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ANALYSIS OF INVESTMENT AND INNOVATION PROCESS INDICATORS OF THE DEVELOPMENT OF THE UKRAINIAN BLACK SEA REGION

АНАЛІЗ ПОКАЗНИКІВ ІНВЕСТИЦІЙНО-ІННОВАЦІЙНИХ ПРОЦЕСІВ РОЗВИТКУ УКРАЇНСЬКОГО ПРИЧОРНОМОР'Я

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Єрмакова О.А., Степанов В.М., Купінець Л.Є., Шершун О.М. Аналіз показників інвестиційно-інноваційних процесів розвитку Українського Причорномор'я. Оглядова стаття.
У статті здійснено комплексний аналіз просторово-часових закономірностей інвестиційно-інноваційних процесів у регіонах Українського Причорномор'я у 2020-2024 рр. Обґрунтовано вибір показників, що відображають динаміку прямих іноземних інвестицій, фінансування науково-дослідних і дослідно-конструкторських робіт, інноваційної активності промислових підприємств, інвестування у нематеріальні активи та природоохоронні капітальні інвестиції. На основі офіційних статистичних даних виявлено суттєві територіальні асиметрії, зумовлені воєнними ризиками, руйнуванням виробничої та наукової інфраструктури, скороченням інноваційно активних підприємств і нерівномірністю відновлення регіональних економік. Окреслено ключові виклики та фактори, що впливають на стійкість інноваційного розвитку макрорегіону в умовах підвищеної економічної та інституційної вразливості. Сформульовано висновки щодо необхідності посилення регіональної політики, зокрема підтримки НДДКР, розширення інвестицій у нематеріальні активи та створення умов для технологічного оновлення регіонів Українського Причорномор'я.
Ключові слова: інвестиційні процеси, інноваційний розвиток, регіональні диспропорції, Українське Причорномор'я, фінансування НДДКР, нематеріальні активи, природоохоронні капітальні інвестиції, післявоєнне відновлення

Iermakova O.A., Stepanov V.M., Kupinets L.Ye., Shershun O.M. Analysis of Investment and Innovation Process Indicators of the Development of the Ukrainian Black Sea Region. Review article.
This article provides a comprehensive analysis of the spatial and temporal patterns of investment and innovation processes in the regions of the Ukrainian Black Sea region during 2020-2024. The study substantiates the selection of indicators that reflect the dynamics of foreign direct investment, financing of research and development (R&D), industrial innovation activity, investment in intangible assets, and environmental capital investments. Based on official statistical data, the analysis reveals significant structural asymmetries between the regions, driven by wartime risks, the destruction of production and scientific infrastructure, and uneven post-crisis recovery trajectories. The research identifies key challenges and determinants influencing the resilience of innovation development in the Black Sea region under conditions of heightened economic and institutional vulnerability. The findings underline the need for targeted regional policy measures, strengthened support for R&D, and the creation of conditions for attracting investment into intangible assets and technologically advanced production.
Keywords: investment processes, innovation development, regional disparities, Ukrainian Black Sea region, R&D financing, intangible assets, environmental capital investments, post-war reconstruction

In 2020-2024, investment and innovation processes in Ukraine underwent substantial transformations driven by a combination of crisis factors – military hostilities, disrupted logistics chains, the destruction of production and research infrastructure, changes in the structure of regional economies, and a decline in the number of innovation-active enterprises. These processes were particularly acute in the regions of the Ukrainian Black Sea region, where war-related risks and limited resource capacity deepened territorial asymmetries in investment flows and undermined the resilience of innovation-driven development. The uneven

recovery of economic activity, the loss of a share of enterprises, the contraction of business activity, and the inaccessibility of several statistical indicators (confidentiality marker "k") hinder a comprehensive assessment of regional dynamics and necessitate a systematic investigation of the patterns shaping regional developmental trajectories.

The relevance of this issue arises from the need to identify spatial imbalances in key indicators of investment and innovation activity that determine the ability of regions to restore and modernise their economies in post-war conditions. Understanding the structure and dynamics of investment flows, R&D funding, the innovation activity of industrial enterprises, investments in intangible assets, and capital investments in environmental protection makes it possible to assess the extent of loss or preservation of the innovation potential of the Black Sea region. Given the strategic importance of these regions for the national economy, analysing their investment and innovation processes is essential for shaping effective public policy and developing sound mechanisms for regional recovery.

Analysis of recent researches and publications

Contemporary academic literature indicates that the effectiveness of investment and innovation activity is determined not only by financial and accounting approaches but also by external market, technological and institutional conditions. Studies on the influence of conservatism on innovation-related investments show that financial prudence constrains risk-bearing expenditure on the development of new products and technologies. For instance, Zou and Othman (2024) [1], based on the example of Chinese firms, established a significant negative correlation between the level of accounting conservatism and R&D expenditure, emphasising the need to adapt corporate financial strategies to innovation-oriented objectives in specific market environments.

Global studies of the economic effectiveness of investment in innovation demonstrate its delayed cumulative effect. Rexhepi et al. [2] found that, in the short term, innovation-related investment positively influences human development, while in the long term it also enhances productivity and GDP per capita. At the same time, the low efficiency of investment in Kosovo underscores the need to account for the national context and the time required for the cumulative effect to materialise.

Methodological approaches to assessing investment and innovation activity continue to evolve, adapting to the challenges posed by digital transformation and an unstable business environment. Petrovskyi [3] and Hryniv [4] proposed indicator systems for evaluating investment support for innovation in the agricultural and trade sectors respectively, combining input and output indicators and taking into account external and internal factors influencing innovation. Karmanskyi and Korol [5] expanded these approaches by developing a comprehensive multi-level assessment system covering operational, risk-related, tactical and strategic dimensions, and integrating ESG criteria and digital analytics tools, thereby enabling real-time evaluation of innovation investments.

An important aspect of ensuring the economic security of enterprises is the integration of innovation-investment determinants into strategic management. Malysh [6] argues that innovation potential, production modernisation, technological competitiveness, and financial support for innovation projects are key factors shaping the resilience of industrial enterprises. Rakytska [7] emphasises that strategic planning of investment and innovation processes in conditions of uncertainty requires a systematic definition of optimality criteria and performance monitoring to ensure the adaptability of the economy to global and local challenges.

In the national context, particularly under martial law, the issues of financial support and the preservation of investment and innovation potential have become critically important. Zozuliak [8] identifies the key problems of innovation financing in Ukraine, pointing to structural and organisational barriers, whereas Bilyk [9] demonstrates that the full-scale war has significantly intensified the factors weakening investment and innovation potential, highlighting the need for institutional reform and structural change to support economic security and national competitiveness.

It is also important to consider the role of investors in shaping innovation potential. Aas, Rossfjord and Østlie [10] show that venture capitalists prioritise innovation, focusing on qualitative criteria, whereas private investors and fund managers incorporate innovation as part of a broader financial analysis. This indicates the importance of investors' strategic objectives and risk profiles for effective investment in innovative projects.

Thus, contemporary academic literature forms a consensus that the effectiveness of investment and innovation activity is determined by the interplay of financial strategies, assessment methods, technological development, the institutional environment and external market conditions. In this context, the development of adaptive assessment methodologies capable of accounting for short- and long-term effects of innovation investment, sectoral specificities, uncertainty-related risks, and the strategies of different categories of investors is particularly relevant, as it ensures comprehensive support for economic security and sustainable national development.

Unsolved aspects of the problem

Despite the existing body of research on investment and innovation activity, systematic assessments of their effectiveness at the regional level, particularly in the Ukrainian Black Sea region, are lacking. The combined influence of accounting approaches, financial support mechanisms and local institutional characteristics on innovation development has not been comprehensively examined. Furthermore, the relationship between investment activity and regional economic security under high uncertainty and post-war recovery remains

insufficiently studied, complicating the formation of effective management strategies and development priorities for innovation processes in the post-war reconstruction period.

The main part

The selection of basic indicators for the analysis of spatial-temporal patterns of investment and innovation processes is based on the conceptual foundations of the Strategy of Economic Security of Ukraine for the period until 2025, which defines the indicators of the block "Investment and Innovation Security". The document emphasizes that the sustainable development of the national economy depends on the state's ability to ensure the dynamics of investment flows, the effective functioning of the research and development sector and the effectiveness of the innovation activity of industrial enterprises. These provisions became the methodological basis for the selection of indicators adapted to the regional level.

Indicators of growth in foreign direct investment, expenditures on scientific research and development, including at the expense of the state budget, the number of industrial enterprises implementing innovations, and the volume of innovative products sold reflect the key channels for the formation of the investment and innovation potential of regions. Their choice is due to the fact that in the conditions of post-war economic recovery, not only the absolute level of investment attraction and funding of science becomes important, but also the spatial-temporal structure of these processes, which allows us to assess the differentiation between regions and identify centers of concentration of innovative activity.

Since the strategic document is focused on national positions, in this study the indicators were converted into a value expression (thousands of UAH, units) to ensure comparability between regions and track dynamics over time, which allows us to investigate not the level of achievement of strategic goals, but the direct nature of transformations of the investment and innovation environment in a regional context.

In summary, the justified choice of these five indicators reflects the logic of the national economic security system, while providing an opportunity to reveal the regional specifics of the development of innovation processes, identify stable and vulnerable territories, and trace the evolution of Ukraine's investment and scientific potential in 2020-2024.

The choice of the indicator "volume of capital investments in intangible assets" is justified, since it reflects one of the key processes of forming innovation potential and structural modernization of the economy. As noted by the World Intellectual Property Organization (WIPO), it is intangible assets that act as drivers of innovation, productivity, and economic growth, ensuring the creation of new knowledge, technologies, and management practices that have a multiplier effect on other sectors of the economy.

Despite the recognized role of investment in intangible assets as a source of growth, innovation and added value, research indicates the lack of a unified approach to their measurement, which complicates the development of sound economic policies. As emphasized by Brynjolfsson et al. [11], intangible assets are often created within enterprises over a long period, are rarely reflected in accounting systems and do not have a standardized valuation. Their mobility between countries and corporations leads to a distortion of the real value, and the lack of harmonized statistical tools makes it difficult to monitor such investments. That is why official statistics should more actively take into account the specifics of intangible assets, developing a methodological basis for their systematic accounting and analysis.

In the macroeconomic context, the growing role of intangible assets also explains the change in the dynamics of capital accumulation in post-industrial economies. As Orhangazi's research [12] shows, since the 2000s, the increased use of intangible assets by non-financial corporations has caused a gap between profitability and investment activity. Enterprises increase market value and profits due to intellectual property, brands and patents, but this is not accompanied by an increase in physical capital investment. Such a transformation of the capital structure is especially noticeable in high-tech and knowledge-intensive industries, where the intensity of investment in intangible assets determines long-term competitiveness.

Thus, the use of the indicator "volume of capital investment in intangible assets" is conceptually justified for assessing the investment and innovation security of the regions of Ukraine, but limited from a statistical point of view. It allows us to trace not only the level of investment in the sphere of intangible production, but also the potential of the economy to reproduce intellectual capital, integrate into global value chains and increase technological sustainability in the post-war period.

The choice of the indicator of the volume of capital investments in environmental protection is due to the need to assess the relationship between environmental policy, investment activity and innovative development in the context of sustainable growth of regions. In modern economic science and practice, this indicator is considered as a comprehensive indicator of the effectiveness of environmental management, the ability of economic entities to adapt to environmental challenges and create the prerequisites for the development of a "green" innovative economy.

International studies confirm that capital investments in the environmental protection sphere form a dual effect within the innovation process. On the one hand, an excessive burden of environmental obligations can temporarily reduce the resources of enterprises aimed at scientific developments and technological innovations, which reflects the so-called crowding-out effect [13]. On the other hand, in a strategic perspective, environmental investments become a catalyst for technological renewal, especially in highly developed or low-carbon regions, where the institutional capacity for natural resource management is combined with decentralized models of environmental

administration. Thus, a study based on data from 30 provinces in China (2008-2016) has shown that investments in environmental protection, combined with an effective environmental management system, stimulate the development of "green" technologies [14].

European experience also demonstrates the interdependence between the level of environmental investment and the effectiveness of innovation processes at the regional level. An analysis of German regions shows that in developed cluster ecosystems, enterprises that invest in environmental protection achieve higher efficiency in the formation of intangible assets and strengthen the innovative capacity of not only their own business, but also of adjacent cluster participants [15].

The generalization of the results of the above studies shows that investments in environmental protection are not limited to the ecological function, but are a component of the structural renewal of the economy, forming the prerequisites for the transition to innovation-oriented and resource-efficient development models.

As a result, a system of quantitative indicators covering both the investment and scientific aspects of development was used to assess the spatio-temporal patterns of investment and innovation processes in the regions of Ukraine. It includes the dynamics of foreign direct investment, expenditures on scientific research and development, including budget financing, the intensity of innovative activity of industrial enterprises, as well as capital investments in intangible assets and the environmental sphere. Such a structure allows us to identify the spatial differentiation of regions in terms of the level of innovation potential and investment attractiveness, to identify growth centers and peripheral territories, and to assess the relationship between financial, scientific and technological factors of development.

The analysis used official open data from the State Statistics Service of Ukraine and the National Bank of Ukraine, which ensures the reliability and reproducibility of the results.

In 2020-2024, the dynamics of foreign direct investment growth in Ukraine is characterized by sharp fluctuations, reflecting the sensitivity of the national economy to foreign policy and security factors. After a negative balance in 2020 (-36 million USD), there was a rapid increase in 2021 to over 7.3 billion USD, which indicates the recovery of activity after the pandemic downturn. In the future, the trend had a wave-like nature: a sharp decrease in 2022 to 531 million USD under the influence of the start of a full-scale war, relative stabilization in 2023 ($4.48 billion) and a moderate decrease in 2024 to $3.55 billion. The average value for the period, $3.17 billion, reflects the overall recovery potential, but at the same time high volatility of investment flows.

The spatial structure of attracting foreign direct investment reveals a clear concentration in the Kyiv region: Kyiv and Kyiv region form more than half of the average national growth (1657.8 and 1201.8 million USD, respectively), which indicates the preservation of the dominance of the capital in the investment system. Compared to them, the remaining regions demonstrate significantly lower and unstable values, and in a number of regions negative average growth is observed, which indicates an outflow of capital.

The regions of the Ukrainian Black Sea region attract particular analytical attention, where from 2020 to 2024 the dynamics of foreign direct investment reflects a complex combination of crisis phenomena and partial signs of adaptation. In Odesa region, in 2020-2021, a positive balance of investments was maintained, however, in 2022 the indicator decreased to 6.2 million USD, after which there was a recovery to 185.2 million USD. in 2023 and 104.8 million USD in 2024, which indicates a gradual stabilization in the services sector and transport logistics. Mykolaiv region had positive investment dynamics at the beginning of the period, but since 2022 a decline has been recorded, and the average value for 2020-2024 is only 83 million USD. In Kherson region, where statistical reporting is partially absent after 2022, the average indicator ($83.6 million) reflects the situation before the occupation, which makes an adequate spatial-temporal assessment after the start of hostilities impossible. In the Zaporizhia region, which is a transition between the industrial East and the Black Sea region, there is deep instability: the positive growth in 2021 ($522.7 million) is replaced by a double drop in 2022-2023 to negative values, and the average result for the period ($2 million) actually means a loss of investment activity. The problem of confidentiality and lack of data after 2022 becomes systemic. For Donetsk, Luhansk and partly Kherson regions, indicators are marked as missing, which makes it impossible to build complete time series and indicates not only a restriction of statistical access, but also the actual absence of the phenomenon itself due to the suspension of economic activity. In the absence of complete data, the average values for the period are of a corrective nature and do not reflect the real structure of flows in 2022-2024.

Thus, in the spatio-temporal aspect, the growth of foreign direct investment demonstrates a clear regional asymmetry with a concentration in the central part of the country and a loss of activity in the southern and eastern regions. The Black Sea region is characterized by multidirectional dynamics: from the recovery of Odesa to the decline of Mykolaiv and Kherson regions. This indicates a deep territorial imbalance in the investment space and forms the basis for a separate analysis of the post-war investment recovery of the regions of the Black Sea region.

During 2020-2024, the volume of expenditures on scientific research and development in Ukraine increased overall from UAH 17.0 to UAH 28.3 billion, which indicates a gradual recovery after the decline in 2022 caused by the full-scale invasion. The spatial distribution of these costs reveals a deep territorial asymmetry, with most financial flows concentrated in the capital and several scientific and industrial centers. Kyiv provides more than half of all national volumes, while in most regions the resources are fragmented and do not form sustainable scientific and innovative systems.

After 2022, not only a reduction in funding in regions close to the front line is observed, but also the emergence of cases of complete absence of data due to access restrictions or the secrecy of statistical materials. In several regions (in particular, Zaporizhia, partly Kirovohrad, Luhansk, Kherson and Khmelnytskyi) the "k" marks were recorded, which indicates the confidentiality of information – both due to small amounts of funding and the impossibility of official disclosure of data under martial law. In these cases, the spatio-temporal picture is disturbed, and the assessment of dynamics requires careful interpretation.

After 2023, the recovery of spending will mainly occur in large scientific agglomerations, where sustainable research institutions have been formed and external funding channels have been restored. This increases the contrast between regions where science remains resource-limited or virtually non-existent.

The spatial structure of funding demonstrates a high degree of concentration in the capital, which retains a leading position among all regions in terms of budget allocations. Kyiv accumulates a larger share of state funds allocated to science, which is explained by the dense presence of academic and industry institutions, scientific institutes and higher educational institutions. At the same time, high indicators are also recorded in Kharkiv, Lviv, Dnipropetrovsk and Odesa regions, which historically have developed scientific potential and are able to attract both budgetary and extra-budgetary funding. These trends are of particular importance for the regions of the Ukrainian Black Sea region, where a combination of military risks, disruption of logistics and reduction of personnel potential led to a temporary disorganization of the system of budgetary funding of science. Despite the partial preservation of research activities in Mykolaiv and Odesa regions, the overall level of state support here remains below the national average. This indicates the need to restore the institutional capacity of regional research centers, because they can become the cornerstones in the formation of a strategy for the scientific and technological revival of the Black Sea region.

The dynamics of the number of industrial enterprises that introduced innovations in 2020-2024 reflects a general decrease in the pace of innovation activity due to systemic crisis phenomena in the economy and armed aggression against Ukraine. If in 2020 there were more than seven hundred innovatively active enterprises in the country, then in 2021-2023 their number decreased by more than half, with a partial recovery in 2024, when 597 such entities were recorded. The average value for the five-year period is 444 enterprises, which indicates the presence of cyclicality due to the influence of extraordinary circumstances and uneven regional development.

In spatial terms, there is a stable concentration of innovation activity in industrial centers, in particular in Kharkiv, Dnipropetrovsk and Lviv regions, where the average number of innovatively active enterprises exceeds forty units. This is explained by the preservation of scientific and technical potential, the presence of developed industry clusters and research structures. Kyiv and its region also demonstrate a relatively high intensity of the introduction of new technologies, although the share of urban enterprises in the national indicator is gradually decreasing due to the reorientation of part of the business to relocation or conservation of production.

In the regions of the Ukrainian Black Sea region, innovation activity remains vulnerable. Odesa region maintains moderate stability, while Mykolaiv and Kherson regions have experienced a significant reduction in the number of enterprises implementing innovations. For the Mykolaiv region, the decrease in the indicator to seven enterprises in 2024 compared to twelve in 2020 is characteristic, and for the Kherson region, the actual cessation of registration of innovative activity after 2021. These trends are associated with damage to the production infrastructure, personnel outflow and disruption of supply chains.

There is also an increase in cases of the absence or partial confidentiality of statistical data, which makes it impossible to fully reconstruct the spatial picture of innovative activity. This situation is due to both objective factors of military aggression and methodological limitations in official reporting, in particular regarding small enterprises and enterprises located in the combat zone. This creates additional analytical challenges for assessing the spatio-temporal dynamics of innovation processes.

The dynamics of the volume of innovative industrial products sold in Ukraine in 2020-2024 demonstrates extremely uneven development. In 2020, UAH 47.5 billion of innovative products were sold, while in 2024 this figure increased to over UAH 138 billion, which led to an increase in the average value for the period to UAH 54.8 billion. However, such growth is disproportionate: some regions demonstrate sharp jumps in the volume of innovative production, while other regions remain at the same level.

The features of the spatial structure indicate that innovative activity is concentrated mainly in the following regions: in the city of Kyiv, Dnipropetrovsk, Poltava, Kharkiv and Lviv regions. The city of Kyiv stably maintains a leading position with an average annual volume of over UAH 10.8 billion, which can be explained by the concentration of high-tech industries, research institutions and the presence of a wide network of internal market connections. Dnipropetrovsk region demonstrates high variability of indicators – from UAH 6.4 billion in 2020 to over UAH 54 billion in 2024, which may indicate the intensification of export-oriented production and the implementation of large-scale technological solutions in the mining and metallurgical complex.

In the regions of the Ukrainian Black Sea region, the situation remains more controversial. The Odesa region demonstrates relative stability. In contrast, the Mykolaiv region is characterized by minimal volumes of innovative products sold, which in 2024 did not exceed 113 thousand UAH, and in some years the data was not published at all. In the Kherson region, innovative activity actually stopped after 2021, which is directly related to the destruction of industrial infrastructure as a result of military operations.

The dynamics of capital investments in intangible assets in Ukraine in 2020-2024 is marked by instability, which reflects the impact of crisis and military factors on the innovation potential of the regions. The national indicator tends to grow – from 24.9 billion UAH in 2020 to over 44 billion UAH in 2024, which is an average of about 30.3 billion UAH over the five-year period. However, this growth is uneven: after a decline in 2022, associated with the start of a full-scale invasion, there was a gradual recovery in 2023-2024, due to the reorientation of investment flows.

The regional distribution shows an extremely high concentration of capital investments in the city of Kyiv, where the average volume is over UAH 20.8 billion, which exceeds the combined indicators of most regions combined. This reflects the centralized nature of the innovation infrastructure and the concentration of large enterprises and financial centers in the capital. Significant investment volumes were also observed in Kyiv, Lviv, Dnipropetrovsk, Odesa and Cherkasy regions, which indicates their participation in the development of the digital economy and information technology.

In regions close to the war zone, in particular, in Donetsk, Luhansk, Zaporizhia and Kherson regions, a sharp reduction or absence of published data was recorded due to both objective reasons and restrictions related to compliance with statistical confidentiality. For Luhansk and Kherson regions, where information was not published in 2023-2024, this may reflect not only security risks, but also the cessation of the activities of most enterprises that could invest in intangible assets. The sharp increase in capital investment volumes in some regions, for example, in Rivne and Zhytomyr in 2021 and 2024, is likely to be a one-time phenomenon and is associated with individual large innovation projects or the transfer of some enterprises from the eastern regions. In general, there is a gradual recovery of activity after 2022, but it is asymmetric, with an advantage in those territories where there are stable financing channels, a scientific and technical base and favorable conditions for attracting investments in intangible assets.

In 2020-2024, capital investments in environmental protection in Ukraine demonstrate pronounced instability with a tendency to decrease compared to the pre-war period. The average figure for the country is about UAH 9.98 billion, while in 2020-2021 the volumes exceeded UAH 13-14 billion, and in 2022 they sharply decreased by more than half. This decrease reflects the systemic impact of the full-scale invasion on investment activity, the destruction of industrial capacities and the reorientation of financial resources to military and humanitarian needs.

The highest investment volumes were traditionally recorded in the Dnipropetrovsk region, where the average level exceeds UAH 4.4 billion, which is explained by the concentration of environmentally hazardous industries, in particular metallurgy and mining, which require significant expenditures on environmental protection measures. Capital investments were also significant in the city of Kyiv, Lviv, Poltava, Kharkiv and Zaporizhia regions.

Regions that have experienced direct military operations are characterized by a sharp decline in environmental investments or minimal values. In Donetsk, Luhansk and Kherson regions, some years are represented by only symbolic values or episodic injections in 2020-2021. In some cases, such as in Luhansk region, the volumes have become practically zero, which may indicate a complete cessation of capital programs in the field of environmental protection.

It is also worth noting positive examples of the growth of environmental investments in the western regions, in particular in Volyn, Rivne and Zakarpattia regions. Their increase after 2022 may be associated with the relocation of some enterprises. Despite regional disparities, the trend towards a gradual recovery of environmental investments in 2023-2024 remains, which is a sign of the state's gradual return to a policy of sustainable recovery, in which the environmental component becomes an important element of investment planning.

To assess the dynamics of investment and innovation activity in the regions of Ukraine, a comparative ranking of regions was conducted for two time intervals - 2020-2021 and 2022-2024, which made it possible to determine spatio-temporal shifts in the leadership structure of regions and to identify trends in the adaptation of innovation and investment activity to the conditions of war and post-war challenges.

The comparison of ratings showed the continued dominance of the city of Kyiv, Kyiv, Dnipropetrovsk and Kharkiv regions, which confirms their systemic potential in the formation of a scientific and innovative environment and attracting capital. At the same time, in the second period, an increase in the positions of Lviv, Vinnytsia and Poltava regions is clearly visible, which reflects the strengthening of investment activity in relatively safe western regions. The southern territories, in particular the Odesa, Mykolaiv and Kherson regions, are characterized by a change in role from moderately stable to vulnerable: in 2020-2021 they demonstrated an average level of positions, while in 2022-2024 they showed a downward trend, which is due to military risks, destruction of infrastructure and reorientation of investment flows to safer regions. At the same time, the continued activity of the Odesa region in the field of capital investments and scientific spending indicates the presence of recovery potential, which can be realized provided that institutional support is strengthened and the economic environment is stabilized.

Conclusions

The study found that investment and innovation processes in Ukraine in 2020-2024 developed in conditions of growing spatial asymmetry, reinforced by military, economic and institutional factors. The regions of the Ukrainian Black Sea region are characterized by a combination of structural imbalances: from a partial restoration of investment activity in the Odesa region to a sharp reduction or lack of effective data in the Mykolaiv and

Kherson regions. An analysis of R&D indicators and budget funding for science confirmed the high concentration of scientific potential in the capital and the limited resource base of the regions that suffered military destruction.

The innovative activity of industrial enterprises demonstrates a downward trend with a partial recovery in 2024, but in the Black Sea region negative trends related to the cessation of enterprise operations, relocation and staff reduction prevail. The dynamics of investments in intangible assets and environmental protection demonstrate both the potential for structural renewal of the economy and significant territorial gaps that have deepened after 2022. The results obtained confirm the need to develop targeted regional policy instruments to restore the scientific and technological potential of the Black Sea regions, strengthen R&D funding, and create conditions for attracting investments in intangible assets and innovative production.

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Abstract

The article presents a comprehensive examination of the spatial and temporal patterns of investment and innovation processes in the regions of the Ukrainian Black Sea region during 2020-2024. The relevance of the study is determined by the growing regional asymmetry in investment flows, the disruption of research and industrial infrastructure, and the impact of wartime risks on the capacity of regions to maintain or restore innovation-driven development. The purpose of the article is to analyse the dynamics and structural characteristics of key indicators that reflect the state of investment activity, the distribution of R&D financing, industrial innovation performance, and the development of intangible and environmental capital investments in the Black Sea region.

The research tasks include the justification of indicator selection for regional assessment, evaluation of the dynamics of foreign direct investment, analysis of R&D funding and innovation activity, assessment of investment in intangible assets and environmental protection, and identification of spatial disparities and factors affecting regional resilience. Methodologically, the study is based on comparative and structural analysis, spatial-temporal comparison of indicators, and indicative assessment. The empirical base consists of official statistical data provided by the State Statistics Service of Ukraine and the National Bank of Ukraine, ensuring data reliability and reproducibility of results.

The results reveal substantial territorial asymmetries caused by wartime destruction, limited scientific capacity in individual regions, relocation and decline of innovation-active enterprises, and uneven conditions for economic recovery. Odesa region demonstrates relatively greater resilience in investment dynamics, while Mykolaiv and Kherson regions face severe data gaps, reduced innovation activity, and constrained capacity for recovery. The analysis of R&D funding confirms strong national concentration in the capital region and insufficient resources in war-affected territories. Investments in intangible assets and environmental capital show both potential for structural renewal and deepening disparities between the regions.

The study concludes that targeted regional policy tools, expansion of support for R&D, and improved conditions for attracting investment into intangible and innovative assets are essential for restoring the scientific and technological potential of the Ukrainian Black Sea region. Strengthening institutional capacity and ensuring stable funding mechanisms are critical for enhancing regional resilience and supporting the long-term innovation trajectory under conditions of heightened risk and uncertainty.

Список літератури:

1. Zou W., Othman A. The impact of accounting conservatism on enterprise innovation investment / W. Zou, A. Othman // Heliyon. – 2024. – Article e36106. DOI: 10.1016/j.heliyon.2024.e36106.
2. Rexhepi B.R., Nuredini L., Sadiku M.K., Hajrizi E. Economic efficiency of investment in innovation in a knowledge-based economy / B.R. Rexhepi, L. Nuredini, M.K. Sadiku, E. Hajrizi // Economics of Development. – 2024. – 23(4). – С. 95-106. DOI: 10.57111/econ/4.2024.95.
3. Петровський О. Інвестиційне забезпечення інноваційної діяльності в аграрному секторі: методичні основи оцінки / О. Петровський // Ukrainian Journal of Applied Economics and Technology. – 2025. – 2. – С. 195-199. DOI: 10.36887/2415-8453-2025-2-38.
4. Hryniv V. Factors influence on the possibility of realizing the innovation and investment potential of the trade industry / V. Hryniv // Ukrainian Journal of Applied Economics and Technology. – 2024. – 4. – С. 212-217. DOI: 10.36887/2415-8453-2024-4-32.

5. Карманський А., Король С. Методичні підходи до оцінки ефективності інвестиційно-інноваційної діяльності / А. Карманський, С. Король // Європейський науковий журнал Економічних та Фінансових інновацій. – 2025. – 3(17). – С. 290-301. DOI: 10.32750/2025-0325.
6. Malysh V. Innovation and investment determinants of ensuring the economic security of industrial enterprises / V. Malysh // Scientific Bulletin of Polissia. – 2025. – 2(29). – С. 308-321. DOI: 10.25140/2410-9576-2024-2(29)-308-321.
7. Ракитська А. Формування та реалізація стратегічних цілей розвитку інвестиційно-інноваційних процесів в умовах невизначеності / А. Ракитська // Via Economica. – 2025. – № 8. – С. 135-141. DOI: 10.32782/2786-8559/2025-8-20.
8. Зозуляк М. Проблеми фінансового забезпечення інноваційних процесів / М. Зозуляк // Економіка та суспільство. – 2022. – № 42. DOI: 10.32782/2524-0072/2022-42-87.
9. Білик В. Чинники послаблення інвестиційно-інноваційного потенціалу в системі економічної безпеки України в умовах повномасштабної війни / В. Білик // Development Service Industry Management. – 2023. – № 4. – С. 149-155. DOI: 10.31891/dsim-2023-4(25).
10. Aas T.H., Rossfjord M., Østlie K. Evaluating innovation in equity investment decisions: Insights from venture capital, private equity and equity fund perspectives / T.H. Aas, M. Rossfjord, K. Østlie // International Journal of Innovation Management. – 2025. DOI: 10.1142/s1363919625400146.
11. Bavdaž M., et al. Measuring investment in intangible assets / M. Bavdaž et al. // Advances in Business Statistics, Methods and Data Collection. – 2023. DOI: 10.1002/9781119672333.ch5.
12. Orhangazi Ö. The role of intangible assets in explaining the investment-profit puzzle / Ö. Orhangazi // Cambridge Journal of Economics. – 2018. – 43(5). – P. 1251-1286. DOI: 10.1093/cje/bey046.
13. Jiang X., et al. Environmental protection investment and enterprise innovation: Evidence from Chinese listed companies / X. Jiang et al. // Kybernetes. – 2022. DOI: 10.1108/k-12-2021-1292.
14. Zhang Y., Li H. Environmental decentralization, environmental protection investment, and green technology innovation / Y. Zhang, H. Li // Environmental Science and Pollution Research. – 2020. DOI: 10.1007/s11356-020-09849-z.
15. Temouri Y., et al. Regional environmental protection investments, cluster ecosystems, and firm innovation: Evidence from Germany / Y. Temouri et al. // Business Strategy and the Environment. – 2025. DOI: 10.1002/bse.4270.

References:

1. Zou W., Othman A. (2024). The impact of accounting conservatism on enterprise innovation investment. Heliyon, Article e36106. DOI: 10.1016/j.heliyon.2024.e36106 [in English].
2. Rexhepi B.R., Nuredini L., & Sadiku M.K., Hajrizi E. (2024). Economic efficiency of investment in innovation in a knowledge-based economy. Economics of Development, 23(4), 95-106. DOI: 10.57111/econ/4.2024.95 [in English].
3. Petrovskyi, O. (2025). Investment provision of innovation activity in agricultural sector: Methodological foundation of assessment. Ukrainian Journal of Applied Economics and Technology, 2, 195-199. DOI: 10.36887/2415-8453-2025-2-38 [in Ukrainian].
4. Hryniv, V. (2024) Factors influence on the possibility of realizing the innovation and investment potential of the trade industry. Ukrainian Journal of Applied Economics and Technology, 4, 212-217. DOI: 10.36887/2415-8453-2024-4-32 [in Ukrainian].
5. Karmanskyi, A., & Korol, S. (2025). Methodical approaches to evaluating the efficiency of investment-innovation activities. European Scientific Journal of Economic and Financial Innovations, 3(17), 290-301. DOI: 10.32750/2025-0325 [in Ukrainian].
6. Malysh, V. (2025). Innovation and investment determinants of ensuring the economic security of industrial enterprises. Scientific Bulletin of Polissia, 2(29), 308-321. DOI: 10.25140/2410-9576-2024-2(29)-308-321 [in English].
7. Rakitska, A. (2025). Formation and implementation of strategic goals of investment-innovation processes under uncertainty. Via Economica, (8), 135-141. DOI: 10.32782/2786-8559/2025-8-20 [in Ukrainian].
8. Zozuliak, M. (2022). Problems of financial provision of innovation processes. Economics and Society, (42). DOI: 10.32782/2524-0072/2022-42-87 [in Ukrainian].
9. Bilyk, V. (2023). Factors weakening the investment-innovation potential in the economic security system of Ukraine under full-scale war. Development Service Industry Management, (4), 149-155. DOI: 10.31891/dsim-2023-4(25) [in Ukrainian].
10. Aas, T.H., Rossfjord, M., & Østlie, K. (2025). Evaluating innovation in equity investment decisions: Insights from venture capital, private equity and equity fund perspectives. International Journal of Innovation Management. DOI: 10.1142/s1363919625400146 [in English].

11. Bavdaz, M., et al. (2023). Measuring investment in intangible assets. Advances in Business Statistics, Methods and Data Collection. DOI: 10.1002/9781119672333.ch5 [in English].
12. Orhangazi, Ö. (2018) The role of intangible assets in explaining the investment-profit puzzle. Cambridge Journal of Economics, 43(5), 1251-1286. DOI: 10.1093/cje/bey046 [in English].
13. Jiang X., et al. (2022). Environmental protection investment and enterprise innovation: Evidence from Chinese listed companies. Kybernetes. DOI: 10.1108/k-12-2021-1292 [in English].
14. Zhang, Y., & Li, H. (2020). Environmental decentralization, environmental protection investment, and green technology innovation. Environmental Science and Pollution Research. DOI: 10.1007/s11356-020-09849-z [in English].
15. Temouri, Y., et al. (2025). Regional environmental protection investments, cluster ecosystems, and firm innovation: Evidence from Germany. Business Strategy and the Environment. DOI: 10.1002/bse.4270 [in English].

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DOI: 10.15276/EJ.04.2025.6. DOI: 10.5281/zenodo.18090363.

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