authors emphasise such a phenomenon as entrepreneurship and its importance for achieving sustainable development through the economical use of natural resources for economic growth, taking into account innovations and achieving social justice in society. It would also be appropriate to offer partial and integral key figures according to the measures indicated in the article. An analytical toolkit for determining the level of sustainable development is proposed by R. Wang *et al*. (2023) to measure the connection between macroeconomic key figures of sustainable development and the active use of renewable energy as the main modern economic resource. Also, the authors investigated the impact of technical innovations on economic development. The authors investigate technical innovations and develop measures to achieve sustainable development, taking into account the listed factors. Their proposals are correct, but the work does not clearly specify the key figures calculation sequence, which complicates their practical use for determining general indicators of sustainable economic development.

Sustainable development is impossible without taking into account changes in human capital. That is why some scientists, like Z. Tokhtyyeva *et al*. (2024), pay considerable attention to it as the most important development factor, using the example of its newest direction, the green economy in Asia. The results of the article are justified, but it would be appropriate to develop these studies from the standpoint of measuring structural shifts in human capital as a factor of sustainable development, which turns it into a stable one. Proposals for the use of human capital in Latin America are presented by A. López-Concepción *et al*. (2024). This study examines human capital from the perspective of the formation of labour values in Latin America and the interaction between socio-demographic characteristics and well-being. It would be appropriate to develop models for other regions of the world economy, which would prove their typicality and substantial practical significance.

Covering the research of scientists A. Kazemikhasragh & M.V. Buoni Pineda (2023) from different countries of the world, for example, in West Africa, it is appropriate to note the effect of certain factors that concern the population of these continents. Thus, researchers from West African countries conducted in-depth studies of poverty factors, the state of the oil and petroleum products markets, and the volume of tourist flows. And the increase in health care costs will contribute to positive changes in the trends of sustainable development, which should be taken into account in accordance with the deterioration of the global epidemiological situation. The publication by H. Bartelings & G. Philippidis (2024) sets out proposals related to a separate development goal set by the UN: the use of food products and food waste. Such proposals regarding the developed scenarios for achieving the development goal related to the specific consumption of food products and waste will contribute to the improvement of the quality of working life and the professional development of employees. However, the authors do not propose specific programmes for retraining workers, and this makes it difficult to achieve the development goal of providing food products to improve the quality of life of the population.

The level of population development should primarily contribute to the growth of sustainable economic development in countries. J. Pokorný & A. Palacká (2023) wrote about it and proved it on the built correlation and regression models. Sustainable economic development was analysed in accordance with the needs of A. Maslow's pyramid and the growth curve of S. Kuznets. The authors proved that the main key figures affecting sustainable development are the state of the labour market, wages on the labour market, its equality between women and men, as well as the workers' health state. The proposals of scientists are well-founded and can be applied to the analysis of key figures in the sustainable and stable development of countries.

Thus, the given results of the scientists' research indicate their difference from the results of the research presented in the article. Scientists mainly focus their attention on the inclusion and definition of one or another characteristic of the country's stable development, but none of them mentions the structure of this development in terms of dynamics or the influence of relevant factors on the level of development. The advantage of this approach is the possibility of effective control of stable development based on adjusting the dynamics of structural changes.

CONCLUSIONS

The following results were obtained in the study. The expediency of distinguishing the concepts of "sustainable development" and "stable development" was established. The necessity of managing structural changes for the stable development of the country is substantiated. It is established that, in order to manage stable development, the structural changes of this development should be evaluated. The algorithm of the method of assessing the dynamics of structural changes in the country's stable development based on the calculation of the influence of factors on the structural dynamics of the country's stable development has been improved. The influence of factors on the structural dynamics of the country's stable development is often non-linear. What is new is a well-grounded dynamic structural benchmark for the stable development of developing countries. In the process of substantiating the dynamic structural benchmark of stable development, it is necessary to take into account the current national conditions of the country's economy and the global Stable Development Programme.

The proposed appropriate number of key figures in the dynamic structural benchmark of a country's stable development – ten main macroeconomic key figures. The proposed list of macroeconomic key figures in the dynamic structural benchmark of the country's stable development, namely: Nominal GDP of Ukraine per capita; Gross foreign debt; Average salary per full-time employee; Current expenses for environmental protection; Economically active population aged 15-70, in total, thousand persons; Registered unemployed; Volume of sold industrial products (goods, services); Export of goods; Import of goods;

Net international investment position. The level of structural dynamics of stable development in Ukraine is low; it varies in the interval [0.28; 0.35]. In Ukraine, in order to ensure stable development, it is urgently necessary to develop management measures to adjust the change rates of relevant macroeconomic key figures. Further research into issues of assessing the stable development of countries is needed to determine their general level, taking into account both qualitative and quantitative structural changes, as well as identifying their benchmark tolerance values.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Anton, C.E., Zamfirache, A., Albu, R.-G., Suciu, T., Sofian, S.M., & Ghiță-Pîrnuță, O.A. (2024). Sustainable entrepreneurship: Romanian entrepreneurs' funding sources in the present-day context of sustainability. *Sustainability*, 16(2), article number 654. doi: 10.3390/su16020654.

[2] Bartelings, H., & Philippidis, G. (2024). A novel macroeconomic modelling assessment of food loss and waste in the EU: An application to the sustainable development goal of halving household food waste. *Sustainable Production and Consumption*, 45, 567-581. doi: 10.1016/j.spc.2024.01.025.

[3] Bogolyubov, V. (Ed.). (2018). *Sustainable development strategy*. (2nd ed.). Kyiv: National University of Life and Environmental Sciences of Ukraine.

[4] Butlin, J. (1989). Our common future. *Journal of International Development*, 1(2), 284-287. doi: 10.1002/jid.3380010208.

[5] Daly, H.E. (1991). Sustainable development: From concept and theory towards operational principles. *Population and Development Review*, 16, 25-43. doi: 10.2307/2808061.

[6] Galchynsky, A.S. (2009). *Crises and cycles of world development*. Kyiv: ADEF-Ukraine.

[7] Georgescu-Roegen, N. (2011). *From bioeconomics to degrowth*. London: Taylor & Francis. doi: 10.4324/9780203830413.

[8] Kazemikhasragh, A., & Buoni Pineda, M.V. (2023). Fiscal space policies for sustainable development and debt relief: Empirical analysis in West African countries. *New Global Studies*, 17(1), 1-16. doi: 10.1515/ngs-2021-0040.

[9] Kharazishvili, Y., Lyashenko, V., Grishnova, O., Hutsaliuk, O., Petrova, I., & Kalinin, O. (2023). Modeling of priority institutional measures to overcome threats to sustainable development of the region. *IOP Conference Series: Earth and Environmental Science*, 1269(1), article number 012023. doi: 10.1088/1755-1315/1269/1/012023.

[10] Kolodiziev, O., Tyschenko, V., & Azizova, K. (2017). Project finance risk management for public-private partnership. *Investment Management and Financial Innovations*, 14(4), 171-180. doi: 10.21511/imfi.14(4).2017.14.

[11] López-Concepción, A., Gil-Lacruz, A.I., Saz-Gil, I., Garcia-Madurga, M.Á., & Sánchez-Medalón, I. (2024). What are the factors that most influence the formation of workers' labor values in order to achieve sustainable development in Latin America? *Business Strategy and the Environment*. doi: 10.1002/bse.3737.

[12] Macroeconomic indicators. (n.d.). Retrieved from https://bank.gov.ua/ua/statistic/macro-indicators.

[13] Malyarets, L.M., Barannik, I.O., Sabadash, L.O., & Grynko, P.O. (2019). Modeling the economic sustainability of the macro system (for example Ukraine). *Montenegrin Journal of Economic*, 14(3), 23-35. doi: 10.14254/1800-5845/2019.15-3.2.

[14] Mazhara, G., Pyshnograiev, I., & Zavalna, M. (2023). Scenario modeling of the critical macroeconomic and sustainable development indicators of Ukraine. *E3S Web of Conferences*, 408, article number 01019. doi: 10.1051/e3sconf/202340801019.

[15] Melnyk, A.O. (2014). *World economic crisis: Theory and methodology*. Kyiv: Institute of Agrarian Economics.

[16] Paridhi, P., & Ritika, R. (2024). Sustainability reporting for boosting national commitment and overcoming challenges: A hierarchical model. *Business Strategy & Development*, 7(1), article number e334. doi: 10.1002/bsd2.334.

[17] Pokorný, J., & Palacká, A. (2023). Well-being as a prerequisite for sustainability on a macroeconomic scale? Case of V4 countries. *Quality Innovation Prosperity*, 27(3), 141-153. doi: 10.12776/QIP.V27I3.1945.

[18] Proença, S., & Soukiazis, E. (2023). The process of sustainable entrepreneurship: A multi-country analysis. *Environment, Development and Sustainability*, 25, 10995-11010. doi: 10.1007/s10668-022-02515-z.

[19] Ramazanov, S.K., Burbelo, O.A., & Vitlinskyi, V.V. (2012). *Risks, security, crises and sustainable development in the economy. Methodologies, models, decision-making and management methods*. Luhansk: Knowledge.

[20] State Statistics Service of Ukraine. (n.d.). Retrieved from https://www.ukrstat.gov.ua/.

[21] The 17 goals. (n.d.). Retrieved from https://sdgs.un.org/goals.

[22] Tokhtyyeva, Z., Kurbanova, I., Abdyzhusupova, A., & Savin, V. (2024). The human factor in the development of a green economy in the Kyrgyz Republic. *BIO Web of Conferences*, 83, article number 07003. doi: 10.1051/bioconf/20248307003.

[23] Wang, R., Laila, U., Nazir, R., & Hao, X. (2023). Unleashing the influence of industrialization and trade openness on renewable energy intensity using path model analysis: A roadmap towards sustainable development. *Renewable Energy*, 202, 280-288. doi: 10.1016/j.renene.2022.11.035.

[24] Weng, D., & Xia, Q. (2023). Nexus between financial inclusion and natural resource management: How human development affects the sustainability practices. *Geological Journal*, 58(12), 4596-4609. doi: 10.1002/gj.4862.

[25] World economic situation and prospects as of mid-2024. (2024). Retrieved from https://www.un.org/development/desa/dpad/publication/world-economic-situation-and-prospects-as-of-mid-2024/.

[26] Zhao, X., Gao, Y., Hou, Y., Albasher, G., & Bu, F. (2024). Addressing the resource curse: Empirical analysis of greenhouse gas mitigation strategies for sustainable development. *Resources Policy*, 88, article number 104454. doi: 10.1016/j.resourpol.2023.104454.

Людмила Малярець
Доктор економічних наук, професор
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0002-1684-9805
Олена Ястремська
Доктор економічних наук, професор
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0002-5653-6301
Ігор Бараннік
Кандидат економічних наук, докторант
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0001-6364-4768
Олеся Ястремська
Кандидат економічних наук, доцент
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0003-1865-0282
Катерина Ларіна
Кандидат економічних наук, доцент
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0009-0008-0009-9270

Оцінка структурних змін стійкого розвитку країни

Анотація. Проблема структурних змін є погано дослідженою та невирішеною в оцінці сталого розвитку країн світу й залишається актуальною багато років. Метою статті було уточнення змісту проблеми структурних змін, обґрунтування методу оцінки структурної динаміки стійкого розвитку країни для забезпечення її об'єктивності та достовірності. Для досягнення мети було використано абстрактно-логічний метод – для визначення ступеня вирішення проблеми оцінки структурних змін стійкого розвитку країн та для розроблення структурного динамічного еталону. Метод побудови інтегрального показника структурної динаміки – для визначення рівня стійкого розвитку країни на прикладі України. Регресійний аналіз – для визначення залежності структурної динаміки стійкого розвитку від основних факторів. Виявлено, що результати оцінки структурної динаміки стійкого розвитку залежать від структурного динамічного еталону, оскільки з ним порівнюється стан. Цей структурний динамічний еталон стійкого розвитку країн є основним інструментом здійснення оцінки. Обґрунтовано новий структурний динамічний еталон стійкого розвитку країн, які розвиваються. В обчисленні інтегрального показника структурної динаміки стійкого розвитку були використані базисні темпи макроекономічних показників, які відображають цей розвиток. Запропоновано визначати фактори впливу на інтегральний показник структурної динаміки стійкого розвитку. Діапазон [0,28; 0,35] відображає низький рівень структурної динаміки стабільного розвитку України. Практичне значення запропонованого підходу до оцінки структурних змін стійкого розвитку країни полягає у можливості здійснювати експрес-діагностику та моніторинг цих змін для завчасного коригування негативних наслідків явищ, які сповільнюють розвиток

Ключові слова: сталий розвиток; структурний динамічний еталон; макроекономічні показники; інтегральний показник; визначення факторів впливу

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2
2024

UDC 658.15:330
DOI: 10.57111/econ/2.2024.17

Elvira Nogoibaeva
PhD in Economics, Associate Professor
M. Ryskulbekov Kyrgyz Economic University
720033, 58 Togolok Moldo Str., Bishkek, Kyrgyz Republic
https://orcid.org/0000-0003-1867-6650

Nazira Mamatova*
PhD in Economics, Associate Professor
M. Ryskulbekov Kyrgyz Economic University
720033, 58 Togolok Moldo Str., Bishkek, Kyrgyz Republic
https://orcid.org/0000-0002-4685-9342

Saltanat Derkenbaeva
Senior Lecturer
Kyrgyz National Agrarian University named after K.I. Skryabin
720005, 68 Mederov Str., Bishkek, Kyrgyz Republic
https://orcid.org/0000-0002-4580-9730

Umut Omurzakova
PhD in Economics
Kyrgyz State Technical University named after I. Razzakov
720044, 66 Ch. Aitmatov Ave., Bishkek, Kyrgyz Republic
https://orcid.org/0000-0003-2149-2959

Integrated approach to risk analysis in financial statements to ensure economic security of the enterprise

Abstract. In the current conditions of international turbulence, it remains particularly important to find new approaches to analysing risks for enterprises to ensure their quality future functioning. In this regard, the study aimed to propose one such approach, which would allow for assessment of the provision of economic security for companies. The study used a systematic approach and forecasting method to analyse financial statements, applying a process approach that includes evaluating the market position, external factors, and company reputation. This comprehensive assessment helped to identify risks and find mitigation methods. Financial risks identified in the company's statements were categorised into market, credit, and liquidity risks. This approach was applied to Manas International Airport Joint-Stock Company from 2017 to 2023. The systematic approach assessed the company's stable market position, positively impacting financial stability. Studying external factors, such as economic conditions and regulatory changes, helped evaluate potential risks. The forecasting method assessed financial indicators like profitability, sales, and assets, revealing positive trends: increased profitability, higher sales volumes and assets, and reduced debt load. These trends indicate financial stability and effective control of risks, even in crises. Liquidity analysis showed sufficient liquid assets to cover short-term obligations, emphasising financial stability. Thus, the company effectively manages

Article's History: Received: 16.02.2024; Revised: 21.05.2024; Accepted: 27.06.2024

Suggested Citation:
Nogoibaeva, E., Mamatova, N., Derkenbaeva, S., & Omurzakova, U. (2024). Integrated approach to risk analysis in financial statements to ensure economic security of the enterprise. *Economics of Development,* 23(2), 17-26. doi: 10.57111/econ/2.2024.17.

*Corresponding author

financial risks. The results obtained in the framework of the study can be applied for further assessment of the economic well-being of enterprises in Kyrgyzstan, both by government representatives and independent representatives

Keywords: audit; diversification; liquidity; insurance; hedging

INTRODUCTION

Financial statement risk analysis is the process of assessing potential risks that could affect the financial results and position of a company based on financial statement data. This type of analysis is important for both internal and external users of financial statements, including the company's managers, investors, creditors, and analysts. Financial statement risk analysis is pivotal in assessing a company's financial strength and performance, as well as identifying potential threats and opportunities. It consists of several approaches, and its main purpose is to determine the risks that the company has at the moment, as well as to find methods to avoid them, to prevent them from being realised, or to reduce their negative impact. At the moment, there are many approaches and methods for analysing financial reporting risks, as stated by A.-I. Sabău *et al*. (2021). Nevertheless, all of them have their flaws and shortcomings, so it is not always possible to identify all the main negative indicators and related problems that may arise during the long-term operation of the company. In this regard, the proposal of new approaches of this kind remains relevant. In the framework of this study, the proposals are aimed primarily at enterprises in Kyrgyzstan. Numerous scholars contributed to the approaches to risk assessment in enterprises (Rodríguez-Espíndola *et al*., 2022; Alotaibi, 2023).

The methodology of enterprise financial risk management was reviewed by B. Alieva *et al*. (2020). Researchers described the importance of this component even though it is impossible to fully protect against price impact. They also noted the existing knowledge gaps in this area among managers, but do not offer effective approaches to hedging, or methods to improve the quality of knowledge among employees of enterprises. A. Kulustayeva *et al*. (2020) tested hypotheses related to the impact of various financial indicators on the profitability of insurance companies. They confirmed the existence of a positive correlation between financial leverage, firm size, and attractiveness; some other relationships related to profitability and growth potential were also considered. However, approaches to improve the financial health of firms were not provided. Risk management approaches of banks in Germany and Kyrgyzstan were assessed by H.C. Brauweiler & N. Madmarov (2020). The results showed that banks in Germany mainly face operational risk and banks in Kyrgyzstan face credit risk. It was also shown that the German approach is generally more effective, which may indicate the relevance of applying some principles of local managers in the financial sector. H. Ma *et al*. (2020) in turn assessed the risks of transnational oil investments in Central Asia. They also formulated a comprehensive assessment approach for this and proposed methods to mitigate their impact on the company's operations. The peculiarities of the economic, social, political and legal fields among entrepreneurs in Kyrgyzstan were assessed by A. Generalov & O. Generalova-Kutuzova (2021). At the same time, the scientists described what negative and positive components of these spheres affect the financial condition of companies.

Research conducted by scholars has already considered many aspects of enterprise financial risk, but some aspects remain insufficiently studied. The lack of comprehensive approaches to financial risk control in the context of Kyrgyz enterprises is an important problem. Attention has been focused on developed countries or specific industries, while local approaches for Kyrgyz enterprises have not been fully developed or adapted. Although there are many studies on the impact of various financial indicators on profitability, no specific recommendations have been provided to improve the financial health of enterprises. Studies that assessed risks did not always include suggestions on how to reduce or avoid them. The lack of new approaches to financial risk assessment is also a significant problem. Existing approaches to financial risk assessment have their drawbacks and cannot always detect all negative indicators. The need for new, more adapted methods for local enterprises remains relevant. Long-term studies of the impact of various risks on enterprises in the context of Kyrgyzstan have not been sufficiently covered. Thus, the main objective of this study was to fill these gaps, to propose new approaches to financial risk control that would meet the specific conditions of Kyrgyzstan, and to provide specific recommendations for improving the financial condition of enterprises in this region.

MATERIALS AND METHODS

Within the framework of the research, some approaches were used to calculate the main liquidity and creditworthiness ratios of companies by years from 2017 to 2023 was carried out. One of the used indicators was the current liquidity ratio, which shows the ability of the company to fulfil its short-term obligations. It is determined by the formula:

$$Cr = \frac{CA}{CL}, \quad (1)$$

where *Cr* – current ratio; *CA* – current assets; *CL* – current liabilities. Another value is the value of quick liquidity, which should remain at the level of one for a sufficient level. Its formula is as follows:

$$Qr = \frac{(QA-I-PE)}{CL}, \quad (2)$$

where *Qr* – quick ratio; *I* – inventories; *PE* – prepaid expenses. Another value is the cash ratio. It was calculated by formula:

$$CaR = \frac{CaE}{CL}, \quad (3)$$

where *CaR* – cash ratio; *CaE* – cash and cash equivalents. These three basic types of liquidity ratios are the main ones, although there are many more. Another indicator for calculating the level of riskiness of a company is its profitability. The number of types of profitability also remains very high, but for this study, it is worth citing only a few of the main ones. The first type is the return on assets, the calculation methodology of which is shown in formula:

$$ROA = \frac{NI}{A} \times 100\%, \quad (4)$$

where *ROA* – return on assets; *NI* – net income; *A* – assets. Another value is the return on sales, which is calculated as follows:

$$ROS = \frac{S}{A} \times 100\%, \quad (5)$$

where *ROS* – return on sales; where *S* – sales. Another value is the return on equity, the formula for calculating which can be found in formula:

$$ROE = \frac{NI}{E} \times 100\%, \quad (6)$$

where *ROE* – return on equity; *E* – equity. A less frequently used calculation is the return on fixed assets, which is calculated as shown in formula:

$$ROFA = \frac{NI}{FA} \times 100\%, \quad (7)$$

where *ROFA* – return on fixed assets; *FA* – fixed assets. Furthermore, the asset turnover ratio was used in the analysis, which is calculated as follows:

$$ATR = \frac{S}{A}, \quad (8)$$

where *ATR* – asset turnover ratio. The financial dependence indicator was also used, which reflects how large a part in the structure of liabilities accounts payable has in the structure of liabilities. Accordingly, the higher this indicator is, the worse it is. The indicator is calculated as shown in formula:

$$FDR = \frac{(CL+LTL)}{A} \times 100\%, \quad (9)$$

where *FDR* – financial dependency ratio; *LTL* – long-term liabilities. Another indicator used is the inventory turnover ratio, which shows how quickly the company's inventory turns over. The higher this indicator is, the better. It is calculated as shown in formula:

$$ITR = \frac{CGS}{AI}, \quad (10)$$

where *ITR* – inventory turnover ratio; *CGS* – costs of goods sold; *AI* – average inventory. Based on these 10 indicators, conclusions were formed about how risky the business process is. Joint-Stock Company (JSC) Manas International Airport was chosen to demonstrate the assessment process, as it is one of the largest and most profitable companies in Kyrgyzstan, and, in addition, has a lot of information available to analyse financial statements. Furthermore, within the framework of the work, calculations according to Altman Z-Score were used, the formula for finding the values of which is as follows:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5, \quad (11)$$

where Z – model value; X_1 – ratio of the difference between current assets and liabilities to total assets; X_2 – net income to assets ratio; X_3 – earnings before interest and taxes value to asset ratio; X_4 – equity to debt ratio; X_5 – operating income to assets ratio. Numerous scientific methods were used in the research. Thus, the system method was used to depict the risks that affect the company's activities within a single system, where they interact with each other, affecting its financial results. The forecasting method was also used, which allowed us to assess the probable future trends of the company's development.

RESULTS

The integrated approach to risk analysis in financial reporting to ensure the economic security of the enterprise involves the integrated use of various techniques and tools to assess potential threats and vulnerabilities that may affect the financial condition and stability of the company. This approach includes several key stages: risk recognition (their identification and classification: for example, changes in interest rates, exchange rates, and operational risks), risk assessment (using quantitative methods such as sensitivity analysis, scenario analysis and others), risk management (development of strategies and practices to minimise the negative impact of risks on the company through diversification, insurance, hedging) and the direct integration of such a strategy into the planning, budgeting and control processes. Risk monitoring should be carried out on an ongoing basis to assess changes in financial indicators and identify changes in the level of risk and timely response to them. The increased use of information technology to collect, process and analyse risk data, as well as for monitoring and reporting, also remains relevant (Mosteanu & Faccia, 2020).

It is also worth differentiating force majeure from risks. Force majeure is an event that is impossible to foresee, it is unpredictable and does not depend on the activities of the business. Accordingly, it cannot be managed. On the contrary, risk can be assessed, the probability of its occurrence can be determined, and it depends on the actions of companies. This indicates that it can be managed, proper preventive measures are taken. Thus, business managers should address risk management as only in this way they can reduce the sustainability of the company in the long term (Kliestik *et al.*, 2020). The main risk that can be identified from a company's statements is financial risk, which can be categorised into three others: market risk (shows how market trends affect the value of the business or the company's future cash flows), credit risk (shows the likelihood that the business will not be able to pay its debts), and liquidity risk (reflects the likelihood that the business will not be able to pay its obligations when due). Nevertheless, an integrated approach to risk analysis should be a more comprehensive phenomenon than a simple assessment of financial indicators. Such an analysis should include consideration of operational, strategic, regulatory, reputational, and other types of risks affecting the business. One of the characteristics of such analysis is multidisciplinarity, i.e. integration of knowledge and methods from different disciplines.

In such a context, there may be a need for collaboration between different departments and divisions of the organisation, such as finance, strategic planning, and others, to get the right information to conclude the company. Understanding risk management should be at the level of a process approach, that is, a continuous cyclical flow that includes the steps of identifying, assessing, monitoring, and responding to risks, as well as auditing and adapting them (Dudek *et al.*, 2023). It also remains relevant to

assess the extent to which the current state of the company converges with its long-term development strategy. In the process of data collection and analysis itself, it is worth using the latest technology to simplify the process. All this addresses the organisation as a single mechanism, a system where risks in one area can affect other areas, which requires a comprehensive approach to risk analysis and full control at all levels. It is worth evaluating the possibilities of using the proposed methodology on a specific example. Within the framework of this study, JSC Manas International Airport was selected for this purpose. The data in this regard are shown in Table 1.

Table 1. Data used in analysing financial risks of the selected enterprise in the period from 2017 to 2023, billion KGS

Value	2017	2018	2019	2020	2021	2022	2023
CA	3.85	3.25	4.87	4.07	8.54	13.17	13.14
CL	0.73	0.54	0.68	0.64	1.07	1.42	1.13
I	0.63	0.71	0.59	0.74	1.07	1.7	0.64
Monetary funds and equivalents	2.28	1.97	0.78	0.74	5.77	7.69	7.07
Net profit	1.79	1.63	2.11	0.62	4	5.3	5.24
S	7.1	5.83	7.23	3.69	10.12	15.05	9.03
E	9.52	10.32	11.55	10.91	14.52	22.54	32.53
A	10.89	11.06	12.46	11.73	15.8	24.2	33.83
Primary funds	6.34	6.92	6.84	6.93	6.55	10.22	18.98
LTL	0.64	0.21	0.22	0.18	0.21	0.23	0.18
Cost of sales	5.08	3.82	4.6	3.2	5.57	9.36	4.32

Source: compiled by the authors based on Kyrgyz stock exchange (2024)

As can be seen from Table 1, the company's profits and sales are increasing over time, as are assets, while debt is only decreasing, as is the cost of sales. Already this indicates good trends in the company. Formulas for the 10 values were demonstrated in previous section of the article, the calculation has been done to analyse the risks of the company. Table 2 demonstrates the calculated values for these indicators for the company.

Table 2. Data of the company's financial risk assessment indicators and their change trend in the period from 2018 to 2023

Value	2018	2019	2020	2021	2022	2023	Trend
Cr	6.06	7.11	6.39	7.95	9.29	11.67	92.52
QR	4.73	6.25	5.24	6.95	8.09	11.1	134.7
CaR	3.67	1.14	1.16	5.37	5.42	6.28	71.11
ROA, %	14.74	16.92	5.31	25.35	21.91	15.47	4.96
ROS, %	52.65	58.03	31.46	64.08	62.19	26.69	–49.3
ROE, %	15.8	18.24	5.71	27.59	23.51	16.09	1.84
ROFA, %	23.56	30.83	8.99	61.09	51.87	27.58	17.09
ATR	8.67	11.08	5.56	11.22	10.86	7.7	–11.22
FDR, %	6.71	7.27	6.99	8.12	6.82	3.85	–42.66
ITR	5.69	7.05	4.81	6.17	6.75	3.69	–35.24

Source: compiled by the authors based on Kyrgyz stock exchange (2024)

To determine how qualitative data are sufficient to define the company as financially stable and having no significant risks within its business processes, it is worth setting certain limits for the indicators. Thus, the *Cr* and *Qr* indicators can be considered to be above 4-5, which is observed in Table 2 throughout the period, and in 2023 this value becomes above 10. As for *CaR*, the normative value is between 0.2 and 0.5, while it remains significantly higher throughout the time. Profitability indicators cannot have clear normative values: in this case, it is worth focusing on the trend, which for all of them remains positive, which indicates the growth of all profitability indicators, which is a positive factor for business development. It is worth noting that even in 2020, which was a particularly difficult year for the airline industry, the company was able to remain profitable. The *ATR* value, which shows asset turnover, although it is below the 2018 figure, remains within the normative limits for it (between 5 and 10). The *FDR* value indicates that the level of debt in the company is negligible: long-term and short-term liabilities occupy no more than 10% of the liabilities structure, while equity capital occupies more than 90%. Value decrease in 2023 in this case only once again shows the high level of stability of the company. The last value is *ITR*, which also decreased significantly in 2023. Nevertheless, this is caused by a significant decrease in both the level of inventories and the cost of manufactured products, which in general can be considered positive trends. Thus, the JSC Manas International Airport, from the point of view of financial statements, can be considered financially sustainable, even considering the use of higher normative values for assessing financial risks for Kyrgyzstan. Another indicator that is quite often used to assess the probability of bankruptcy of the company is Altman Z-Score. The value for the period from 2018 to 2023 for the JSC Manas International Airport can be seen in Figure 1.

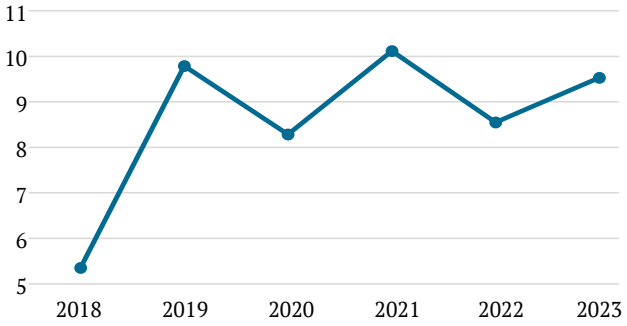

Figure 1. *Z* score for the JSC Manas International Airport in the period from 2018 to 2023
Source: compiled by the authors based on Kyrgyz stock exchange (2024)

As can be seen from Figure 1, the *z* score is very high: a value above 2.8 is already considered to indicate an extremely low probability of bankruptcy, whereas for the selected company it is above 8 in the period from 2019, which indicates an extremely high level of financial stability. The increase in the value in 2019 is associated primarily with a decrease in the level of long-term and short-term debt, which was not at a high level even before. Nevertheless, a comprehensive approach implies a deeper dive into the peculiarities of the company's activities to form conclusions. It was mentioned above that within the framework of analysing the state of development of a company, it is important to assess the market risk factor, i.e. it is necessary to conclude how the current market trends affect the development of an individual company. In this case, the situation is special since the aviation industry is important for the national security of the country, and therefore can count on state support in case of problems.

In 2020, this area began to face problems due to the onset of the COVID-19 crisis and the restriction on air transport, which caused the company to face certain difficulties, which was also visible in the deterioration of financial indicators during this period (Podra & Petryshyn, 2023). This was also the reason for increased geopolitical instability in the region. In JSC Manas International Airport, however, the deterioration of the situation is not observed, and the decrease in profitability indicators is due to the increase in the value of assets rather than a decrease in profits. In this regard, it is possible to conclude that the current global crisis trends do not have a significant negative effect on the functioning of the company. Moreover, the industry has opportunities for development in the future considering that there are still some difficulties in it, even in terms of the formation of international routes. In other words, no significant problems could be found in the context of air transport market development. To assess the impact of changes in exchange rates on the company. It is worth estimating the impact of foreign exchange gains/losses on profit before tax. These data are shown in Figure 2.

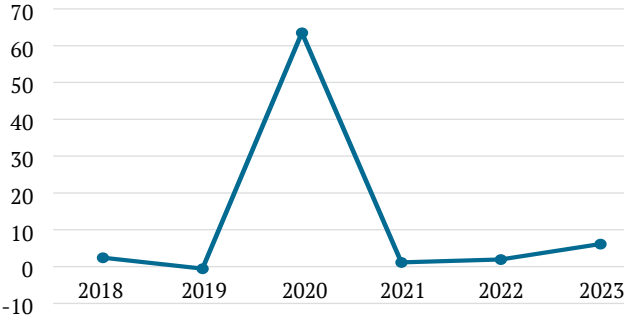

Figure 2. Data on the ratio of foreign exchange gains/losses to profit before tax for the period from 2018 to 2023, %
Source: compiled by the authors based on Kyrgyz stock exchange (2024)

The impact of changes in foreign exchange rates mainly had a positive effect on the company's profitability (with the exception of 2019). In 2020, income from changes in exchange rates accounted for more than 60% of the company's total income. However, there was a sharp decline after 2020, which should be analysed and understood for further planning and financial risk management. This may indicate that the company adheres to a competent strategy in the context of changes in exchange rates and does not receive a negative impact due to this factor. As for reputational risks, there are no significant problems in this context, and difficulties related to the internal control of production processes are solved by the company's employees after an independent audit. One of the components of the company's risk analysis is sensitivity analysis. Its essence consists of the estimation of changes in the results of the company's activity depending on the decrease/increase of its separate indicators, for example – revenue, and cost price. In practice, each company should calculate individual indicators for which sensitivity analysis will be carried out (Kupyra & Kyryshko, 2020). For the company analysed in this study, the following variables were selected: revenue, cost of sales, general and administrative expenses, foreign exchange income and financial income. The valuation data can be seen in Table 3 and Table 4.

Table 3. Statement of comprehensive income of JSC Manas International Airport for the period from 2022 to 2023, thousand KGS

Core operating activities	2022	2023
Profit	8,112,140	9,030,791
Cost price	–3,502,984	–4,321,352
Net profit	4,609,156	4,709,439
Other income/expenses from operating activities	369,914	478,530
Costs of sales	–5,640	–3,975
General and administrative expenses	–343,211	–456,506
Operating expenses	21,063	18,049

Table 3. Continued

Core operating activities	2022	2023
Profit from operating activities	4,630,219	4,727,488
Finance income	158,573	235,057
Finance costs	−414	0
Other income/expense (income from associated subsidiaries)	111,233	392,417
Other income/expenses	−20,170	6,034
Foreign exchange gains/losses	97,653	348,990
Total income/expense from non-operating activities	346,875	982,498
Profit/loss from taxation	4,977,094	5,709,986
Income tax expense	−457,390	−474,884
Profit after tax	4,519,704	5,235,102

Source: compiled by the authors based on Kyrgyz stock exchange (2024)

Table 4. Sensitivity analysis of selected indicators for JSC Manas International Airport for the period from 2022 to 2023

Profit −10%		
Year	2022	2023
Effect on net income	1.63	1.58
Cost of sales +10%		
Year	2022	2023
Effect on net income	0.704	0.757
General and administrative expenses +10%		
Year	2022	2023
Effect on net income	0.069	0.08
Foreign exchange gains will decrease by 10%		
Year	2022	2023
Effect on net income	0.0196	0.061
Decrease in finance income by 10%		
Year	2022	2023
Effect on net income	0.0319	0.0412

Source: compiled by the authors based on Kyrgyz stock exchange (2024)

As can be seen from Table 3 and Table 4, different indicators, when changed by 10%, show different impacts on the final net profit. Nevertheless, from the analysis in Table 4, only revenue and cost of sales have any significant impact. Thus, when revenue decreased by 10%, net profit decreased by 15.8%, and when the cost of sales increased by 10%, net profit decreased by 7.57%. Given this information, it is worth assuming that the most effective strategy for the company is to maximise revenue. Several methods can be used for this purpose: firstly, increasing marketing efforts to attract more passengers and airlines, both through more active advertising campaigns and by improving loyalty programmes and forming deeper cooperation with travel agencies (Li *et al.*, 2020). Additional investment in infrastructure to make it more attractive and convenient for passengers and airlines to increase both its capacity and popularity among the population should also be effective.

Another option for risk assessment is probabilistic analysis, which evaluates company data using statistical data evaluation methods. Nevertheless, it is difficult to perform it based on available data for the selected company, because the data on financial statements are available only for the period from 2017 to 2023, i.e. for 7 years, based on which it is difficult to build any model. Within the scope of the work, it was possible to make only some estimation for the available statistical data to be taken from the financial statements of the company. The results obtained regarding the real net profit are shown in Figure 3.

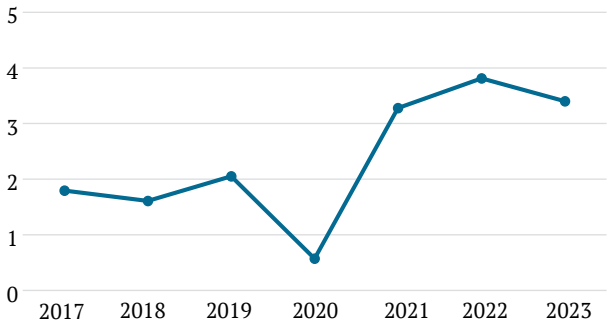

Figure 3. Data on real net profit of JSC Manas International Airport (in 2017 prices) for the period from 2017 to 2023, billion KGS
Source: compiled by the authors based on Kyrgyz stock exchange (2024) and Kyrgyzstan inflation (2024)

Based on the data from Figure 3, a linear regression formula was constructed in which the constant is 0.3735 and the coefficient near the dependent variable (order of year from 1 to 7, where 1 is 2017 and 7 is 2023) is 0.8664. This concludes that the value of the company's profitability

in real terms will be equal to 3.854 billion KGS (considering the standard deviation, which is equal to 0.785 billion KGS). At the same time, the probability that the company's income in real terms will be higher is equal to 72%, and the probability that it will become negative is very close to zero (0.000046%). In other words, the company can become unprofitable only in the case of a "black swan", which is also a sign of its financial stability. However, it is still worth considering that the conclusions were made based on data from only 7 years, and therefore may be inaccurate. More data is required to form more accurate judgements.

As described above, an integrated approach to analysing financial statement risks involves meaningfully more information than simply analysing data from the financial statements. This has been partially done above, as some market trends have been considered, reputational risks have been assessed, and the impact of the international situation on the company's future analysis capabilities has been analysed. Nevertheless, a full-fledged analysis of this kind is possible only in case of direct contact with the management of the company to understand internal trends, processes, and development strategies, and assess the specifics of their practices. To fully assess and understand the company's risks, one should be either an auditor (external or internal) or work directly in the company. However, some common components of an integrated approach to risk analysis can be applied without this information.

DISCUSSION

Thus, the conducted study on risk analysis and economic security of JSC Manas International Airport for the period from 2017 to 2023 revealed the financial stability and risk tolerance of the company. The company as a whole demonstrates positive trends of profit, sales, and asset growth with simultaneous reduction of debt liabilities. The calculated indicators confirmed high financial stability and effective control of financial risks. Despite the challenges of the COVID-19 pandemic and geopolitical changes, the company was able to maintain profitability, indicating a strong governance and risk minimisation strategy. Altman Z-Score also confirms the extremely low probability of bankruptcy and the high level of financial stability of the company (Xhafka *et al*., 2023). Overall, the integrated approach to risk analysis of JSC Manas International Airport's financial statements demonstrates the company's strong position and its ability to effectively manage financial risks, ensuring long-term sustainability. However, the company's managers should monitor changes in the world to be able to quickly apply solutions in case of sudden changes in the geopolitical or economic situation, as was the case at the beginning of the COVID-19 pandemic (Nimani & Spahija, 2023).

A new model on the principles of flexibility and sustainability was proposed by D. Settembre-Blundo *et al*. (2021). They proposed a conceptual model that combines strategic and operational aspects of risk, which tries to link the selected variables (different types of risks, the company itself and the operations it carries out) through positivist and qualitative interpretation. S. Pizzi *et al*. (2021) also linked selected risks to sustainability objectives and therefore tried to categorise them according to their relevance. The present study also addressed risk management as one of the components of the qualitative development of the company. The features of the integrated model, also described in the paper, could be used for better identification of risks, and thus for finding opportunities to face them. Thus, the application of the recommendations outlined in this study can significantly improve the ability of companies to reduce the risk of any risky situations.

The assessment of risks of overseas investments on the example of Haier Group following international financial reporting standards was carried out by B. Zhong *et al*. (2022). Researchers categorised the risks into macro and micro risks, with macro risks being those that cover international political crises, fluctuations in economic development, market changes, legal problems, cultural integration problems and epidemic risks, and micro risks being the reduction in the cost of enterprise operations and fluctuations in international exchange rates. To assess and identify these risks, the *z* score and the event analysis method were used, combining qualitative and quantitative approaches. The conclusions they have formed advised the importance of combining the efforts of governments and society with a robust domestic system can help enterprises balance the benefits and risks of overseas investment. This study did not distinguish between micro and macro risks but also used Altman Z-Score, which is a fairly effective method of calculating the probability of a company's bankruptcy. Its application in current conditions, especially in the case of customising it to apply to the realities of individual industries and countries.

A multidimensional approach to the assessment of corporate financial risk was described by M.S. Çolak (2021). He proposed the use of two innovative composite indices designed to assess the financial condition of non-financial firms. The indices they described were adapted specifically for the conditions of Turkish firms, while they outperform the original Altman Z-Score in terms of accuracy. The analysis shows that firms with open currency positions tend to have lower scores on the selected indices, indicating a higher vulnerability to economic shocks. This vulnerability is more pronounced for smaller firms, which also constitute the majority of firms in the distress zone despite their smaller share in total assets, and conversely, larger firms with better currency control predominantly occupy the safe zone (Spytska, 2023). In this study, Altman Z-Score was used to form conclusions regarding the assessment of the bankruptcy risk of the selected firm but without introducing any modification to it. To assess the financial stability of the analysed company addressing the inherent risks of Kyrgyzstan, a higher bar was chosen during the analysis of individual financial indicators to conclude the stability of the company, and to increase their accuracy.

The importance of financial reporting as a crucial tool for identifying and systematising business risks in accounting was shown by E.W. Babuska (2021). The study suggested the use of specific analytical financial indicators to facilitate risk analysis, allowing detailed characterisation and systematisation of risks based on their visibility in the components and items of financial statements. The study also noted that while financial reporting is publicly available and serves as a valuable resource for various stakeholders, including investors, to identify and assess risks, it does not cover risks related to social and environmental issues,

making it increasingly relevant over time to create reports that can assess these risks as well. The present study also proposed quite clear financial indicators for analysing the financial condition of the enterprise and described methods of forming assessments about the situation in this context. However, it is worth noting that in the world at the moment it is more and more common to submit reports that disclose not only financial but also other indicators of the company's activity (Stender, 2023). Thus, the spread of this type of reporting culture in Kyrgyzstan would make it easier to analyse risks and the overall situation of the company.

H. Wu *et al*. (2022) evaluated the financial fraud risk analysis based on data from financial statements. Researchers noted that fraud corporations tend to hire audit firms that have previously issued standard unqualified opinions to other fraud organisations and that auditors with experience in auditing fraud are likely to continue working for fraud corporations after a change of employment. In other words, they believe that there should be some changes both in the processes for selecting auditors to detect fraud in companies and also in terms of the approaches to evaluating financial statements themselves. This study did not focus on the possibility of auditors acting in bad faith when preparing financial statements, but it is worth recognising that this is a widespread problem and that public authorities should take appropriate measures to counter it.

The overall results of the risk and economic security study of JSC Manas International Airport for the period from 2017 to 2023 confirmed the financial stability and high level of risk tolerance of the company. The company generally demonstrates positive trends in the growth of profits, turnover and assets, while reducing debt. The calculated indicators confirmed high financial stability and effective control of financial risks. Despite the challenges of the COVID-19 pandemic and geopolitical changes, the company has managed to maintain profitability, which indicates a strong strategy. The Altman Z-Score also confirms the extremely low probability of bankruptcy and the high level of financial stability of the company. In general, the integrated approach to risk analysis of the financial statements of JSC Manas International Airport demonstrates the company's strong position and its ability to effectively manage financial risks, ensuring long-term sustainability. However, the company's managers should monitor changes in the world to be able to quickly apply solutions in the event of sudden changes in the geopolitical or economic situation, as happened at the beginning of the COVID-19 pandemic.

CONCLUSIONS

The study has shown that a comprehensive approach to analysing risks in financial reporting, aimed to ensure the economic security of the enterprise, includes a variety of methods and tools for assessing potential threats and vulnerabilities affecting the financial health and stability of the company. This strategy is complex and involves several major steps related not only to the assessment of the company's financial performance but also other variables. The risks themselves can be divided into several subtypes, such as market, credit, and liquidity risks, but a thorough analysis of them should make it possible to evaluate them and propose methods to improve the ability to manage them.

The described principles were used to assess the risks inherent in JSC Manas International Airport for the period from 2017 to 2023. The analysis revealed positive trends in the company's financial performance, including growth in profits, sales, and assets, as well as a reduction in debts. The calculated financial ratios suggest that the company is financially sound and effectively manages its financial risks even in the face of challenges such as the COVID-19 pandemic and geopolitical instability. Altman Z-Score further confirms the financial strength of the company, indicating an extremely low probability of bankruptcy. The impact of exchange rate changes on the company's profitability, except for a small deviation in 2019, was generally positive, suggesting a competent strategy in this area. Given the comprehensive approach to analysing the company's financial statements, reputational risks were also assessed, but no significant issues were found in this context. In addition, a sensitivity analysis of some indicators (the impact of their change on net profit) and a probabilistic analysis were carried out, which showed that the company has a fairly stable financial position. Its long-term strategy should focus on increasing revenue, as the sensitivity analysis showed that this is what leads to profit maximisation. Further research should focus on the development of other approaches for analysing the risks of the financial statements of companies. In addition, it remains relevant to carry out calculations of the state of the risk level at other enterprises in the country.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Alieva, B., Saparbayev, A., Zhanibekova, G., Noiyanov, M., & Kim, V. (2020). Methodology for managing financial risks of Kazakhstan enterprises. *E3S Web of Conferences*, 159, article number 04018. doi: 10.1051/e3sconf/202015904018.

[2] Alotaibi, E.M. (2023). Risk assessment using predictive analytics. *International Journal of Professional Business Review*, 8(5), article number e01723. doi: 10.26668/businessreview/2023.v8i5.1723.

[3] Babuska, E.W. (2021). Financial statements as the basis for the systematics of risks in the accounting area. *Journal of Accounting and Auditing: Research & Practice*, 2021, article number 420535. doi: 10.5171/2021.420535.

[4] Brauweiler, H.C., & Madmarov, N. (2020). Risk management attitude of banks: Comparative analyses of national and foreign banks in Germany and Kyrgyzstan. In *Proceedings of the jubilee international scientific conference dedicated to the 100th anniversary of the University of Economics "Economic science, education and the real economy: Development and interactions in the digital age"* (pp. 123-137). Varna: University of Economics.

[5] Çolak, M.S. (2021). A new multivariate approach for assessing corporate financial risk using balance sheets. *Borsa Istanbul Review*, 21(3), 239-255. doi: 10.1016/j.bir.2020.10.007.

[6] Dudek, M., Bashynska, I., Filyppova, S., Yermak, S., & Cichoń, D. (2023). Methodology for assessment of inclusive social responsibility of the energy industry enterprises. *Journal of Cleaner Production*, 394, article number 136317. doi: 10.1016/j.jclepro.2023.136317.
[7] Generalov, A., & Generalova-Kutuzova, O. (2021). Economics, legal, political and social environment of entrepreneurs in Kyrgyzstan. In *Engines of economic prosperity* (pp. 337-357). Cham: Palgrave Macmillan. doi: 10.1007/978-3-030-76088-5_18.
[8] Kliestik, T., Valaskova, K., Lazaroiu, G., Kovacova, M., & Vrbka, J. (2020). Remaining financially healthy and competitive: The role of financial predictors. *Journal of Competitiveness*, 12(1), 74-92. doi: 10.7441/joc.2020.01.05.
[9] Kulustayeva, A., Jondelbayeva, A., Nurmagambetova, A., Dossayeva, A., & Bikteubayeva, A. (2020). Financial data reporting analysis of the factors influencing on profitability for insurance companies. *Entrepreneurship and Sustainability Issues*, 7(3), 2394-2406. doi: 10.9770/jesi.2020.7.3(62).
[10] Kupyra, M., & Kyryshko, M. (2020). Formation of financial strategy in the system of providing of competitiveness of enterprises. *Economic Forum*, 3, 104-110. doi: 10.36910/6775-2308-8559-2020-3-16.
[11] Kyrgyz stock exchange. (2024). Retrieved from https://www.kse.kg/ru/ListingDetails/MAIR.
[12] Kyrgyzstan inflation. (2024). Retrieved from https://www.focus-economics.com/country-indicator/kyrgyzstan/inflation/#:~:text=Consumer%20price%20inflation%20in%20Kyrgyzstan,information%2C%20visit%20our%20dedicated%20page.
[13] Li, J., Feng, Y., Li, G., & Sun, X. (2020). Tourism companies' risk exposures on text disclosure. *Annals of Tourism Research*, 84, article number 102986. doi: 10.1016/j.annals.2020.102986.
[14] Ma, H., Sun, Z., & Fang, C. (2020). Risk assessment of transnational oil investment in Central Asia using a fuzzy comprehensive evaluation method. *Regional Sustainability*, 1(1), 11-19. doi: 10.1016/j.regsus.2020.06.002.
[15] Mosteanu, N.R., & Faccia, A. (2020). Digital systems and new challenges of financial management – fintech, XBRL, blockchain and cryptocurrencies. *Quality – Access to Success*, 21(174), 159-166.
[16] Nimani, A., & Spahija, D. (2023). Financial markets and price increases in Europe after the russian-Ukrainian War. *Scientific Horizons*, 26(3), 135-145. doi: 10.48077/scihor3.2023.135.
[17] Pizzi, S., Rosati, F., & Venturelli, A. (2021). The determinants of business contribution to the 2030 agenda: Introducing the SDG reporting score. *Business Strategy and the Environment*, 30(1), 404-421. doi: 10.1002/bse.2628.
[18] Podra, O., & Petryshyn, N. (2023). Theoretical and methodological aspects of analysing the foreign economic activity of enterprises. *Economics, Entrepreneurship, Management*, 10(1), 51-58. doi: 10.56318/eem2023.01.051.
[19] Rodríguez-Espíndola, O., Chowdhury, S., Dey, P.K., Albores, P., & Emrouznejad, A. (2022). Analysis of the adoption of emergent technologies for risk management in the era of digital manufacturing. *Technological Forecasting and Social Change*, 178, article number 121562. doi: 10.1016/j.techfore.2022.121562.
[20] Sabău, A.-I., Mare, C., & Safta, I.L. (2021). A statistical model of fraud risk in financial statements. Case for Romania companies. *Risks*, 9(6), article number 116. doi: 10.3390/risks9060116.
[21] Settembre-Blundo, D., González-Sánchez, R., Medina-Salgado, S., & García-Muiña, F.E. (2021). Flexibility and resilience in corporate decision making: A new sustainability-based risk management system in uncertain times. *Global Journal of Flexible Systems Management*, 22(2), 107-132. doi: 10.1007/s40171-021-00277-7.
[22] Spytska, L. (2023). Prospects for the legalization of cryptocurrency in Ukraine, based on the experience of other countries. *Social and Legal Studios*, 6(4), 226-232. doi: 10.32518/sals4.2023.226.
[23] Stender, S. (2023). Improvement of accounting and tax accounting of receivables. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 10(2), 42-53. doi: 10.52566/msu-econ2.2023.42.
[24] Wu, H., Chang, Y., Li, J., & Zhu, X. (2022). Financial fraud risk analysis based on audit information knowledge graph. *Procedia Computer Science*, 199, 780-787. doi: 10.1016/j.procs.2022.01.097.
[25] Xhafka, E., Teta, J., Philippov, D.I., Kostyrin, E.V., Leelang, S., Nikolaeva, I.V., Maramygin, M.S., Ruban-Lazareva, N.V., Muda, I., & Dudnik, O.V. (2023). Private health insurance in the post-pandemic era: Spatial econometric market development analysis. *Emerging Science Journal*, 7(6), 2080-2096. doi: 10.28991/ESJ-2023-07-06-013.
[26] Zhong, B., Soh, W.N., Ong, T.S., Muhammad, H.B., & He, C.X. (2022). Risk assessment of Haier Group's overseas investment under international financial reporting standards. *Frontiers in Psychology*, 13, article number 889670. doi: 10.3389/fpsyg.2022.889670.

Ельвіра Ногоїбаєва
Кандидат економічних наук, доцент
Киргизький економічний університет імені М. Рискулбекова
720033, вул. Тоголок Молдо, 58, м. Бішкек, Республіка Киргизстан
https://orcid.org/0000-0003-1867-6650

Назіра Маматова
Кандидат економічних наук, доцент
Киргизький економічний університет імені М. Рискулбекова
720033, вул. Тоголок Молдо, 58, м. Бішкек, Республіка Киргизстан
https://orcid.org/0000-0002-4685-9342

Салтанат Деркенбаєва
Старший викладач
Киргизький національний аграрний університет імені К.І. Скрябіна
720005, вул. Медерова, 68, м. Бішкек, Республіка Киргизстан
https://orcid.org/0000-0002-4580-9730

Умут Омурзакова
Кандидат економічних наук
Киргизький державний технічний університет імені І. Раззакова
720044, просп. Ч. Айтматова, 66, м. Бішкек, Республіка Киргизстан
https://orcid.org/0000-0003-2149-2959

Інтегрований підхід до аналізу ризиків у фінансовій звітності для забезпечення економічної безпеки підприємства

Анотація. У поточних умовах міжнародної турбулентності залишається актуальним пошук нових підходів до аналізу ризиків для підприємств із метою забезпечення їх якісної майбутньої діяльності. У цьому контексті дослідження мало на меті запропонувати один із таких підходів, який дозволить оцінити забезпечення економічної безпеки компаній. У дослідженні використано системний підхід та метод прогнозування для аналізу фінансової звітності, застосовано процесний підхід, що включає оцінку ринкового положення, зовнішніх факторів та репутації компанії. Ця комплексна оцінка допомогла виявити ризики та знайти методи їхнього зменшення. Фінансові ризики, виявлені у звітності компанії, були категоризовані на ринкові, кредитні та ризики ліквідності. Цей підхід був застосований до Акціонерного товариства «Міжнародний аеропорт Манас» із 2017 року по 2023. Системний підхід дозволив оцінити стійке ринкове положення компанії, що позитивно впливає на фінансову стабільність. Вивчення зовнішніх факторів, таких як економічні умови та регуляторні зміни, допомогло оцінити потенційні ризики. Методом прогнозування оцінено фінансові показники, такі як прибутковість, обсяги продажів та активи, розкриваючи позитивні тенденції: збільшення прибутковості, вищі обсяги продажів та активів, зменшення заборгованості. Ці тенденції свідчать про фінансову стабільність та ефективний контроль ризиків, навіть у кризові періоди. Аналіз ліквідності показав достатній обсяг ліквідних активів для покриття короткострокових зобов'язань, що підкреслює фінансову стабільність. Таким чином, компанія ефективно керує фінансовими ризиками. Результати, що отримано в рамках дослідження, можуть бути застосовані для подальшої оцінки економічного добробуту підприємств у Киргизстані як урядовими представниками, так і незалежними експертами

Ключові слова: аудит; диверсифікація; ліквідність; страхування; хеджування

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2
2024

UDC 338.2
DOI: 10.57111/econ/2.2024.27

Marharyta Berdar*
Doctor of Economics, Professor
Taras Shevchenko National University of Kyiv
01033, 60 Volodymyrska Str., Kyiv, Ukraine
https://orcid.org/0000-0001-5124-5233

Liudmyla Kot
PhD in Economics, Associate Professor
Taras Shevchenko National University of Kyiv
01033, 60 Volodymyrska Str., Kyiv, Ukraine
https://orcid.org/0000-0002-7142-8149

Lyudmila Martyniuk
PhD in Economics, Associate Professor
Taras Shevchenko National University of Kyiv
01033, 60 Volodymyrska Str., Kyiv, Ukraine
https://orcid.org/0000-0002-3642-170X

Olha Yevtushevska
PhD in Economics, Associate Professor
Borys Grinchenko Kyiv Metropolitan University
04053, 18/2 Bulvarno-Kudriavska Str., Kyiv, Ukraine
https://orcid.org/0000-0002-4935-5473

Yurii Sapachuk
PhD in Economics, Senior Lecturer
National University of Kyiv-Mohyla Academy
04070, 2 Skovoroda Str., Kyiv, Ukraine
https://orcid.org/0009-0005-4301-5442

Challenges and prospects of innovation and investment development of enterprises in the post-war period

Abstract. Innovation and investment development a key factor that will influence the recovery and development of enterprises in the post-war period. Investments in innovations can become a source of economic growth after the war, which will stimulate the creation of new jobs, and increase the productivity and competitiveness of enterprises, which will contribute to the development of all sectors of the economy. Thus, the study aimed to identify the main problems and opportunities for investment and innovative business development in the country in the post-war period. Theoretical research methods such as generalisation, statistical analysis, in particular, data aggregation and sample grouping, and analysis of development indices were used to achieve this goal. The study, based on the analysis of key factors, substantiated the relationship between investment and innovation, as well as between investment opportunities and financial results

Article's History: Received: 11.02.2024; Revised: 15.05.2024; Accepted: 27.06.2024

Suggested Citation:
Berdar, M., Kot, L., Martyniuk, L., Yevtushevska, O., & Sapachuk, Yu. (2024). Challenges and prospects of innovation and investment development of enterprises in the post-war period. *Economics of Development,* 23(2), 27-37. doi: 10.57111/econ/2.2024.27.

*Corresponding author

of business entities. Several key issues that hinder the innovation and investment development of enterprises in Ukraine and will have an impact in the future were identified and analysed in detail using statistical data, including the lack of financial resources, lack of proper infrastructure, problems with human resources, and corruption, which significantly affects Ukraine's position in certain international investment ratings, resulting in difficulties in attracting foreign capital. It was established that all the above problems were significantly escalated as a result of the war. The features of innovative activity of enterprises in the conditions of war were studied and the main directions of support required by business in this area were formed. The necessity of comprehensive state support to stimulate the innovation and investment development of enterprises in the post-war period was substantiated. The results of the study can be used by public authorities, business entities and the scientific community dealing with the issues of innovation and investment activities of enterprises

Keywords: competitiveness; financial resources; economic recovery; infrastructure; government support; financial incentives

INTRODUCTION

The war that has been going on in Ukraine since 2014 has triggered transformational changes both at the national level and at the level of business entities, which have partially or completely changed their operating conditions, from reorientation to new, European, markets to relocation of production facilities and revision of business strategies. The challenging socio-economic conditions currently prevailing in Ukraine have a significant impact on business development. New problems that business entities face all the time require rapid adaptation to modern realities. The innovation and investment component can become a catalyst for restoring and unlocking the economic potential of enterprises, both now and after the end of the war. The innovation and investment development of enterprises in the post-war period is critical for economic recovery and further sustainable economic growth. As a result of the war, businesses faced destroyed infrastructure and production capacity, as well as economic instability. Therefore, opportunities for innovative solutions and investment projects need to be created to help restore production capacity, increase productivity, and provide a positive impact on the economy (Garafonova *et al.*, 2023).

The problems of innovation and investment activity in the period of post-war reconstruction of Ukraine were studied by V. Levytskyi & S. Radynskyi (2023). The authors concluded that the regulatory framework needs to be improved to ensure the development of the country's innovation system and the gradual application of the principles of attracting public investment and managing innovation. However, they did not indicate what exactly in the legal documents should be changed to promote innovation and stimulate investment, and how this will affect these processes in the post-war period. The conditions for preserving and post-war development of the innovation and investment potential of Ukrainian enterprises were studied by R.V. Mann & S.V. Makhno (2022). According to the results of the study, the researchers argued that the introduction and intensification of the investment and innovation component in the activities of enterprises is a long-term and systematic process that involves the comprehensive work of both business entities and government agencies. In particular, the authors proposed to develop an algorithm for the practical implementation of legislatively enshrined instruments aimed at stimulating both investment and innovation activities, with an emphasis on protecting investors' rights and expanding government programmes of preferential business lending.

M. Panchenko (2023) dedicated considerable emphasis to digital transformation as one of the key areas of post-war revival and the development of innovation and investment opportunities in the national economy. The author concluded that the introduction of digital technologies into the national economy will contribute to a more effective disclosure of the innovation and investment potential of Ukrainian business, as well as contribute to the modernisation of Ukrainian society, making it more adaptable, mobile and ready for change. However, the study did not explore how to implement digital transformation and how to encourage businesses to do so. O. Popelo & V. Malysh (2023) noted that the prolonged economic changes caused by the war create a need for accelerated implementation of innovative solutions, which involves the use of new management methods that should also consider the specifics of state regulation and support for small and medium-sized businesses, both during the war and in the post-war period. In other words, the authors considered adaptive management as a key approach that should be used by domestic enterprises for innovation and investment opportunities. O. Kulakov (2023) analysed the current state of innovation and investment activity in Ukraine in his study. The results obtained gave grounds to assert that the key indicators of innovation and investment activity indicate insignificant changes in this area, which hurts the competitiveness of the Ukrainian economy. The author noted that the problems of the low level of innovation orientation of enterprises and the lack of investment attractiveness remain unresolved.

Despite the existing developments, the issue of factors that influence the innovation and investment activities of enterprises in the current crisis conditions remains insufficiently covered and the relationship between investment and innovation of business entities in Ukrainian realities is not sufficiently substantiated. Therefore, the study aimed to identify the main problems and barriers in the innovation and investment activities of Ukrainian enterprises and assess the prospects for their post-war development based on investment in innovative solutions.

MATERIALS AND METHODS

To establish and substantiate the relationship between investment and innovation in enterprises, as well as to determine the role of the state in investment and business development, scientific studies were analysed. Theoretical methods were used to analyse and interpret existing theories and concepts in the field of investment and innovation

development, in particular, the generalisation of induction and deduction. The relationship between the financial results of enterprises and their investment and innovation activities was established. Using empirical data, based on the method of formalisation, several barriers had been formed that limit the innovation and investment development of enterprises in Ukraine and will increase in the post-war period. Analysis of statistical data published by the State Statistics Service of Ukraine (Capital investment by type..., n.d.; Capital investment indices..., n.d.; Expenditure on research..., n.d.; Net profit..., n.d.; Sources of financing..., 2020; Implementation of innovations..., 2021; Number of innovatively..., 2021) was carried out.

The structural analysis method, in particular, the share indicator, which determines the relative contribution or importance of a particular element in the formation of the final result, was used to determine the share of expenditures on research and development (R&D) about gross domestic product (GDP), the share of implemented investments in R&D in the total amount of capital investments, the share of innovatively active enterprises in the total number of business entities, as well as the share of the volume of sold innovative products. To analyse investment and innovation activity, the indicator of capital investment was used, since it characterises the financing of costs incurred for the purchase or production of both tangible and intangible assets, including investments in the purchase, development, and creation of rights to use natural resources, various property assets, information technology products and databases, patents, licences, and other copyrighted items. At the same time, the dynamics of the capital investment index were studied to determine the impact of inflation.

Based on the graphical method of grouping and displaying data, which uses graphs to visualise and analyse relationships to identify patterns, the trends in the change in the capital investment index and the share of innovative products sold in the total number of all products sold by industrial enterprises in Ukraine were identified. Indicators of time series analysis, particularly the growth rate, which characterises the percentage rate of change relative to a certain period, were used to determine the percentage change in R&D costs in 2015-2022, official statistics for 2023 are not available. A sociological survey of Ukrainian business conducted by the Institute for Economic Research and Policy Consulting (Kuziakiv *et al.*, 2023) was used to assess the relevance of innovation activities of enterprises in Ukraine during the war, and the key desirable factors for Ukrainian enterprises to stimulate their investment and innovation activities were formed.

RESULTS

Innovation and investment activities involve enterprises investing financial resources in the R&D of new, innovative products, technologies, or processes to increase their competitiveness and revenues (Hou & Feng, 2024). Several key aspects can be identified. The relationship between innovation and investment is key to the development of any economy (Cherep *et al.*, 2021). Innovations contribute to the creation of new products, services, technologies and processes that can improve productivity, competitiveness and quality of life. Investment, in turn, provides the resources to implement innovative ideas and projects. Investment provides financial support for R&D, the introduction of new technologies and the creation of innovative products. Without adequate funding, innovative projects may remain at the conceptual stage or lack sufficient resources for effective development (Shabbir & Wisdom, 2020). Undoubtedly, investment and innovation activities stimulate competitiveness. Innovations can help companies differentiate themselves from competitors by creating unique products or services (Audretsch *et al.*, 2024). Therefore, investments in such innovations allow companies to maintain or enhance their competitiveness in the market.

On the other hand, innovative activities create opportunities for additional capital attraction. Successful innovation projects can attract new capital to companies or regions. Investors are interested in promising innovations that can generate high returns in the future (Gonçalves *et al.*, 2024). Investing in innovation can create new market opportunities for businesses and their investors. Innovations often open the door to new market segments or allow businesses to take leadership positions in existing markets. In addition, innovation can lead to an increase in the efficiency of resource use. Innovations can contribute to more efficient use of resources, which in turn can lead to increased profitability and lower costs (Ocadiz Amador & Robles Acevedo, 2023). Therefore, investing in such innovations is beneficial from an economic point of view. Thus, innovation and investment are interconnected and interdependent, as innovation requires investment for its development, and investment can stimulate innovation, which in turn contributes to the growth of both business entities and the country's economy as a whole.

The ability of enterprises to implement innovation and investment projects is influenced by the performance of their core business activities (Sinoimeri & Teta, 2023). The profitability of an enterprise determines its financial capacity and ability to invest in innovation. The relationship between profitability and investment in innovation can be viewed from several perspectives. The first is access to capital for investment, i.e. firms with high profitability usually have better access to capital. They can more easily raise funds through equity, bank loans, or corporate bonds. This allows them to finance innovative projects and research without significant financial constraints. In addition, companies with successful financial performance attract investors and risk capital. Investors who see the potential in enterprises with high profitability may be more inclined to invest in innovative projects of this enterprise (Liang *et al.*, 2023). Another aspect is an accumulation of internal reserves for innovation, i.e. high profitability allows enterprises to build up internal reserves that can be used to finance innovation. This is important because it reduces dependence on external sources of funding and the risks associated with external loans or investments.

Businesses that are focused on long-term success and strategic development may be more inclined to invest in innovation, even if it requires significant upfront costs. These organisations recognise that innovation can be a key factor in ensuring long-term competitiveness (Peng *et al.*, 2022). Therefore, given all the above, it is possible to argue that an enterprise's profitability determines its ability and propensity to invest in innovation, which in turn can contribute to its development and maintain

competitiveness in the market. Before the full-scale war, enterprises in Ukraine faced several challenges in innovation and investment. Lack of financial resources was one of the key barriers in this area. Many enterprises in the Ukrainian economy had limited access to financial resources for R&D, the introduction of new technologies and the creation of innovative products, and the full-scale war further impeded the development of innovation (Makohon & Adamenko, 2023). For example, R&D expenditures in 2016-2022 grew by an average of only 1.07% per year, and comparing 2022 to 2015, expenditures increased by only 6.1 billion UAH (Table 1).

Table 1. Expenditure on R&D by type of work

Year	Expenditure on R&D		Including			Share of R&D expenditures in GDP, %
	million UAH	Growth rate, %	Basic research, million UAH	Applied research, million UAH	R&D (experimental), million UAH	
2015	11,003.6	–	2,460.2	1,960.6	6,582.8	0.55
2016	11,530.7	4.79	2,225.7	2,561.2	6,743.8	0.48
2017	13,379.3	16.03	2,924.5	3,163.2	7,291.6	0.45
2018	16,773.7	25.37	3,756.5	3,568.3	9,448.9	0.47
2019	17,254.6	2.86	3,740.4	3,635.7	9,878.5	0.43
2020	17,022.4	–1.34	4,259	3,971.4	8,792.1	0.41
2021	20,923	22.91	5,155.2	4,782.9	10,985	0.38
2022	17,117.8	–18.18	4,081.3	4,827.6	8,208.9	0.33

Source: compiled by the authors based on Expenditure on research and development by type of work by region (n.d.)

The share of expenditures on research in GDP for all years was extremely small and averaged only 0.437% over the study period. Over the period 2015-2022, this indicator showed a downward trend, so when comparing 2022 to 2015, it is possible to establish that the share of expenditures in GDP decreased by 0.22%. The lack of a developed infrastructure for R&D significantly affects innovation activity and development opportunities in this area. Ukraine has an insufficiently developed scientific and technical base and infrastructure that could meet modern requirements, particularly the criteria of high technology, for effective R&D, which hinders the innovation activity of enterprises. The key aspect of this situation is the lack of capital investment (Table 2).

Table 2. Capital investment figures for the period 2018-2022

Indicators	2018	2019	2020	2021	2022
Total capital investments, million UAH	578,726.4	623,978.9	508,217	673,899.3	409,660
Capital investments in R&D, million UAH	1,511.4	2,057.6	2,076.2	2,629.9	3,185.2
% of investments in R&D	0.2612	0.3298	0.4085	0.3903	0.7775

Source: compiled by the authors based on Capital investment by type of economic activity of industry by region (n.d.)

Despite the growth of capital investment in R&D in 2022, when the indicator grew by more than 20%, the capital investment index showed negative dynamics due to significant inflationary processes caused by the war (Fig. 1).

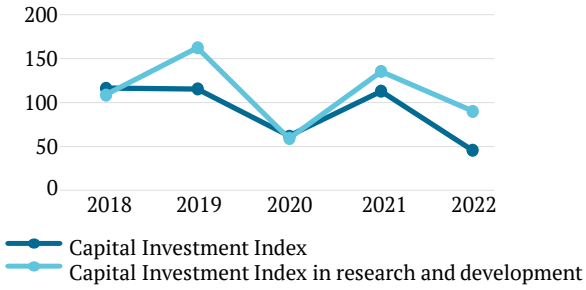

Figure 1. Dynamics of individual capital investment indices, %

Source: compiled by the authors based on Capital investment by type of economic activity of industry by region (n.d.), Capital investment indices by type of economic activity (n.d.)

The lack of appropriate human resources also has a significant impact. The low level of skills of employees in some sectors of the economy limited the ability of enterprises to implement innovative projects and introduce new technologies. In addition, an unstable legislative framework and the lack of effective tax support for innovative projects created uncertainty and risks for businesses willing to invest in innovation. Therefore, the number of enterprises engaged in innovation and classified as innovation-active is declining. Thus, the number of innovation-active enterprises in Ukraine in 2018-2020 decreased by 5,982 business entities compared to 2016-2018 (Table 3).

Table 3. Innovation-active enterprises in Ukraine

Number of innovation-active enterprises		Share of innovatively active enterprises in the total number of enterprises, %	
2016-2018	2018-2020	2016-2018	2018-2020
8,173	2,281	28.1	8.5

Source: compiled by the authors based on Number of innovatively active enterprises by type of economic activity (2016-2018, 2018-2020) (2021)

The share of innovation-active enterprises in the total number of business entities in 2018-2020 decreased significantly, by 19.6%, compared to 2016-2018. Official statistics are available only for 2020, but the number of both

business entities and innovation-active enterprises has decreased over the past two years of the war due to the occupation of the territories and economic instability. The most negative dynamics are in the field of industrial enterprises, where the number of innovation-active business entities decreased by more than 60% over the study period. Accordingly, the share of the volume of innovative products (goods and services) sold in the total amount of all products sold by industrial enterprises in Ukraine is constantly decreasing (Fig. 2).

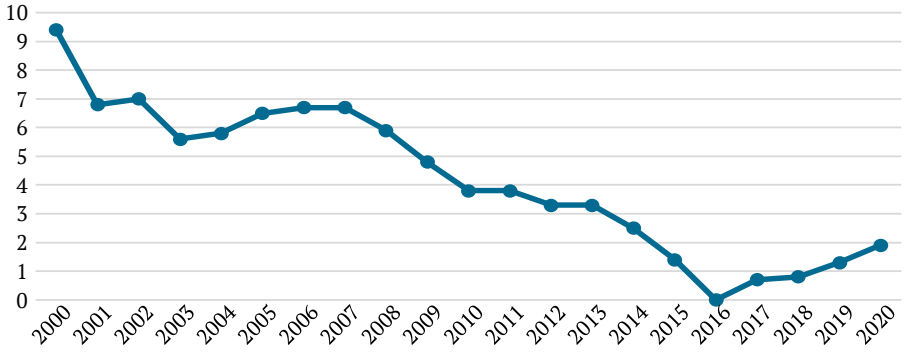

Figure 2. Share of innovative products sold in the total volume of all products sold by Ukrainian industrial enterprises, %

Source: compiled by the authors based on Implementation of innovations at industrial enterprises (2000-2020) (2021)

As can be seen from Figure 2, despite a slight increase in the indicator since 2017, Ukrainian industrial producers have not reached the level of 2014. The main sources of financing investment activity of enterprises in Ukraine are internally generated resources, which are formed as a result of financial and economic activity (Table 4).

Table 4. Share of sources of financing of innovation activities of industrial enterprises in Ukraine, %

Year	Own funds of enterprises	State budget funds	Funds of non-resident investors	Funds from other sources
2014	85	4.5	1.8	8.7
2015	97.2	0.4	0.4	2
2016	94.9	0.8	0.1	4.3
2017	84.5	2.5	1.2	11.8
2018	88.2	5.2	0.9	5.7
2019	87.7	3.9	0.3	8.1
2020	85.4	1.9	0.9	11.8

Source: compiled by the authors based on Sources of financing innovation activities of industrial enterprises (2020)

Furthermore, as shown in Table 4, the low level of trust in the investment climate in the country, in the stability and transparency of institutional actors, led to a limitation of opportunities to attract investment flows from sources other than own funds, which caused postponement of decisions on the development of innovative projects. In particular, the share of investment funds attracted from foreign investors has been very low throughout the study period, as they are reluctant to invest in the real sector of the economy, based on Ukrainian positions in various international rankings (Table 5). In terms of internal capacity to invest in innovation, due to the coronavirus pandemic and the restrictions imposed on their ability to operate and generate income, in 2020, the net profit of enterprises in Ukraine decreased significantly (only 13% of the previous period), and the number of enterprises that incurred losses increased significantly due to the war (Table 6).

Table 5. Ukrainian positions in selected international rankings

Global indices	2019	2020	2021	2022	2023
Global Innovation Index, ranking	47	45	49	57	55
Legatum Prosperity Index (investment environment), ranking	123	123	124	121	124
Investment Freedom Index, score	35	35	35	35	–
Investment Risk Index	–	–	–	–	18.2% (very high)

Source: compiled by the authors based on World Intellectual Property Organization (2023), A. Damodaran (2023), Index of economic freedom (n.d.)

Table 6. Profitability (loss) of Ukrainian enterprises, 2016-2022

Year	Net profit (loss), thousand UAH	Enterprises that generated profit	Enterprises that suffered losses
		As a % of the total number of enterprises	As a % of the total number of enterprises
2016	29,705,020.1	73	27
2017	168,752,792.7	72.4	27.6

Table 6. Continued

Year	Net profit (loss), thousand UAH	Enterprises that generated profit	Enterprises that suffered losses
		As a % of the total number of enterprises	As a % of the total number of enterprises
2018	288,305,468.1	73.9	26.1
2019	523,779,001.5	73.6	26.4
2020	68,054,905.5	71	29
2021	885,276,479.5	72.9	27.1
2022	–276,277,742.8	65.8	34.2

Source: compiled by the authors based on Net profit (loss) by region (n.d.)

All the above-mentioned problems hindered the innovation and investment activities of Ukrainian enterprises and required a comprehensive approach from the government, businesses and the public to address them, the war only exacerbated all these negative processes, and as a result, a significant number of enterprises in Ukraine, especially in the industrial sector, suffered losses and, accordingly, had little opportunity to invest, including in innovation. In general, the war contributed to the economic crisis, which decreased consumer demand and increased production costs. In addition, the decline in investment and the deterioration of the investment climate harmed the development and expansion of enterprises. There were fewer opportunities to export goods and services, which affected the profitability of enterprises. In addition, companies were forced to increase spending on security and personnel protection. It is also important to note that the military conflict caused significant exchange rate fluctuations, which affected the cost of imported materials and products used by domestic producers (Varnalii & Bondarenko, 2023). Finally, the war has reduced the labour market in the country due to the large number of refugees, mobilisation and other factors. Such conditions have significantly narrowed the opportunities for investment and innovation development of business entities in Ukraine.

According to a survey conducted by the Institute for Economic Research and Policy Consulting, the implementation of innovations in times of war is relevant to a varying degree for most enterprises (Kuziakiv *et al.*, 2023). For example, about 23% of companies, despite the war, emphasise that innovation is an extremely urgent and necessary process that is their priority. At the same time, for 46% of companies, innovations are relevant in the case of individual cases, mainly for competitive purposes. However, for 30% of the surveyed businesses, innovation is not relevant. It should also be noted that there is a certain level of uncertainty about the relevance of innovations, as about 16% of respondents could not answer this question specifically. It is worth noting that there is a connection between the relevance of innovation and the size of the enterprise. The larger the size of the business, the more likely it is that innovation will be implemented or is relevant for certain projects. Thus, approximately 43% of small enterprises do not consider innovations to be relevant at all, in contrast to medium and large enterprises, where the figure is 27% and 20%, respectively. In other words, about 80% of large industrial enterprises understand the importance and relevance of innovation, with 38% of enterprises making it a priority. After the outbreak of the all-out war, many enterprises were forced to cut spending on innovation (development and introduction of new or improved products and production methods), which accounted for half of businesses (42%). Only large businesses slightly increased their spending on innovation (35%), while 36% of large enterprises kept their spending at the pre-war level, which can be considered a good indicator.

Almost three-quarters of companies note that they need special long-term support programmes at the industry level. Many firms need specific financial (including tax) incentives and support measures to establish contacts with relevant innovators. In addition, one-third of companies need support in training relevant specialists in this area. At the same time, there is a high level of uncertainty, meaning that companies are unable to determine what exactly can stimulate their innovation activities in the current and future environment (Fig. 3).

Figure 3. Desirable factors for stimulating investment and innovation activities for Ukrainian enterprises (% of responses of the surveyed enterprises)
Source: compiled by the authors based on Capital investment by type of economic activity of industry by region (n.d.)

Different business support programmes can be useful for different types of firms. Micro-enterprises usually need financial incentives. Connecting with innovators and training professionals is critical for small and medium-sized businesses. The construction materials sector, which was heavily affected by the war, is best suited to targeted sectoral support programmes. At the same time, national steelmaking is likely to benefit the most from financial and fiscal incentives.

DISCUSSION

Thus, as the study results showed, investments have a decisive impact on the innovation activities of enterprises and shape their ability to develop and compete. Several important aspects can be identified in this area. This includes the development of new products and services. Investment allows enterprises to finance R&D to create new innovative products and services. This may include the introduction of new technologies, design, production processes and other innovative elements. Technological development itself plays an important role. Investment in technology is a key element of innovation. Businesses can invest in the development of new technologies, and upgrades to equipment and software, which increases their technical competitiveness. Investments provide enterprises with research centres, laboratories and groups to conduct scientific research. This is an important element for innovation, as it provides incentives for the creation of new knowledge and technologies. In addition, an important element of innovation and investment development of an enterprise is the unlocking of human resources, i.e. investments can be directed to the training and development of personnel specialising in innovation (Kichurchak, 2023).

Competent and creative employees are a key element for successful innovation. This is consistent with C. Lehmann *et al.* (2022), who addressed investment and innovation as drivers of the circular economy, that investment can be directed at creating and strengthening an innovative culture within the enterprise. This includes creating a favourable environment for creativity, supporting the idea of experimentation and risk-taking, and forming the basis for further investment in innovations that can provide the enterprise with a market advantage, increasing its competitiveness and attracting customers. Furthermore, in the context of innovation and investment development of enterprises, there is feedback between innovation and investment. This was confirmed by the results of the study. Companies that demonstrate innovative potential and successful results in this area can attract the attention of external investors (Ilchuk *et al.*, 2023). These can be venturing capitalists, private investors, corporate investors, or government funds that are interested in investing in companies with high growth and profit potential. Innovations can increase the value of a company by creating new products or services, expanding markets, improving production efficiency and other factors. Z. Wang *et al.* (2024) investigated methods and ideas for fostering resource efficiency and sustainability by creating robust resource markets. In order to support sustainable resource recovery and the ideas of the circular economy, the researchers looked at the function of resource markets.

O. Radchenko *et al.* (2023) concluded in their research that to implement investment and innovation projects, it is necessary to generate appropriate resources. This was confirmed by the results of the study, which determined that the most important source of funds in the Ukrainian context is the profit of the enterprises themselves. Enterprises with positive financial results can use their internal resources to finance innovative projects (Denysiuk *et al.*, 2022). This may include the profit remaining after paying all expenses and taxes, as well as accumulated reserves. As the results of the study showed, a positive financial result can increase an enterprise's access to external sources of funding, such as bank loans, corporate bonds or attracting investors. This allows the enterprise to raise additional funds for the implementation of innovative ideas and projects and increases the market reputation of the enterprise and, accordingly, the trust of investors, who may be more inclined to invest in such an enterprise that already demonstrates successful financial performance, thus making it easier to raise funds for innovative initiatives. As summarised by Ș.C. Gherghina *et al.* (2020), in a study that addressed the issue of investment and innovation of enterprises as a driving force for economic growth, and confirmed by the study, the financial performance of companies shapes their innovation activity, which cannot be implemented without appropriate investments that are formed from the company's profits.

Based on the study results, it was possible to state that the innovation and investment activities of enterprises in Ukraine had long suffered from several major problems, which were particularly acute during the full-scale war and will continue to exist in the post-war period. The primary constraint to innovation and investment development is the lack of funding. The lack of capital and affordable financial resources is one of the biggest obstacles to the development of innovative projects in Ukraine. The low level of investment in domestic start-ups and innovative enterprises forces many of them to seek funding abroad, limit their development to a slower pace, or postpone innovation due to a lack of resources. Another important factor is the outdated or non-existent infrastructure for innovation (Kramskyi *et al.*, 2023). Ukraine faces challenges in creating an effective innovation infrastructure, such as incubators, technology parks, and research centres, which, according to the study, is evidenced by the low level of capital investment. It is these structures that could create innovations that could be commercialised in the future. The absence of such institutions limits the opportunities for cooperation between businesses, research institutions and government agencies, which complicates the process of creating and developing innovative products. The high level of corruption also has a significant negative impact. Corruption is a serious impediment to business development in Ukraine, including the innovation sector (Buka *et al.*, 2023). Insufficient transparency, lack of stability and high risk in dealing with government agencies and regulators complicate the process of attracting investment, especially foreign investment. This was evidenced by the results of the study, including Ukraine's low positions in various international investment rankings. The lack of qualified personnel is also an urgent problem, as the results of the study showed, and will remain so in the post-war period. Insufficient level of

education and relevant skills in the field of innovation is an obstacle to the successful implementation of innovative projects. It is necessary to ensure an adequate level of state support for the training of specialists in science, technology and innovation to ensure sustainable economic development, so close cooperation between enterprises and scientific and educational institutions in this area will be critical. This was also confirmed by J. Schot & W.E. Steinmueller (2018), which substantiates the importance of state support for science and research after the Second World War in promoting economic growth and addressing the inability of the private sector to create new knowledge independently.

All the above problems require a comprehensive approach by the state, business and research institutions to create a favourable environment for the development of innovation and investment activities in Ukraine. R.V. Mann & S.V. Makhno (2022), in their study of the innovation and investment potential of Ukrainian enterprises, identified the need to ensure transparency and accessibility of information about investment opportunities, both for enterprises and start-ups and directly for investors. However, this statement is not entirely valid, as this is already being effectively implemented. Back in 2016, UkraineInvest, a governmental investment promotion and support organisation, was established to encourage foreign direct investment and to help existing investors scale up their businesses in Ukraine. This structure provides reliable and up-to-date information on optimal investment prospects and opportunities, advises on doing business in Ukraine, facilitates communication between investors and government agencies at various levels, and provides support and assistance in solving systemic problems that investors face. However, the authors rightly noted that the state plays a key role in enhancing the investment and innovation development of enterprises. The leading role of the state as a catalyst for these processes was confirmed by the results of the study, but it should be noted that enterprises themselves must understand the need to spend their funds on innovative developments to ensure their sustainable development. Encouraging innovation and entrepreneurship can be an important element of post-war economic recovery, as confirmed by the study by O. Garafonova *et al*. (2023). Therefore, it was possible to state that the government can create favourable conditions for investment in start-ups and innovative enterprises, for example, through financial incentives, grants and tax breaks, thus motivating business owners and management to implement innovations and increase the level of innovation culture in enterprises.

In general, the results of the study showed that in the post-war period, the prospects for innovation and investment development of enterprises will be shaped by several important aspects. First, it is the restoration of infrastructure. It is worth noting that modern investment in innovative technologies, in construction, transport, logistics, and energy, will ensure a quick and efficient restoration of infrastructure capabilities. The war shifted priority to security and defence technologies (Strilets *et al*., 2024). Therefore, the prospects for innovation and investment development in this sector may include the development and improvement of innovative security systems, drones, cyber defence and other innovative technologies that are already in use and will help ensure the security of both individual business entities and the state in the future. Given the unique opportunities provided by the use of innovative developments during military operations, it can become a competitive advantage for Ukrainian defence companies at the international level in the post-war period.

Thus, the investment and innovation development of enterprises in the post-war period is critical for the economic recovery and stabilisation of the country, which will be necessary due to the destroyed infrastructure, lack of resources, shortage of human resources and low level of trust in the country's financial and economic sector. In such circumstances, the effective use of investment and innovation can become a catalyst for economic growth. In general, the investment and innovation development of enterprises in the post-war period should play a leading role in economic recovery and sustainable development. An important condition for this is the creation of a favourable environment for investment and innovation, as well as careful planning and coordination of government measures, considering the specific needs and capabilities of businesses.

CONCLUSIONS

Investments and innovations are closely interrelated, i.e. both investments influence innovation activities and innovations influence the ability of businesses to generate their resources and attract external investments. Innovative development of enterprises is possible only if this area of activity is adequately financed. The basis of investment in innovation at Ukrainian enterprises is their funds, but the opportunities for Ukrainian business have been significantly reduced because of the war, so the prospect of further development on an innovative basis will largely depend on the ability of the state to support and stimulate this process. Thus, the main problem in the investment and innovation sphere of Ukrainian business is the lack of financial resources. Expenditures on innovation as a percentage of GDP are constantly decreasing, and the share of innovatively active enterprises in the total number of enterprises in the country is also showing negative dynamics. The decline in the capital investment index confirms the fact that Ukraine has an insufficiently developed scientific and technical base and infrastructure for R&D, which further slows down the innovation activity of Ukrainian enterprises. Businesses need special long-term support programmes at the sectoral level, which would include specific fiscal benefits and incentives, facilitate communication with innovation developers, and provide training for relevant innovation specialists.

In general, after the war, the prospects for innovation and investment development of enterprises will be determined by the need to restore infrastructure, so investments in infrastructure reconstruction and modernisation will be extremely important, and innovative technologies and developments can be used in this direction, by enterprises in the construction, transport, and energy sectors. Investments in the innovations of defence enterprises in Ukraine, because of the war, can be a good basis for further development of this industry, shaping the security and effectiveness of Ukrainian defence and strengthening the competitiveness of national defence enterprises in the international arena, which is determined by the possibility of implementing and testing innovations in real conditions.

The state will have to lead the innovative development of enterprises by creating a favourable environment for attracting investment and stimulating entrepreneurship and innovation. This may include providing financial support, implementing development strategies, carrying out state orders providing tax incentives for innovative enterprises, and funding research programmes in priority areas of the economy. Further research should focus on the development of practical sectoral support programmes for enterprises to stimulate their investment and innovation development.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Audretsch, D.B., Belitski, M., & Chowdhury, F. (2024). Knowledge investment and search for innovation: Evidence from the UK firms. *Journal of Technology Transfer*. doi: 10.1007/s10961-023-10045-7.

[2] Buka, S., Tkachuk, V., Kondratiuk, V., Tonkha, O., & Slobodyanyuk, N. (2023). Prospects for agribusiness in Ukraine over the next 5 years. *International Journal of Environmental Studies*, 80(2), 291-298. doi: 10.1080/00207233.2022.2157630.

[3] Capital investment by type of economic activity of industry by region. (n.d.). Retrieved from https://ukrstat.gov.ua/operativ/operativ2023/ibd/kin_reg/kin_vedp_new_u.htm.

[4] Capital investment indices by type of economic activity. (n.d.). Retrieved from https://ukrstat.gov.ua/operativ/operativ2013/ibd/iki_ed/iki_ed_u/arh_ikedvk_u.html.

[5] Cherep, A., Mostenska, T., Cherep, O., Tarasiuk, H., & Bexhter, L. (2021). Relationship of investment development and innovative activity of industrial enterprises. In *The importance of new technologies and entrepreneurship in business development: In the context of economic diversity in developing countries* (pp. 286-303). Cham: Springer. doi: 10.1007/978-3-030-69221-6_21.

[6] Damodaran, A. (2023). *Country risk: Determinants, measures and implications – the 2023 edition*. doi: 10.2139/ssrn.4509578.

[7] Denysiuk, O., Svitlyshyn, I., Tsaruk, I., Vikarchuk, O., & Dankevych, A. (2022). Diversification in the enterprises' activities for sustainable development in the agricultural sector. *Review of Studies on Sustainability*, 12(2), 85-102. doi: 10.3280/RISS2022-002007.

[8] Expenditure on research and development by type of work by region. (n.d.). Retrieved from https://ukrstat.gov.ua/operativ/operativ2021/ni/ni_vvndrvr_reg.html.

[9] Garafonova, O., Yankovoi, R., Zhosan, H., Lomachynska, I., Ananiev, M., & Dvornyk, I. (2023). International experience in applying innovative financial management strategies for business revitalization in the post-war period in Ukraine. *Financial and Credit Activity: Problems of Theory and Practice*, 6(53), 43-57. doi: 10.55643/fcaptp.6.53.2023.4140.

[10] Gherghina, Ș.C., Botezatu, M.A., Hosszu, A., & Simionescu, L.N. (2020). Small and medium-sized enterprises (SMEs): The engine of economic growth through investments and innovation. *Sustainability*, 12(1), article number 347. doi: 10.3390/su12010347.

[11] Gonçalves, L., Faccin, K., Garay, J., Zarpelon, F., & Balestrin, A. (2024). The development of innovation and entrepreneurial ecosystems in cities: An institutional work approach. *Cities*, 146, article number 104747. doi: 10.1016/j.cities.2023.104747.

[12] Hou, G., & Feng, C. (2024). Innovation-driven policy and firm investment. *Finance Research Letters*, 61, article number 105001. doi: 10.1016/j.frl.2024.105001.

[13] Ilchuk, M., Nikitchenko, S., Sytnyk, O., & Pavlenko, V. (2023). Diversification of entrepreneurial activities in the agricultural sector of Ukraine's economy in the post-war period. *Ekonomika APK*, 30(4), 25-35. doi: 10.32317/2221-1055.202304025.

[14] Implementation of innovations at industrial enterprises (2000-2020). (2021). Retrieved from https://ukrstat.gov.ua/operativ/menu/menu_u/ni.htm.

[15] Index of economic freedom. (n.d.). Retrieved from https://www.heritage.org/index/pages/all-country-scores.

[16] Kichurchak, M. (2023). Impact of the information and communication sector on spatial development and post-war recovery of creative industries in Ukraine's economy. *Economic Forum*, 1(3), 12-21. doi: 10.36910/6775-2308-8559-2023-3-2.

[17] Kramskyi, S., Kolodinskyi, S., & Zakharchenko, O. (2023). Conceptual model for managing the phases of implementation of infrastructure projects and programmes in the post-war period. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 10(3), 33-40. doi: 10.52566/msu-econ3.2023.33.

[18] Kulakov, O. (2023). Analysis of the current state of investment innovative activity of Ukraine. *State and Regions. Series: Economics and Business*, 2(128), 12-18. doi: 10.32782/1814-1161/2023-2-2.

[19] Kuziakiv, O., Angel, Y., Gulik, A., & Fedets, I. (2023). *New monthly business survey*. Kyiv: The Institute for Economic Research and Policy Consulting.

[20] Lehmann, C., Cruz-Jesus, F., Oliveira, T., & Damasio, B. (2022). Leveraging the circular economy: Investment and innovation as drivers. *Journal of Cleaner Production*, 360, article number 132146. doi: 10.1016/j.jclepro.2022.132146.

[21] Levytskyi, V., & Radynskiy, S. (2023). Improvement of innovation and investment activities in the post-war reconstruction period of Ukraine: Organizational and legal aspects. *Galician Economic Journal*, 84(5), 151-161. doi: 10.33108/galicianvisnyk_tntu2023.05.151.
[22] Liang, W., Wang, Y., & Hou, L. (2023). Does private equity investment influence enterprise innovation strategy? *Finance Research Letters*, 58(D), article number 104593. doi: 10.1016/j.frl.2023.104593.
[23] Makohon, V., & Adamenko, I. (2023). Financial stabilization directions of the national economy in the marital law conditions. *University Economic Bulletin*, 18(3), 133-139. doi: 10.31470/2306-546X-2023-58-133-139.
[24] Mann, R.V., & Makhno, S.V. (2022). Innovation and investment potential of Ukrainian enterprises: Conditions of preservation and development in the post-war period. *Economic Scope*, 182, 144-148. doi: 10.32782/2224-6282/182-23.
[25] Net profit (loss) by region. (n.d.). Retrieved from https://ukrstat.gov.ua/operativ/operativ2020/fin/chpr/chpr_reg/chpr_reg_u/arh_chpr_reg2020_u.htm.
[26] Number of innovatively active enterprises by type of economic activity (2016-2018, 2018-2020). (2021). Retrieved from https://ukrstat.gov.ua/operativ/menu/menu_u/ni.htm.
[27] Ocadiz Amador, V., & Robles Acevedo, M.A. (2023). The influence of foreign direct investment on innovation and sustainability in the Mediterranean Basin. In *Proceedings book of the 8th multidisciplinary international conference "Human heritage, innovation and sustainable development in the Mediterranean Basin"* (pp. 371-378). Bruxelles: ETQA.
[28] Panchenko, M. (2023). Digital transformation as a direction for post-war recovery and realization of innovation and investment potential of Ukraine. *Economy and Society*, 51. doi: 10.32782/2524-0072/2023-51-4.
[29] Peng, J., Huang, W., Gao, H., & Wang, H. (2022). Modeling the unintended consequences of short selling for innovation investment. *North American Journal of Economics and Finance*, 62, article number 101763. doi: 10.1016/j.najef.2022.101763.
[30] Popelo, O., & Malysh, V. (2023). Adaptive management of innovative and investment development of industrial enterprises as factor of ensuring economic security. *Economic Synergy*, 1, 48-56. doi: 10.53920/ES-2023-1-4.
[31] Radchenko, O., Tkach, L., & Dendebera, O. (2023). Financing innovations in the agricultural industry as a component of the digital development of Ukraine's economy. *Scientific Bulletin of Mukachevo State University. Series Economics*, 10(4), 54-65. doi: 10.52566/msu-econ4.2023.54.
[32] Schot, J., & Steinmueller, W.E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47(9), 1554-1567. doi: 10.1016/j.respol.2018.08.011.
[33] Shabbir, M.S., & Wisdom, O. (2020). The relationship between corporate social responsibility, environmental investments and financial performance: Evidence from manufacturing companies. *Environmental Science and Pollution Research*, 27, 39946-39957. doi: 10.1007/s11356-020-10217-0.
[34] Sinoimeri, D., & Teta, J. (2023). Supply chain management performance measurement. Case studies from developing countries. *International Journal of Membrane Science and Technology*, 10(2), 1323-1331. doi: 10.15379/ijmst.v10i2.1380.
[35] Sources of financing innovation activities of industrial enterprises. (2020). Retrieved from https://www.ukrstat.gov.ua/operativ/operativ2020/ni/dj_fin_igpp/dj_fin_idpp_u.htm.
[36] Strilets, V., Franko, L., Dykha, M., Ivanov, M., & Rybina, L. (2024). The influence of innovative development in the EU countries and Ukraine on the competitiveness of national economies: A comparative analysis. *Problems and Perspectives in Management*, 22(2), 1-16. doi: 10.21511/ppm.22(2).2024.01.
[37] Varnalii, Z., & Bondarenko, S. (2023). Financial security of Ukrainian enterprises during the war and post-war period. *University Economic Bulletin*, 18(1), 106-113. doi: 10.31470/2306-546X-2023-56-106-113.
[38] Wang, Z., Feng, N., Zuo, W., & Jia, Y. (2024). Sustainable recovery through efficient resource markets: Innovations and solutions. *Resources Policy*, 88, article number 104350. doi: 10.1016/j.resourpol.2023.104350.
[39] World Intellectual Property Organization. (2023). *Global innovation index 2023: Innovation in the face of uncertainty* (16th ed.). Geneva: WIPO. doi: 10.34667/tind.48220.

Маргарита Бердар
Доктор економічних наук, професор
Київський національний університет імені Тараса Шевченка
01033, вул. Володимирська, 60, м. Київ, Україна
https://orcid.org/0000-0001-5124-5233

Людмила Кот
Кандидат економічних наук, доцент
Київський національний університет імені Тараса Шевченка
01033, вул. Володимирська, 60, м. Київ, Україна
https://orcid.org/0000-0002-7142-8149

Людмила Мартинюк
Кандидат економічних наук, доцент
Київський національний університет імені Тараса Шевченка
01033, вул. Володимирська, 60, м. Київ, Україна
https://orcid.org/0000-0002-3642-170X

Ольга Євтушевська
Кандидат економічних наук, доцент
Київський столичний університет імені Бориса Грінченка
04053, вул. Бульварно-Кудрявська, 18/2, м. Київ, Україна
https://orcid.org/0000-0002-4935-5473

Юрій Сапачук
Кандидат економічних наук, старший викладач
Національний університет «Києво-Могилянська академія»
04070, вул. Сковороди, 2, м. Київ, Україна
https://orcid.org/0009-0005-4301-5442

Виклики та перспективи інноваційно-інвестиційного розвитку підприємств у післявоєнний період

Анотація. Інноваційно-інвестиційний розвиток є ключовим фактором, який впливатиме на відновлення та розвиток підприємств у післявоєнний період. Інвестиції в інновації можуть стати джерелом економічного зростання після війни, що стимулюватиме створення нових робочих місць, підвищення продуктивності та конкурентоспроможності підприємств, що сприятиме розвитку всіх галузей економіки. Таким чином, метою дослідження було визначення основних проблем та можливостей інвестиційного та інноваційного розвитку бізнесу в країні в післявоєнний період. Для досягнення поставленої мети були використані такі теоретичні методи дослідження, як узагальнення, статистичний аналіз, зокрема, агрегування даних та групування вибірки, аналіз індексів розвитку. На основі аналізу ключових факторів у дослідженні обґрунтовано взаємозв'язок між інвестиціями та інноваціями, а також між інвестиційними можливостями та фінансовими результатами суб'єктів господарювання. Виявлено та детально проаналізовано з використанням статистичних даних кілька ключових проблем, які стримують інноваційно-інвестиційний розвиток підприємств в Україні та матимуть вплив у майбутньому, серед яких нестача фінансових ресурсів, відсутність належної інфраструктури, проблеми з кадрами та корупція, що суттєво впливає на позиції України в певних міжнародних інвестиційних рейтингах, що призводить до труднощів із залученням іноземного капіталу. Встановлено, що всі вищезазначені проблеми значно загострилися внаслідок війни. Досліджено особливості інноваційної діяльності підприємств в умовах війни та сформовано основні напрями підтримки, якої потребує бізнес у цій сфері. Обґрунтовано необхідність комплексної державної підтримки для стимулювання інноваційно-інвестиційного розвитку підприємств у післявоєнний період. Результати дослідження можуть бути використані органами державної влади, суб'єктами господарювання та науковою спільнотою, які займаються питаннями інноваційно-інвестиційної діяльності підприємств

Ключові слова: конкурентоспроможність; фінансові ресурси; економічне відновлення; інфраструктура; державна підтримка; фінансові стимули

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2
2024

UDC 336.051
DOI: 10.57111/econ/2.2024.38

Ludmila Piddubna*
Doctor of Economics, Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0002-9471-2820

Inna Dybach
Doctor of Economics, Associate Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0009-0003-4351-7077

Valeriy Krasovskiy
Postgraduate Student
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0009-0002-4387-6144

Kostiantyn Pliekhanov
Postgraduate Student
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0003-4590-2836

Ruslan Mogylevskyi
Postgraduate Student
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0009-0000-4396-7543

Analysis of the impact of digital development on a country's economic growth

Abstract. Examining the impact of digital technologies on advanced economies is crucial. The COVID-19 pandemic underscores their role in economic stability, emphasising the need to assess digitization's relationship with economic growth using regression models, which was the aim of this study. Analytical and inductive methods were utilised to determine the basic set of digitalization indicators. Through expert evaluation, a basis of five key indicators was formed: internet coverage level, level of financial activity online, level of digital skills development among the population, degree of integration of digital technologies into government processes, and volume of online purchases. To isolate the most influential factors, an experimental approach involving the construction of a linear regression model and the partial use of data augmentation statistical methods based on autoregression was employed. The results indicate that the most significant factor is the level of financial activity online. However, negative effects are observed in certain aspects

Article's History: Received: 25.12.2023; Revised: 20.03.2024; Accepted: 27.06.2024

Suggested Citation:
Piddubna, L., Dybach, I., Krasovskiy, V., Pliekhanov, K., & Mogylevskyi, R. (2024). Analysis of the impact of digital development on a country's economic growth. *Economics of Development,* 23(2), 38-46. doi: 10.57111/econ/2.2024.38.

*Corresponding author

of digitalization, such as online purchases, which require further analysis. The inclusion of state factors in the model proved to be crucial for accurately assessing the impact of digitalization on the economy. This underscores the need for further research in this area to gain a deeper understanding of the mechanisms by which digital technologies influence economic development and to develop development strategies. The overall results confirm theoretical concepts regarding the positive correlation between digitalization and economic development but also indicate the need for refinement and additional research into the specific mechanisms of this impact. This opens the way for further detailed evaluation of potential sub-indicators of this metric and a comprehensive understanding of the relationship between digitalization and the economy. In the public sector, these data can serve as a practical basis for policy adjustments related to the implementation of new technologies aimed at improving the economic situation

Keywords: transformation; digital economy; digitization; macroeconomic indicators; coefficient of determination

INTRODUCTION

Digitization is one of the key drivers of the global economy, necessitating a thorough analysis of its impact on the economic growth of nations. Digital development contributes to increased labour productivity through process automation and resource management optimisation. Digital technologies enable enterprises to reduce costs and enhance efficiency, thereby positively impacting the economic growth of the country. The integration of digital technologies into education and scientific activities opens up new opportunities for human capital development. With access to global information and resources, educational institutions can enhance the skills of their workforce, which is a fundamental factor in supporting sustainable economic growth. Digitization opens up new avenues for countries to engage in international trade and the global market. E-commerce, digital payment systems, and digital logistics significantly streamline international operations, providing faster and more efficient service to customers from around the world. It can be noted that digital development also contributes to the democratisation of the economy by providing broader access to market opportunities for small and medium-sized businesses. This stimulates innovative activity, entrepreneurial initiative, and competition, which are important for healthy economic development.

The process of digitization and its impact on economic development has been the subject of numerous academic works by foreign and Ukrainian scholars. L. Török (2024), in his article, explored the relationship between digital development and economic growth in European Union member states. The study confirmed a positive impact of digital development on the gross domestic product (GDP) of EU member countries. However, it was noted that this correlation did not apply to the year 2020 due to the influence of the COVID-19 pandemic. The research also revealed that more digitally advanced countries experienced a more dynamic development in digitization and GDP compared to less developed EU member states, indicating an increase in the gap between them. A.A. Oloyede *et al*. (2023) conducted research on defining and measuring the impact of the digital economy on the development of countries, utilising a systematic literature review and the PRISMA model. The results indicated that the lack of awareness of relevant datasets and the diversity of country-specific definitions complicated the harmonisation of concepts and metrics in the digital economy. It was suggested to create a tool that would facilitate comprehensive measurement, aiding in accurately determining the contribution of the digital economy to the GDP of developing countries. J. Zhang *et al*. (2022b) researched the impact of the digital economy on the development of countries along the "belt and road" and the consequences of the COVID-19 pandemic on their digital sectors. The results demonstrated a positive influence of the digital economy on economic development, as well as an increased demand for digital industries during the pandemic, particularly in Armenia, Israel, Latvia, and Estonia. The proposed recommendations include the necessity of infrastructure development, creating a favourable environment for the growth of digital enterprises, and expanding cooperation in digital trade.

S. Gomes *et al*. (2022) investigated the impact of the digital economy on the development of OECD countries, categorising them into groups based on their level of development. The results indicated that information and communication technology (ICT) positively influences the economic development of OECD countries, but the impact varies depending on the country's level of development. The authors also proposed recommendations for policymakers to reduce the digital divide and promote the development of the digital economy. I. Tiutiunyk *et al*. (2021) examined the role of digital transformation in achieving competitive advantages in the economy and identified a correlation between the level of macroeconomic stability and the digital transformation index for most EU countries. The obtained results demonstrated a bidirectional cause-and-effect relationship between the digital transformation of the economy and indicators of its macroeconomic stability. For further research, the importance of determining the intensity and nature of the relationship between the level of business competitive advantages and the digital transformation index was identified. A.I. Magoutas *et al*. (2024) investigated the relationship between the economic growth of the European Union and rapid advancements in ICT, using data from three global sources. The results demonstrated a positive correlation between ICT development and the GDP index, while also highlighting the crucial role of new artificial intelligence technologies in the business sector. The study underscores the necessity of enhancing human capital and accelerating the growth of e-government technologies to support the economic resilience of European countries.

Taking the above into account, researching the impact of digital development on a country's economic growth is extremely relevant and important for shaping digital transformation strategies at the national level, ensuring sustainable development, and improving the standard of living for the population. This article aimed to investigate the impact of digitization on the economic development of countries

and enterprises and to identify key factors determining this impact. Specifically, the goal was to analyse the coefficients of linear regression for countries with developed economies and technologies. To achieve the stated objective, the following tasks were set: to conduct an analysis of the coefficients of linear regression for a range of countries and determine their impact on economic development; to identify the key factors of digitization that have the greatest influence on GDP and other economic indicators.

MATERIALS AND METHODS

It was decided to utilise a family of regression models for further investigation. Their relative simplicity, while limiting the applicability of results for forecasting economic trends, allows for comparing the extent to which the target indicators are influential. At the same time, the selection of appropriate regularisation and normalisation algorithms prevented the obtaining of unbalanced coefficients, which might have arisen due to different measurement scales of digitization indicators. The first step in building the model was data selection. To identify the factors that best describe the digitization process, it was decided to conduct expert assessments among 200 IT specialists, smart city project managers, and innovation implementation managers from Kharkiv, Kyiv, Lviv, Vienna, Lisbon, Prague, and Krakow in 2024. All participants were informed about the aim and task of the study, which were stated in the appropriate form. At the same time, all ethical standards for working with respondents provided for by the Declaration of Helsinki (2013) were fulfilled. The essence of the survey was to provide each respondent with a list of 10 factors, the data on which is provided by Eurostat (digital economy and society) (Database, n.d.).

The survey was conducted using Google Forms, where the user could choose the 5 most important factors. After that, the number of important points was calculated for each of the factors. The five factors with the highest number of points (total points count equal 1,000) later served as the basis for the model. In addition, the condition was considered: with an equal number of points, all relevant options are taken. The survey factors are as follows: internet coverage level; level of financial activity online; level of digital skills development among the population; degree of integration of digital technologies into government processes; volume of online purchases; level of use of the internet of things; usage of information technologies at work; usage of information technologies in the enterprise; trust level to new devices; demand level on information technology specialists. The following description of the method is based on the results of an expert survey.

After processing the experts' responses, the 5 most influential factors were determined: internet coverage level (IC); level of financial activity online (FA); level of digital skills development among the population (DS); degree of integration of digital technologies into government processes (IIP); volume of online purchases (IP). In addition to these core indicators, it was decided to consider the influence of the information environment (IE) and the state (G) as a whole. The latter indicator was intended to show to what extent the regression would depend on the selected countries and serve as a "benchmark indicator", allowing for the determination of the real influence of the selected factors. On the other hand, the information environment was a synthetic indicator that entered the model as a weighted sampling coefficient. In contrast to the previous ones, IE was formed based on the frequency analysis of the 50 most popular news articles for each year within the selected timeframe in the target countries.

The general algorithm for transforming textual information was as follows: retrieving data from the most influential sources (e.g., BBC, Euronews, etc.); cleaning the texts from elements that do not carry linguistic load; extracting main components, followed by stemming and lemmatization operations (these steps are permissible, as the language of the selected news is English, which is not polymorphic); calculating the frequency indicator (VM25) and the polarity indicator; determining the emotional tone of the text and aggregating the data; normalising the obtained results within the range of 0 to 1. The next step in model formation involves choosing the data regularisation algorithm. Considering that one of the target indicators (specifically G) is categorical, the best choice would be the group LASSO algorithm. This was because for linear regression to work with categories, they needed to be transformed into a set of Boolean values. The formation of a group of related variables necessitates their group processing. In this case, the general formula for linear regression with the selected regularisation algorithm can be presented as follows:

$$arg\frac{1}{n}\min_{\beta_g\in\mathbb{R}^{d_g}}||\sum_{g\in K}[\boldsymbol{X}_g\beta_g]-\boldsymbol{y}||_2^2+\lambda_1||\beta||_1+\\+\lambda_2\sum_{g\in K}\sqrt{d_g}||\beta_g||_2, \quad (1)$$

where $X_g\in\mathbb{R}^{n\times dg}$ – the matrix corresponding to the values of target indicators g; β_g – the regression coefficients; $\boldsymbol{y}\in\mathbb{R}^n$ – the target regression function; n – the number of observations; d_g – the dimensionality of the target indicator group; λ_1 – the regularisation parameter at the indicator level; λ_2 – the regularisation parameter for indicator groups; K – the set of indicator groups. It is worth noting that in the formula above, the L2 norm is not quadratic. As a result, the regularizer has a "kink" at the zero level, causing uninformative groups of target indicators to have regression coefficients equal to zero. Another step was the standardisation and enrichment of the input data. The selected indicators were available for the period from 2010 to 2023 in annual format. However, this volume of data was insufficient to create a high-quality model. To address this issue, data augmentation operations, or synthetic expansion, were performed. The vector autoregression moving average algorithm was utilised for this purpose. This choice was made to smooth out fluctuations in target indicators and due to the proven overall effectiveness of the approach (Yakovlev *et al*., 2023). Formally, it can be presented as follows:

$$\Phi_0 y_t=\Phi_1 y_{t-1}+\ldots+\Phi_p y_{t-p}+\Theta_0 u_t+\Theta_1 u_{t-1}+\ldots+\Theta_q u_{t-q}, \quad (2)$$

where y_t – N-dimensional time series; Φ_i,Θ_i – non-degenerate coefficient matrices of autoregression with dimensions $N\times N$, $i=\overline{1,p}$, $j=\overline{1,q}$; u_t – N-dimensional white noise vector; p – number of target factors; q – number of external influence factors. It was worth noting that since the coefficient matrices were non-degenerate, they could be easily normalised within the range of 0 to 1. The model could be used to examine short-term periods, provided there was no

significant external influence. Since this study focused on the medium-term perspective for augmentation (one month), it was necessary to find the delta between the given formula and the forecast for the previous period. Therefore, the following formula was presented:

$$\Phi_0 \Delta y_t = \prod y_{t-1} + \ldots + \Psi_p y_{t-p+1} + \Theta_0 u_t + \Theta_1 u_{t-1} + \ldots + \Theta_q u_{t-q}, \quad (3)$$

where $\prod = -(\Phi_0 - \Phi_1 - \ldots - \Phi_p)$; $\Psi_i = -(\Phi_{i+1} + \ldots + \Phi_p)$; $i = \overline{1,p}$, $j = \overline{1,q}$. The obtained coefficient matrices, given the total number of unknowns to be considered during generation, might have varied. As for standardisation, it was decided to use the classical method of data normalisation, which could be presented in the following form:

$$X_n = \frac{X - \mu_X}{\sigma_X}, \quad (4)$$

where X – the original vector of target variable values; X_n – the normalised value of the target variable; μ_X – the mathematical expectation of variable X; σ_X – the standard deviation of variable X. The target countries for model formation were chosen to be those with developed economies and technologies, following consultation with the aforementioned experts. The selected countries were Denmark, Germany, the Netherlands, Sweden, and Finland. The proposed model was implemented using the Python 3 programming language with relevant libraries for scientific research, including polars, celer, scikit-learn, nltk, etc. The importance of factors was determined by a simple comparison of denormalized coefficients of linear regression, with GDP per capita considered as the target variable.

RESULTS

The general distribution of survey results is as follows: internet coverage level – 200 points; level of financial activity online – 200 points; level of digital skills development among the population – 180 points; degree of integration of digital technologies into government processes – 155 points; volume of online purchases – 100 points; level of use internet of things – 65 points; usage of information technologies at work – 60; usage of information technologies in the enterprise – 30 points; trust level to new devices – 10 points; demand level on information technology specialists – 0 points. The results for each country were examined individually. Specifically, for Denmark, the following set of coefficients was observed (Table 1).

Table 1. Coefficient values for Denmark

Indicator	Coefficient	R^2
IP	0.207171	0.613561
FA	0.672529	0.613561
DS	0.103562	0.613561
IIP	–0.183898	0.613561
IC	0.004964	0.613561

Source: developed by the authors

The most influential factor was the financial activity indicator, which logically had a direct impact on the multiplier of consumer spending and, consequently, on GDP per capita. At the same time, it was noticed that the integration of digital technologies had a negative coefficient. Within this context, it was worthwhile to consider several hypotheses: calculation error resulting from the imperfection of the augmentation algorithm, and consequently, insufficient reliable data for model construction; multicollinearity – internal correlation between indicators, which biassed the coefficient values, making them erroneous; implementation of digitization at the foundational stages increased the unemployment rate, which in turn affected the purchasing power of the population, and therefore, the target GDP indicator.

Verification of the mentioned hypotheses required further research and a larger amount of original data, which would allow for mitigating the short-term negative impact of digitization. It was also worth paying attention to the coefficient of determination; overall, its value was acceptable for conducting comparative analysis. The next country chosen for examination was Germany. Below are the coefficient values for Germany (Table 2).

Table 2. Coefficient values for Germany

Indicator	Coefficient	R^2
IP	0.198209	0.876453
FA	1.167393	0.876453
DS	0.091381	0.876453
IIP	–0.055128	0.876453
IC	–0.156201	0.876453

Source: developed by the authors

The obtained results revealed a similar situation for Germany as observed for Denmark. However, the coefficient of determination is significantly higher for Germany, indicating that the model better captured the relationship in this country. A significant exception compared to the previous case was the negative coefficient for the level of internet purchases. To explain this, the following hypotheses were highlighted: a calculation issue, as in the case of the negative IP; a short-term crisis related to the inability of businesses to quickly transition to digital platforms and

open up opportunities for international purchases (both within the EU and beyond its borders). For the Netherlands, the situation was similar both in terms of the determination coefficient and the signs of the coefficients (Table 3).

Table 3. Coefficient values for the Netherlands

Indicator	Coefficient	R^2
IP	0.040353	0.852356
FA	0.128875	0.852356
DS	0.443139	0.852356
IIP	−0.120588	0.852356
IC	−0.307203	0.852356

Source: developed by the authors

A notable difference was that the FA indicator was not the most influential; however, the difference between other coefficients was not significant, so this could be disregarded. In the case of Finland (Table 4), a negative impact of financial activity was observed; however, considering the accuracy of this model (based on R^2) – this could be a data error or explained by a general transformational process. The fact is that, compared to other selected countries, Finland was the least developed in the digital sphere for a long time (until 2020).

Table 4. Coefficient values for Finland

Indicator	Coefficient	R^2
IP	0.015163	0.681786
FA	−0.318534	0.681786
DS	0.32096	0.681786
IIP	−0.217509	0.681786
IC	−0.028013	0.681786

Source: developed by the authors

The final country under consideration was Sweden (Table 5). It had the highest coefficient of determination, which might have indicated model overfitting. However, the overall values obtained were consistent with the conclusions mentioned above. As an additional verification step, a general model was created for all countries, considering the factor of the country without its influence. For the second case, the following coefficients were presented (Table 6).

Table 5. Coefficient values for Sweden

Indicator	Coefficient	R^2
IP	0.208919	0.969962
FA	0.305002	0.969962
DS	0.007243	0.969962
IIP	−0.113182	0.969962
IC	−0.218243	0.969962

Source: developed by the authors

Table 6. General coefficient values without considering the influence of the country

Indicator	Coefficient	R^2
IP	0.053698	0.47955
FA	0.179769	0.47955
DS	0.288621	0.47955
IIP	−0.3723	0.47955
IC	0.219011	0.47955

Source: developed by the authors

Although the obtained values overall correspond to the hypotheses presented, the coefficient of determination indicates a significant problem in describing the dependencies. This can be explained by including country-specific factors in the model (Fig. 1). It was evident that the country factor is the most influential in terms of GDP per capita. The conclusion obtained generally corresponds to modern principles of macroeconomic theory, which consider the selected target indicator as one that can be influenced by numerous other indicators.

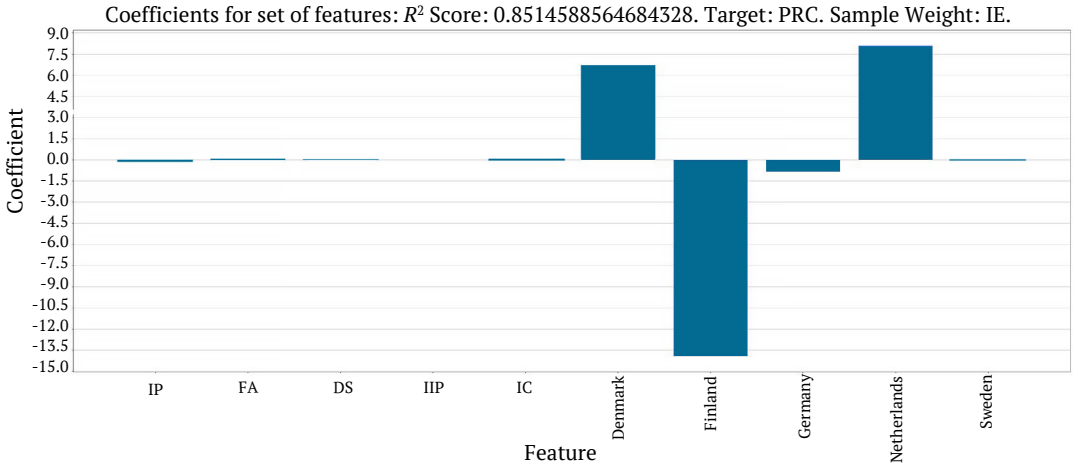

Figure 1. Overall coefficient values taking into account the influence of the country
Source: developed by the authors

In other words, when examining the relationship between digitization and economic growth, inter-country analysis requires additional adjustments, which can be expressed either by using other independent variables or by a certain data transformation algorithm. This, in turn, goes beyond the scope of the current work, thereby opening up possible avenues for further research. Thus, it can be concluded that the overall impact of digitization on the economy is positive for the country. At the same time, the most significant factors are those directly related to the consumption process, both at the individual and business levels. It is also worth mentioning the simplification of bureaucratic procedures, which are difficult to reflect using indicators but undoubtedly help reduce the costs of companies, both real and alternative.

The accuracy of the model is enhanced by the country's component, demonstrating the complexity of the interactions between the economy and digitalization. Due to its complexity, more research is required to fully understand how each digitalization aspect affects the economic development of different nations and businesses. For a precise assessment of the effects of digitalization on the economy, state elements had to be included in the model. This emphasises the necessity of developing development strategies and gaining a greater grasp of the ways in which digital technologies affect economic development. The findings support the theoretical notion that digitization and economic progress are positively correlated, but they also highlight the need for further investigation and improvement into the precise mechanisms underlying these effects. This creates opportunities for more in-depth analysis of possible metric sub-indicators as well as a thorough comprehension of the connection between the economy and digitalization.

DISCUSSION

The issue of the impact of digitalization on economic development has been repeatedly raised in both European and global practices. However, the target methods have varied, encompassing purely mathematical or econometric approaches as well as more general methods aimed at utilising comparative analysis. An example of the latter can be seen in the work of G. Myovella *et al.* (2020), dedicated to studying the dynamics of economic development and digitalization in African countries. Similar to the current research, it confirmed a significant correlation and partial dependence between indicators of technological progress and the growth of key macroeconomic indicators. Despite the descriptive nature of the presentation, such studies provide a deeper understanding of the selected indicators and have formed the basis for a set of metrics provided to the expert group during the current study.

Regarding the econometric approach, it is worth mentioning the work of Chinese scientists W. Zhang *et al.* (2021) from Chongqing University of Posts and Telecommunications dedicated to applying the Cobb-Douglas function to verify the impact of digital technology implementation on production efficiency and, consequently, economic development. In comparison with the current research, it should be noted that the set of factors considered is similar to the one chosen above. Specifically, the levels of financial activity and internet penetration are also examined. However, that study evaluates the overall impact of technological development rather than identifying what specifically holds the most significance for a country's economy. A linear model was constructed by a group of scientists from Nanjing C. Ding *et al.* (2022) with a similar purpose. Its feature is its generally conditional nature, allowing a connection between economic growth and digitalization. However, due to the construction specifics, the equation derived by the scientists is oriented towards the market conditions in China, and for European realities, it provides less accurate results (indicated by a higher aggregated value of the root mean square error).

Regarding the European scientific community, it is worth mentioning the work of a team of Spanish researchers, A. Fernández-Portillo *et al.* (2020), who, unlike their Asian counterparts, examined in more detail the impact of individual factors on information technology development. Although the results can be considered similar to those obtained using the described and constructed model above, this study employed a simpler least squares method. Similar indicator importance values were obtained by R.P. Pradhan *et al.* (2020) during an international study dedicated to the use of a vector error correction model. Similar in nature to the described approach is the use of

autoregressive models, which have been applied for data augmentation. However, based on existing research by A. Khovrat *et al*. (2022), it is important to note that such algorithms require substantial volumes of information to generate accurate forecasts and, consequently, coefficients of influence for various indicators. Additionally, external influence indicators must be considered, necessitating further research, such as involving a separate expert group, similar to the one convened to determine the target indicators in the current study.

It is important to note that the computational approaches described above are relatively simple and do not require additional hardware capabilities for analysis. This simplicity allows for rapid retraining of the algorithm but may result in inaccurate outcomes. A potential solution is the use of artificial neural networks, as demonstrated by researchers I. Petkovski *et al*. (2022), or deep networks, as shown in the work of C. Cheng & H. Huang (2022). These approaches are significantly more sensitive to data compared to linear regression and require substantial volumes of information, as evidenced by the research conducted by A.B. Çolak (2021). Based on this, it can be concluded that neural networks cannot be applied to the selected indicators with quarterly reporting. However, their overall effectiveness requires further verification using a different set of target indicators.

Another group of algorithms used to determine the impact of digitalization on economic development is the family of probabilistic models, such as Markov or Bayesian networks. Although computationally similar to regression models, their overall effectiveness depends on the quality of the network construction. This also requires larger volumes of real empirical data, a problem noted by several groups of scientists from various parts of the world (Li & Qiao, 2022; Zatonatska *et al*., 2022). Another significant drawback is the general complexity of the model, which is difficult to interpret and requires more time for data processing. In the context of the current work, the latter factor is not significant, but it may become more important if these approaches are implemented in information systems.

The results obtained above confirm the existence of causal relationships between the indicators but do not determine their nature or essence. Various aspects of this issue have already been repeatedly raised in the European and global communities. Notably, studies have focused on the impact of digitalization on poverty (Kwilinski *et al*., 2020) and the energy sector (Zhang *et al*., 2022a), highlighting its mediating role in relation to economic development. Equally important are studies on the social impact of digitalization. For instance, research by scientists from Beijing X. Zhang *et al*. (2020) on the development of inclusivity, and Romanian and Spanish researchers F.-D. Tănase *et al*. (2022) and M. Núñez-Canal *et al*. (2022) who examined the impact on the education sector during the COVID-19 pandemic. Despite the specific focus, these studies emphasised the subsequent effects of targeted changes on the economy.

Considering all the above, it can be concluded that the conducted research and its results are fully consistent with the achievements of the global scientific community. Additionally, it complements these achievements in the context of limited data volumes and computational resources. The obtained research results also confirm the influence of digitization on the economic development of the country, as in the studies conducted by other researchers. However, the proposed approach allows assessing the significance of the impact of each of the considered factors, enabling the formation of a list of the most influential factors. Such an approach will further allow considering factors not only at the country level but also identifying the most influential digitization factors at the level of enterprise economic development.

CONCLUSIONS

Based on the provided information, several important conclusions can be drawn regarding the impact of digitalization on economic development. The analysis of linear regression coefficients for countries such as Denmark, Germany, the Netherlands, Finland, and Sweden demonstrates that digital technologies exert a significant influence on the economy. Specifically, financial activity emerges as one of the most influential factors, directly affecting consumer spending and, consequently, GDP per capita. However, the negative impacts of certain aspects of digitalization, such as the level of internet purchases, have also been identified. These results indicate the need for further research and increased availability of data for a more accurate model. Additionally, the analysis of coefficients for the overall model, without considering the influence of the country factor, confirms the significant impact of digitalization on economic development.

However, including the country factor significantly improves the model's accuracy, which indicates the complexity of the relationships between digitalization and the economy. This complexity underscores the necessity for further research aimed at examining the impact of each digitalization factor on the economic development of individual countries and enterprises. Such an approach will not only deepen understanding of the mechanisms of digital technology influence but also provide specific recommendations for management decisions and development strategies. Moreover, it is crucial to highlight that including country factors in the model is essential for reflecting the complexity of the relationships between digitalization and economic development. This approach opens up new opportunities for research and analysis, enabling a more nuanced understanding of how different elements of digitalization interact with economic variables in diverse national contexts.

In conclusion, the findings of this analysis emphasise the importance of continued investigation into the specific effects of digitalization on economic growth. Policymakers and business leaders can leverage these insights to formulate more effective strategies that harness the benefits of digital technologies while mitigating potential downsides. The incorporation of comprehensive data and sophisticated modelling techniques will be pivotal in advancing this field of study, ensuring that future research can offer actionable insights tailored to the unique circumstances of each country.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Cheng, C., & Huang, H. (2022). Evaluation and analysis of regional economic growth factors in digital economy based on the deep neural network. *Mathematical Problems in Engineering*, 2022(1), article number 1121886. doi: 10.1155/2022/1121886.

[2] Çolak, A.B. (2021). An experimental study on the comparative analysis of the effect of the number of data on the error rates of artificial neural networks. *International Journal of Energy Research*, 45(1), 478-500. doi: 10.1002/er.5680.

[3] Database. (n.d.). Retrieved from https://ec.europa.eu/eurostat/web/main/data/database.

[4] Declaration of Helsinki. (2013). Retrieved from https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/.

[5] Ding, C., Liu, C., Zheng, C., & Li, F. (2022). Digital economy, technological innovation and high-quality economic development: Based on spatial effect and mediation effect. *Sustainability*, 14(1), article number 216. doi: 10.3390/su14010216.

[6] Fernández-Portillo, A., Almodóvar-González, M., & Hernández-Mogollón, R. (2020). Impact of ICT development on economic growth. A study of OECD European Union countries. *Technology in Society*, 63, article number 101420. doi: 10.1016/j.techsoc.2020.101420.

[7] Gomes, S., Lopes, J.M., & Ferreira, L. (2022). The impact of the digital economy on economic growth: The case of OECD countries. *Revista de Administração Mackenzie*, 23(6), article number eRAMD220029. doi: 10.1590/1678-6971/eRAMD220029.en.

[8] Khovrat, A., Kobziev, V., Nazarov, A., & Yakovlev, S. (2022). Parallelization of the VAR algorithm family to increase the efficiency of forecasting market indicators during social disaster. In *IX international scientific conference "Information technology and implementation" (IT&I-2022)* (pp. 222-233). Kyiv: Taras Shevchenko National University of Kyiv.

[9] Kwilinski, A., Vyshnevskyi, O., & Dzwigol, H. (2020). Digitalization of the EU economies and people at risk of poverty or social exclusion. *Journal of Risk and Financial Management*, 13(7), article number 142. doi: 10.3390/jrfm13070142.

[10] Li, C., & Qiao, L. (2022). Rapid prediction algorithm for economic development trend of tourism using Markov chain. *Mobile Information Systems*, 2022(1), article number 8726206. doi: 10.1155/2022/8726206.

[11] Magoutas, A.I., Chaideftou, M., Skandali, D., & Chountalas, P.T. (2024). Digital progression and economic growth: Analyzing the impact of ICT advancements on the GDP of European Union countries. *Economies*, 12(3), article number 63. doi: 10.3390/economies12030063.

[12] Myovella, G., Karacuka, M., & Haucap, J. (2020). Digitalization and economic growth: A comparative analysis of Sub-Saharan Africa and OECD economies. *Telecommunications Policy*, 44(2), article number 101856. doi: 10.1016/j.telpol.2019.101856.

[13] Núñez-Canal, M., de Obesso, M.L.M., & Pérez-Rivero, C.A. (2022). New challenges in higher education: A study of the digital competence of educators in Covid times. *Technological Forecasting and Social Change*, 174, article number 121270. doi: 10.1016/j.techfore.2021.121270.

[14] Oloyede, A.A., Faruk, N., Noma, N., Tebepah, E., & Nwaulune, A.K. (2023). Measuring the impact of the digital economy in developing countries: A systematic review and meta- analysis. *Heliyon*, 9(7), article number E17654. doi: 10.1016/j.heliyon.2023.e17654.

[15] Petkovski, I., Fedajev, A., & Bazen, J. (2022). Modelling complex relationships between sustainable competitiveness and digitalization. *Journal of Competitiveness*, 14(2), 79-96. doi: 10.7441/joc.2022.02.05.

[16] Pradhan, R.P., Arvin, M.B., Nair, M., & Bennett, S.E. (2020). Sustainable economic growth in the European Union: The role of ICT, venture capital, and innovation. *Review of Financial Economics*, 38(1), 34-62. doi: 10.1002/rfe.1064.

[17] Tănase, F.-D., Demyen, S., Manciu, V.-C., & Tănase, A.-C. (2022). Online education in the COVID-19 pandemic – premise for economic competitiveness growth? *Sustainability*, 14(6), article number 3503. doi: 10.3390/su14063503.

[18] Tiutiunyk, I., Drabek, J., Antoniuk, N., Navickas, V., & Rubanov, P. (2021). The impact of digital transformation on macroeconomic stability: Evidence from EU countries. *Journal of International Studies*, 14(3), 220-234. doi: 10.14254/2071-8330.2021/14-3/14.

[19] Török, L. (2024). The relationship between digital development and economic growth in the European Union. *International Review of Applied Sciences and Engineering*. doi: 10.1556/1848.2024.00797.

[20] Yakovlev, S., Khovrat, A., & Kobziev, V. (2023). Using parallelized neural networks to detect falsified audio information in socially oriented systems. In *X international scientific conference "Information technology and implementation" (IT&I-2023)* (pp. 220-238). Kyiv: Taras Shevchenko National University of Kyiv.

[21] Zatonatska, T., Klapkiv, Y., Dluhopolskyi, O., & Fedirko, O. (2022). Forecasting of the employment rate in the EU ICT field. *Comparative Economic Research. Central and Eastern Europe*, 25(3), 7-25. doi: 10.18778/1508-2008.25.19.

[22] Zhang, J., Lyu, Y., Li, Y., & Geng, Y. (2022a). Digital economy: An innovation driving factor for low-carbon development. *Environmental Impact Assessment Review*, 96, article number 106821. doi: 10.1016/j.eiar.2022.106821.

[23] Zhang, J., Zhao, W., Cheng, B., Li, A., Wang, Y., Yang, N., & Tian, Y. (2022b). The impact of digital economy on the economic growth and the development strategies in the post-COVID-19 era: Evidence from countries along the "belt and road". *Frontiers in Public Health*, 10, article number 856142. doi: 10.3389/fpubh.2022.856142.

[24] Zhang, W., Zhao, S., Wan, X., & Yao, Y. (2021). Study on the effect of digital economy on high-quality economic development in China. *PLoS ONE*, 16(9), article number e0257365. doi: 10.1371/journal.pone.0257365.

[25] Zhang, X., Wan, G., Zhang, J., & He, Z. (2020). Digital economy, financial inclusion and inclusive growth. *China Economist*, 15(3), 92-105. doi: 10.19602/j.chinaeconomist.2020.05.07.

Людмила Піддубна

Доктор економічних наук, професор
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0002-9471-2820

Інна Дибач

Доктор економічних наук, доцент
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0009-0003-4351-7077

Валерій Красовський

Аспірант
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0009-0002-4387-6144

Костянтин Плєханов

Аспірант
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0003-4590-2836

Руслан Могилевський

Аспірант
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0009-0000-4396-7543

Аналіз впливу цифрового розвитку на економічне зростання країни

Анотація. Вивчення впливу цифрових технологій на розвинені економіки має вирішальне значення. Пандемія COVID-19 підкреслює їх роль у економічній стабільності, що акцентує необхідність оцінки взаємозв'язку між цифровізацією та економічним зростанням за допомогою регресійних моделей, що і було метою цього дослідження. Використано аналітичний та індуктивний методи для визначення базового набору індикаторів цифровізації. Серед них за допомогою експертного оцінювання сформовано базис із п'яти ключових показників: рівень охоплення інтернетом; рівень фінансової активності в інтернеті; рівень розвитку цифрових навичок серед населення; ступінь інтеграції цифрових технологій у державні процеси; обсяг онлайн-покупок. Задля виокремлення найбільш впливових факторів було вирішено задіяти експериментальний підхід із побудовою моделі лінійної регресії та частковим залученням статистичних методів аугментації даних, що ґрунтуються на авторегресії. Отримані результати вказують на те, що найбільш значним є рівень фінансової активності онлайн. Однак у певних аспектах цифровізації, таких як онлайн-покупки, спостерігаються негативні наслідки, що потребують подальшого аналізу. Включення державних факторів у модель виявилося вирішальним для точного оцінювання впливу цифровізації на економіку. Це підкреслює необхідність додаткових досліджень у цій сфері для глибшого розуміння механізмів, за допомогою яких цифрові технології впливають на економічний розвиток, і для розробки відповідних стратегій розвитку. Загальні результати підтверджують теоретичні концепції щодо позитивної кореляції між цифровізацією та економічним розвитком, але також вказують на потребу в уточненні та додаткових дослідженнях конкретних механізмів цього впливу. Це відкриває шлях до подальшого детального оцінювання можливих підпоказників цього індикатора і загального розуміння взаємозв'язку між цифровізацією та економікою. У випадку державного сектору ці дані можуть слугувати практичною основою для корекції політики щодо впровадження нових технологій орієнтованих на поліпшення економічного становищах

Ключові слова: трансформація; цифрова економіка; цифровізація; макроекономічні показники; коефіцієнт детермінації

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2
2024

UDC 657.2
DOI: 10.57111/econ/2.2024.47

Elkhan Jafarov
PhD in Economics, Associate Professor
Azerbaijan State University of Economics
1001, 6 Istiglaliyyat Str., Baku, Republic of Azerbaijan
https://orcid.org/0000-0002-3161-7869
Nusret Babayev*
Senior Lecturer
Azerbaijan State University of Economics
1001, 6 Istiglaliyyat Str., Baku, Republic of Azerbaijan
https://orcid.org/0009-0003-7168-1763

Problems of preparing business financial statements according to international standards

Abstract. The importance of the study stemmed from the necessity to identify ways to enhance the quality and harmonise the financial statements of small and medium-sized firms in Azerbaijan so that they met international requirements. The aim of the work was to analyse the reporting of Azerbaijani small and medium-sized enterprises, as well as to identify significant inconsistencies between the basic concepts and principles in certain sections of international standards, the elimination of which will increase the comparability of the financial data of Azerbaijani enterprises at the global level. The methodological approach was based on statistical data analysis, which was used to study the change in the number of small and medium-sized enterprises in Azerbaijan for 2018-2023; and an analogy method for comparing the qualitative characteristics of financial statements specified in the Conceptual Framework for Financial Reporting to international standards. The main results include: a proposal to adopt indicators of the quality of information in the financial statements in accordance with the characteristics specified in the Conceptual Framework for Financial Reporting; justification of the need to use the initial and fair value methods based on the requirements for assessing the possible, current and discounted value of assets, liabilities, income, and expenses, as well as using simpler approaches to reflect them in financial statements; proof of the need for wider disclosure of information presented in the explanatory notes to the financial statements, which would help improve the quality and usefulness of information on the financial condition of business entities. The findings of scientific research, as well as the conclusions drawn from it, are of practical value to small and medium-sized business leaders, national politicians, and financial statement auditors

Keywords: comparability of information; conceptual approaches; display of assets; innovation; harmonization

INTRODUCTION

Modern trends in the domain of internationalization of economic and financial relations have led to the creation of a world market that does not recognize national boundaries. Disclosure of reliable information on the development of enterprises in Azerbaijan, the creation of an information base that meets modern requirements for accounting and disclosure of financial statements were the main conditions for attracting investors and the interest of creditors,

Article's History: Received: 12.01.2024; Revised: 08.04.2024; Accepted: 27.06.2024

Suggested Citation:
Jafarov, E., & Babayev, N. (2024). Problems of preparing business financial statements according to international standards. *Economics of Development,* 23(2), 47-56. doi: 110.57111/econ/2.2024.47.

*Corresponding author

whose support contributes to business development. The necessity to reveal information about the financial health of small and medium-sized enterprises (SMEs) in compliance with international standards that govern the presentation of financial statements has been reinforced by the growth of cooperation between Azerbaijani economic entities and European nations.

For instance, J. Hasanova-Vagif (2021) showed that small enterprises provide important flexibility in market conditions and show a good ability to pay off. In addition, the author proved that small firms are more likely to innovate and seek to establish mass production. The research carried out by F. Ganbarov *et al*. (2020) showed that increasing the openness of trade and involvement in worldwide supply chains may enhance a nation's export diversification, attract foreign investment and ensure an annual income growth of 5-10%. At the same time, scientists were studying the detrimental effects of the coronavirus pandemic on SMEs operations and suggesting ways to improve the financial condition of enterprises. N. Gasimova (2022) claimed that as a result of restrictive measures, many enterprises have closed their activities. The author proved that the most stable model of overcoming the crisis for Azerbaijan is the model of European countries. However, changes were required to guarantee the long-term growth of SMEs in Azerbaijan. These included the provision of profitable loans to businesses and the development of innovative activities (Sadikhov, 2024). Studies of Azerbaijan's foreign policy issues in the context of the economic crisis were carried out by the scientists A. Hajiyeva *et al*. (2020), who showed the importance of interaction with international financial institutions. The scientists argued that the expertise in preparing financial statements utilising international standards is positive for Azerbaijan, in particular for increasing the inflow of foreign investment.

The validation of a successful methodology for Azerbaijan's integration of national accounting standards with international standards in their work was done by scientists A. Valiyev *et al*. (2021), who assessed the benefits and barriers to the implementation of international standards depending on the practice models for the consolidation of national and international standards. F. Sultanov (2022) conducted a comparative review of the condition of the accounting systems in Azerbaijan and Turkey, emphasising that the direct translation of international standards into Azerbaijani is one of the right steps in terms of flexibility. However, the Turkish reporting and auditing system can be taken as a model for Azerbaijan. The issue of translating international standards into languages of different countries was considered by A. Hellmann & C. Patel (2021), who emphasized the importance of observing the comparability of the meaning of the requirements for displaying financial information.

Azerbaijani and other scientists have made significant contributions to studying the comparability of financial reporting and the preparation of statements according to international standards, yet many debatable issues persist, requiring further investigation. Due to the presence of a number of obstacles to the transition of the preparation of financial statements of Azerbaijani enterprises in accordance with international requirements, the need for research was updated to identify factors that make it difficult for SMEs to prepare statements according to international standards and develop proposals to improve the quality and usefulness of reporting. The main purpose of this scientific work was to study the identification of significant inconsistencies between the main concepts (principles) in certain sections of the International Financial Reporting Standards for small and medium-sized businesses (IFRS for SMEs) on the example of Azerbaijan, which hinder the improvement of the comparability of reporting at the global level and improve its quality and usefulness for stakeholders.

MATERIALS AND METHODS

Statistical data analysis method was utilized to examine changes in the number of enterprises. Analogies were drawn to compare the qualitative characteristics of financial statements across various regulatory documents. A graphical method was employed to visually display the obtained data. A generalization method was applied to synthesize and derive conclusive information from the findings. The theoretical foundation for this study was established by the writings of previous authors who had investigated the issues of increasing the quality and harmonising the financial statements of businesses with worldwide standards.

Analysis of statistical data, based on the Entrepreneurship in Azerbaijan (2023), made it possible to study the number of SMEs in Azerbaijan, their structure, and part in the total number of business entities for 2018-2023. To analyse the number of SMEs in 27 countries of the EU and their dynamics for 2018-2022, information from the Statista was used (Number of small and medium-sized enterprises..., 2022). The structure and role of SMEs that they played in the employment rates of the population in Germany, France, Croatia, Spain, and Denmark were analysed based on EU statistics (Number of enterprises..., 2022). The Conceptual Framework for Financial Reporting (also referred to as the Fundamentals) and IFRS for SMEs were compared using the analogy method to determine the qualitative aspects of reporting (International standards..., 2022). The legal framework of Azerbaijan in terms of reporting requirements, including provisions of Law of the Republic of Azerbaijan No. 716-IIQ "On Accounting" (2004), was examined. The utilisation of the graphical approach allowed for the visualisation and trend analysis of the dynamics of increase in the number of SMEs in European countries for 2018-2023.

The use of the generalization method summed up the results of the study regarding: the role of SMEs for the economic growth of Azerbaijan and European countries, the comparability of the reporting quality requirements specified in the IFRS for SMEs and the Conceptual Framework for Financial Reporting, to identify problems that are an obstacle to reporting by enterprises; formulation of conclusions that served as a final reflection of the results of the study. These conclusions aimed to substantiate proposals regarding the simplification of reporting in accordance with international standards, identify areas that should be paid attention to and change approaches to displaying information, improve the quality, comparability, and accessibility of information for potential investors, and determine further directions for studying this issue and improving the preparation of reports for SMEs.

RESULTS

As of the beginning of 2023, SMEs in Azerbaijan accounted for 99.7% of all operating business entities (Entrepreneurship in Azerbaijan, 2023). The first step to attract foreign investors and expand international cooperation was to transform the financial statements of enterprises and bring them closer to international standards, which in turn could contribute to the transparency and attractiveness of Azerbaijan's business. Companies in more than 100 countries prepared their financial statements on the basis of IFRS, which were an important means of increasing the comparability of information contained in the financial statements of companies from different countries (Entrepreneurship in Azerbaijan, 2023). Azerbaijani enterprises were classified by the number of employees and, accordingly, by their annual income (Table 1).

Table 1. Criteria for business size in Azerbaijan by the number of employees

Business entity categories	Mean number of employees	Annual income (ig)
Micro-enterprises	1-10	ig ⩽ 200
Small businesses	11-50	200 < ig ⩽ 3,000
Medium enterprises	51-250	3,000 < ig ⩽ 30,000
Large enterprises	251 and more	30,000 < ig

Source: made by the authors based on Entrepreneurship in Azerbaijan (2023)

As shown in Table 1, SMEs include enterprises with up to 250 employees, and more are considered large enterprises. In the structure of the total number of Azerbaijani enterprises, the main part is occupied by SMEs (Table 2).

Table 2. The structure of SMEs in Azerbaijan and its dynamics

Indicators	2018	2019	2020	2021	2022	2023
Total number of enterprises	245,800	272,295	317,299	356,910	378,726	415,763
The total number of SMEs, including:	244,883	271,304	316,370	355,998	377,842	414,832
micro-enterprises	237,815	262,622	307,717	346,171	366,944	403,062
▪ small businesses	4,930	5,956	5,943	6,856	7,760	8,735
▪ medium enterprises	2,138	2,726	2,710	2,879	3,138	3,304
Part of SMEs in total	99.6%	99.6%	99.7%	99.7%	99.6%	99.7%

Source: made by the authors based on Entrepreneurship in Azerbaijan (2023)

As can be seen from Table 2, during 2018-2023, the share of SMEs in the total number of Azerbaijani enterprises remained above 99%, indicating their advantage in the structure of economic entities in the country. The largest growth in the number was shown by SMEs in 2019 – 21% and 27% but the COVID-19 pandemic's economic crisis in 2020 resulted in a slight decrease (Entrepreneurship in Azerbaijan, 2023). In 2022 and 2023, the total number of enterprises continued to grow. Similarly, the number of SMEs increased, maintaining their dominant share in the economy. Micro-enterprises, small businesses, and medium enterprises saw significant growth. The involvement of SMEs was crucial to maintaining the smooth operation of the economy in the setting of the globalization of economic connections. Foreign experience shows that in modern conditions, SMEs are the basis of the European economy and a potential source of employment and economic growth in the country. According to a statistical estimate, there are about 22 million SMEs in the EU (Fig. 1).

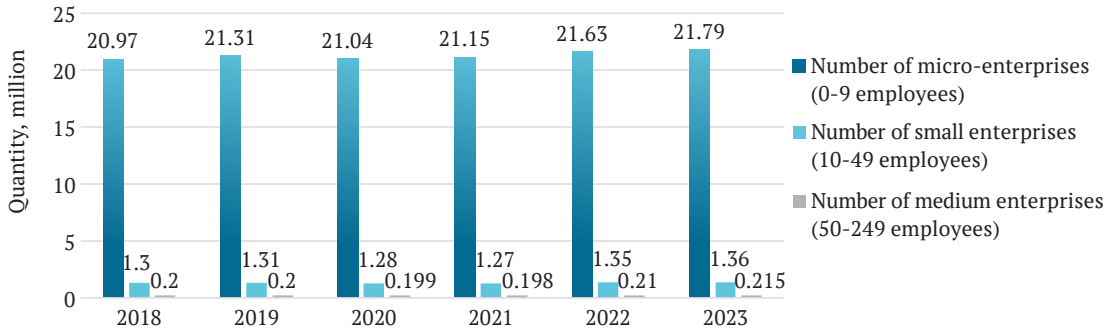

Figure 1. Dynamics of the SMEs increase in European countries

Source: made by the authors based on Number of small and medium-sized enterprises (SMEs) in the European Union from 2008 to 2023, by number of enterprises (2022)

The data in Figure 1 indicate a significant predominance of micro-enterprises in the total number of SMEs (about 98%) and a low proportion of medium-sized enterprises (less than 1%). As of 2023, 1.36 million enterprises

are small, and about 215 thousand are medium-sized firms. At the same time, non-financial sector workers in Italy owned around 3.56 million SMEs. By analysing the distribution of SMEs in European nations, it was possible to examine their structure and involvement in the employment rates of the population of states (Table 3).

Table 3. Share of enterprises and employed employees in European countries for 2022

Country	Part of enterprises, %			Part of employed employees at enterprises, %		
	small	medium	large	small	medium	large
Germany	97.4	2.1	0.5	40.6	17.2	42.2
France	99.4	0.5	0.1	44.5	11.3	42.2
Croatia	98.9	0.9	0.2	53.6	17	29.4
Spain	99.2	0.7	0.1	53.8	13.9	33.4
Denmark	98.5	1.2	0.2	43.3	21.2	35.5

Source: made by the authors based on Number of enterprises by enterprise size class, 2022 (2022)

The data in Table 3 shows that SMEs occupied a significant share in the total number of enterprises, averaging around 98.7% across the listed European countries in 2022. This accounted for an average of approximately 47.66% of all employed employees. In some countries, medium enterprises reached up to 2.1%, but small enterprises dominated. In 2023, SMEs in Azerbaijan increased their nominal value added by 30% compared to the previous year, comprising 18% of the national economy's total value added. Additionally, medium-sized enterprises employed up to 55% of the workforce found in small enterprises, with approximately 35-55% of employees being in large business entities (World Intellectual Property Organization, 2023). For the development of SMEs in Azerbaijan, it was expedient to use the experience of European countries. In addition, the development of close cooperation between Azerbaijan and the EU, the main focus of which was the oil and gas industry and the transport sector, contributed to the formation of a favourable business environment for the functioning of SMEs. In turn, the transparency of the activities of SMEs would contribute to the interest of foreign investors to invest in their development. One of the tools to ensure the transparency of the activities of SMEs was to improve the quality of their financial statements and bring them closer to the requirements established by international standards.

Azerbaijan's financial reporting requirements were established and regulated by the Law of the Republic of Azerbaijan No. 716-IIQ "On Accounting" (2004) (as amended in June 2018), which also established financial reporting requirements. According to it, The Ministry of Finance of Azerbaijan is responsible for the use of IFRS for SMEs, the correctness of their translation into Azerbaijani, and ensuring their availability to the public. However, it should be noted that the practical implementation of reporting requirements in accordance with IFRS for SMEs in Azerbaijan is still formal. The main obstacles to a full transition to the preparation of financial statements in accordance with IFRS for SMEs are the quality of the translation of this standard from English into Azerbaijani as well as in some cases this is also a discrepancy with the original English text. In addition, one of the main challenges in transitioning to comply with IFRS for SMEs is the inadequate professional expertise among accounting service representatives at enterprises, compounded by an ineffective mechanism to monitor audit firms responsible for ensuring the quality of these reports (Berest & Sablina, 2024). This has led to the fact that accounting is mainly reduced to calculations without sufficient analysis, which could show the presence of problematic issues in the accounting of the enterprise. These factors are disruptive to the transition process of preparing financial statements in accordance with IFRS for SMEs. According to the Law of the Republic of Azerbaijan No. 716-IIQ "On Accounting" (2004), business entities are required to prepare reports based on their status. Either the complete version of IFRS or the IFRS for SMEs must be followed by large businesses. Medium-sized businesses can choose to use the full version of IFRS or the IFRS for SMEs. Small enterprises, on the other hand, are mandated to comply with either the rules for micro and small enterprises established by the Ministry of Finance of Azerbaijan, the IFRS for SMEs, or the full version of IFRS. The study also identified several factors that negatively affected SME activities in Azerbaijan. These included the inadequate knowledge and competence of company managers regarding market economics, ineffective marketing strategies, burdensome tax expenses, high fixed costs leading to reduced profits, and a shortage of financial resources for SME development.

In order for business leaders to be aware of these problems and be able to make the right management decisions in time, it is necessary to increase the transparency and quality of reporting (Mehdiyev, 2024). One of the main characteristics, the observance of which increases the usefulness of financial statements, is its quality. The IFRS for SMEs contains a list of qualitative characteristics that SME reporting must comply with (International standards..., 2022). Also, similar characteristics are defined by IFRS, which describes the criteria for information in reporting, according to which such information will be useful for investors and creditors when making decisions about an enterprise based on information in its financial statements (Table 4).

Table 4. Comparison of the qualitative characteristics specified in the Fundamentals and the IFRS for SMEs

Qualitative characteristics	Conceptual framework IFRS, paragraph "Qualitative characteristics of useful financial information"	Qualitative characteristics	IFRS for SMEs, "Basic concepts and principles"
Fundamental qualitative characteristics	(QC5)	1. Understandability	2.4
1. Relevance	(QC6-QC10)	2. Relevance	2.5

Table 4. Continued

Qualitative characteristics	Conceptual framework IFRS, paragraph "Qualitative characteristics of useful financial information"	Qualitative characteristics	IFRS for SMEs, "Basic concepts and principles"
1.1. Materiality	(QC11)	3.Materiality	2.6
2. Faithful representation	(QC12)	4. Reliability	2.7
2.1. Complete	(QC13)	5. Substance over form	2.8
2.2. Neutral	(QC14)	6. Prudence	2.9
2.3. Free from error	(QC15)	7. Completeness	2.10
3. Enhancing qualitative characteristics	(QC19)	8. Comparability	2.11
3.1. Comparability	(QC20-25)	9. Timeliness	2.12
3.2. Verifiability	(QC26-QC28)	10. Balance between benefit and cost	2.13-2.14
3.3. Timeliness	(QC29)	11. Undue cost or effort	2.14A-2.14C
3.4. Understandability	(QC30-QC32)		
4. Applying the enhancing qualitative characteristics	(QC33-QC34)		
5. The cost constraint on useful financial reporting	(QC35-QC39)		

Source: made by the authors based on IFRS Foundation (2018), International standards of financial reporting and other pronouncements (2022)

The information provided in Table 4 indicates that there are differences in approaches to determining the characteristics of the reporting information defined in IFRS. The characteristics are subdivided according to the criteria of importance: into basic and improving, which allowes to pay attention when preparing reports in accordance with its main characteristics. It should be noted that between the conditional indicators of accounting information, which are given in the relevant paragraphs of section 2 "Basic concepts and principles" of the IFRS for SMEs, and the quality of this information, which is indicated in section 3 "Qualitative characteristics of useful financial information", completely different approaches were taken. Arbitrary indicators for the data in the financial statements are displayed in paragraphs 2.4-2.14D of section 2 of this IFRS for SMEs are presented in paragraphs 24-43 of the Framework for the preparation and presentation of financial statements (2001), in accordance with the qualitative characteristics of the financial statements in the form in which they are, and in the specified sequence.

The section 3, discussion of the qualitative aspects of valuable financial information, is presented with different approaches. According to the criteria for recognizing qualitative characteristics of financial information outlined in relevant documents, the full disclosure of financial data, both collectively and individually, is required in the preparation of enterprise financial statements. However, despite financial statements being issued with favourable opinions from professional auditors based on IFRS for SMEs requirements, the quality of this information may not be presented clearly, transparently, and reliably due to subjective management decisions influenced by adverse events within enterprise operations. It should be emphasized that grouping the financial statements primarily by the qualitative characteristics of the relevant financial information – which were defined in the IFRS for SMEs – should be preferred in order to reflect relatively high-quality financial information in accordance with the specified criteria. This approach is also reflected in the section 3 "Qualitative characteristics of useful financial information" of the Fundamentals. In addition to applying the qualitative characteristics of financial statements, a problematic issue in the preparation of financial statements in accordance with the IFRS for SMEs is the valuation of assets, liabilities, income, and expenses. The IFRS for SMEs provides various approaches and methods for measuring assets, liabilities, income, and expenses. According to the content of paragraph 2.34 of the section 2 of the IFRS for SMEs, it is indicated that the valuation of assets, liabilities, income, and expenses should be carried out on the basis of two general methods – initial cost and fair value. However, other measurement methods are also used (Table 5).

Table 5. Methods for measuring assets, liabilities, income, and expenses in accordance with the IFRS for SMEs

Chapter		Items	Assessment methods		
No.	Name		possible selling price	present value	discounted value
11	Basic financial instruments	11.20, 11.25		+	
12	Other issues with financial instruments	12.11, 12.12			+
15	Investments in joint ventures	15.16, 15.17	+		
16	Investment property	16.5		+	
		16.6			+
20	Leases	20.9, 20.10, 20.21, 20.23		+	
21	Provisions and contingencies	21.7, 21.11		+	+
23	Income	23.5		+	+

Table 5. Continued

Chapter		Items	Assessment methods		
No.	Name		possible selling price	present value	discounted value
27	Impairment of assets	27.9			+
		27.15, 27.20		+	+
28	Employee benefits	28.7			+
		28.15, 28.16, 28.30, 28.37		+	
		28.17		+	+
29	Income tax	29.32			+
34	Specialized activity	34.6		+	

Source: made by the authors based on The IFRS for SMEs standard (2015), International standards of financial reporting and other pronouncements (2022)

The data in Table 5 shows that in addition to measuring assets, liabilities, income, and expenses at initial and fair value, the relevant sections of the IFRS for SMEs use valuation methods based on possible selling price, present value, and present value. At the same time, it should be noted that such an approach to assessment does not provide high-quality preparation and presentation of information in financial statements, which is advisable for auditors, investors, and creditors to use when making decisions. Taking into account the requirement to apply valuation methods to measure the elements of financial statements on the basis of the possible sale value, current and present value, there is a need to amend paragraph 2.34 of the section 2 of the IFRS for SMEs, namely: to specify that for the valuation of assets, liabilities, income and expenses, the methods of initial and fair value are used, taking into account the requirements for applying valuation at: possible, current and present value. This can improve the valuation of assets, liabilities, income, and expenses of SMEs and improve the efficiency and quality of their financial information.

It should also be noted that the presentation of these financial elements in accordance with the IFRS for SMEs in financial statements was carried out with relatively simpler approaches compared to the requirements of IFRS. According to clause 5.1 of section 5 "Comprehensive income statement and profit and loss statement" of IFRS for SMEs, an enterprise must show its total income for the period in the statements, that is, the financial results of its activities in one financial statement. In accordance with paragraph 7.7 of section 7 of "Statement of cash flows", an entity's statement of cash flows for the period must solely display cash flows from operational operations using the direct method. In addition, in comparison with IFRS, it is necessary to disclose more widely the information presented in the explanatory notes to the financial statements in the relevant sections of the IFRS for SMEs according to the specific features of their activities, namely: on the business characteristics of SMEs.

To accelerate the harmonization of financial reporting of SMEs in Azerbaijan, one of the necessary requirements is to increase the use of innovative solutions that help improve the activities of SMEs. The analysis of the global innovation index for 2019 showed that Azerbaijan ranked 84th out of 129 countries, which is two positions lower than in 2018, and in 2023, 89th out of 132 countries (World Intellectual Property Organization, 2023). Such data indicates that the country continues to face problems in the development of innovative activities and the application of its results in practice. In order to develop an effective policy aimed at the development of innovation activity, the Government of Azerbaijan needs to collect information from the financial statements on the innovation activity of companies in order to be able to manage the development of this area.

As a result, it should be highlighted that Azerbaijan's SMEs played a significant role in the growth of the national economy. For the further successful development of SMEs in the context of globalization, a necessary condition is the harmonization of their financial statements to international standards. The study revealed significant inconsistencies between the basic concepts and principles of individual sections of IFRS for SMEs, which make it more difficult for SMEs to prepare financial statements in compliance with IFRS, namely: different approaches to presenting useful financial information to the qualitative characteristics; shortcomings in the definition of methods for valuation of assets, liabilities, income, and expenses in IFRS for SMEs; the need to use simpler approaches for SMEs in terms of presenting assets, liabilities, income, and expenses in financial statements; inadequate broad disclosure of the data in the financial statements' explanatory notes. These problems and shortcomings have become the basis for developing proposals for improving approaches to the preparation of SME financial statements, which will improve its quality and bring it closer to the requirements of international standards.

DISCUSSION

The findings obtained as a result of the study allowed to assert that the developed proposals were aimed at increasing the requirements for the quality of reporting compiled by SMEs and its harmonization with international standards. As a result of the study, it was proved that the existing differences in approaches to describing the characteristics of financial reporting information, which are specified in section 3 of the Fundamentals and section 2 of the IFRS for SMEs, require improvement in the grouping of qualitative characteristics and, in general, an increase in the requirements for the quality of SME reporting.

Other scientists who have investigated the significance of the quality of reporting information backed a similar position. Indonesian scientists T. Rahayuningsih & W. Utami (2022) looked at what factors determine how well SMEs disclose their financial information. The authors assessed the impact on the quality of financial reports of

SMEs of information technologies used for accounting, the competence of SME accountants, as well as their understanding of accounting and reporting standards for SMEs. The study's findings demonstrated to the authors that the aforementioned elements significantly improved the calibre of financial reports for SMEs. In turn, the Romanian scientists E. Budai *et al*. (2021) in their studies systematized various approaches to the quality of financial reporting, considered the relevance of the identified aspects of the quality of reporting by SMEs, as well as the adaptability of methods for testing the quality of financial reporting before applying them in practice. Another area that requires improvement in order to eliminate difficulties in preparing financial statements in accordance with IFRS for SMEs is the difference in approaches to the valuation of assets, liabilities, income, and expenses, on the basis of which it is proposed to take into account the requirements for valuation at a possible, current and present value when using the cost and fair value methods (Kalyuzhna *et al*., 2024). On this occasion, also was conducted the research by the Hungarian scientists Z. Széles *et al*. (2019), who highlighted the potential and difficulties in applying the fair value approach practically to SMEs' financial statements. The authors emphasized that the fair value model was often used as a more appropriate valuation method compared to the cost model for a specific group of business entities, namely: SMEs. The paper compared the use of valuation methods for SMEs and large enterprises and showed the advantages of using the fair value model.

The importance of assessing the assets of enterprises, which are the main component of economic relations, was shown in the research of the Ukrainian scientist I. Kalynichenko (2020), who aimed to investigate theoretical and methodological requirements and create practical suggestions for estimating the value of firm assets for management choices. The author proved that for the pricing mechanism of such an asset as real estate, it is important to evaluate these objects by the owners themselves, and also advised utilising the owner's rate of return rather than the market rate. One should agree with the point of view of many scientists who focus on the difficulties faced by SMEs in many countries during the transition to international standards (Petrenko *et al*., 2023). For example, Tunisian scientists H. Khlif *et al*. (2020) emphasized that the main problems include: ignorance of the features of accounting systems based on IFRS principles by professional SME accountants, as well as difficulties in assessing fair value for SMEs.

Approaches with which one can fully agree are emphasized by Qatari scientists A. Al-Bakri *et al*. (2014), who revealed the nature and requirements for displaying financial information on SMEs compared to large corporations in Jordan. The authors, using a questionnaire, collected data on the information required for disclosure, prepared in accordance with IFRS. According to the data, the proportion of critical things that should be revealed in SMEs' reporting was 40%, whereas large firms reported 90%. The form and degree of disclosure in SMEs' financial statements received increased attention. Confirming the authors' point of view, SME workers should be encouraged to improve the effectiveness of accounting and control systems, which improves the efficiency of their financial reports and assures more transparency and disclosure of their financial data.

Valuable research was carried out by Brazilian scientists F.J.A. Gonçalves *et al*. (2022), who studied the elements that influence the application of the IFRS for SMEs in Brazil and showed that the main factor is the discrepancy between the perception of difficulties by accountants and the nature of the difficulties themselves that arise in reporting. In this regard, the position of the authors on the necessity to expand the availability of educational programmes for accountants and encourage the adoption of worldwide standards warranted consideration. A similar study was conducted by the Swedish scientist M.M. Bengtsson (2021), who considered the obstacles to the complete or partial non-acceptance of IFRS. The author classified the factors into three significant categories. The paper logically emphasized the importance of the country's government showing caution when interpreting the results of the implementation of IFRS.

Egyptian scientists M. El-Helaly *et al*. (2020) investigated the connection between cultural factors and policy decisions on the adoption of IFRS. It has been demonstrated that the adoption of IFRS depends on how little these standards are used. Fully concurring with the authors, it is important to emphasize that variations in national culture significantly influenced how countries reacted to the implementation of IFRS as a means to standardize accounting and reporting practices globally. American scientists M. Rykaczewski *et al*. (2022) highlighted that tax-based accounting predominates in financial reporting in Eastern European countries. This circumstance has led to diminished interest among potential shareholders and creditors. The leaders of most SMEs continue to struggle with the outdated mind-sets of accountants and the poor performance of local auditors (Wolff & Liñeira, 2023).

Alongside this study the affirmations of the German scientist A.H. Güngörmüş (2020), who also considered the issues of the independent audit of SMEs and demonstrated that, in order for SMEs to achieve meaningful outcomes, shared objectives in the fields of accounting and audit are required, and they merit consideration. In addition to the difficulties that SMEs face in preparing financial statements under IFRS, as other authors argue, there are factors that negatively affect the usefulness of SME financial reporting. One of these factors, according to the results of a study by Estonian scientists O. Lukason & M.D.M. Camacho-Miñano (2021), is a violation of the deadlines for the submission of annual reports of SMEs. The following categories of variables were identified by the authors as contributing factors to this phenomenon: the incidence of financial challenges, corporate governance features, and management conduct.

Georgian scientists V. Charaia *et al*. (2021) studied digitalization trends in the Central Caucasus countries (Georgia, Azerbaijan, and Armenia) and the Baltic countries in order to reduce the financial gap for SMEs in the Central Caucasus countries. Scientists in their work proved that the SME sector continues to face significant credit constraints. Modern digital technologies, which are already widely used in the Baltic countries, should be applied in Georgia, Azerbaijan, and Armenia to improve the system of accounting and reporting of SMEs in these countries (Manachynska *et al*., 2024). Despite a number of difficulties that arise in the preparation of SME reporting in accordance with international standards, one cannot

fail to say about the usefulness of these standards. Australian scientists D. Perera *et al*. (2022) demonstrated that ensuring users' input in the creation of accounting and reporting standards was essential to meeting their genuine demands for financial information.

Thus, the examination of other scientists' research findings on the difficulties of creating financial statements for SMEs validated the conclusions and ideas offered in this paper. The proposed ways to reduce the difficulties and discrepancies in the preparation of financial statements in accordance with IFRS for SMEs are mainly in the need to eliminate discrepancies in approaches to the assessment of assets, liabilities, income, and expenses and their reflection in the statements, compliance with the requirements for the qualitative characteristics of statements in accordance with IFRS, and the use of simpler approaches to the presentation of these financial elements in the financial statements. This will improve the quality and utility of financial data in SMEs' reporting, as well as investor interest in their future development.

CONCLUSIONS

The conducted scientific research showed that the compliance of the financial statements of SMEs with international requirements is the main condition for increasing the comparability of the results of doing business for SMEs at the global level. The goal formulated in this work and the analysis of the preparation of SME financial statements allowed the development of the following proposals. It was proposed to adopt the information quality indicators in the financial statements given in paragraphs of section 2 "Basic concepts and principles" of the IFRS for SMEs in accordance with the quality characteristics included in section 3 "Qualitative characteristics of useful financial information" of Fundamentals in order to eliminate discrepancies in approaches before determining the qualitative characteristics of the financial statements of SMEs in Azerbaijan in accordance with IFRS for SMEs and the Fundamentals. The necessity of making changes to paragraph 2.34 of the section 2 of the IFRS for SMEs in terms of using the initial and fair value methods based on the requirements for applying valuation at: possible, current, and present value for the valuation of assets, liabilities, income, and expenses was justified, which can improve the valuation of assets, liabilities, income, and expenses of SMEs in Azerbaijan.

The importance of using simpler approaches to reflect assets, liabilities, income, and expenses in financial statements was proved, which consist in: displaying, in accordance with article 5.1 of section 5 of the IFRS for SMEs, the financial results of an enterprise for a period in one financial statement; presentation of information on cash flows from operations, in accordance with clause 7.7 of section 7, only on the basis of the direct method in the statement of cash flows for the period for the enterprise. This will simplify the perception of financial information by users. The necessity of providing a more comprehensive disclosure of the data included in the financial statements' explanatory notes was emphasised, taking into account the unique aspects of business operations. The main directions for further research in this direction will be an in-depth study of the shortcomings in the requirements of the IFRS for SMEs, which are the reason for the insufficient reflection of the real state of SMEs in a constantly changing economic environment both within the country and at the global level.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Al-Bakri, A., Matar, M., & Nour, A.N.I. (2014). The required information and financial statements disclosure in SMEs. *Journal of Finance and Accountancy*, 16, 1-15.

[2] Bengtsson, M.M. (2021). Determinants of *de jure* adoption of international financial reporting standards: A review. *Pacific Accounting Review*, 34(1), 156-173. doi: 10.1108/PAR-10-2020-0193.

[3] Berest, M., & Sablina, N. (2024). Evaluation of the effectiveness of strategic and tactical controlling based on the analysis of the company's financial reports. *Development Management*, 23(1), 8-18. doi: 10.57111/devt/1.2024.08.

[4] Budai, E., Denich, E., & Hajdu, D. (2021). Financial reporting quality at SMEs – a theoretical approach. *Annales Universitatis Apulensis. Series Economica*, 23(1), 109-121. doi: 10.29302/oeconomica.2021.23.1.11.

[5] Charaia, V., Chochia, A., & Lashkhi, M. (2021). Promoting fintech financing for SME in S. Caucasian and Baltic states, during the COVID-19 global pandemic. *Business, Management and Economics Engineering*, 19(2), 358-372. doi: 10.3846/bmee.2021.14755.

[6] El-Helaly, M., Ntim, C.G., & Soliman, M. (2020). The role of national culture in international financial reporting standards adoption. *Research in International Business and Finance*, 54, article number 101241. doi: 10.1016/j.ribaf.2020.101241.

[7] Entrepreneurship in Azerbaijan. (2023). Retrieved from https://stat.gov.az/source/entrepreneurship/?lang=en.

[8] Framework for the preparation and presentation of financial statements. (2001). Retrieved from https://www.mca.gov.in/XBRL/pdf/framework_fin_statements.pdf.

[9] Ganbarov, F., Alieva, G., & Babazade, I. (2020). The role of exchange rates in non-oil export activity: Evidence from Azerbaijan. *Journal of Eastern European and Central Asian Research*, 7(3), 340-350. doi: 10.15549/jeecar.v7i3.477.

[10] Gasimova, N. (2022). *Assessment of impact of COVID-19 on SMEs in Azerbaijan: Consequences and perspectives*. Baku: Centre for Economic and Social Development.

[11] Gonçalves, F.J.A., De Moura, A.A.F., & Motoki, F.Y.S. (2022). What influences the implementation of IFRS for SMEs? The Brazilian case. *Accounting & Finance*, 62(2), 2947-2992. doi: 10.1111/acfi.12917.

[12] Güngörmüş, A.H. (2020). The role of independent audit in solving administrative, financial, and accounting problems in small and medium-sized enterprises. *Journal of Accounting, Finance and Auditing Studies*, 6(2), 87-104. doi: 10.32602/jafas.2020.012.
[13] Hajiyeva, A., Musayeva, N., Hajiyeva, A., & Mirzayeva, F. (2020). *The stages and effectiveness of international financial reporting standards implementation*. doi: 10.13140/RG.2.2.19613.13282.
[14] Hasanova-Vagif, J. (2021). An analysis of SMEs market in history of Azerbaijan. *SHS Web of Conferences*, 129, article number 09006. doi: 10.1051/shsconf/202112909006.
[15] Hellmann, A., & Patel, C. (2021). Translation of international financial reporting standards and implications for judgments and decision-making. *Journal of Behavioral and Experimental Finance*, 30, article number 100479. doi: 10.1016/j.jbef.2021.100479.
[16] IFRS Foundation. (2018). *Conceptual framework for financial reporting*. London: IFRS.
[17] International standards of financial reporting and other pronouncements. (2022). Retrieved from https://www.iasplus.com/en/standards#international-financial-reporting-standards.
[18] Kalynichenko, I. (2020). Asset value of enterprises as a basic component of economic relations. *Economic Analysis*, 30(1), 97-101. doi: 10.35774/econa2020.01.01.097.
[19] Kalyuzhna, N., Smutchak, Z., Chorna, N., Chornyi, R., Baldyniuk, O., & Chuba, R. (2024). Toolkit for multi-vector adaptation and development of corporate culture of international companies. *Technology: Toward Business Sustainability*, 927, 501-514. doi: 10.1007/978-3-031-54009-7_45.
[20] Khlif, H., Ahmed, K., & Alam, M. (2020). Accounting regulations and IFRS adoption in francophone North African countries: The experience of Algeria, Morocco, and Tunisia. *The International Journal of Accounting*, 55(1), article number 2050004. doi: 10.1142/s1094406020500043.
[21] Law of the Republic of Azerbaijan No. 716-IIQ "On Accounting". (2004, June). Retrieved from http://www.maliyye.gov.az/en/static/135/law-of-the-republic-of-azerbaijan-on-accounting-.
[22] Lukason, O., & Camacho-Minano, M.D.M. (2021). What best explains reporting delays? A SME population level study of different factors. *Sustainability*, 13(9), article number 4663. doi: 10.3390/su13094663.
[23] Manachynska, Yu., Luchyk, M., & Luchyk, S. (2024). Financial modelling of cash flow management for agribusiness security: Accounting and analytical aspect. *Scientific Horizons*, 27(4), 154-165. doi: 10.48077/scihor4.2024.154.
[24] Mehdiyev, V. (2024). Harmonization of capital accounting in Azerbaijan commercial enterprises in accordance with IFRS requirements. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 11(1), 40-49. doi: 10.52566/msu-econ1.2024.40.
[25] Number of enterprises by enterprise size class, 2022. (2022). Retrieved from https://ec.europa.eu/eurostat/cache/website/structural-business-statistics/.
[26] Number of small and medium-sized enterprises (SMEs) in the European Union from 2008 to 2023, by number of enterprises. (2024). Retrieved from https://www.statista.com/statistics/878412/number-of-smes-in-europe-by-size/.
[27] Perera, D., Chand, P., & Mala, R. (2022). Users' perspective on the usefulness of international financial reporting standards for small and medium-sized enterprises-based financial reports. *Meditari Accountancy Research*, 31(5), 1133-1164. doi: 10.1108/medar-03-2020-0809.
[28] Petrenko, N., Yaremenko, L., & Kashcheieva, G. (2023). Crowdfunding as a socio-economic opportunity for state support. *University Economic Bulletin*, 18(4), 33-40. doi: 10.69587/ueb/4.2023.33.
[29] Rahayuningsih, T., & Utami, W. (2022). The determinants quality of SME financial reporting: A case study in Tangerang, Indonesia. *Journal of Accounting Auditing and Business*, 5(1), 67-79. doi: 10.24198/jaab.v5i1.38688.
[30] Rykaczewski, M., Thevenot, M.A., & Vulcheva, M. (2022). International accounting and auditing standards adoption in non-EU Eastern European countries: Review of regulations and literature. *Journal of International Accounting Research*, 21(1), 77-100. doi: 10.2308/jiar-2021-104.
[31] Sadikhov, Sh. (2024). Possibilities of creating clusters in the weaving industry of the Republic of Azerbaijan. *Economics, Entrepreneurship, Management*, 11(1), 17-24. doi: 10.56318/eem2024.01.017.
[32] Sultanov, F. (2022). Comparative analysis of accounting systems in Azerbaijan and Turkey. In *International congress of social studies* (pp. 68-69). Erzurum: International Society Research Association. doi: 10.5281/zenodo.8051830.
[33] Széles, Z., Decman, N., & Rep, A. (2019). Opportunities and challenges in the practical application of fair value model in the field of SMEs financial reporting. In R. Resperger & T. Czeglédy (Eds.), *Modern economy, smart development* (pp. 475-489). Sopron: University of Sopron Press.
[34] The IFRS for SMEs standard. (2015). Retrieved from https://www.ifrs.org/issued-standards/ifrs-for-smes/view-ifrs-smes.html/content/dam/ifrs/publications/html-standards/english/2021/required/sme/.
[35] Valiyev, A., Huseynov, A., Gadimli, N., Huseynov, I., & Elmar, A. (2021). A practical model to implementing IFRS in the national accounting system: The case of Azerbaijan. *Journal of Eastern European and Central Asian Research*, 8(4), 585-598. doi: 10.15549/jeecar.v8i4.836.
[36] Wolff, S., & Liñeira, R. (2023). From the treaty of Rome to Brexit: A historiographical discourse of British influence on EU politics and economics. *European Chronicle*, 8(1), 16-27. doi: 10.59430/euch/1.2023.16.
[37] World Intellectual Property Organization. (2023). *Global innovation index 2023: Innovation in the face of uncertainty*. Geneva: WIPO. doi: 10.34667/tind.48220.

Ельхан Джафаров
Кандидат економічних наук, доцент
Азербайджанський державний економічний університет
1001, вул. Істіглаліят, 6, м. Баку, Азербайджанська Республіка
https://orcid.org/0000-0002-3161-7869
Нусрет Бабаєв
Старший викладач
Азербайджанський державний економічний університет
1001, вул. Істіглаліят, 6, м. Баку, Азербайджанська Республіка
https://orcid.org/0009-0003-7168-1763

Проблеми підготовки фінансової звітності бізнесу за міжнародними стандартами

Анотація. Актуальність дослідження зумовлена необхідністю пошуку шляхів підвищення якості та гармонізації фінансової звітності суб'єктів малого та середнього бізнесу в Азербайджані згідно з міжнародними вимогами. Метою роботи був аналіз звітності азербайджанських малих і середніх підприємств, а також виявлення суттєвих невідповідностей між основними поняттями та принципами в окремих розділах міжнародних стандартів, усунення яких дозволить підвищити співставність фінансових даних азербайджанських підприємств на глобальному рівні. Основу методологічного підходу склали: аналіз статистичних даних, за допомогою якого було досліджено зміну кількості малих та середніх підприємств в Азербайджані за 2018-2023 роки; метод аналогії для порівняння якісних характеристик фінансової звітності, зазначених у «Концептуальній основі фінансової звітності» та міжнародних стандартах. До основних результатів необхідно віднести пропозицію щодо прийняття показників якості інформації у фінансовій звітності відповідно до характеристик, визначених «Концептуальною основою фінансової звітності»; обґрунтування необхідності використання методів первісної та справедливої вартості, з огляду на оцінку можливої, теперішньої та дисконтованої вартості активів, зобов'язання, доходи і витрати, а також використання простіших підходів до їх відображення у фінансовій звітності; доведення необхідності ширшого розкриття інформації, представленої у пояснювальних записках фінансової звітності, що сприятиме підвищенню якості та корисності інформації про фінансовий стан суб'єктів господарювання. Результати наукової роботи, а також сформульовані на їх основі висновки матимуть практичне значення для керівників підприємств малого та середнього бізнесу, керівництва країни, аудиторів фінансової звітності

Ключові слова: співставність інформації; концептуальні підходи; відображення активів; інновації; гармонізація

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2
2024

UDC 657.421.3:334.724.6
DOI: 10.57111/econ/2.2024.57

Svitlana Levytska
Doctor of Economics, Professor
National University of Water and Environmental Engineering
33028, 11 Soborna Str., Rivne, Ukraine
https://orcid.org/0000-0002-4739-0486

Nataliia Ostapiuk
Doctor of Economics, Professor
Sopot Academy of Applied Sciences
81-855, 5 Rzemieslnicza Str., Sopot, Poland
https://orcid.org/0000-0003-2347-3815

Olena Tsiatkovska*
PhD in Economics, Associate Professor
Kyiv National Economic University named after Vadym Hetman
03057, 54/1 Beresteiska Ave., Kyiv, Ukraine
https://orcid.org/0000-0001-8825-9778

Maryna Resler
Doctor of Economics, Professor
Mukachevo State University
89600, 26 Uzhhorodska Str., Mukachevo, Ukraine
https://orcid.org/0000-0002-3787-9472

Olena Mykhalska
PhD in Economics, Associate Professor
Taras Shevchenko National University of Kyiv
01033, 60 Volodymyrska Str., Kyiv, Ukraine
https://orcid.org/0000-0003-1921-6293

State institution non-financial asset audit strategy development

Abstract. The aim of the study was to determine optimal strategies and methods for improving audit activities in the field of management of non-financial assets of public institutions. Audit reports, financial statements of state institutions, the legal framework for audit activities and information on asset management strategies were used in the study. The study results demonstrate that effective and objective control over assets ensures financial discipline, optimises costs and complies with legal requirements. The study discusses the traditional, risk-based and integrated approaches to asset auditing, as well as the importance of an integrated audit approach that considers not only financial indicators but also non-financial aspects that affect the performance of an institution. The real situation in Ukraine is addressed and compared with other countries, namely the United States, the United Kingdom, India, Brazil and Hungary. The study noted that the development of the audit of non-financial assets of public institutions is a complex and dynamic process that occurs on constant changes in legislation and requirements of international standards. In addition, the challenges and

Article's History: Received: 21.02.2024; Revised: 06.05.2024; Accepted: 27.06.2024

Suggested Citation:
Levytska, S., Ostapiuk, N., Tsiatkovska, O., Resler, M., & Mykhalska, O. (2024). State institution non-financial asset audit strategy development. *Economics of Development,* 23(2), 57-68. doi: 10.57111/econ/2.2024.57.

*Corresponding author

problems faced by auditors auditing non-financial assets of government agencies are highlighted. It is proposed to expand the concept of audit effectiveness from the "3E" to the "9E", which provides a deeper assessment of performance, covering various factors. Based on the study, the key areas of the strategy for auditing non-financial assets of public institutions, including improving the audit system, identifying and managing risks and introducing modern technologies, were formulated. These findings are valuable for auditors, financial managers, civil servants and resource management experts as they provide practical recommendations for improving audit performance and the efficient use of non-financial assets

Keywords: budget programmes; transparency; concept of efficiency; areas of implementation; non-financial assets

INTRODUCTION

The control of non-financial assets in public institutions is crucial in ensuring the stability and efficiency of operations. One of the key tools for controlling these assets is audit, which is an integral part of strategic resource management in any organisation. The audit of non-financial assets is focused on assessing the efficiency of their use, monitoring compliance with legislation and ensuring transparency. It is also important to note that the current conditions of technological development, changes in legislation and the expansion of the functions of public institutions require continuous improvement of methods and approaches to the audit of non-financial assets. Organisations need to develop and implement new strategies and techniques to meet the growing demands and ensure high-quality audit processes. According to O. Radchenko *et al*. (2023), an audit of non-financial assets identifies potential problems and risks associated with the control of these assets and provides recommendations for their resolution. One of the key problems in the context of auditing non-financial assets is the lack of a clear methodological approach to assessing their efficiency. This can cause heterogeneity in the audit process and make it difficult to identify strategic directions for development. Another issue is the insufficient use of innovative approaches in the audit of non-financial assets. The use of analytical tools and the development of digital platforms can greatly facilitate the audit process and provide more accurate results, as N. Musayeva *et al*. (2022) noted.

The development of strategies and methods for auditing non-financial assets of public institutions is aimed at achieving sustainable development and effective use of public resources. This involves strengthening control over assets by improving methods of analysing them and ensuring compliance with the law. The main goal of such strategies is to ensure transparency and efficient use of resources, which will optimise the performance of institutions and achieve their strategic goals. It is also important to introduce modern technologies and innovations into the audit process, which can improve control efficiency and reduce the risks of unreliable information.

The problem of developing the audit of non-financial assets is relevant and important in the modern system of accounting and auditing, which encourages active research on this issue. Numerous studies were conducted to identify the main trends and issues related to the audit of non-financial assets. D. Khudhair *et al.* (2019) and D.H. Downey & J.C. Bedard (2019) highlighted the importance of improving communication between auditors and managers to ensure the effectiveness of the process. They emphasised that understanding and mutual acceptance between these parties play a key role in the success of the audit. S. Grishchuk (2019) addressed the importance of developing objective criteria for assessing audit results to avoid subjectivity. He emphasised that establishing clear and objective criteria would increase the level of objectivity and reliability of audit procedures. M.T. Fülöp *et al.* (2020) and O. Tsiatkovska (2021) addressed the role of stakeholders in ensuring transparency in the audit of non-financial assets. They highlighted the importance of including various stakeholders in the audit process to ensure that audit opinions are objective and unbiased.

A. Tiron-Tudor & D. Deliu (2022) noted the need to constantly update audit strategies to adapt to changing conditions and requirements. This approach allows the auditors to be prepared for challenges and changes in the audit industry. S.V. Oneshko *et al.* (2021) and R. Lamboglia *et al.* (2021) highlighted the possibilities of using advanced technologies in the field of audit. They noted that the use of the latest technology can significantly improve the efficiency and accuracy of audit procedures. E.E. Griffith (2020) addressed the issue of professional training of auditors, emphasising the importance of continuous development in this area. He noted that the rapidly changing nature of auditing requires auditors to constantly update their knowledge and skills. S. Sudirman *et al.* (2021) noted the need to improve legislation for the effective functioning of audit procedures. The statement highlights the need to keep the legal framework for auditing up to date to ensure a high standard.

The analysis of the results of research in the field of audit of non-financial assets conducted by other scientists reveals a wide range of modern directions in this area. They focused on such aspects as improving communication between auditors and managers, developing objective criteria for evaluating audit results, the role of stakeholders in ensuring transparency in auditing, constantly updating audit strategies, using advanced technologies, professional training of auditors and the need to improve legislation. However, such issues as the development of standards and methodologies for assessing the value of non-financial assets that would address their impact on socio-economic development remain unexplored. It is also necessary to address the challenges and opportunities associated with the increased use of technology and analytics in audit practice, in particular, the ethical aspects and possible risks of this process. The study aimed to improve the quality and efficiency of audit procedures in the area of non-financial assets of public institutions to promote greater public confidence in audit results.

MATERIALS AND METHODS

Various sources of information were used to conduct the stu-dy on the audit of non-financial assets in state institutions. An analysis of relevant scientific sources, including articles, books and research reports related to audit and

asset management in the public administration sector, was carried out. This analysis provided a comprehensive overview of current trends and approaches in this area. The general system of research methods was used to obtain an objective and comprehensive assessment of the situation with the audit of non-financial assets in public institutions. The analysis of literature and scientific publications provided a basic understanding of the theoretical aspects of the problem, while the collection of official reports and documents allowed us to obtain specific data on the actual audit results and identified problems. This approach provided an informed expert assessment of the situation and the development of recommendations for further improving the use of non-financial assets in public institutions.

To collect primary data and statistical information on the audit of non-financial assets in public institutions, data from government agencies such as the State Audit Service of Ukraine were used, namely Report on the use of budget funds by the State Audit Service of Ukraine (2023) and Performance of the State Audit Service and its interregional territorial bodies (2023). The data of the Ministry of Finance of Ukraine were also analysed, namely the Ministry of Finance of Ukraine statistical collection (n.d.). These sources provided detailed information on the scope and results of the audit, which were used to identify issues and recommendations for asset management.

The statistical method of research was used to analyse the audit results, identify various indicators of asset management efficiency and assess risks. This method was used for an objective and scientific approach to analysing the results of the audit of non-financial assets in public institutions and drawing reasonable conclusions and recommendations for their use. The comparative method was used to identify certain general trends in the audit of non-financial assets, such as the popularity of certain methodologies and the prevalence of certain problems. This provided the overall context of their operation and identified opportunities for further improvement of audit processes. The development of the audit of non-financial assets in Ukraine was compared with the Hungary (Accounting and auditing, n.d.), India (CAG's auditing…, 2017), United States (Accounting research guide, 2023), the United Kingdom (Financial Reporting Council…, 2024) and Brazil (International Federation…, 2024).

To analyse the changes in legislation and standards related to the audit of non-financial assets in public institutions, the documents of the Budget Code of Ukraine (2010) that regulate the audit in the public administration sector and relevant regulations (Resolution of the Cabinet of Ministers of Ukraine No. 1805-p, 2021) were first collected. These documents were then analysed, addressing the latest changes and updates that may have occurred at the time of the study. Particular attention was devoted to those aspects directly related to the audit of non-financial assets, such as the requirements for accounting, reporting, control and audit of these assets in public institutions. The International Public Sector Accounting Standards were also reviewed to determine their relevance to the current needs and requirements for the audit of non-financial assets.

The reports on the Performance of the State Audit Service and its interregional territorial bodies (2023) were used to analyse the distribution of budget funds and identify financial irregularities in state institutions. These reports contain information on the violations identified, ways to resolve them, and the projected consequences for the financial stability of state-owned institutions. The use of this data on financial risks provided an objective assessment of the state of financial performance of public institutions, identified violations, and understood strategies to address them.

RESULTS

Auditing assets in public institutions is a complex part of public financial management. Ensuring effective and objective control over assets ensures financial discipline, optimises costs and ensures compliance with legal requirements. One of the main methods of asset auditing is the traditional approach, which is the foundation of many audit operations and ensures relative objectivity in determining the condition of assets. This approach is based on the application of standard audit procedures and methodologies, including reviewing financial statements and documentation, analysing risks and performing necessary audit procedures to verify the reliability and correctness of asset accounting. The advantage of the traditional approach is its stability and familiarity, which allows auditors to effectively conduct an audit following established standards and procedures. At the same time, however, this approach may be limited in its ability to identify complex or unusual risks arising from non-financial assets.

In addition to the traditional approach, some government agencies use risk-based audit planning. This approach focuses on identifying and assessing the risks associated with the assets and designing audit procedures responsive to those risks. Its advantage is the ability to efficiently use resources to review the most significant aspects of assets while ensuring a high level of objectivity and efficiency. Given the increasing complexity and risks associated with the assets of public entities, it is important to use a combination of traditional and risk-based audit approaches (Begma *et al.*, 2019). This will ensure not only high objectivity and reliability of audit results, but also effective identification and control of risks related to the assets of state-owned institutions.

An integrated audit approach is also important, as it is key to ensuring a comprehensive analysis of the activities of state institutions and a balanced assessment of their effectiveness. This approach reflects the recognition that successful governance is not limited to financial performance but also includes non-financial aspects that affect the overall performance of an institution. The integrated approach covers various factors that affect an institution's operations. The first is to assess the efficiency of resource management. Auditors analyse how rationally and efficiently the financial and material resources of the institution are managed, and whether they meet the strategic goals and development plans. The second aspect addressed in the integrated approach is compliance with regulatory requirements. Auditors check whether an institution's actions comply with financial laws and regulations and whether control and reporting procedures are followed. The third element is risk analysis. Auditors identify potential risks that may affect the financial position and operations of an institution and develop strategies to manage and mitigate them. In addition, the integrated

approach covers other factors such as environmental aspects, social responsibility, and technological and innovative capabilities. All of these components provide a more complete and comprehensive view of the state of asset management of public institutions, identify potential problems and opportunities for improvement, and develop recommendations for optimising operations.

Auditors auditing non-financial assets of public entities face several challenges that require careful analysis and professionalism. These assets are increasingly complex to manage due to their diverse nature and the impact of external factors. One of the main challenges faced by auditors is the difficulty of defining audit objectives. Non-financial assets can be diverse, including material, human, intellectual and social resources. Assessing their effectiveness and defining audit objectives requires a deep understanding of the specifics of the institution's activities and its strategic goals. Another significant challenge is the lack of standards and methodologies for auditing non-financial assets. The lack of set rules and guidelines can complicate the audit process and reduce objectivity. Auditors need to be creative and flexible in using existing tools and developing methods to meet these challenges. The third challenge is the lack of access to the necessary information. It is often difficult for auditors to gain access to internal documents and information about an institution's assets. This can significantly complicate the audit and lead to an incomplete assessment of risks and potential problems. The risk of internal fraud is the fourth problem. Non-financial assets may be vulnerable to internal fraud or inadequate controls. Auditors should be very attentive and able to identify possible signs of fraud and deficiencies (García-Sánchez *et al.*, 2023). In addition, constant changes in legislation and standards pose an additional challenge for auditors. Changes in the legal environment may require revision of audit methodology and procedures, which requires constant updating and training of audit personnel. Auditors working in the area of non-financial assets of public entities face numerous challenges and issues that require high skill, patience and professionalism. Strategic planning, ongoing training and the improvement of audit methods will help auditors effectively address these challenges and achieve success.

Despite the continuous development of audit methods, techniques and procedures, audit practices are taking on new forms and manifesting themselves in various ways. The development of the audit of non-financial assets of public institutions in Ukraine is a complex and dynamic process that is underway based on constant changes in legislation, requirements of international standards and internal needs to improve management systems. The initial stages of the development of the audit of non-financial assets in Ukraine were associated with the transition to a market economy after independence. At that time, there was a need to build effective control and audit systems that would ensure not only financial but also operational and strategic compliance. Over the past 20 years, audit practice in Ukraine has significantly transformed. New audit standards were developed to address the specifics of the public sector and its peculiarities. There is also an increase in requirements for the quality of audit services in terms of identifying and assessing risks, as well as providing recommendations for their mitigation and control.

In the context of the strategy of modernising the public sector accounting and financial reporting system, it is important to ensure timely and accurate information on budget execution, which is a key factor for the development and improvement of finance controlling at the state and local government levels. The introduction of national public sector accounting regulations based on the International Public Sector Accounting Standards generates relevant information for medium- and long-term budget planning and effective control over the use of budget funds. The National Regulation (Standard) on Public Sector Accounting establishes the methodological framework for accounting for the income and expenditure of public institutions, as well as the execution of state and local budgets (Resolution of the Cabinet of Ministers of Ukraine No. 1805-p, 2021). As part of the budget process, particular attention is devoted to accounting and reporting on the execution of budgets and estimates of budget entities. For instance, according to Article 56 of the Budget Code of Ukraine (2010), accounting for all operations related to the execution of the State Budget of Ukraine is performed by the Treasury of Ukraine following the procedures established by the Ministry of Finance of Ukraine for recording information on the assets and liabilities of the state. Accounting for the execution of budget estimates of budget entities is carried out by the Accounting Regulations and other regulations established by the Ministry of Finance of Ukraine.

Political factors related to changes in power as a result of the presidential and parliamentary elections in Ukraine, as well as reforms introduced in various areas to harmonise the national system with the European one, are important aspects of the current political landscape of Ukraine. Particular attention is devoted to the factor of war on the territory of the country. As such, budget expenditures are redistributed not only between budget programmes based on their efficiency but also between those programmes that are essential for the proper functioning of the country, economic stability, development of various sectors of the economy and provision of minimum social guarantees for citizens. The state financial control covers state-owned institutions, so information on the number of institutions covered by the control and where violations were detected is shown in Figure 1 and Table 1.

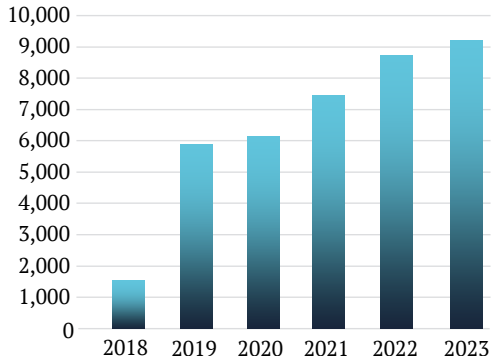

Figure 1. The number of institutions covered by state financial control by the State Audit Service of Ukraine in 2018-2023 (the number of actually inspected facilities)
Source: compiled by the authors based on the Performance of the State Audit Service and its interregional territorial bodies (2023)

Table 1. The number of institutions where financial irregularities were detected during the state financial control by the State Audit Service of Ukraine in 2018-2023

Value	2018	2019	2020	2021	2022	2023	Deviation	
							Abs., units	Deviation, %
Number of enterprises, institutions and organisations where financial irregularities were detected, total	1,344	5,657	5,599	6,032	6,543	6,338	4,994	371.58
In budgetary institutions and organisations	933	4,163	3,549	3,581	3,913	3,728	2,795	299.57
For public and municipal sector entities	372	1,446	1,958	2,351	2,557	2,526	2,154	579.03
Share of institutions where offences were detected in the total number of institutions covered by the state financial control	86.93	96.14	91.31	81.12	74.98	68.91	–18.03	–20.74

Source: compiled by the authors based on the Performance of the State Audit Service and its interregional territorial bodies (2023)

Compared to 2018, in 2023, the number of institutions subject to state financial control increased by 7,652 units, which is 494.95%. This indicates a significant increase in the number of institutions inspected during the year. One of the main reasons for the increase in the number of institutions subject to audits is the active implementation of procurement procedures and decentralisation reforms. During the period under review, there was an increase in the number of detected violations from 1,344 in 2018 to 6,338 in 2023, which indicates a general increase in attention to the financial activities of institutions. It is also necessary to note that although the total number of institutions where violations were detected has increased, the share of such institutions in the total number of institutions covered by state financial control has decreased from 86.93% in 2018 to 68.91% in 2023. This may indicate that in absolute terms more institutions were inspected, but in relative terms, fewer violations were detected compared to the total number of institutions inspected.

Compared to Ukraine, some countries, such as the US and the UK, have more developed and standardised audit standards and practices. For instance, they have more advanced and high-quality regulations that define audit procedures and requirements. In addition, these countries have strong professional associations of auditors that actively work to improve audit practices and promote the development of common standards and norms. These countries also have specialised bodies or committees that are responsible for providing guidance and recommendations on audit matters. These bodies include representatives of professional associations, industry experts, and government officials. Countries with more developed audit environments also have greater opportunities for the professional development of auditors, access to the latest audit technologies and techniques, and greater confidence in the independence and objectivity of audit organisations (Accounting research guide, 2023; Financial Reporting Council..., 2024). In Ukraine, the audit of non-financial assets has not yet reached this level of development. Despite significant improvements in recent years, the audit industry still faces challenges, such as insufficient standardisation of procedures, low professionalism of some audit firms and ineffective control mechanisms. As a result, the objectivity and reliability of the audit results cannot always be guaranteed, which raises questions about the credibility of the audit results.

In emerging and transition economies, such as India, Brazil and Hungary, the situation concerning the audit of non-financial assets is also different. The process of auditing non-financial assets, as in Ukraine, is less developed than in the US and the UK due to the lack of necessary resources, including qualified personnel and financial support. However, these countries have seen a growing interest in the audit of non-financial assets due to the increased focus on the effective management of public resources and the fight against corruption. The governments of these countries are implementing reforms in the audit system to improve its quality and efficiency. However, the process of these changes may take longer and require more support from international partners (International Federation..., n.d.; CAG's auditing..., 2017).

There is a concept of efficiency in auditing known as the "3E" concept, which derives its name from the first letters of its components (economy, efficiency, effectiveness), which means that the assessment of economy, efficiency and effectiveness should be carried out to ensure optimal use of resources and achievement of the set goals (De Widt *et al.*, 2022). The "3E" concept has become a key component of modern audits aimed at assessing the efficiency and effectiveness of organisations. This concept is essential for auditors in determining whether resources are being used efficiently and whether audit objectives are being met. The first component, the economy, focuses on the rational use of the organisation's resources. Auditors analyse how efficiently and economically money and other resources are spent to achieve the set goals. Assessing the cost-effectiveness of activities helps to identify opportunities to reduce costs and optimise the use of resources. The second component, efficiency, is defined as the speed and quality of achieving results with the means and resources available. Auditors analyse how effectively an organisation uses its resources to achieve its goals. Performance measurement identifies opportunities to improve processes and increase productivity. The third component, effectiveness, determines how successfully an organisation achieves its goals and objectives. Auditors analyse whether the organisation is achieving the expected results in terms of the use of resources. Performance measurement determines how effectively the organisation's functions are performed and whether the results are in line with the goals set. The application of the "3E" concept allows auditors to conduct an in-depth analysis of the efficiency and effectiveness of an organisation's activities. This concept can be successfully applied across a variety of audit areas, such as financial, operational and strategic, helping auditors identify opportunities for improvement in the use of resources and achievement of objectives.

The "3E" concept in auditing, which is known for its use in performance measurement, is being expanded by Klynveld Peat Marwick Goerdeler (KPMG) to the "6E" concept with additional components that add depth and complexity to the analysis (Performance auditing, 2013). The following components are added to the original concept: environment, equity and ethics. Environment refers to sustainable development and reflects an organisation's ability to meet the needs of the present without compromising the opportunities of future generations. Equity reflects fairness and impartiality in the use of public funds. Ethics refers to the ethical aspects of managing public funds and requires honesty, integrity and commitment to duty (Guidara *et al.*, 2022). This expanded concept provides auditors with a broader approach to assessing the performance and activities of organisations, addressing not only economic and operational aspects, but also their social and environmental responsibility and compliance with ethical principles.

The study proposed to expand the concept of efficiency in audit to "9E", based on the basic principles of the sustainable development strategy, which recognises the importance of a balance between economic, environmental and social aspects. This promotes the idea of sustainable development, which seeks to meet the needs of the current generation without compromising the opportunities of future generations. The study of the concept of audit of non-financial assets of public institutions revealed the need to identify the main components aimed at assessing the effectiveness, efficiency and compliance of control and use of not only budget funds but also the asset itself. The main components of this concept are shown in Table 2.

Table 2. The main components of the "9E" concept for auditing non-financial assets in public institutions

No.	Component	Meaning
1	Economy	Indicates the need to create cost-effective strategies that ensure the profitability and stability of the economic system. Auditors should consider cost-effectiveness, including whether the required amount of resources has been spent to achieve the objective without incurring excessive costs.
2	Efficiency	Indicates how efficiently the auditor performed its tasks and whether the maximum result was achieved from the resources spent. The main outcome here is to achieve maximum results at minimum cost.
3	Effectiveness	Determines the extent to which the audit activity helped achieve the objective or fulfilled its function. This concept is intended to determine the extent to which audit procedures and recommendations have led to improvements or achieved the intended objective.
4	Environment	Emphasises the importance of considering the impact of strategies on the natural environment and making decisions that promote environmental sustainability and conservation of natural resources.
5	Equity	Identifies the need to consider social equity in governance and strategic planning, as well as ensuring the equitable distribution of resources and opportunities for all members of society.
6	Ethics	Refers to the qualities of honesty and integrity in personal behaviour and commitment to the duty of a steward of public funds.
7	Effective communication	An assessment of how effectively the auditors communicate with clients, management and other stakeholders. Clarity and reporting can have a significant impact on the perception of an audit and the acceptance of recommendations.
8	Expertise	The ability of auditors to apply a high level of professional knowledge and skills in a specific audit area. This may include an in-depth understanding of the client's industry and the use of current audit techniques.
9	Electronic auditing	Application of modern technologies and analytical tools to improve the efficiency and accuracy of audit processes.

Source: compiled by the authors

Effective audit communication is critical to the success of audit procedures and the achievement of their objectives. It assesses the extent to which the auditors can establish and maintain effective communication with various stakeholders. Clarity and accountability in communications are important aspects of effective engagement. Clear and understandable explanations by auditors of their findings, recommendations and audit processes contribute to increased trust and understanding by clients and other stakeholders. If auditors can communicate their results in a clear and accessible manner, it contributes to informed decision-making and improves the perception of audit findings (Farkas *et al.*, 2019). Such open and clear communication helps build partnerships between the auditors and their clients, strengthens the company's reputation and ensures support from other stakeholders, which in turn improves the quality and effectiveness of audit services. Audit expertise is a key element of successful audit procedures and ensuring high-quality audit services. This means that auditors are required to have deep and extensive knowledge of the specific industry in which their client operates. This includes an understanding of the key principles and processes that characterise the industry, as well as the specifics of a particular business or organisation. Audit expertise involves the use of modern and up-to-date audit techniques that address the latest trends and standards in the industry (Gao & Zhang, 2019). Auditors should be proficient not only in traditional audit approaches but also have an understanding of modern technologies and innovations used in the chosen industry. In addition, auditors must be able to adapt to changing market conditions and requirements. This means that they must be able to respond quickly to changes in legislation, regulation and the economic environment to ensure that they can fulfil their responsibilities effectively and provide a high level of audit services.

E-audit is a modern and innovative practice that involves the use of the latest technologies and analytical tools to optimise and improve the quality of audit processes (Sliusar & Burdonos, 2022). This methodology includes a wide range of actions and the use of specialised programs and software to automate and improve the audit. E-auditing involves the use of specialised software and tools that allow auditors to conduct audit procedures efficiently. These can be programs for analysing financial statements, tools for checking internal control procedures, or programs for automating data collection and processing (Hasan, 2021). Electronic audits also use data analysis to identify anomalies, unusual patterns or potential risks. Using specialised analytical tools, auditors can conduct in-depth analysis of large amounts of data, which allows them to quickly identify potential problems and risks, as well as to make a more objective assessment of financial statements and internal processes (Tenyukh *et al.*, 2022). In general, e-auditing contributes to the efficiency and accuracy of audit processes by providing auditors with access to powerful tools and technologies to perform their duties to a high standard.

The proposal to extend the concept from the "3E" to the "9E" was based on practical research by audit organisations, as well as from the current realities and specifics of the functioning of public institutions. This extension allows auditors to assess their performance in a more in-depth manner, addressing various factors that affect the quality and effectiveness of audit services. In addition, it aims to create a system of effective and ethical management of non-financial assets in public institutions, contributing to the achievement of strategic goals and responsible use of resources. The introduction of the "9E" concept into the strategy for the development of the state audit of non-financial assets of state institutions is aimed at a more complete and comprehensive assessment of the effectiveness of asset management in various spheres of society, including economic, social and environmental aspects. This development system aims to create effective public finance controlling, ensuring the legal, efficient and targeted use of budget funds in the acquisition, ownership, disposal, use and alienation of non-financial assets. The implementation of the audit strategy for non-financial assets of public institutions includes several key objectives aimed at the effective management and use of these assets. The study systematised the main objectives of the audit strategy for non-financial assets of public institutions, which can be addressed when developing and implementing the strategy. The main areas of the strategy implementation are shown in Figure 2.

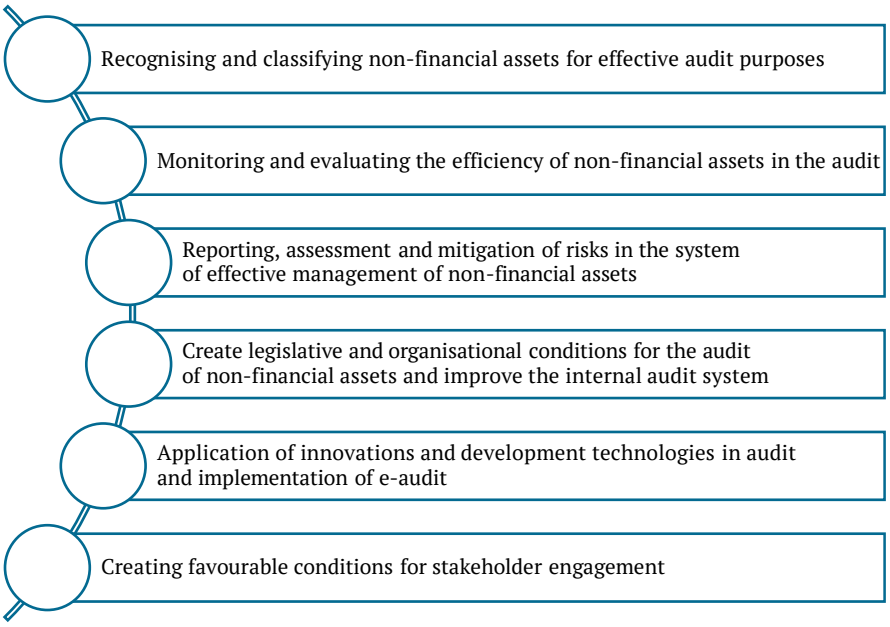

Figure 2. Key areas of implementation of the audit strategy for non-financial assets of state institutions
Source: made by the authors

The implementation of the strategy for auditing non-financial assets of state-owned institutions includes several key areas. The first of these is the recognition and classification of non-financial assets for effective audit. This area involves the systematic recognition and classification of all non-financial assets of public entities to prepare for an effective audit. It includes the identification of all assets, their classification into categories and groups, as well as an assessment of their value and potential impact on the institution's operations. The second area is to monitor and evaluate the use of these assets during the audit. It is aimed at continuously monitoring and evaluating the results of the use of non-financial assets of public institutions to determine their effectiveness. It includes regular analysis of the implementation of the institution's strategic goals and objectives for the use of assets, as well as an assessment of their contribution to achieving these goals. The third area is to ensure reporting, assessment and mitigation of risks in the non-financial asset management system. This area involves creating mechanisms for reporting and assessing risks associated with the management of non-financial assets. It includes analysing and identifying

potential risks, developing strategies to mitigate and control them, and ensuring transparency and compliance in asset management. The fourth area is to create the necessary conditions for auditing and improving the internal audit system. This area is aimed at creating the necessary legal and organisational framework for the audit of non-financial assets, as well as at continuously improving the internal audit system in the institution. The fifth area is the introduction of innovative technologies and electronic audits. It involves the introduction of modern innovative technologies and e-auditing to improve the efficiency and accuracy of audit processes. Finally, the sixth area is to create favourable conditions for stakeholder engagement. This involves developing mechanisms for cooperation and communication with all stakeholders to ensure the effective use of non-financial assets.

DISCUSSION

Various methods are used to audit non-financial assets in public institutions to ensure effective control and objective assessment of their condition. The traditional approach, which relies on standard audit procedures and techniques such as financial statement analysis, risk analysis and testing, provides stability and objectivity but may be limited in identifying complex risks. To overcome these limitations, risk-based audit planning is used to identify and assess risks and design appropriate audit procedures. The integration of traditional and risk-based approaches ensures high objectivity and efficiency of the audit. This comprehensive approach allows not only to assess financial performance but also to address non-financial aspects that affect the efficiency of asset management. T. Sun (2019) and M.H. Christ *et al.* (2021) also note the importance of using not only traditional but also high-risk approaches in the process of auditing public institutions. They emphasise that a combination of these approaches helps to ensure not only objectivity but also efficiency of audit procedures. This approach is important because it addresses the specifics of institutional asset management, which can often be complex and fraught with risks. However, the current study indicates that a combination of approaches is not enough. To achieve optimal results in audit activities, it is necessary to carefully analyse the contextual factors affecting the activities of public institutions. An in-depth understanding of these factors can be used to develop more effective audit strategies that meet the specific needs and challenges of each institution.

The audit of non-financial assets of public institutions is a task that poses many challenges and problems for auditors, requiring careful analysis and a professional approach. Defining the audit objectives is a major challenge, as non-financial assets can be very diverse, including material, human, intellectual and social resources, as noted by S. Shevchenko (2023). The lack of standards and methodologies for auditing non-financial assets is also a significant challenge. In addition, the lack of access to the necessary information complicates the audit and makes it more challenging for auditors. A. Hecimovic & N. Martinov-Bennie (2023) examine various aspects of the audit of non-financial assets in public institutions, in particular, the focus on identifying and addressing new challenges in this area. For example, one of these challenges is the lack of integration of information systems used to account for non-financial assets, which complicates the process of collecting and analysing data for audit purposes. On the other hand, M. Milojević *et al.* (2020) focus on the problem associated with insufficient automation of audit processes, which may affect the efficiency and accuracy of the audit. This may include insufficient automation of data collection, insufficient integration of audit programmes with existing information systems, and other aspects that impede auditors from performing tasks and may lead to a decrease in audit quality. In the current study, other important challenges affecting the audit of non-financial assets in public institutions were identified and considered. The challenges identified by the authors highlight the importance of developing technological solutions to improve the efficiency and accuracy of auditing, which provides a valuable contribution to understanding and addressing challenges in this area.

The expansion of the audit concept from the "3E" to the "9E" not only reflects the current realities and functioning of public institutions but also creates an opportunity for auditors to assess the effectiveness of their work in more depth. This approach provides a broader approach to assessing the efficiency and effectiveness of state asset management, covering not only economic and operational aspects, but also their social and environmental responsibility, as well as innovation and ethical principles. J.C. Burton & P. Fairfield (2020) and G. Kontogeorga & A. Papapanagiotou (2023) also propose an extension of the "3E" audit concept to include social and environmental responsibility, reflecting the current requirements and realities of public asset management. This approach is designed to address social and environmental impacts, reflecting the growing focus on sustainable development and corporate social responsibility. This coincides with the current findings, which indicate the importance of integrating non-financial aspects, but the current study additionally considered ethical principles, communication and innovation aspects that were not mentioned in previous studies. Achieving the strategy of auditing non-financial assets of public institutions involves identifying and systematising the main areas for the effective control and use of these assets. The approach includes identifying all assets, classifying them, continuously monitoring and evaluating their performance, establishing reporting and risk assessment mechanisms, ensuring favourable conditions for auditing and using innovative technologies. S. Alhababsah (2019) focuses on defining the direction of the audit strategy for various assets of public institutions. This approach emphasises the importance of a set definition of the objective and structuring the areas of focus, which ensures focus and consistency in the performance of the audit engagement. This approach differs from the current results, as the author does not focus on the integration of non-financial aspects, such as social and environmental responsibility, to ensure a comprehensive approach to assessing asset management performance.

Political factors, such as changes in government and the implementation of reforms, are important for the functioning of the audit system in Ukraine. In particular, an important aspect is the introduction of martial law in the country, which has led to a redistribution of budget expenditures and changes in financial discipline. These factors affect the scope of audits and the detection of financial irregularities in public institutions. Å. Johnsen (2019)

also focuses on the impact of political factors on the audit system in a country, in particular, the effects of changes in political leadership and reforms. However, the study prioritises detail on their impact on the functioning of the audit and the allocation of budgetary funds, which reflects the importance of understanding the political context when analysing the effectiveness of the audit system. G. Grossi *et al.* (2020), in turn, considered the impact of political factors on the audit system from a different perspective. The mentioned study focused on the interconnection of political and economic processes in the context of forming an audit strategy for public institutions. In particular, the impact of policy decisions on financial discipline and asset management efficiency in the face of economic change was addressed. The current results and studies of the authors point to the importance of political factors in the audit system but with some differences in the focus and aspects studied. The approach of the latter author differs from the current results, as he considers political factors from a broader socio-economic perspective, rather than being limited to the financial discipline.

An important innovative practice is the use of digital audits. It provides automation of many aspects of audit activities, reducing the impact of the human factor on the process and increasing the speed of information collection and processing. Specialised software and analytical tools can be used to effectively detect anomalies, identify risks and identify opportunities to optimise asset management processes, as A. Nikonchuk (2023) noted. In addition, e-auditing contributes to the preservation and protection of data, which is a critical aspect in the growing digital environment. F. Hashem & R. Alqatamin (2021) examined in detail the role of e-auditing in the non-financial sector, noting the benefits and challenges associated with this type of audit. The author also considered the possibilities of using artificial intelligence and analytical systems to automate audit processes and increase its efficiency. This approach is consistent with the current research results, but the author's study addresses specific technological solutions that can be applied in practice. The use of specific software tools for data analysis and automation of audit processes is discussed in detail, and their effectiveness in real-world conditions is evaluated.

Various aspects of the audit of non-financial assets of public institutions were considered. The main challenges faced by auditors are identified, such as the definition of objectives, lack of standards and limited access to information. The study noted that a combination of traditional and risk-based approaches can ensure the objectivity and effectiveness of the audit. The author also notes the need to expand the audit concept to include social and environmental responsibility, as well as strategic asset management. Comparison with other authors has highlighted the importance of analysing different approaches and using best practices to achieve efficiency and objectivity in audit activities.

CONCLUSIONS

The results of the study highlight the importance of asset audits in public institutions for the effective control of public finances. Effective and objective control over assets helps to ensure financial discipline, optimise costs and comply with legal requirements. The traditional approach to asset auditing is one of the main methods that ensures relative objectivity in determining the condition of assets. In addition, government agencies use risk-based audit planning and an integrated approach to provide a comprehensive analysis of institutions. The study identified the main challenges and problems of asset audits in state-owned institutions. One of the key challenges is the difficulty of defining audit objectives due to the diversity of non-financial assets. In addition, the lack of standards and methodologies for auditing non-financial assets complicates the audit process and may affect its objectivity.

Analysing the situation in Ukraine from 2018 to 2023, the importance of internal and external audits in the public administration sector is evident. Despite the continuous development of audit methods, techniques and procedures, these practices are taking on new forms and manifesting themselves in various ways. Ukraine, along with other countries, is committed to continuous improvement of its system of auditing non-financial assets in public institutions, especially in connection with changes in legislation, requirements of international standards and internal needs to improve management systems. At the initial stages of the development of the audit of non-financial assets in Ukraine, there was a need to introduce effective control and audit systems to ensure financial, operational and strategic compliance of management decisions. A strategy to modernise the accounting and financial reporting system in the public administration sector is important to ensure timely and accurate information on budget execution. Compared to the United States and the United Kingdom, the development of audit of non-financial assets in Ukraine appears to be less developed, as these countries have more advanced audit systems and practices. However, there have been some improvements in recent years in Ukraine, which indicate a trend towards an increased level of development of the audit of non-financial assets.

The study also examined the extension of the "3E" concept to the "9E", which indicates an enrichment of the assessment of organisational performance and effectiveness. Additional components are defined as environment, equity and ethics, which consider social and environmental responsibility, adherence to ethical management principles, and also consider the effectiveness of communication, audit expertise and e-auditing. The study also examines in detail the key areas of implementation of the non-financial assets audit strategy in public institutions, namely systematic recognition and classification of assets, monitoring of their use, reporting and risk management, improvement of the internal audit system, integration of innovations and stakeholder engagement. This reflects the need for a comprehensive approach to assess the management of these assets and improve their efficiency. Further research should address the impact of specific technological solutions on the effectiveness of e-audit in the non-financial sector, in particular, the impact on the accuracy of risk and financial irregularities detection. It is also necessary to study the impact of e-audits on the long-term sustainability and development of enterprises.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Accounting and auditing. (n.d.). Retrieved from https://doingbusinessinhungary.com/accounting-and-auditing.
[2] Accounting research guide. (2023). Retrieved from https://guides.ll.georgetown.edu/accounting/auditing-standards.
[3] Alhababsah, S. (2019). Ownership structure and audit quality: An empirical analysis considering ownership types in Jordan. *Journal of International Accounting, Auditing and Taxation*, 35, 71-84. doi: 10.1016/j.intaccaudtax.2019.05.006.
[4] Begma, V.M., Lutsik, J.O., Skurinevska, L.V., Tkach, I.M., Trehubenko, S.S., & Ulianov, K.Y. (2019). Events identification and risks evaluation in the process of planning of risk-oriented internal audit. *Revista Espacios*, 40(38), article number 15.
[5] Budget Code of Ukraine. (2010, July). Retrieved from https://zakon.rada.gov.ua/laws/show/2456-17#Text.
[6] Burton, J.C., & Fairfield, P. (2020). Auditing evolution in a changing environment. In *The evolution of audit thought and practice* (pp. 294-315). London: Routledge.
[7] CAG's auditing standards. (2017). Retrieved from https://cag.gov.in/en/page-cag-s-auditing-standards-2017.
[8] Christ, M.H., Eulerich, M., Krane, R., & Wood, D.A. (2021). New frontiers for internal audit research. *Accounting Perspectives*, 20(4), 449-475. doi: 10.1111/1911-3838.12272.
[9] De Widt, D., Llewelyn, I., & Thorogood, T. (2022). Stakeholder attitudes towards audit credibility in English local government: A post-audit commission analysis. *Financial Accountability & Management*, 38(1), 29-55. doi: 10.1111/faam.12267.
[10] Downey, D.H., & Bedard, J.C. (2019). Coordination and communication challenges in global group audits. *Auditing: A Journal of Practice & Theory*, 38(1), 123-147. doi: 10.2308/ajpt-52016.
[11] Farkas, M., Hirsch, R., & Kokina, J. (2019). Internal auditor communications: An experimental investigation of managerial perceptions. *Managerial Auditing Journal*, 34(4), 462-485. doi: 10.1108/MAJ-06-2018-1910.
[12] Financial Reporting Council auditing standards. (2024). Retrieved from https://www.frc.org.uk/library/standards-codes-policy/audit-assurance-and-ethics/auditing-standards/.
[13] Fülöp, M.T., Breaz, T.O., Raita, G., & Bugnariu, A.D. (2020). More confidence of the financial and non-financial information with the assurance of sustainability reporting. *Annales Universitatis Apulensis Series Oeconomica*, 22(2), 26-39. doi: 10.29302/oeconomica.2020.22.2.3.
[14] Gao, P., & Zhang, G. (2019). Auditing standards, professional judgment, and audit quality. *The Accounting Review*, 94(6), 201-225. doi: 10.2308/accr-52389.
[15] García-Sánchez, I.-M., Raimo, N., Amor-Esteban, V., & Vitolla, F. (2023). Board committees and non-financial information assurance services. *Journal of Management and Governance*, 27(1), 1-42. doi: 10.1007/s10997-021-09613-6.
[16] Griffith, E.E. (2020). Auditors, specialists, and professional jurisdiction in audits of fair values. *Contemporary Accounting Research*, 37(1), 245-276. doi: 10.1111/1911-3846.12506.
[17] Grishchuk, S. (2019). Features and problems of selective method of audit organization. *Modern Economics*, 14, 77-80. doi: 10.31521/modecon.V14(2019)-12.
[18] Grossi, G., Kallio, K.-M., Sargiacomo, M., & Skoog, M. (2020). Accounting, performance management systems and accountability changes in knowledge-intensive public organizations: A literature review and research agenda. *Accounting, Auditing & Accountability Journal*, 33(1), 256-280. doi: 10.1108/AAAJ-02-2019-3869.
[19] Guidara, A., Ammari, A.E., & Khlif, H. (2022). Strength of auditing and reporting standards, ethical behavior of firms and sustainability: A cross-country investigation. *EuroMed Journal of Business*, 17(1), 105-116. doi: 10.1108/EMJB-10-2020-0107.
[20] Hasan, A.R. (2021). Artificial intelligence (AI) in accounting & auditing: A literature review. *Open Journal of Business and Management*, 10(1), 440-465. doi: 10.4236/ojbm.2022.101026.
[21] Hashem, F., & Alqatamin, R. (2021). Role of artificial intelligence in enhancing efficiency of accounting information system and non-financial performance of the manufacturing companies. *International Business Research*, 14(12), 65-75. doi: 10.5539/ibr.v14n12p65.
[22] Hecimovic, A., & Martinov-Bennie, N. (2023). Audit report construction: Public sector organisation perspectives within a non-financial information context. *Journal of Public Budgeting, Accounting & Financial Management*, 35(2), 172-191. doi: 10.1108/JPBAFM-09-2021-0135.
[23] International Federation of Accountants. Brazil. (n.d.). Retrieved from https://www.ifac.org/about-ifac/membership/profile/brazil.
[24] Johnsen, Å., Reichborn-Kjennerud, K., Carrington, T., Jeppesen, K.K., Taro, K., & Vakkuri, J. (2019). Supreme audit institutions in a high-impact context: A comparative analysis of performance audit in four Nordic countries. *Financial Accountability & Management*, 35(2), 158-181. doi: 10.1111/faam.12188.
[25] Khudhair, D.Z., Al-Zubaidi, F.K.A., & Raji, A.A. (2019). The effect of board characteristics and audit committee characteristics on audit quality. *Management Science Letters*, 9, 271-282. doi: 10.5267/j.msl.2018.11.012.
[26] Kontogeorga, G., & Papapanagiotou, A. (2023). Auditing ethics and corruption: Old challenges and new trends for supreme audit institutions in turbulent times. *Journal of Public Budgeting, Accounting & Financial Management*, 35(4), 474-492. doi: 10.1108/JPBAFM-08-2021-0131.
[27] Lamboglia, R., Lavorato, D., Scornavacca, E., & Za, S. (2021). Exploring the relationship between audit and technology. A bibliometric analysis. *Meditari Accountancy Research*, 29(5), 1233-1260. doi: 10.1108/MEDAR-03-2020-0836.
[28] Milojević, M., Urbański, M., Terzić, I., & Prasolov, V. (2020). Impact of non-financial factors on the effectiveness of audits in energy companies. *Energies*, 13(23), article number 6212. doi: 10.3390/en13236212.

[29] Ministry of Finance of Ukraine statistical collection. (n.d.). Retrieved from https://mof.gov.ua/uk/statistichnij-zbirnik.
[30] Musayeva, N., Atakishiyeva, N., Mammadova, M., & Mammadova, U. (2022). Innovations in the Azerbaijan auditing activity. *Review of Economics and Finance*, 20, 1286-1294. doi: 10.55365/1923.x2022.20.141.
[31] Nikonchuk, A. (2023). Legal genesis of virtual asset circulation in Ukraine and worldwide: Risks and concerns. *Law Journal of the National Academy of Internal Affairs*, 13(3), 26-36. doi: 10.56215/naia-chasopis/3.2023.26.
[32] Oneshko, S., Viter, S., & Viremeichyk, A. (2021). Audit development strategy in the conditions of digital economy. *Investments: Practice and Experience*, 15, 64-69. doi: 10.32702/2306-6814.2021.15.64.
[33] Performance auditing. (2013). Retrieved from https://assets.kpmg.com/content/dam/kpmg/pdf/2016/05/Performance-Auditing.pdf.
[34] Performance of the State Audit Service and its interregional territorial bodies. (2023). Retrieved from https://dasu.gov.ua/ua/plugins/userPages/3517.
[35] Radchenko, O., Tkach, L., & Dendebera, O. (2023). Financing innovations in the agricultural industry as a component of the digital development of Ukraine's economy. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 10(4), 54-65. doi: 10.52566/msu-econ4.2023.54.
[36] Report on the use of budget funds by the State Audit Service of Ukraine. (2023). Retrieved from https://dasu.gov.ua/ua/plugins/userPages/866.
[37] Resolution of the Cabinet of Ministers of Ukraine No. 1805-p "On the Approval of the Strategy for Reforming the State Finance Management System for 2022-2025 and the Action Plan for its Implementation". (2021, December). Retrieved from https://zakon.rada.gov.ua/laws/show/1805-2021-%D1%80#Text.
[38] Shevchenko, S. (2023). State regulation of the process of initiating innovative projects under conditions of limited funding. *Democratic Governance*, 2(32), 79-90. doi: 10.23939/dg2023.02.079.
[39] Sliusar, S., & Burdonos, L. (2022). Accounting, analysis and control in the conditions of applying information technologies. *University Economic Bulletin*, 52, 53-60. doi: 10.31470/2306-546X-2022-52-53-60.
[40] Sudirman, S., Sasmita, H., Djabir, D.M., Krisnanto, B., & Muchsidin, F.F. (2021). Effectiveness of internal audit in supporting internal control and prevention of fraud. *Bongaya Journal of Research in Accounting*, 4(1), 8-15. doi: 10.37888/bjra.v4i1.271.
[41] Sun, T. (2019). Applying deep learning to audit procedures: An illustrative framework. *Accounting Horizons*, 33(3), 89-109. doi: 10.2308/acch-52455.
[42] Tenyukh, Z., Pelekh, U., & Khocha, N. (2022). Application of digital technologies in accounting and auditing at enterprises of Ukraine. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 9(4), 46-55. doi: 10.52566/msu-econ.9(4).2022.46-55.
[43] Tiron-Tudor, A., & Deliu, D. (2022). Reflections on the human-algorithm complex duality perspectives in the auditing process. *Qualitative Research in Accounting & Management*, 19(3), 255-285. doi: 10.1108/QRAM-04-2021-0059.
[44] Tsiatkovska, O. (2021). Accounting for non-financial assets in the management of public sector entities. *Economy and Society*, 32. doi: 10.32782/2524-0072/2021-32-101.

Світлана Левицька
Доктор економічних наук, професор
Національний університет водного господарства та природокористування
33028, вул. Соборна, 11, м. Рівне, Україна
https://orcid.org/0000-0002-4739-0486

Наталія Остап'юк
Доктор економічних наук, професор
Сопотська академія прикладних наук
81-855, вул. Рземєслніца, 5, м. Сопот, Польща
https://orcid.org/0000-0003-2347-3815

Олена Цятковська
Кандидат економічних наук, доцент
Київський національний економічний університет імені Вадима Гетьмана
03057, просп. Берестейський, 54/1, м. Київ, Україна
https://orcid.org/0000-0001-8825-9778

Марина Реслер
Доктор економічних наук, професор
Мукачівський державний університет
89600, вул. Ужгородська, 26, м. Мукачево, Україна
https://orcid.org/0000-0002-3787-9472

Олена Михальська
Кандидат економічних наук, доцент
Київський національний університет імені Тараса Шевченка
01033, вул. Володимирська, 60, м. Київ, Україна
https://orcid.org/0000-0003-1921-6293

Стратегія розвитку аудиту нефінансових активів державних установ

Анотація. Метою дослідження було виявлення оптимальних стратегій і методів покращення аудиторської діяльності у сфері управління нефінансовими активами державних установ. У процесі дослідження використано матеріали, які включають аудиторські звіти, фінансові звіти державних установ, правову базу аудиторської діяльності та інформацію про стратегії управління активами. Результати дослідження показали, що ефективний та об'єктивний контроль над активами дозволяє забезпечити дотримання фінансової дисципліни, оптимізувати витрати та дотримуватися вимог законодавства. У статті розглянуто традиційний, ризик-орієнтований та інтегрований підходи до аудиту активів, а також важливість інтегрованого підходу до аудиту, який враховує не лише фінансові показники, а й нефінансові аспекти, що впливають на результативність установи. Розглянуто реальну ситуацію в Україні, а також проведено порівняння з іншими країнами, а саме США, Великобританією, Індією, Бразилією та Угорщиною. Зазначено, що розвиток аудиту нефінансових активів державних установ є складним та динамічним процесом, що відбувається на тлі постійних змін у законодавстві та вимогах міжнародних стандартів. Крім того, в статті висвітлено виклики та проблеми, з якими стикаються аудитори, що аудитують нефінансові активи урядових установ. Запропоновано розширення концепції ефективності в аудиті з «3E's» на «9E's», що дозволяє глибше оцінювати результативність роботи з врахуванням різноманітних факторів. На основі проведеного дослідження сформульовано ключові напрями стратегії аудиту нефінансових активів державних установ, що включають вдосконалення системи аудиту, виявлення та управління ризиками та впровадження сучасних технологій. Ці результати є цінними для аудиторів, фінансових менеджерів, державних службовців та експертів з управління ресурсами, оскільки вони надають практичні рекомендації для покращення аудиторської діяльності та ефективного використання нефінансових активів

Ключові слова: бюджетні програми; прозорість; концепція ефективності; напрямки реалізації; нефінансові активи

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2
2024

UDC 004.8:004.738.5
DOI: 10.57111/econ/2.2024.69

Nataliia Shveda*
PhD in Economics, Associate Professor
Ternopil Ivan Puluj National Technical University
46001, 56 Ruska Str., Ternopil, Ukraine
https://orcid.org/0000-0002-0278-3243

Oksana Garmatiuk
PhD in Economics, Associate Professor
Ternopil Ivan Puluj National Technical University
46001, 56 Ruska Str., Ternopil, Ukraine
https://orcid.org/0000-0001-9792-600X

Tetiana Kuzhda
PhD in Economics, Associate Professor
Ternopil Ivan Puluj National Technical University
46001, 56 Ruska Str., Ternopil, Ukraine
https://orcid.org/0000-0002-5962-0795

Halyna Mashliy
PhD in Economics, Associate Professor
Ternopil Ivan Puluj National Technical University
46001, 56 Ruska Str., Ternopil, Ukraine
https://orcid.org/0000-0002-5989-5270

Nataliia Yuryk
PhD in Economics, Associate Professor
Ternopil Ivan Puluj National Technical University
46001, 56 Ruska Str., Ternopil, Ukraine
https://orcid.org/0000-0002-1672-3049

Digital transformation as an imperative for innovative development of business processes under martial law (Ukrainian experience)

Abstract. Digital transformation in business is becoming a key factor that determines the competitive advantage and viability of modern enterprises in the economic environment. The relevance of the study is of particular importance in light of the importance of ensuring the continuity of business processes in an unstable environment. The purpose of the study was to establish the theoretical, conceptual, and practical foundations of Ukraine's digital transformation example under martial law and to develop recommendations for improving the development of digital transformation processes.

Article's History: Received: 19.12.2023; Revised: 26.03.2024; Accepted: 27.06.2024

Suggested Citation:
Shveda, N., Garmatiuk, O., Kuzhda, T., Mashliy, H., & Yuryk, N. (2024). Digital transformation as an imperative for innovative development of business processes under martial law (Ukrainian experience). *Economics of Development,* 23(2), 69-79. doi: 110.57111/econ/2.2024.69.

*Corresponding author

The study employed a mixed-methods approach. The economic and statistical analysis, utilising techniques like data processing and comparative analysis, revealed Ukraine's inconsistent performance in global digital competitiveness rankings, with areas for improvement identified in future readiness and technological integration. Qualitative methods such as analysis, synthesis, comparison, systematisation, grouping, induction, deduction, and generalisation facilitated a comprehensive understanding of the advantages, disadvantages, and challenges associated with digital transformation in Ukraine, including cybersecurity vulnerabilities and the digital divide. Specifically, the systematisation method allowed careful consideration of the main disadvantages and advantages of digital transformation. The grouping method enabled compiling international rankings based on different criteria over time to identify trends impacting competitiveness. It has been determined that resolving cybersecurity flaws needs to be a primary concern, particularly given the increased threats brought on by the ongoing armed war. Legislative changes, in particular, are thought to be crucial in fostering an atmosphere that is supportive of digital business transformation. It is stressed that knowledge transfer, access to cutting-edge technologies, and best practices in digital transformation can be facilitated via strategic relationships with global organisations, technology businesses, and academic institutions. The study provides practical recommendations for improving digital transformation and identifies the challenges that need to be addressed for the successful implementation of further digitalization strategies in Ukraine

Keywords: innovation; digitalization; e-commerce; business models; cybersecurity

INTRODUCTION

The modern world is experiencing the intensification of information technology (IT), where digital transformation plays an important role in the development of business and society as a whole. This transformation is defined as a comprehensive process of introducing digital technologies and digital thinking into various areas of business. The specificity of this process is that digital technologies are not limited to the implementation of information systems or automation of certain processes, but involve profound changes in the strategy, organisation, and culture of the enterprise.

Many authors and scholars have studied the theoretical and practical aspects of digital transformation. S. Bashlai & I. Yaremko (2023) focused on the peculiarities of digitalization in the context of European integration, pointing out the importance of the country's participation in the Digital Europe programme. Their conclusions on building a reliable data infrastructure for measuring the digital economy show strategic opportunities for Ukraine in the long term. A. Samoilenko (2023) analysed the directions of digital economy development in Ukraine. The author described the main digital trends and the role of regulations in modernising and building digital infrastructure, as well as in strengthening cyber defence and developing new digital technologies. The study also highlights the opportunities for digital transformation for Ukrainian business entities through participation in the European Union's Digital Europe programme until 2027 to improve the country's competitiveness. The author emphasises the importance of Ukraine's integration into the European Community's information space, in particular, the importance of digital transformation of financial transactions, e-government, and the personalisation of needs and production through IT.

G. Zhekalo (2019) examined the peculiarities of the digital economy development in Ukraine and identified its indicators using an assessment tool used to measure the development of the digital economy and society in the European Union. The author analysed such indicators as the quality and accessibility of the Internet, the level of digital skills and human capital, the use of information and communication technologies (ICT) by citizens and businesses, and the level of accessibility of digital public services. The study also identified the main problems and obstacles that hinder the development of the digital economy in Ukraine. It is noted that the development of the digital economy can act as an important mechanism for the transition from old to new governance systems, increasing competitiveness and stimulating economic growth in the country. T. Shtal & K. Pliekhanov (2023) analysed Ukraine's digital competitiveness, considering the digital competitiveness index, considering Ukraine's place in this ranking, and assessing the value of its components. The study also covered various indices, such as the Digital Economy and Society Index, the Ease of Doing Digital Business Index, and the ICT Development Index. It is noted that some of these indices do not assess the level of development in Ukraine according to the relevant indicators.

A. Cherep & O. Cherep (2022) considered the digital transformation of society as a prerequisite for its innovative development. In their work, the authors argued that by 2025, digital transformation will become necessary for all spheres of life in most countries in the world. They identified that this transformation is associated with the development of an innovative information society and is based on the use of innovative IT, which leads to qualitative changes in social relations and improves the quality of services and labour productivity. The authors also defined the goals and strategic directions of digital transformation and summarised the advantages and disadvantages of the digital economy in Ukraine. O. Shevchenko & A. Strelets (2022) pointed out that digitalization opens up new opportunities and helps to optimise and improve business processes, which is especially relevant for Ukrainian businesses during martial law.

Given the large number of existing studies covering various aspects of digital transformation, the question of its impact on the innovative development of business processes under martial law in Ukraine remained open. The full-scale invasion of Russia and the blackouts highlighted the importance of business adaptation to emergencies and change. Digital transformation could play a key role in ensuring the resilience of business process infrastructure and the ability to continue effective operations even under martial law. Therefore, studying the impact of digital transformation on business processes under martial law could help

develop strategies and solutions that would assist businesses and the government in adapting to new realities and ensuring the resilience of the economy in the face of uncertainty. The purpose of the study was to identify and analyse the theoretical and practical aspects of the digital transformation of business structures in Ukraine under martial law, as well as to develop recommendations for improving the development of digitalization transformation processes.

MATERIALS AND METHODS

The study of the digitalization of economic processes in Ukraine utilised a variety of methods, covering a wide range of areas. The use of the economic and statistical method in this study allowed for a comparative analysis of the level of Ukraine's digital economy with the best digital economies in the world. This method was based on the processing of a large amount of statistical and empirical data, which made it possible to assess the level of digitalization in Ukraine and include this data in the ranking of the best digital economies. The assessment was based on three key comprehensive criteria: the level of knowledge, the technological environment, and openness to the future (IMD world digital..., 2021; Global innovation index..., 2022; Nominal GDP..., 2022; IMD world digital..., 2022; IMD world digital..., 2023). This analysis showed how countries used digital technologies to develop their economies and societies. The economic and statistical methods of analysis contributed to a deeper understanding of not only the level of digital transformation in Ukraine but also its reflection in the international context.

In the study of the digitalization of economic processes, the use of charts and graphs helped visualise complex phenomena, processes, and patterns. Diagrams facilitated the identification of relationships between economic factors and the impact of digital innovations on the country's economic development. The article presented data on the share of digitalized enterprises in the world gross domestic product (GDP), the ranking of countries in global digital competitiveness, and the dynamics of digital transformation in Ukraine. This assessment was based on key indicators such as knowledge, the technological environment, and openness to the future.

The methods of analysis, synthesis, and comparison allowed for a detailed study of the phenomenon under investigation by analysing its main elements, considering the synergistic effect between digital technologies and economic processes, and comparing the achievements and challenges of digitalization in Ukraine with other countries. The systematisation method enabled a careful consideration and organization of the main disadvantages and advantages of digital transformation for the country. Furthermore, the application of this method facilitated the structuring and summarising of the results, providing a comprehensive understanding of the primary challenges and opportunities in the digital sphere for the country. The grouping method allowed for the collection of international rankings based on different criteria over a specific period. The application of this method to compile international rankings by different criteria enabled the identification of the dynamics of changes in these criteria over a certain time, which was crucial for understanding trends and their impact on the country's digital competitiveness.

The methods of induction and deduction were used to critically analyse the information obtained, which enabled the identification of the main threats and trends in the further development of digitalization in Ukraine. The method of generalisation allowed for the drawing of objective conclusions, the identification of key trends, and the emphasis on the need for a comprehensive approach to digital transformation for the country, providing a basis for further strategies and development.

RESULTS

Digital transformation is the process of transforming and modernising the organisational, economic, and technological aspects of an organisation or society through the use of digital technologies. It involved the introduction of digital tools, processes, and approaches to improve efficiency, innovation, competitiveness, and the ability to adapt to a changing environment (Bashlai & Yaremko, 2023). Digital transformation included the transformation of existing analogue (sometimes electronic) products, processes, and business models of organizations. This process was based on the effective use of digital technologies and aimed to increase the productivity of innovative products and services (Feliciano-Cestero *et al*., 2023).

The digital economy is a model of an economic system where digital data, such as binary information and network transactions, are the main resources and tools of production. Such data was used to improve the productivity and efficiency of processes, as well as to increase the value of the goods and services created (Laudon & Traver, 2023). Table 1 shows the advantages and disadvantages of digital transformation for the country.

Table 1. Advantages and disadvantages of digital transformation for the country's business and economy

Aspect	Advantages	Disadvantages
Competitiveness	The implementation of modern digital technologies ensures speed, quality, and innovation in business activities.	Increase in cyber-attacks and data security breaches due to increased digital processes and data sharing.
Productivity	Optimises production processes and resource management, leading to increased labour productivity and efficient resource use.	Requires significant investment in infrastructure, staff training, and equipment upgrades.
Access to services	Facilitates online access to education, healthcare, financial services, and more.	Automation and robotization may lead to job losses in some sectors, necessitating workforce reskilling.
Cost efficiency	Lowers production and management costs through process automation and optimisation.	Not all population groups have equal access to digital technologies, contributing to increased societal inequality.

Table 1. Continued

Aspect	Advantages	Disadvantages
Innovation	Stimulates the development of new technologies, products, and services, fostering innovation and new economic sectors.	Raises concerns about privacy protection and ethical use of personal data with increased collection and processing of data.
Adaptability	Enables quick adaptation to environmental changes and new challenges.	Dependence on digital technologies increases societal vulnerability to failures or disruptions in technology.
Infrastructure development	Attracts investments and opens new economic development opportunities.	Shifts in culture and social interactions due to digital transformation provoke societal resistance.
Environmental impact	Promotes efficient resource use and minimises harmful emissions, improving environmental conditions.	Dependence on technology providers creates risks for national security.
Job creation	Increases demand for skills in digital literacy and tech proficiency, providing opportunities for training and career advancement.	In certain industries, automation and robotization may result in job losses, requiring the workers to undergo extensive retraining and reskilling.

Source: made by the authors based on S. Nadkarni & R. Prügl (2021), I. Revak & R. Gren (2022)

The digital transformation of Ukraine's business and economy represents a shift towards an economic model centred on digital data and network transactions as primary resources and production tools. This transition aimed to enhance productivity, streamline processes, and elevate the value of goods and services. As Ukraine embraced digitalization, it anticipated improvements in efficiency, innovation, and overall quality of life for its citizens. Nevertheless, challenges such as cybersecurity vulnerabilities, initial implementation costs, and potential job displacements require careful consideration. Additionally, addressing disparities in access to digital technologies and safeguarding data privacy emerged as critical concerns in this evolving landscape. By recognising and preventing such challenges, the country could achieve more balanced and sustainable development through digital transformation (Yuan *et al.*, 2023).

The accelerated development and implementation of digital tools in business processes and everyday life became important factors in the competitiveness of countries and various business structures (Ultan, 2023). The forecast suggested that over the next decade, more than 70% of global value added would be based on digital products, which in 2023 had already reached USD 53.3 trillion, almost four times higher than in 2018 (Fig. 1).

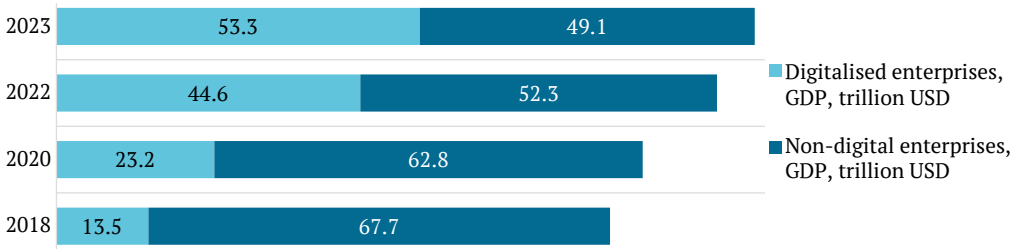

Figure 1. Digitized enterprises in world GDP, trillion dollars

Source: made by the authors based on Nominal GDP driven by digitally transformed and other enterprises worldwide from 2018 to 2023 (2022)

This trend defined a new reality in the world economy and the role of digital technologies in the global business environment. Figure 2 presents the ranking of the best digital economies in 2019-2023. The presented comparative data on the level of digitization of the economy and society in different countries was interesting because of the World Digital Competitiveness Rating. This ranking assessed countries on their ability to adopt and effectively use digital technologies to change regulation, business models, and society in general. The assessment was based on three key comprehensive criteria: knowledge, technological environment, and openness to the future.

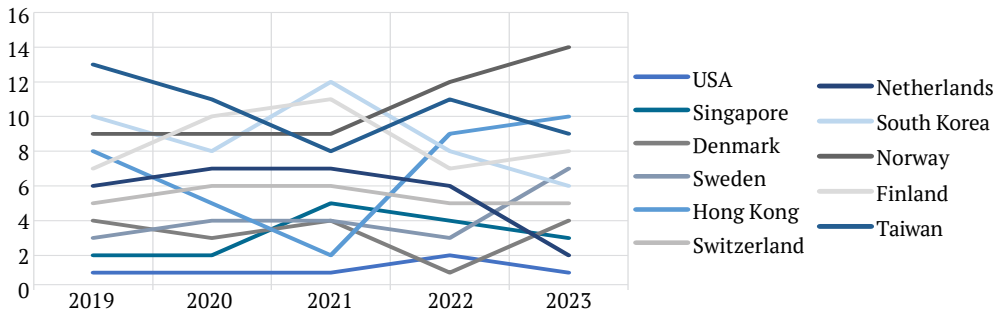

Figure 2. Top 10 countries in the IMD world digital competitiveness rating

Source: made by the authors based on IMD world digital competitiveness ranking (2021; 2022; 2023)

Figure 3 illustrates the dynamics of the share of the digital economy in Ukraine's GDP from 2021 to 2030, showcasing both historical data and future forecasts. The data indicates a steady increase in the contribution of the digital economy to GDP, reflecting Ukraine's ongoing digital transformation and economic modernization efforts. According to Figure 3, by 2030, the digital economy is projected to account for 65% of Ukraine's GDP, highlighting its critical role in the nation's economic growth and development. Figure 4 shows the dynamics of the level of digital transformation in Ukraine over the period 2017-2021.

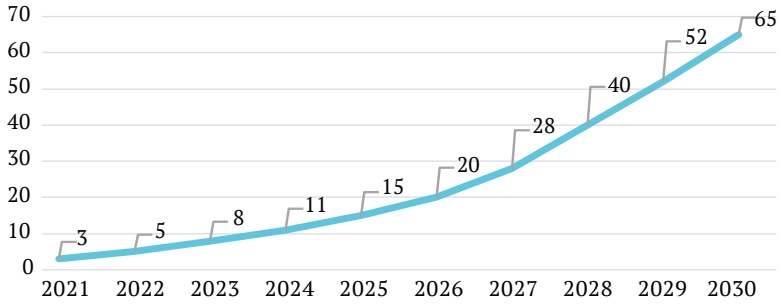

Figure 3. Dynamics of the share of digital economy in the Ukraine's GDP with a forecast until 2030, %
Source: made by the authors based on Ukraine 2030E – a country with a developed digital economy (2019)

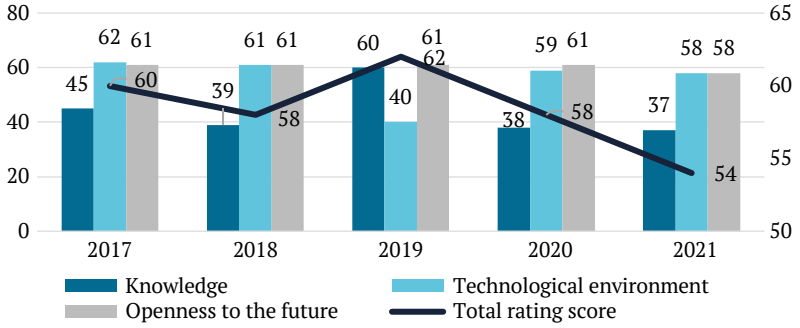

Figure 4. Dynamics of the level of digital transformation in Ukraine, assessed on the basis of a set of key indicators
Source: made by the authors based on the IMD world digital competitiveness ranking (2022)

Thus, Ukraine's position is characterised by instability and a lack of positive dynamics. Figure 5 shows that the most problematic indicators for Ukraine are related to the criterion of openness to the future, especially in the area of IT integration, where Ukraine ranks 58th overall (according to the results of 2021). The best result can be seen in knowledge, which improved from 45th in 2017 to 37th in 2021, indicating some progress and efforts to develop education and research in Ukraine. The improvement in this index also reflects the growing level of digital literacy and the improvement of educational programmes in the country. The overall score dropped significantly in 2020 and continued its negative trend in 2021. Unfortunately, there is no data on Ukraine's participation in 2022 and 2023 in this ranking. The digital economy is proving to be a key factor of resilience and a reliable source of tax revenues, as it is less dependent on physical assets, which is especially important in a crisis (Zhang *et al.*, 2023). An example is the Ukrainian IT industry, which became one of the most stable sectors of the economy after the start of military aggression and showed an increase in exports in 2022, confirming the importance of digital sectors for economic resilience (Report on the activities…, 2023).

The development of the ICT sector largely depends on the demand of society for products and services in this area. The ICT sector has seen significant growth, with the number of companies and enterprises providing digital services contributing 7.35 billion USD or 4.5% of the GDP to Ukraine's economy in 2022 (Stender *et al.*, 2024). The rate of digital innovation is growing every year, with the number of end-users increasing, and the number of mobile users, active Internet users, and users of social networks also seeing significant growth. The digital economy has the potential to provide stability and growth in necessary financial revenues, especially for post-war reconstruction. Key factors contributing to the development of the digital economy include a well-developed field of ICT, strong educational institutions, and competitive innovations. The digital transformation of the Ukrainian economy has become an important condition for improving management decisions in the context of the full-scale invasion of Ukraine by the Russian Federation. The implementation of digital initiatives has been crucial to supporting the inclusive and sustainable growth of the digital economy. Key events that influenced the implementation of systemic measures include the following.

Ukraine has joined the National Pavilion Account pilot innovation project, which is one of the e-commerce accelerator initiatives under the EU4Digital initiative. The project is aimed at harmonising e-commerce in key areas with the European Union, implementing solutions for the development of cross-border e-commerce, increasing the competitiveness of enterprises, creating new jobs, and improving the quality of life of citizens. A memorandum

was signed between the Ministry of Digital Transformation and the European trade association DIGITALEUROPE aimed at attracting investments from the European Union to build digital infrastructure in Ukraine and develop Ukrainian small and medium-sized businesses, in particular, in the field of artificial intelligence. A decree has been issued approving the list of indicators of the Digital Economy and Society Index (DESI) in Ukraine, as well as the procedure for collecting and exchanging information on these indicators in accordance with the EU methodology. Ukraine's inclusion in the DESI will help to realise the state's potential in the field of digital competitiveness and facilitate Ukraine's integration into the European Union's Digital Single Market.

In 2023, Recorded Future, a private intelligence analytics company, invested in Ukraine by expanding access to its Intelligence Cloud software platform, which provides intelligence to government agencies and businesses to protect critical infrastructure through tools such as Recorded Future Network Intelligence, phishing data, and malware information. Ukraine has taken a significant step towards accelerating its digital transformation with the adoption of Resolution of the Cabinet of the Ministers of Ukraine No. 1340 "On Approval of the Plan for the Allocation and Use of Radio Frequency Spectrum in Ukraine" (2023). This resolution establishes a framework for implementing cutting-edge technologies like 5G across the country, paving the way for businesses and the economy to leverage the benefits of advanced wireless connectivity. By ensuring efficient management of the radio frequency spectrum, the resolution addresses the challenges posed by the digital era, enabling businesses to harness the power of emerging technologies. This measure is crucial for bridging the digital divide between urban and rural areas, allowing companies in remote regions to access high-speed internet and digital services on par with their counterparts in cities. Thus, new tools for the digital transformation of the economy have the potential to help overcome the vulnerabilities caused by the war and improve the ability of businesses to adapt to the risks of military conflicts and actively participate in the country's recovery process.

The expansion of new digital transformation tools indicates the possibility of ensuring economic sustainability in a very difficult period for the country and attracting additional financial resources for technological progress in the recovery process (Mossberger *et al.*, 2022; Zhang *et al.*, 2023). Creating and supporting innovative enterprises based on advanced digital solutions and technologies has significant potential to provide Ukraine with a competitive advantage on the global stage. This will also help the country recover from the war and support its development once the conflict is over.

Ukraine's digital transformation under martial law faces a number of serious challenges that affect various aspects of the economy. Martial law conditions, especially when a country is in a state of conflict, can increase the threat of cyberattacks and cyberespionage (Kryvovyazyuk & Kryvoviaziuk, 2023). One of the most vulnerable areas is critical infrastructure, which includes energy facilities, transport systems, the banking industry, and other sectors that ensure the normal functioning of the country. Attacks on such facilities can have serious consequences for the lives of citizens and the stability of the country. For example, on December 12, 2023, the world's largest hacker attack on the telecommunications infrastructure (Kyivstar) in Ukraine was carried out, resulting in the loss of communication for 24 million subscribers. The disruption affected the entire infrastructure that used Kyivstar services, causing serious infrastructure problems across the country. It is worth noting that this attack took place in the context of the Russian invasion of Ukraine. Microsoft, Cisco, Ericsson, and other companies were involved in the response to the attack. Therefore, it is extremely important to ensure a high level of cybersecurity for these facilities and systems. Cybersecurity measures include the development and implementation of modern systems for protecting, monitoring, and responding to cyber threats. It is also important to raise awareness among the public and cybersecurity professionals to avoid social engineering and other types of attacks (Cheberyako & Herus, 2023; Yehorycheva *et al.*, 2023).

Scholars see the importance of digitalization for the economy and businesses in the context of the modern world. The main common points that can be distinguished from this are the following. Theoretical and legislative framework – Ukraine has the necessary basis for the development of digitalization, both in terms of theoretical research and legislation. However, for the successful development of digitalization, it is important to combine theoretical research with the needs and capabilities of stakeholders such as business, government, and society (Endres *et al.*, 2022; Skare *et al.*, 2023). For the successful development of digitalization, Ukraine really lacks only a theoretical framework and relevant legislation. This is only the first step in the transition to a digital economy. The integration of digital strategies should be tailored to the specific requirements of industries and markets, providing a favourable climate for innovation and the development of the digital technology ecosystem. Only such a comprehensive approach will allow for truly maximising the potential of digitalization to improve the country's competitiveness.

Innovative nature: digitalization is innovative and important for business organisations, especially in the context of fierce competition and rapid technological development. It affects various aspects of business operations, including customer experience, partnerships, data management, innovation, resource management, and more (Bagheri *et al.*, 2019; Hokkanen *et al.*, 2021; Feliciano-Cestero *et al.*, 2023). Digitalization has indeed become a major catalyst for business organisations in the modern world. This process affects all aspects of their operations: from optimising customer experience to better managing resources and driving innovation. Thus, it is not just a tool for improving efficiency, but also a means of achieving strategic goals and developing an enterprise as an adaptive and open system. It is the key to successfully adapting to changes in modern fast-paced business environment and securing a competitive advantage.

Digitalization strategy: to ensure the competitiveness of enterprises, it is important to develop and implement a digitalization strategy that covers various aspects of business, such as customer service, partnerships, and collaborations with other stakeholders, data development and analysis, innovation, human resource management strategy, and corporate culture (Ultan, 2023; Yuan *et al.*, 2023).

Such a strategy should include not only technical aspects but also focus on cooperation with customers, partners, and other stakeholders, as well as data analysis and utilisation for driving innovation. Leveraging digital channels to enhance communication, co-create solutions, and deliver personalised experiences will be crucial for aligning digital initiatives with market needs and fostering ecosystem-wide synergies.

Consistency of implementation: it is important to follow a consistent and cyclical approach to the implementation of the digitalization strategy to minimise mistakes and effectively implement digital technologies in the business. Work on digitalization should be a constant iterative process (Bagheri *et al.*, 2019; Yuan *et al.*, 2023). It is worth believing that this is the right approach. Continuous improvement and iteration in digitalization work allows a company to adapt more quickly to changes in technology, market conditions, and customer requirements.

With restrictions on external contacts and customs, it is difficult to supply components, technologies, and services used in digital processes, which slows down the development of digital companies and limits their ability to innovate. In addition, martial law leads to a decrease in demand for digital products and services in domestic markets. Under such conditions, consumers and companies become more conservative and refrain from investing in digital technologies, which leads to a decrease in the revenues of companies operating in this sector. To foster the digital economy, several critical measures are essential across IT, education, science, and innovation. These include establishing a robust legal framework to regulate alternative funding sources and streamline investment procedures, thereby encouraging private sector investment in IT and innovation. Reforming higher education by granting universities more autonomy and updating curricula to meet labour market demands will significantly enhance the training of IT professionals. Initiatives to enhance digital literacy among the population through subsidised training programmes aim to bridge the digital divide, especially among non-internet users. Local authorities are urged to implement digitalization projects that improve community-level infrastructure, expand broadband access, and promote electronic services for residents, thereby advancing local digital development. Moreover, aligning Ukrainian intellectual property laws with EU standards will protect rights to inventions, copyrights, and intellectual property, thereby stimulating innovation and technological progress.

The digital transformation of Ukraine's economy has gained significant momentum, with the digital sector contributing substantially to the country's GDP and demonstrating resilience amidst the challenges posed by the ongoing military conflict. However, Ukraine's performance in global digital competitiveness rankings has been inconsistent, highlighting areas requiring improvement, such as future readiness and technological integration. Addressing cybersecurity vulnerabilities, bridging the digital divide, and fostering an enabling environment for innovation through legislative reforms and strategic partnerships are crucial for accelerating the country's digital transformation journey. Ultimately, a comprehensive approach that aligns digital strategies with industry-specific requirements and fosters collaboration among stakeholders will be instrumental in maximising the potential of digitalization to enhance Ukraine's competitiveness.

DISCUSSION

Digital transformation affects various aspects of business, including internal processes, interactions with customers, suppliers, and partners, and the development of new products and services. However, it is important to keep in mind that digital transformation can be particularly challenging in the context of martial law. Martial law and instability pose serious challenges for Ukrainian businesses. But modern businesses are trying to adapt to the new conditions and find new opportunities in the digital space. Thus, the challenges of martial law are becoming catalysts for faster and more radical digital transformation in Ukraine (Buka *et al.*, 2022). This context gives the topic even more practical and academic significance, as it highlights the need to understand the relationship between digital innovation and the challenging economic and political environment. Under the influence of these challenges, the business environment and the government have begun to see digital transformation as a strategic imperative for the innovative development of Ukrainian business, which will not only allow it to survive in an unstable environment, but also to develop and create new innovative processes and products (Pyrih, 2023).

D. Kotelevets (2022) analyses the readiness of the Ukrainian economy for digital transformation. The author points out that Ukraine is currently not a world leader in terms of the pace of digitalization of the economy and does not use its full potential in this area. The article analyses basic indicators, including the number and structure of enterprises with Internet access, the availability of websites and chat services for communication with customers, and the sending of invoices in electronic or paper form. The author also points out the importance of digital transformation for the competitiveness of enterprises in the current competitive market environment and in the context of a pandemic and military operations. The article emphasises the importance of further research into the trends in the use of modern IT and their role in the development of the digital economy in Ukraine. The authors agree that digital transformation is crucial for Ukraine's economic competitiveness and resilience, but they differ in their emphasis on specific challenges and solutions. The authors highlight the need for a multifaceted approach, including the development of a legal basis for digital transformations, the creation of opportunities for innovation and entrepreneurship, and the integration of advanced technologies such as artificial intelligence and blockchain.

A study of the digital economy by A.A. Oloyede *et al.* (2023) covers the concept of the digital economy, the measurement of its impact, and the involvement of regulators in this process. It describes the challenges and seeks to harmonise definitions and indicators used in different countries. Instead, this study focuses on specific aspects of the digital transformation of business structures in Ukraine during martial law. It focuses on the essence of digital transformation in Ukraine, conducting a comparative analysis with the best digital economies in the world, assessing the level of digitalization, and identifying

initiatives and challenges that arise in the context of this transformation. The authors agree with the researchers' opinion that accurately defining and measuring the impact of the digital economy remains a complex endeavour, particularly in developing countries. Both studies acknowledge the challenges in harmonising definitions and metrics used across different countries due to the scarcity of appropriate datasets and variations in country-specific approaches.

The work of A. Fernández-Portillo *et al*. (2020) aims to analyse the impact of ICT on the economic growth of the European Union. The authors used the least squares method and the Digital Economy and Society Index databases for their analysis. The results of the study showed that progress in the introduction and use of ICTs has a positive impact on the economic growth of countries that are part of the developed European economies. The authors' conclusions about the driving force of ICTs in the economic growth of developed European economies reflect the essential aspects of this issue. It is worth agreeing with their conclusion that ICTs have an impact on economic development. Effective public policy should focus on the development of physical infrastructure and the efficient use of ICTs (Shpykuliak *et al*., 2024). Compared to this study, which aimed to analyse the digital transformation of Ukraine's business structures under martial law, the work of the researchers is more general in its focus.

The study by P. Leão *et al*. (2023) examined the institutional problems that hinder companies' innovation activity, including the lack of clear rules, skilled labour, access to data and financial resources, which turned out to be the main factors hindering digitalization. The study also found that companies are able to identify opportunities and implement digital strategies that support the digitalization process, even despite the challenges. The authors correctly noted the positive impact of digitalization on business in all its aspects, including facilitating decision-making processes, increasing communication with customers and stakeholders, and improving products and services. It is particularly important to note that, in the context of small and medium enterprises, digitalization fosters innovation and facilitates opportunities for international expansion. In terms of challenges identified in emerging markets, low levels of regulation and insufficient data skills and resources are mentioned as impediments to rapid digitalization (Makedon *et al*., 2022). However, it is important to note that companies are actively learning how to innovate and create their strategies using data to overcome these challenges. Compared to this study, which analyses the digital transformation of business structures under martial law, the study by the researchers focuses more on institutional constraints to innovation and digital transformation, while this study contains specific tasks aimed at assessing the level of digitalization in Ukraine and identifying existing problems and possible solutions in the context of war.

The study by Đ. Mitrović (2020) describes the use of data conversion analysis methods and the Malmquist Productivity Index to assess the effectiveness of digital economy development in the European Union. It is worth agreeing with the author's conclusions regarding the applied methodology, as it is an important tool for understanding the effectiveness of national strategies for the development of the digital economy in the European Union. This methodology makes it possible to identify both the strengths and weaknesses of such strategies, which allows policymakers to focus on specific aspects to improve and optimise digital development. Compared to the present study, which examines in detail the aspects of digital transformation of business structures under martial law in Ukraine, the study by the researcher analyses the level of development of the digital economy in various European countries and focuses on the digital divide between the European Union and the Western Balkans. Both studies cover aspects of digital development but have a different geographical and thematic focus in their analyses.

The constraints faced by emerging economies can be an obstacle to the progress of the Ukrainian economy. Such economic processes, albeit indirectly, have the potential to increase employment and attract foreign capital in the form of wages to the country. Thus, digitalization is an important tool for increasing the competitiveness of Ukrainian enterprises and the economy, which requires further study and implementation of digital technologies in various aspects of business and society.

CONCLUSIONS

The digital transformation of Ukraine's business and economy is a critical endeavour that holds immense potential for enhancing competitiveness, productivity, and resilience in an increasingly digitalized global landscape. While the country has made strides in this direction, as evidenced by the growing contribution of the digital sector to GDP, persistent challenges underscore the need for a comprehensive and strategic approach. Addressing cybersecurity vulnerabilities must be a top priority, particularly in the face of heightened risks posed by the ongoing military conflict. Robust measures to protect critical infrastructure, such as energy facilities, transport systems, and the banking industry, from cyber threats are imperative. Developing and implementing modern systems for cybersecurity monitoring, protection, and incident response is crucial for safeguarding the digital ecosystem.

Furthermore, ensuring consistent access to digital technologies and services across all segments of society is essential to prevent the exacerbation of existing inequalities. Initiatives aimed at bridging the digital divide, such as subsidised training programmes and the expansion of broadband infrastructure in underserved areas, can foster inclusivity and maximise the benefits of digitalization. Legislative reforms play a pivotal role in creating an enabling environment for the digital transformation of businesses. Establishing a robust legal framework to regulate alternative funding sources, streamline investment procedures, and align intellectual property laws with EU standards can stimulate private sector investment, foster innovation, and protect intellectual property rights.

Strategic partnerships with international organizations, technology companies, and academic institutions can facilitate knowledge transfer, access to cutting-edge technologies, and best practices in digital transformation. Collaborative efforts can drive innovation, co-create solutions tailored to market needs, and accelerate the adoption of emerging technologies, such as 5G and artificial intelligence. As Ukraine navigates the complexities of digital transformation, prospects for further research include

exploring effective models for public-private partnerships, assessing the impact on traditional industries and employment patterns, and evaluating the role of digital technologies in post-conflict reconstruction and economic recovery efforts.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Bagheri, M., Mitchelmore, S., Bamiatzi, V., & Nikolopoulos, K. (2019). Internationalization orientation in SMEs: The mediating role of technological innovation. *Journal of International Management*, 25(1), 121-139. doi: 10.1016/j.intman.2018.08.002.

[2] Bashlai, S., & Yaremko, I. (2023). Digitalization of Ukraine's economy in the conditions of European integration processes. *Economy and Society*, 48. doi: 10.32782/2524-0072/2023-48-48.

[3] Buka, S., Tkachuk, V., Kondratiuk, V., Tonkha, O., & Slobodyanyuk, N. (2022). Prospects for agribusiness in Ukraine over the next 5 years. *International Journal of Environmental Studies*, 80(2), 291-298. doi: 10.1080/00207233.2022.2157630.

[4] Cheberyako, O., & Herus, D. (2023). Budgetary security of Ukraine in the context of a large-scale war. *University Economic Bulletin*, 18(4), 50-59. doi: 10.69587/ueb/4.2023.50.

[5] Cherep, A., & Cherep, O. (2022). Digital transformation of society as a necessary condition for its innovative development. In *Proceedings of the V all-Ukrainian scientific and practical conference on intellectual property economics "Digital transformation and digital economy under martial law: Intellectual property aspects"* (pp. 229-234). Kyiv: Scientific and Research Institute of Intellectual Property of the National Academy of Pedagogical Sciences of Ukraine.

[6] Endres, H., Huesig, S., & Pesch, R. (2022). Digital innovation management for entrepreneurial ecosystems: Services and functionalities as drivers of innovation management software adoption. *Review of Managerial Science*, 16, 135-156. doi: 10.1007/s11846-021-00441-4.

[7] Feliciano-Cestero, M.M., Ameen, N., Kotabe, M., Paul, J., & Signoret, M. (2023). Is digital transformation threatened? A systematic literature review of the factors influencing firms' digital transformation and internationalization. *Journal of Business Research*, 157, article number 113546. doi: 10.1016/j.jbusres.2022.113546.

[8] Fernández-Portillo, A., Almodóvar-González, M., & Hernández-Mogollón, R. (2020). Impact of ICT development on economic growth. A study of OECD European Union countries. *Technology in Society*, 63, article number 101420. doi: 10.1016/j.techsoc.2020.101420.

[9] Global innovation index. Ukraine. (2022). Retrieved from https://www.wipo.int/edocs/pubdocs/en/wipo_pub_2000_2022/ua.pdf.

[10] Hokkanen, H., Walker, C., & Donnelly, A. (2021). Business model opportunities in brick and mortar retailing through digitalization. *Journal of Business Models*, 8(3), 33-61. doi: 10.5278/jbm.v8i3.5803.

[11] IMD world digital competitiveness ranking 2019 and 2020. (2021). Retrieved from https://imd.cld.bz/IMD-World-Digital-Competitiveness-Ranking-2020/24/#zoom=z.

[12] IMD world digital competitiveness ranking 2021. (2022). Retrieved from https://imd.cld.bz/Digital-Ranking-Report-2021.

[13] IMD world digital competitiveness ranking 2022. (2023). Retrieved from https://www.imd.org/wp-content/uploads/2023/03/digital-ranking-2022.pdf.

[14] Kotelevets, D. (2022). Development trends of the digital economy in Ukraine. *Problems of Modern Transformations. Series: Economics and Management*, 5. doi: 10.54929/2786-5738-2022-5-03-01.

[15] Kryvovyazyuk, I., & Kryvoviaziuk, B. (2023). Monitoring business structures activity to predict their development under condition of martial law. *Economic Forum*, 1(2), 91-97. doi: 10.36910/6775-2308-8559-2023-2-13.

[16] Laudon, K.C., & Traver, C.G. (2023). *E-commerce 2023: Business, technology, society*. London: Pearson.

[17] Leão, P., Guinlle, G., Rocha, T.N., Azevedo-Rezende, L., & Fleury, M.T.L. (2023). The digitalization phenomenon and digital strategies in emerging countries: A semi-systematic review. *Revista de Administração Mackenzie*, 24(3), article number eRAMR230059. doi: 10.1590/1678-6971/eramr230059.en.

[18] Makedon, V., Krasnikova, N., Krupskyi, O.P., & Stasiuk, Y. (2022). Arrangement of digital leadership strategy by corporate structures: A review. *Economic Studies*, 31(8), 19-40.

[19] Mitrović, Đ. (2020). Measuring the efficiency of digital convergence. *Economics Letters*, 188, article number 108982. doi: 10.1016/j.econlet.2020.108982.

[20] Mossberger, K., LaCombe, S., & Tolbert, C.J. (2022). A new measure of digital economic activity and its impact on local opportunity. *Telecommunications Policy*, 46(1), article number 102231. doi: 10.1016/j.telpol.2021.102231.

[21] Nadkarni, S., & Prügl, R. (2021). Digital transformation: A review, synthesis and opportunities for future research. *Management Review Quarterly*, 71, 233-341. doi: 10.1007/s11301-020-00185-7.

[22] Nominal GDP driven by digitally transformed and other enterprises worldwide from 2018 to 2023. (2022). Retrieved from https://www.statista.com/statistics/1134766/nominal-gdp-driven-by-digitally-transformed-enterprises/.

[23] Oloyede, A.A., Faruk, N., Noma, N., Tebepah, E., & Nwaulune, A.K. (2023). Measuring the impact of the digital economy in developing countries: A systematic review and meta- analysis. *Heliyon*, 9(7), article number e17654. doi: 10.1016/j.heliyon.2023.e17654.

[24] Pyrih, S. (2023). Digital transformation of business in the context of Ukraine digital competitiveness. *Economic Forum*, 1(3), 134-140. doi: 10.36910/6775-2308-8559-2023-3-17.

[25] Report on the activities of the National Commission for the State Regulation of Electronic Communications, Radio Frequency Spectrum and Postal Services for 2022. (2023). Retrieved from https://nkrzi.gov.ua/images/upload/142/10509/Dodatok_do_rishennia_NKEK_29.03.2023__125.pdf.
[26] Resolution of the Cabinet of the Ministers of Ukraine No. 1340 "On Approval of the Plan for the Allocation and Use of Radio Frequency Spectrum in Ukraine". (2023, December). Retrieved from https://zakon.rada.gov.ua/laws/show/1340-2023-%D0%BF#Text.
[27] Revak, I., & Gren, R. (2022). Digital transformation: Background, trends, risks, and threats. *Social and Legal Studios*, 5(2), 61-67. doi: 10.32518/2617-4162-2022-5-2-61-67.
[28] Samoilenko, A. (2023). Digitalization opportunities of national economy of Ukraine. *Galician Economic Journal*, 81(2), 171-177. doi: 10.33108/galicianvisnyk_tntu2023.02.171.
[29] Shevchenko, O., & Strelets, A. (2022). Digitalization of business processes during the war. In *III international scientific and practical conference "Business, innovation, management: Problems and prospects"* (pp. 246-247). Kyiv: Igor Sikorsky Kyiv Polytechnic Institute.
[30] Shpykuliak, O., Malik, M., Kravchenko, S., & Zaburanna, L. (2024). Organisational and economic support for the development of business enterprises in agriculture under martial law. *Ekonomika APK*, 31(2), 60-70. doi: 10.32317/2221-1055.202402060.
[31] Shtal, T., & Pliekhanov, K. (2023). Ukraine's position in international rankings assessing the level of digital development of countries. *Digital Economy and Economic Security*, 8(8), 22-28. doi: 10.32782/dees.8-5.
[32] Skare, M., de las Mercedes de Obesso, M., & Ribeiro-Navarrete, S. (2023). Digital transformation and European small and medium enterprises (SMEs): A comparative study using digital economy and society index data. *International Journal of Information Management*, 68, article number 102594. doi: 10.1016/j.ijinfomgt.2022.102594.
[33] Stender, S., Bulkot, O., Iastremska, O., Saienko, V., & Pereguda, Y. (2024). Digital transformation of the national economy of Ukraine: Challenges and opportunities. *Financial and Credit Activity Problems of Theory and Practice*, 2(55), 333-345. doi: 10.55643/fcaptp.2.55.2024.4328.
[34] Ukraine 2030E – a country with a developed digital economy. (2019). Retrieved from https://hvylya.net/uk/special-projects/177938-ukraina-2030e-kraina-z-rozvinutoju-cifrovoju-ekonomikoju.
[35] Ultan, M.Ö. (2023). The digital transformation of the European Union surveillance technologies from panopticon to Eurosur. *Journal of Biga Economics and Administrative Sciences Faculty*, 4(2), 65-72.
[36] Yehorycheva, S., Hlushko, A., & Khudolii, Y. (2023). Issue of Ukrainian financial sector information security. *Development Management*, 22(4), 45-52. doi: 10.57111/devt/4.2023.45.
[37] Yuan, S., Zhou, R., Li, M., & Lv, C. (2023). Investigating the influence of digital technology application on employee compensation. *Technological Forecasting and Social Change*, 195, article number 122787. doi: 10.1016/j.techfore.2023.122787.
[38] Zhang, X., Xu, Y.Y., & Ma, L. (2023). Information technology investment and digital transformation: The roles of digital transformation strategy and top management. *Business Process Management Journal*, 29(2), 528-549. doi: 10.1108/BPMJ-06-2022-0254.
[39] Zhekalo, G. (2019). Digital economy of Ukraine: Problems and prospects of development. *Uzhhorod National University Herald*, 26(1), 56-60.

Наталя Шведа
Кандидат економічних наук, доцент
Тернопільський національний технічний університет імені Івана Пулюя
46001, вул. Руська, 56, м. Тернопіль, Україна
https://orcid.org/0000-0002-0278-3243
Оксана Гарматюк
Кандидат економічних наук, доцент
Тернопільський національний технічний університет імені Івана Пулюя
46001, вул. Руська, 56, м. Тернопіль, Україна
https://orcid.org/0000-0001-9792-600X
Тетяна Кужда
Кандидат економічних наук, доцент
Тернопільський національний технічний університет імені Івана Пулюя
46001, вул. Руська, 56, м. Тернопіль, Україна
https://orcid.org/0000-0002-5962-0795
Галина Машлій
Кандидат економічних наук, доцент
Тернопільський національний технічний університет імені Івана Пулюя
46001, вул. Руська, 56, м. Тернопіль, Україна
https://orcid.org/0000-0002-5989-5270
Наталія Юрик
Кандидат економічних наук, доцент
Тернопільський національний технічний університет імені Івана Пулюя
46001, вул. Руська, 56, м. Тернопіль, Україна
https://orcid.org/0000-0002-1672-3049

Цифрова трансформація як імператив інноваційного розвитку бізнес-процесів в умовах воєнного стану (досвід України)

Анотація. Цифрова трансформація в бізнесі стає ключовим фактором, що визначає конкурентні переваги та життєздатність сучасних підприємств в економічному середовищі. Актуальність дослідження набуває особливого значення з огляду на важливість забезпечення безперервності бізнес-процесів в умовах нестабільного зовнішнього середовища. Метою дослідження було встановлення теоретичних, концептуальних та практичних засад цифрової трансформації на прикладі України в умовах воєнного стану та розробка рекомендацій щодо вдосконалення розвитку процесів цифрової трансформації. У дослідженні використано змішаний підхід. Економіко-статистичний аналіз з використанням таких методів, як обробка даних та порівняльний аналіз, виявив непослідовність України у світових рейтингах цифрової конкурентоспроможності, а також визначив сфери для покращення у сфері майбутньої готовності та технологічної інтеграції. Якісні методи, такі як аналіз, синтез, порівняння, систематизація, групування, індукція, дедукція та узагальнення, сприяли всебічному розумінню переваг, недоліків та викликів, пов'язаних із цифровою трансформацією в Україні, зокрема вразливостей кібербезпеки та цифрового розриву. Зокрема, метод систематизації дозволив ретельно розглянути основні недоліки та переваги цифрової трансформації. Метод групування дозволив скласти міжнародні рейтинги за різними критеріями в динаміці з метою виявлення тенденцій, що впливають на конкурентоспроможність. Було визначено, що усунення недоліків у сфері кібербезпеки має бути першочерговим завданням, особливо з огляду на посилення загроз, спричинених тривалою війною. Законодавчі зміни, зокрема, вважаються вирішальними для створення атмосфери, сприятливої для цифрової трансформації бізнесу. Підкреслено, що передачу знань, доступ до передових технологій та найкращих практик цифрової трансформації можна полегшити за допомогою стратегічних відносин зі світовими організаціями, технологічним бізнесом та академічними установами. У дослідженні надано практичні рекомендації щодо вдосконалення цифрової трансформації та визначено виклики, які необхідно вирішити для успішної реалізації подальших стратегій цифровізації в Україні

Ключові слова: інновації; цифровізація; електронна комерція; бізнес-моделі; кібербезпека

ECONOMICS OF DEVELOPMENT
Journal homepage: https://ecdev.com.ua/
Vol. 23, No. 2 2024

UDC 330
DOI: 10.57111/econ/2.2024.80

Nataliia Gavkalova*
Doctor of Economics, Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0003-1208-9607

John Martin
PhD, Head of Research
Sustainable Earth Institute at the University of Plymouth
PL4 8AA, Drake Circus, Plymouth, United Kingdom
https://orcid.org/0000-0003-3363-8855

Hanna Shumska
PhD in Economics, Associate Professor
Simon Kuznets Kharkiv National University of Economics
61166, 9A Nauka Ave., Kharkiv, Ukraine
https://orcid.org/0000-0001-7967-9009

Kristina Babenko
Doctor of Economics, Professor
Zhytomyr Economic and Humanitarian Institute of the University "Ukraine"
10020, 18 Vilskyi Shliakh Str., Zhytomyr, Ukraine
https://orcid.org/0000-0001-7227-886X

Landscape and circular economy as a mechanism of sustainable development in globalisation and digitalisation of the world economy

Abstract. The concept of a circular economy is becoming a central component of local and regional economies. Therefore, the purpose of this research was to identify the impact of landscape development and the circular economy on achieving sustainable development goals in the context of globalisation and digitalisation of the world economic system. The following methods were used: system-analytical – to evaluate the details of the structure and functioning of mechanisms of state regulation in the formation and development of the circular economy; categorical and analytical – to demonstrate the theoretical foundations of the formation of a purposeful state policy in the field of development. Digital distribution has great potential for implementing the principles of sustainable development and changing consumer behaviour and outlook in the context of globalisation and digitalisation of the world economic system. It has been studied that the depletion of natural resources creates problems for the future development of industry, providing the world's population with material goods and quality of life. As a result of the irrational use of nature, the increase in material intensity, and inefficient resource provision, there is a deterioration of the ecological state, the depletion of natural resources, a decrease in the efficiency of enterprises, and a deterioration in the quality of products. Based on the analysis, it is concluded that the idea of sustainable development has emerged as the primary paradigm for social development in the future and that one of the mechanisms achieving these goals is the development of the circular

Article's History: Received: 01.03.2024; Revised: 22.05.2024; Accepted: 27.06.2024

Suggested Citation:
Gavkalova, N., Martin, J., Shumska, H., & Babenko, K. (2024). Landscape and circular economy as a mechanism of sustainable development in globalisation and digitalisation of the world economy. *Economics of Development,* 23(2), 80-90. doi: 10.57111/econ/2.2024.80.

*Corresponding author

economy because of its connections to processes like the globalisation and digitalisation of the world economy, the stimulation of innovative activity, and the advancement of digital distribution. It is concluded that this can be considered one of the mechanisms for achieving goals. The provisions, findings, and suggestions produced enhance the theory and practice of the development of the closed-loop economy, which is the practical importance of the acquired results

Keywords: resource cycle; local government; innovative activity; digital distribution; environmental condition; economic development

INTRODUCTION

It is almost impossible for the conventional economy to serve as a positive role model for how society will evolve in the future. Large-scale resource usage has had unanticipated and essentially irreversible effects on regional ecosystems as well as the biosphere overall. The notion of sustainable development is currently capturing the attention of the global community and is poised to transform society's development paradigm going forward. Nevertheless, there isn't much support globally for the systems that would put the ideals of sustainable development into practice. One of the best ways to put the concepts of sustainable development into practice is through the circular economy. The circular economy aims to recover and use resources in a reasonable manner, replacing the current economic structure (Goyal *et al.*, 2021). Furthermore, the circular economy is linked to the ideas of sustainable development and seeks to lessen the negative effects of human activity on the environment.

According to studies by A.J. Hoffman (2018) and M. Varfolomeev & O. Churikanova (2020), circular economy began to develop actively as a result of deep technological, economic, and social changes, including the following. Technological change: the widespread use of 4th Industrial Revolution technologies and the development of the global Internet have changed consumer attitudes towards product ownership, purchase, and use. Economic changes: the digitalisation of the economy, the virtualisation of transactions, and the widespread adoption of e-commerce, on the one hand, and the economic crisis and declining levels of employment and purchasing power, on the other, have changed attitudes towards how products are owned and how they are used. Social changes: consumption as the main meaning of human life and growing opportunities to satisfy needs with the lowest costs have led to a significant increase in communal consumption.

K. Pouikli (2020) considers the circular economy as an economic system of closed cycles, based on systemic thinking, using renewable energy sources with the least possible loss of the value of raw materials, components, and products. J. Korhonen *et al*. (2018) consider the key foundations of the circular economy, the definition of the principles of the circular economy, as well as the definition of the problems of the implementation of the circular economy in modern conditions, and B.C. Lin (2020) considers the circular economy in the context of sustainable development and draws attention primarily to active cooperation between producers and consumers. In their investigation and analysis of COVID-19's effects on the global ecosystem, T. Ibn-Mohammed *et al*. (2020) make the case that substantial structural changes in the economic model – but most importantly, in people's attitudes towards it – are necessary for the sustainable growth of the world economy. However, despite numerous publications in the fields of sustainable development and circular economy, the importance of digital distribution in the context of increasing sustainability remains unclear.

Among the global problems, one of the most important is the problem of optimising the interaction of humanity with the surrounding natural environment. In the conditions of the modern scientific and technological revolution, the general scale of the impact on the surrounding natural environment of industry, agriculture and transport – in other words, the entire set of forms of human life activity – is such that there are many adverse consequences of this activity, and above all, various forms of pollution and degradation of the natural environment become more and more obvious and wide, spreading far beyond the borders of those territories where such activity is concentrated. Therefore, it is quite natural that concern about the fate of the environment as the basis of sustainable development and the existence of all mankind is growing all over the world. Human development requires a transition to a "green" economy – a system of economic activity related to the production and consumption of goods and services that leads to an increase in human well-being without exposing future generations to significant environmental risks. As a result, the global growth of the circular economy is a pressing issue. In order to accomplish the aims of sustainable development in the context of globalisation and the digitisation of the economic system, this paper will examine the effects of landscape development and investigate the theoretical framework of the circular economy.

MATERIALS AND METHODS

In the context of globalisation and the digitisation of the global economy, to complete the research assignments pertaining to the notions of landscape development and the circular economy of sustainable development, attention is focused on general and specific methods of studying economic processes, development, phenomena, and facts, first of all, which are related to resource integration and digitisation. In the course of the study, general scientific and special research methods were used: analysis and synthesis to examine economic processes and phenomena; generalisation of theoretical and practical material; the main provisions of economic, statistical, and comparative analysis; forecasting of socio-economic processes; and graphical interpretation. To achieve the goal of the research, a logical-heuristic approach was used. This method made it possible to assess the level of digitalisation of the country's economy, understand its impact on economic growth, identify risks that affect the effectiveness of digital transformation, and justify how, as a trend of the development of a circular economy and society, digitalisation affects the

modern world. The hypothetical-deductive method was applied to find out the essence of the research object.

To generalise the definition of concepts, a number of theoretical and categorical provisions were analysed. Methods of analysis and synthesis – to summarise the scientific experience of strategic management in the conditions of the modern circular economy. Using the methods of grouping and systematisation, the approach to the interpretation of the concept of "closed-loop economy" is generalised, motives and goals are classified, types of strategies for the implementation and development of the closed-loop economy are developed, the main obstacles to the strategic management of enterprises operating in the conditions of the closed-loop economy are summarised, and an evaluation system is formed to determine the effectiveness of strategies for the implementation and development of the closed-loop economy. The graphic method is for clarity of presentation of the theoretical and methodological material of the work. A visual presentation of the impact of the circular economy on the achievement of sustainable development is offered. The process approach is the determination of the structure of a purposeful, comprehensive policy of the state. A systematic and comprehensive approach to the implementation of a closed economy can be implemented as a whole, but at the same time, the characteristics of a closed economy are the basis of each regional or city system. The informational and analytical basis of the work is the legislative and by-laws of the state, which regulate the issue of the competitiveness of the economy; the scientific achievements of researchers; the statistical data of state authorities; and the authors' research.

RESULTS AND DISCUSSION

In reaction to the depletion of natural resources, civilisation developed the idea of a circular economy. In a broader sense, the circular economy is a new paradigm for economic systems, with its key components being the judicious use of natural resources, their restoration, and the balancing of social and environmental relations. It is founded on the realisation that nature is cyclical and that humans must learn to live within the bounds of closed systems, as well as on a paradigm shift in human behaviour towards the environment. As a result, society is forced to make a choice about further development. Traditional industrial development has drained a large amount of minerals from the earth's interior, depleted the soil, and caused environmental pollution. The very prospects of the future existence of modern societies were under threat. According to projections of mineral reserves, modern industrial production may continue for several more decades (Table 1).

Table 1. World reserves of certain minerals

Resource type	The number of years for which the resource will last
Coal	270
Oil	53
Natural gas	60
Gold	19
Iron Ore	93
Aluminium	31
Zinc	18
Copper	21
Uranium ore	80
Indium	10
Tin	16
Lead	19
Silver	20

Source: compiled by the authors based on J. Vaupotič (2024)

These figures are subject to adjustment and are not final. However, the essence of the problem of resource depletion remains unchanged. It is easy to assume that the world to which the population is accustomed will be completely destroyed. In the coming decades, the global economic system will have to prepare for the absence of such natural resources as oil, natural gas, and silver, which are now necessary for the modern economy. Moreover, the demand for certain materials and resources is likely to increase rapidly. For example, global demand for lithium is growing rapidly against the background of information about the development of electric vehicles and electrical engineering. However, with the advent of new technologies, it can be expected that the demand for this mineral will decrease sharply while the demand for other minerals will increase (Sidhoum, 2018). The same is happening with oil, which was the world's main source of energy a few decades ago. With the advent of new technologies and the development of the gas industry, as well as the development of nuclear technologies and alternative energy sources, the share of oil in energy carriers is gradually decreasing.

For the modern economy, the landscape is the most integral and common resource and the most important in the life of the population of any country. According to the European Landscape Convention (ELC) of the Council of Europe, it is the landscape approach that should be prioritised when solving key environmental problems and preserving the historical, cultural, and natural heritage of Europe. The socio-economic sphere of the landscape is formed by a set of managed systems that are created for the rational use of natural and socio-economic resources with optimal provision for their needs. The control that a person exercises over the development of the sociosphere varies depending on the nature of the laws of social development (De Jesus & Mendonça, 2018). Man is able to regulate the functioning of socio-economic systems in such a way that the

material and energy components of the geosystem are maintained at a level that allows optimally meeting the needs of human society and contributing to the sustainable development of the circular economy. This means that when "exiting" the geosystem, part of the information, on the contrary, is sent in the form of "input", which ensures the regulation and stability of the system as a whole.

The problems of determining the supply of resources arise due to the difficulties of assessing geological deposits. For example, in the 1970s of the 20th century, the first alarming forecasts regarding the depletion of natural resources were made. Humanity was told the figures of 30-40 years to run out of oil, natural gas, etc. After more than half a century, the earth still contains natural gas and oil. This is a result of advances in deposit discovery and development techniques, as well as the application of new machinery and technology. As a result, estimating mineral reserves is a very difficult procedure with a lot of unknowns. However, this doesn't alter the fundamental nature of the problem – namely, the depletion of natural resources. There is only one solution to the global resource crisis: technological advancement, adherence to closed-loop system theory, and adoption of circular economy concepts.

In addition to the problem of mineral depletion, attention should also be paid to other problems arising from deforestation, air pollution, the marine environment, the loss of biodiversity, and the neglect of the rules of traditional agriculture and the development of natural ecosystems. Logical questions arise about possible ways to ensure that the future of modern society does not have such prospects. Prospects for a better future are presented in the concept of sustainable development (Velasco-Muñoz *et al.*, 2018).

A key principle of the concept of sustainable development is intergenerational equity, which means that current generations must take into account guarantees of the ability of future generations to meet their needs. In other words, the world should prioritise qualitative rather than quantitative indicators of development. The notion of sustainable development may be seen as a comprehensive paradigm of human growth for the future, as evidenced by its six key aspects: economic, social, political-legal, international, ecological, and informational. Changing perspectives on the pillars of society's existence, such as its interactions with the environment and other people, is the first step towards sustainable development. Sustainable development is a dynamic idea. Despite the criticism of certain provisions of the concept of sustainable development, society has not been offered a better one to date.

In the process of the evolution of socio-economic systems, their territorial specialisation occurs. Specific regions specialise in a specific monoculture. For the purpose of sustainable development in a particular region, the stability of the system can be maintained only through interaction with other regions of the country. As a result, a socio-economic geosystem of higher order emerges, which includes a number of factors (Zeweld *et al.*, 2017). The sustainable growth of the nation's regions and the nature of the terrain are impacted by the specialisation of socioeconomic systems. A global strategy is required to address the population's most urgent issues in the global community. It is sufficient to remember how the coronavirus pandemic affected the global economy's rate of growth and the conditions of each of its different businesses. Therefore, no country can stand aside from the problems of the development of the world economic system. However, the practical implementation of the principles of sustainable development has encountered problems that can be divided into different categories: political, economic, technical, legal, informative, etc.

The landscape sphere is a hierarchically ordered geosystem. It is a complexly organised open system, the main components of which are interconnected by direct and feedback links, are interchangeable, and partially interpenetrate each other. The impact on individual components causes a chain reaction in the system, which eventually transforms its other elements as well. The basis of the integrity of the landscape sphere is the exchange between the components of the system, where the continuous exchange is accompanied by a change in the structure of the landscape sphere. It should be noted that the rate of change is not the same in different components, which is a characteristic property of the landscape sphere as a self-regulating system.

Thus, four main approaches to defining the term are distinguished. Landscape as a territory. Such an interpretation is considered regional and is hardly used today, as it is limited in definition with an emphasis on territorial boundaries. Structure (pattern) is first and foremost understood as a combination of interacting spatial elements, their area, arrangement, orientation, neighbourhood, connectivity, or fragmentation (Geng *et al.*, 2019). Structure is interpreted as the result of radial and lateral processes, as an indicator (one) and a state (the other). This interpretation turns out to be particularly productive for areas heavily altered by anthropogenic activities, such as zonal landforms preserved in the form of several "islands".

It is no coincidence that, at the initial stage, it was the theory of island biogeography by A.P.M. Velenturf & P. Purnell (2021) that served as the basis for the development of this concept. Landscape as a territory under human influence. As the first international treaty dedicated to all aspects of the landscape, the Landscape Convention of the Council of Europe addresses key issues in the fields of human rights, democracy, and the rule of law for sustainable development. The Convention applies not only to significant landscapes, but also to unusual and degraded landscapes. By taking into consideration the cultural features of the landscape, the signing nations affirm their desire to achieve sustainable development based on a balanced interaction between social demands, economic activity, and the environment. The agreement covers the entire territory, including natural, rural, urban, and suburban areas (Manning *et al.*, 2018). The landscape is used to denote a general idea of the relationship between components. This group consists of the largest number of definitions, which means that it is based on the relationship and active role of land users in the landscape that they use and that they will co-ordinately transform. J. Haeggblom & I. Budde (2020) define in the landscape of the system triad an element, a connection with elements, a new quality arising as a result of a connection. In addition to the mentioned approaches, the landscape is considered from the position of levels that depend on certain characteristics (Fig. 1).

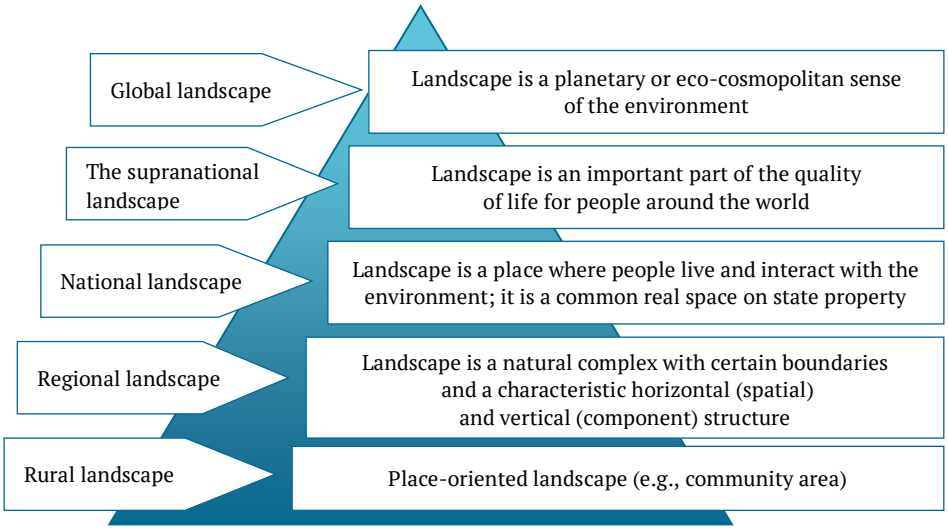

Figure 1. Landscape positions at different levels
Source: made by the authors based on K. Govindan & M. Hasanagic (2018), D. Reike *et al*. (2018), G. Sucozhañay *et al.* (2022)

In addition, one of the important features of the scale of the landscape is the role of the human population, in particular, as the main factor in disrupting ecological processes, which causes the heterogeneity of landscape components (Tura *et al*., 2019). On the one hand, spatial landscapes are distinguished by V. Gurochkina & M. Budzynska (2020). From the viewpoint of an outside observer, spatial landscapes are perceived as a component of a broader (national, for example) space; conversely, they are place-oriented landscapes (i.e., the territory of a local community). The 1990s of the 20th century can be considered the conditional beginning of the theoretical justification of the circular economy, which was determined by the need to reduce, first of all, the load on the environment and optimise the use of resource potential due to a significant increase in the world population from 3 billion people in the 1960s to 7.9 billion people in 2020, of which China and India account for the largest shares (Take action..., n.d.) In general, this approach became a continuation of the idea of ensuring the sustainable development of economies. At the same time, due to the intensification of research on the problems of ensuring sustainable development, confusion with the terminological apparatus has arisen in Ukrainian science, as the categories "circular" and "sustainable" development are often equated. Thus, S.I. Kodnaeva (2020) emphasises the complexity, ambiguity, and multifacetedness of the concept of "sustainable development". The new term "circular economy" adds to these difficulties. Hence, there are fundamental differences between sustainability and circularity that were systematised (Table 2).

Table 2. Fundamental differences between sustainability and circularity of the economy

Sign	Sustainability of the system	Circularity of the system
Definition	Such a state of the system will provide for the needs of the current generation without reducing future opportunities generation	Possibility of regeneration of the system resources by designing it as such in order to minimise consumption of resources, goods, and waste
Characteristics of processes	Responsible for society and the environment	Closed, based on circulation resources and goods
Basic processes	Any processes between stakeholders that meet the principles of sustainability	Design and production, innovation, and services
Relationships between subjects	Responsible for society, current and future generations	Based on various agreements and contracts
Scope	Biosphere	Technosphere, man-made design for maximum circulation of resources
The main initiators	All stakeholders	Public authorities, business structures

Source: made by the authors

Thus, the circular economy is not an economic component of sustainable development but rather a strategy for its implementation. The circular economy also helps to minimise the risks of system operation, especially those related to the volatility of resource prices and the limited availability of resources on the world market. There is a supranational level between national landscapes, which form an integrated economy and infrastructure and form a single perspective, and the global landscape, codified in Europe in the ELC. In the comments to the ELC it is stated that accordingly, the public is encouraged to actively participate in the management and planning of the landscape and to feel responsible for what happens to the landscape. ELC offers a multidimensional approach to landscape architecture and views local government as the primary level of landscape planning. The ELC defines landscape in

terms of social practice rather than aesthetics, taking into account various interests such as social needs, economic activity, and the environment. It is acknowledged that the landscape is of exceptional beauty in both urban and rural areas, in degraded areas, and of high quality (Tura *et al.*, 2019). The ELC aspires to include all landscapes, even those not of outstanding universal value in contrast to the UNESCO Convention on Historic Sites.

An area of land and water that was jointly created by humans and nature is known as a rural landscape. It is used to extract resources for agriculture, livestock and pastoralism, fishing and aquaculture, forestry, hunting, harvesting wildlife, and salt mining in order to produce food and other renewable natural resources. All rural places are also significant to people's culture, both in and out of towns. Thus, territorial borders are typically used to define landscapes. Politics, agriculture, tourism, ecology, technology, education, the military, and other factors are all framed by this demarcation of the landscape notion. The benefit of the landscape idea is that it makes it possible to comprehend the interactions between different natural and human variables in a constrained region in more detail.

Researchers summarise the main areas of activity that form the definition of "landscape": focus on land use (at first exclusively for non-urban areas, further included urban and urbanisation environments); direct aid to the protection of the ecological environment; understand the interaction of man and the environment, which leads to a change in the landscape; use interdisciplinary approaches from environmental and social sciences; and provide solutions to improve human and environmental well-being through design (Abbaszade, 2021). A model that can give impetus to the development of both the urban landscape and the global landscape is a circular economy model, which is based on the principles of resource efficiency, product life cycle control, the formation of an environmentally responsible environment, and the implementation of effective business models. Its solution is the development of a toolkit for strategic diagnostics of the innovative landscape of regions, characterised by the level of innovative development as a basic platform for the transition from a linear economy to a circular economy, taking into account the parameters of resource efficiency, environmentalisation, waste management, and secondary use of materials.

In 2001, UN Secretary General Kofi Annan delivered a report entitled "Changing consumption patterns" at the organisational session of the UN Commission on Sustainable Development in which it was proposed to develop effective measures to promote changes in consumption and production patterns in order to raise the standard of living of the population and simultaneously reduce the negative impact of resource consumption on the environment (Changing consumption patterns, n.d.). The 2012 World Summit on Sustainable Development launched the 10-year framework for sustainable consumption and production (10¥FP), a global commitment to accelerate the transition to sustainable consumption in both developed and developing countries (The 10 year framework…, 2014).

In 2015, the 10-year framework formed the basis of the 12th UN Sustainable Development Goal, which includes: effective use of natural resources; target indicator; sustainable models of consumption and production in the food industry; reduction of emissions of pollutants; reducing the level of environmental pollution due to waste processing; involvement of participants in the process of sustainable development, including the private sector; participation of the public sector in achieving the SCP through the effective practice of public procurement; dissemination of information among consumers and improvement of population literacy in the field of sustainable development and healthy lifestyle; financing and strengthening the potential of sustainable development; development of ecotourism; rationalisation of inefficient fossil fuel subsidies (Singh & Raghubanshi, 2019). The goal of the 12th Sustainable Development Goal of the United Nations is to replace the antiquated production and consumption paradigm with a more effective circular economy model, of which the sharing economy is one of the foundational elements. When building a model, the decisive influence of stakeholders should be determined. To consider their opinions, it is proposed to use a digital platform that allows you to collect and analyse big data. In this way, it is possible to ensure greater objectivity and relevance of the research conducted as well as the content of the developed recommendations.

Resource circulation is connected to the concept of product recycling. The core of the circular economy is the idea of "waste as food", which refers to using trash from one manufacturing process as a raw material in another, thereby lowering consumption by sharing or reusing items in addition to recycling. Creating a circular economy is one way to put the concepts of sustainable development into practice. This growth paradigm perfectly conforms to the fundamentals of sustainable development, as it is predicated on resource recovery and wise consumption. This growth plan is attractive because it can prolong the life of Earth's resources. Innovative efforts aimed at future scientific and technological advancements that will enable the creation of materials at the atomic level must go hand in hand with this process. Only then will future generations be able to meet their needs without depleting finite natural resources or harming the environment.

According to Yu. Neustroiev (2021), the following categories of business models align with the circular economy's tenets: circular value chains: they include substituting entirely renewable resources for scarce ones; restoration and processing: a paradigm whereby advances in technology offer a chance to both restore and process natural resources; maintenance of the product life cycle by rebuilding, repairing, or reselling – the concept is predicated on the shift from the selling of goods to the supply of services for their usage; shared consumption and use: a concept centred on granting access to resources or commodities with minimal utility; a product as a service is a business model where clients rent products or other assets and are paid according to how they use them. It should be noted that the sharing economy is not only closely related to the principles of the circular economy but is also one of its main links and ways to achieve sustainability. Therefore, the circular economy is understood as a system of production and consumption with the most efficient use of resources, zero waste generation, and minimisation of external negative impacts on the environment (Moraga *et al.*, 2019).

Another aspect of solving the problem of sustainable development through the circular economy is the

restoration of natural ecosystems and the creation of new natural and anthropogenic ecosystems (Govindan & Hasanagic, 2018; Velenturf & Purnell, 2021). The need to improve the state of the environment is due to the significant impact of modern man-made civilisation on the environment. It should be agreed that man has significantly changed part of the earth's surface. However, these landscapes can also exist and develop over a period of time. For example, agricultural land, provided it is used rationally, can feed the population for hundreds of years without losing soil fertility. The global economic system is becoming more digital and globalised, which is altering how international marketing is structured. Traditional items are being replaced by digital goods and services. Comparatively speaking, e-commerce is growing at a far faster rate than traditional commercial practices. There is a great deal of opportunity for digital distribution to use sustainable development concepts. Digital distribution causes shifts in consumer behaviour and attitudes in the context of globalisation and the digitisation of the global economic system, with the goals of optimising consumption and balancing societal and environmental links. Figure 2 displays the increasing rate of Internet penetration from 2013 to 2023.

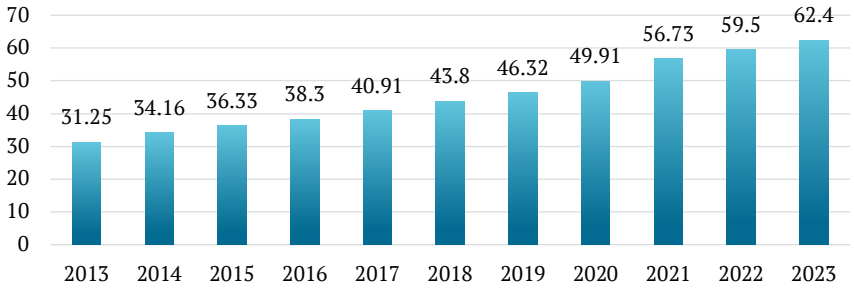

Figure 2. Internet penetration in the world, % of the world population
Source: made by the authors based on Individuals using the Internet (% of population) (2022), Internet penetration rate worldwide (2024)

Thus, it can be said that the synergistic effects of information flows have reached many different areas of society. The transformation of the concept of sustainable development has a significant impact on the transformation of international marketing and also contributes to the development of digital distribution in modern society (Brogi *et al.*, 2022). In turn, the globalisation of the world economy and digital distribution in the context of digitalisation have acquired significant digital content on the Internet. The increase in digital content serves to satisfy the population with intelligent products to achieve the goals of sustainable development. At the same time, a new vision is being formed, based primarily on the principles of rational product consumption as well as finding ways to optimise relations between society and the environment. The circular economy is one of the strategies for accomplishing the objectives of sustainable development. The sensible use of resources is the primary characteristic of this economic development model. The rise of digital distribution, which was based on processes like globalisation and the digitisation of the international economic system, partially provided the groundwork for it (Fig. 3).

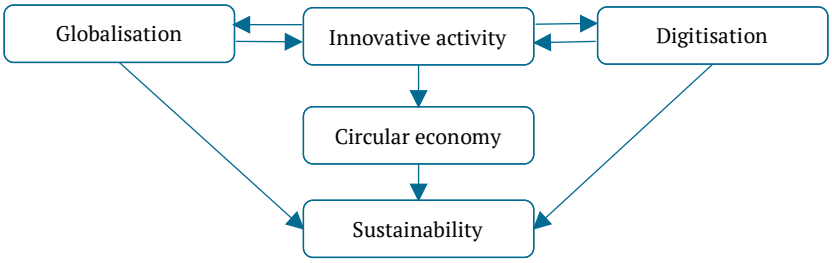

Figure 3. The impact of the circular economy on achieving sustainable development
Source: made by the authors

It is obvious that the development of the circular business model requires persistent support and stimulation from the state – a unified and systematic approach to reorientation to the principle of circulation in the context of ensuring sustainable development. This is evidenced by the main measures of the national regulatory policy of the largest countries in the world, aimed at stimulating the development of circular business models (Table 3).

Table 3. The main measures of the state regulatory policy to stimulate development circular economy

Business model	Characteristics of the event	Country
Circular suppliers	Preferential rates for loans	France
	Tax deductions	Netherlands

Table 3. Continued

Business model	Characteristics of the event	Country
Recovery and recycling of resources	Tax on waste collection and disposal	Great Britain, Germany
	Value-added tax (VAT) reduction for companies that use recycled raw materials	China
	Reduction of VAT on repair services of a certain group of goods (bicycles, clothes, etc.)	Sweden
Sharing platforms	Legal support for consumers of online services (Law on Electronic Commerce of the People's Republic of China)	China
	Development and dissemination of the map of circular initiatives (the list of enterprises participating in sharing is publicly available)	Norway
Extending the life cycle of the product	Direct financial support from grant funds	Scotland
Product as a service	Stimulation of giving consumers access to goods and services as users	Great Britain

Source: made by the authors

Thus, it can be concluded that one of the business models for ensuring the circular economy, which can be implemented with minimal costs, should be the model of "joint consumption" ("joint participation", "sharing model"). This format has already become widespread in developed countries, for example, in the form of garage sales. With the development of technology and the emergence of various online platforms, the costs of providers and users have decreased significantly, which has led to increased coverage and additional growth in demand. Such platforms are already present not only in the segment of consumer goods that can be purchased, but also in services (Airbnb, BlaBlaCar, NeighborGoods, Uber) (Chen *et al*., 2022; Shebanin *et al*., 2022). In general, the sharing business model can be used to share knowledge, skills, production capacities, etc.

The restoration of resources not only helps the circular economy fulfil its second purpose, but it also promotes the advancement of information technology and the rise of the knowledge economy. The significance of the circular economy's growth for the accomplishment of the sustainable development goals is determined by the interplay of these many contributing elements. Because of its connections to globalisation and digitisation of the global economy, innovation and the expansion of digital distribution, and the activation of inventive activities, the circular economy can help accomplish the sustainable development goals. Many contemporary perspectives on the idea of a circular economy have developed throughout the years. The circular economy was born at the junction of the two sciences of ecology and economics. The circular economy has gradually transcended its boundaries, and with the development of the sharing economy, it has acquired a social component.

After conducting an analysis of the circular economy research, one should pay attention to how scientists considered this problem, and reveal their own point of view regarding the circular economy of sustainable development. D. Reike *et al*. (2018) believe that the transition from the traditional linear model of the economy is taking place to a closed-loop economy as a means of ensuring product processing, secondary use, and recovery. In the process of research, the team of authors C.J.C. Jabbour *et al*. (2019) identified a number of stimulating components of the circular economy. The authors point out that in order to eliminate barriers, a group of actors can leverage new technology to influence changes in the legal, social, or economic spheres in a way that will help establish a circular economy. This will open up chances for cyclical processes. According to J. Haeggblom & I. Budde (2020), every incentive element has a distinct effect on lowering obstacles and establishing a circular economy. Thus, for instance, the quality, scalability, and financial feasibility of the primary circular economy tactics are determined by product design.

Considering the obstacles to the implementation of the closed-loop economy, the author team G. Sucozhañay *et al*. (2022) noted that the system of indicators for evaluating the closed-loop economy can be divided into the following groups: political and economic indicators; social development; concern for the environment and depletion of resources; regulatory requirements; self-fulfilment market; and competition. It should be agreed that all these indicators can be reflected in the so-called logical matrix (frame) of the results of the implementation of a closed economy. It clearly shows the contributions, measures, and results and how they correlate with the goals (summaries) of the program. N. Tura *et al*. (2019) identify organisational factors related to the implementation of a common circular economy and sustainability (which may also be related to other organisational factors such as hierarchies), opportunities for value creation, skills, and employee skills.

After studying the scientific sources, a number of technical barriers were identified that prevent the implementation of the closed-loop economy. In particular, if there are technical difficulties in working with materials in a closed-loop economy, there is a technological gap, which is a lack of technical skills. Many authors, including K. Govindan & M. Hasanagic (2018) and C. Vinante *et al*. (2021), recognise that technological development is an important factor determining periodicity. But it is worth agreeing with the authors N. Drebot & I. Semehen (2019) and J. Vaupotič (2024), who believe that technologies and knowledge will facilitate the transition to cyclicality and allow enterprises to use them effectively. For example, information sharing platforms and digitisation can help in efficient planning and management of the circular economy, as well as in material tracking and product identification. Different methodology, sets of indicators, formulas, units of measurement, and calculation goals are used in the scientific literature by K. Govindan & M. Hasanagic (2018) and M. Varfolomeev & O. Churikanova (2020). Some tools are intended to support the process of selecting

indicators, while others aid in monitoring the company's operations, and still others represent the process of developing new products while taking the concepts of the closed-loop economy into consideration. To support the process is the aim. Research such as those of S. Goyal *et al*. (2021) attest to the fact that every mean has a unique structure and approaches the closed-loop economy from various angles.

The concept asserts that the process of forming a closed economy as a major occurrence in economic activity combines ecological and economic efficiency. Businesses may view the circular economy as a chance to distinguish their brand and business strategy, which will enhance value generation and product development. The reputation and image of businesses are impacted by the closed-loop economy since it is linked to their ability to satisfy their social and environmental responsibilities. The government's influence is the primary requirement for the closed-loop economy model to operate well. Financial incentives and administrative and legal compulsion are the two key items that it has recognised, which are basically opposites and may be utilised in many other areas. The most successful approach was found to be the situational application of the second technique and the dominance of the first strategy in state policy.

CONCLUSIONS

Although the idea of sustainable development has emerged as the primary theory guiding the long-term growth of civilisations, there are still major obstacles to putting the concept's tenets into practice. One way to meet the goals of sustainable development in connection with the processes of digitisation and globalisation of the global economy, the start of creative activities, and the expansion of digital distribution is through the rise of the circular economy. The goal of the circular economy, which stands in contrast to the conventional economic structure, is to enhance and rationalise resource usage. In addition to conceptually integrating with the ideas of sustainable development, the circular economy aims to reduce the adverse effects of human activities on the environment.

The implementation of the circular economy model contributes to sustainable economic development. This model ensures the optimal use of resources, taking into account the needs of present and future generations, and is consistent with the UN definition of sustainable development. The pioneers in the development of the circular economy model are the Asian countries, especially China, and the European countries, where appropriate regulatory and legal frameworks have been created and national authorities are developing projects to stimulate the circular economy model together with companies. Thus, the circular economy is one of the fastest-growing contemporary inclusive economic models, based on the principles of social support, collective and responsible consumption and use of goods and services, and environmental care. These ideas make the circular economy inherently consistent with the idea of sustainable development. In summary, the world economy is becoming more digitalised and globalised, which means that sustainable development, economic efficiency, and environmental friendliness are all conditioned by the cyclical model.

The prospect of further research in this direction is the implementation of this stage of transformation in the digital economy. Having gone through all the stages of digital transformation, it is possible to systematically and harmoniously approach a successful organisation of transformation, which determines the key directions necessary for the implementation of digital processes in society. Further research will be aimed at studying one of the most pressing issues of circular economics: the formation and management of reverse flows, which are studied by reverse or reverse logistics, which can be understood as the processes of waste management of products at the end of their life cycle in order to reuse and reduce pressure on the environment, and save resources and energy.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Abbaszade, M. (2021). The main directions of regional economic development in the conditions of modern market economy. *Agroworld*, 5(6), 82-86. doi: 10.32702/2306-6792.2021.5-6.82.

[2] Brogi, M., Cappiello, A., Lagasio, V., & Santoboni, F. (2022). Determinants of insurance companies' environmental, social and governance awareness. *Corporate Social Responsibility and Environmental Management*, 29(5), 1109-1925. doi: 10.1002/csr.2274.

[3] Changing consumption patterns. (n.d.). Retrieved from https://sustainabledevelopment.un.org/content/dsd/agenda21/res_agenda21_04.shtml.

[4] Chen, S., Ding, X., Lou, P., & Song, H. (2022). New evidence of moral hazard: Environmental liability insurance and firms' environmental performance. *Journal of Risk and Insurance*, 89(3), 581-613. doi: 10.1111/jori.12380.

[5] De Jesus, A., & Mendonça, S. (2018). Lost in transition? Drivers and barriers in the eco-innovation road to the circular economy. *Ecological Economics*, 145, 75-89. doi: 10.1016/j.ecolecon.2017.08.001.

[6] Drebot, N., & Semehen, I. (2019). The reform of decentralization in Ukraine: The current state and development prospects. *Scientific Bulletin of UNFU*, 29(4), 24-27. doi: 10.15421/40290404.

[7] Geng, Y., Sarkis, J., & Bleischwitz, R. (2019). How to globalize the circular economy. *Nature*, 565, 153-155. doi: 10.1038/d41586-019-00017-z.

[8] Govindan, K., & Hasanagic, M. (2018). A systematic review on drivers, barriers, and practices towards circular economy: A supply chain perspective. *International Journal of Production Research*, 56(1-2), 278-311. doi: 10.1080/00207543.2017.1402141.

[9] Goyal, S., Chauhan, S., & Mishra, P. (2021). Circular economy research: A bibliometric analysis (2000-2019) and future research insights. *Journal of Cleaner Production*, 287, article number 125011. doi: 10.1016/j.jclepro.2020.125011.
[10] Gurochkina, V., & Budzynska, M. (2020). Circular economy: Ukrainian realities and opportunities for industrial enterprises. *Economic Herald. Series: Finance, Accounting, Taxation*, 5, 52-64.
[11] Haeggblom, J., & Budde, I. (2020). Circular design as a key driver for sustainability in fashion and textiles. In A. Matthes, K. Beyer, H. Cebulla, M.G. Arnold & A. Schumann (Eds.), *Sustainable textile and fashion value chains* (pp. 35-45). Cham: Springer. doi: 10.1007/978-3-030-22018-1_3.
[12] Hoffman, A.J. (2018). The next phase of business sustainability. *Stanford Social Innovation Review*, 16(2), 34-39. doi: 10.2139/ssrn.3191035.
[13] Ibn-Mohammed, T., Mustapha, K.B., Godsell, J., Adamu, Z., Babatunde, K.A., Akintade, D.D., Acquaye, A., Fujii, H., Ndiaye, M.M., Yamoah, F.A., & Koh, S.C.L. (2021). A critical analysis of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies. *Resources, Conservation and Recycling*, 164, article number 105169. doi: 10.1016/j.resconrec.2020.105169.
[14] Individuals using the Internet (% of population). (2022). Retrieved from https://data.worldbank.org/indicator/IT.NET.USER.ZS.
[15] Internet penetration rate worldwide. (2024). https://www.statista.com/statistics/269329/penetration-rate-of-the-internet-by-region/.
[16] Jabbour, C.J.C., de Sousa Jabbour, A.B.L., Sarkis, J., & Godinho Filho, M. (2019). Unlocking the circular economy through new business models based on large-scale data: An integrative framework and research agenda. *Technological Forecasting and Social Change*, 144, 546-552. doi: 10.1016/j.techfore.2017.09.010.
[17] Kodnaeva, S.I. (2020). Circular economy: Current approaches to content and measurement. *Economics: Abstract Journal*, 1, 51-58.
[18] Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: The concept and its limitations. *Ecological Economics*, 143, 37-46. doi: 10.1016/j.ecolecon.2017.06.041.
[19] Lin, B.C. (2020). Sustainable growth: A circular economy perspective. *Journal of Economic Issues*, 54(2), 465-471. doi: 10.1080/00213624.2020.1752542.
[20] Manning, P., van der Plas, F., Soliveres, S., Allan, E., Maestre, F.T., Mace, G., Whittingham, M.J., & Fischer, M. (2018). Redefining ecosystem multifunctionality. *Nature Ecology & Evolution*, 2, 427-436. doi: 10.1038/s41559-017-0461-7.
[21] Moraga, G., Huysveld, S., Mathieux, F., Blengini, G.A., Alaerts, L., Van Acker, K., de Meester, S., & Dewulf, J. (2019). Circular economy indicators: What do they measure? *Resources Conservation and Recycling*, 146, 452-461. doi: 10.1016/j.resconrec.2019.03.045.
[22] Neustroiev, Yu. (2021). Ensuring the economic security of the region. *Agroworld,* 12, 39-44. doi: 10.32702/2306-6792.2021.12.39.
[23] Pouikli, K. (2020). Concretising the role of extended producer responsibility in European Union waste law and policy through the lens of the circular economy. *ERA Forum*, 20, 491-508. doi: 10.1007/s12027-020-00596-9.
[24] Reike, D., Vermeulen, W.J.V., & Witjes, S. (2018). The circular economy: New or refurbished as CE 3.0? Exploring controversies in the conceptualization 15 of the circular economy through a focus on history and resource value retention options. *Resources, Conservation and Recycling*, 135, 246-264. doi: 10.1016/j.resconrec.2017.08.027.
[25] Shebanin, V., Kormyshkin, I., Reshetilov, G., Allakhverdiyeva, I., & Umanska, V. (2022). Sustainable development of the socio-economic security system of the region based on closed cycle technologies. *Review of Studies on Sustainability*, 7(2), 271-288.
[26] Sidhoum, A.A. (2018). Valuing social sustainability in agriculture: An approach based on social outputs' shadow prices. *Journal of Cleaner Production*, 203, 273-286. doi: 10.1016/j.jclepro.2018.08.212.
[27] Singh, R., Singh, H., & Raghubanshi, A.S. (2019). Challenges and opportunities for agricultural sustainability in changing climate scenarios: A perspective on Indian agriculture. *Tropical Ecology*, 60, 167-185. doi: 10.1007/s42965-019-00029-w.
[28] Sucozhañay, G., Vidal, I., & Vanegas, P. (2022). Towards a model for analyzing the circular economy in Ecuadorian companies: A conceptual framework. *Sustainability*, 14(7), article number 4016. doi: 10.3390/su14074016.
[29] Take action for the sustainable development goals. (n.d.). Retrieved from https://www.un.org/sustainabledevelopment/sustainable-development-goals/.
[30] The 10 year framework of programmes on sustainable consumption and production patterns. (2014). Retrieved from https://www.oneplanetnetwordc.orc/sitos/default/files/10yfp-general-brochure-en.pdf.
[31] Tura, N., Keränen, J., & Patala, S. (2019). The darker side of sustainability: Tensions from sustainable business practices in business networks. *Industrial Marketing Management*, 77, 221-223. doi: 10.1016/j.indmarman.2018.09.002.
[32] Varfolomeev, M., & Churikanova, O. (2020). Circular economy as an integral path of the Ukrainian future in the aspect of globalization. *Efficient Economy*, 5. doi: 10.32702/2307-2105-2020.5.200.
[33] Vaupotič, J. (2024). Radon and its short-lived products in indoor air: Present status and perspectives. *Sustainability*, 16(6), article number 2424. doi: 10.3390/su16062424.
[34] Velasco-Muñoz, J.F., Aznar-Sánchez, J.A., Belmonte-Ureña, L.J., & López-Serrano, M.J. (2018). Advances in water use efficiency in agriculture: A bibliometric analysis. *Water*, 10(4), article number 377. doi: 10.3390/w10040377.
[35] Velenturf, A.P.M., & Purnell, P. (2021). Principles for a sustainable circular economy. *Sustainable Production and Consumption*, 27, 1437-1457. doi: 10.1016/j.spc.2021.02.018.

[36] Vinante, C., Sacco, P., Orzes, G., & Borgianni, Y. (2021). Circular economy metrics: Literature review and company-level classification framework. *Journal of Cleaner Production*, 288, article number 125090. doi: 10.1016/j.jclepro.2020.125090.
[37] Zeweld, W., Van Huylenbroeck, G., Tesfay, G., & Speelman, S. (2017). Smallholder farmers' behavioural intentions towards sustainable agricultural practices. *Journal of Environmental Management*, 187, 71-81. doi: 10.1016/j.jenvman.2016.11.014.

Наталія Гавкалова
Доктор економічних наук, професор
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0003-1208-9607

Джон Мартін
Доктор філософії, керівник досліджень
Інститут сталої Землі в Плімутському університеті
PL4 8AA, Drake Circus, м. Плімут, Велика Британія
https://orcid.org/0000-0003-3363-8855

Ганна Шумська
Кандидат економічних наук, доцент
Харківський національний економічний університет імені Семена Кузнеця
61166, просп. Науки, 9А, м. Харків, Україна
https://orcid.org/0000-0001-7967-9009

Кристина Бабенко
Доктор економічних наук, професор
Житомирський економіко-гуманітарний інститут Університету «Україна»
10020, вул. Вільський Шлях, 18, м. Житомир, Україна
https://orcid.org/0000-0001-7227-886X

Ландшафт і циркулярна економіка як механізм сталого розвитку в умовах глобалізації та цифровізації світової економіки

Анотація. Концепція циркулярної економіки стає центральним компонентом місцевої та регіональної економіки. Тому метою цього дослідження було виявити вплив ландшафтного розвитку та циркулярної економіки на досягнення цілей сталого розвитку в контексті глобалізації та цифровізації світової економічної системи. Системно-аналітичні методи використано для оцінки деталей структури та функціонування механізмів державного регулювання становлення і розвитку циркулярної економіки; категоріально-аналітичний для демонстрації теоретичних засад формування цілеспрямованої державної політики у сфері розвитку. Цифрова дистрибуція має великий потенціал у реалізації принципів сталого розвитку, зміні споживчої поведінки й світогляду в контексті глобалізації та цифровізації світової економічної системи. Досліджено, що виснаження природних ресурсів створює проблеми для майбутнього розвитку промисловості, якості життя та забезпечення населення світу матеріальними благами. Внаслідок нераціонального природокористування, зростання матеріаломісткості та неефективного ресурсозабезпечення відбувається погіршення екологічного стану, виснаження природних ресурсів, зниження ефективності діяльності підприємств, погіршення якості продукції. На основі проведеного аналізу зроблено висновок, що ідея сталого розвитку стала основною парадигмою суспільного розвитку в майбутньому, а одним із механізмів досягнення цих цілей є розвиток циркулярної економіки через її зв'язок із такими процесами, як глобалізація та діджиталізація світової економіки, стимулювання інноваційної активності та розвиток цифрової дистрибуції. Зроблено висновок, що це можна розглядати як один із механізмів досягнення цілей. Сформульовані положення, висновки та пропозиції поглиблюють теорію і практику розвитку економіки замкненого циклу, в чому полягає практичне значення одержаних результатів

Ключові слова: кругообіг ресурсів; місцева влада; інноваційна діяльність; цифрова дистрибуція; екологічний стан; економічний розвиток

ЕКОНОМІКА РОЗВИТКУ
Міжнародний економічний журнал

Том 23, № 2
2024

Відповідальний редактор:
К. Нікітішина

Редагування бібліографічних списків:
К. Нікітішина

Комп'ютерна верстка:
К. Пилипенко

Підписано до друку 27.06.2024
Формат 60*84/8
Ум. друк. арк. 10,7
Наклад 50 прим.

Видавництво: Харківський національний економічний університет імені Семена Кузнеця
61166, пров. Інженерний, 1-А, м. Харків, Україна
E-mail: info@ecdev.com.ua
https://ecdev.com.ua/uk

ECONOMICS OF DEVELOPMENT
International Economic Journal

Volume 23, No. 2
2024

Managing Editor:
K. Nikitishyna

Editing bibliographic lists:
K. Nikitishyna

Desktop publishing:
K. Pylypenko

Signed to the print 27.06.2024
Format 60*84/8
Conventional Printed Sheet 10.7
Circulation 50 copies

Publisher: Simon Kuznets Kharkiv National University of Economics
61166, 1-A Inzhenerny Ln., Kharkiv, Ukraine
E-mail: info@ecdev.com.ua
https://ecdev.com.ua/en