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INFLUENCE OF ENVIRONMENTAL INNOVATION ON ECOLOGICAL PRODUCTIVITY

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ABSTRACT

Purpose: This research aims to analyse the potential of advanced environmental technologies and innovations to improve ecological productivity.

Design/Methodology/Approach: The study is theoretical. The methods of generalisation, comparison, systematisation, abstraction, analysis, synthesis, and concretisation were used at the theoretical level.

Research Limitation/Implications: The mechanisms for ensuring sustainable development through implementing environmental innovation activities were analysed. The essence of environmental innovations was identified, and trends in their implementation were revealed.

Findings: The activities of Ukrainian business entities are currently characterised by low innovation activity. Environmental innovations contribute to increasing environmental productivity through an effective coordinated vector of activities aimed at developing green energy.

Social Implication: The potential of economic stimulation and business motivation to transition to renewable energy sources to reduce emissions and increase climate resilience was identified.

Practical Implication: The research results' practical importance lies in their applicability to optimise Ukraine's socio-economic development by implementing sustainable climate policies and preventive environmental conservation measures.

Originality/ Value: The research process has highlighted the significance of reducing the use of exhaustible resources and minimising emissions into the atmosphere to alleviate anthropogenic pressure on the environment.

Keywords: *Ecological. environmental. innovations. productivity. technologies*

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INTRODUCTION

The current stage of the global community's development is characterised by intensified economic growth, significant attention to innovation and investment development driven by the intensification of globalisation and integration and intensive digital optimisation of economic and management processes. At the same time, the current stage of development is marked by an aggravation of environmental issues, rising levels of environmental pollution, and destruction of the natural environment (Horbal & Plish, 2021).

The achievement of significant indicators of socio-economic development creates real threats to the prospects of human life. Implementation of the principles of sustainable development, levelling the goal of achieving high economic growth through extensive development, and preventing the depletion of natural resources and their regeneration is possible only through the development and implementation of an effective innovation policy based on the principles of sustainable development and environmentalisation. At the same time, the introduction of environmental technologies and innovations differs from the rapid intensification of profitability. However, it creates the basis for the prospective provision of high development rates of environmental productivity.

Many works by recent scholars have been devoted to studying the essence of environmental innovations, methodology for assessing the effectiveness of innovation activities, and analysis of the dynamics in the field. In particular, the national scientific field studies the specifics of the use of renewable energy sources as an objective need to improve resource conservation (Kharchenko, 2021; Koblianska et al., 2021), the possibilities of using innovative eco-technologies as part of the circular economy processes are investigated (Boiarynova & Bychkovska, 2020; Komchatnykh, 2021), the potential for environmental optimisation of the national production sector is analysed (Shevchenko & Sheludko, 2023; Bahorka, 2020).

Among the recent scientific works devoted to the scientific development of the problems of the advance of environmental innovation activity and the study of the causes of imbalance phenomena in the studied area, the achievements of researchers stand out (Horbal & Plish, 2021; Kofanov et al., 2023), which detail the analytics of natural resource consumption and identify the role of minimising the process of resource use in the process of socio-economic development. In addition, based on the study of the developed countries that have specific achievements in the effective use of the potential of environmental innovations in the context of sustainable development and decarbonisation, several scholars (Illiashenko et al., 2022; Kosovych, 2021) identify relevant opportunities for adapting the above positive foreign experience in Ukraine.

Coastal destinations play a vital role in the ecological-anthropogenic system, as they are formed by functionally connected elements located in a specific marine area. These elements operate information and communication structures to ensure the implementation of strategies and tactics for producing and realising a tourist product aimed at effective economic, social, and ecological activity in the area.

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More attention should be paid to the problem of identifying potential opportunities to attract business interest in the use of innovative environmental solutions. The issues of implementing practical successful experience in introducing an effective system of motivation for the business sector in this aspect have yet to be studied sufficiently. In this regard, it is necessary to intensify the interest of scientists and managers in exploring the possibilities of combining efforts of the administrative sphere, society, and business to increase resilience to climate change and minimise the destruction of the natural environment.

This research aims to address the existing gap in scientific developments in the field of ecological innovations by justifying the feasibility of ecological-economic modelling of tourist destinations, particularly coastal ones, where the possibilities for improving existing approaches to the economics of nature use are most fully revealed.

The article aims to analyse the potential of environmental technologies and innovations to improve environmental productivity within sustainable development and circular economy.

LITERATURE REVIEW

From different scientific perspectives, the issue under study and its aspects have been reflected in numerous scientific studies. In particular, recent studies highlight aspects of sustainable development concepts using innovative technologies and renewable energy.

Researchers Pakhnenko and Kolomiiets (2021) and Zinchenko and Filenko (2020) analyse the functionality of environmental innovations in the modern business environment. Pakhnenko & Kolomiiets (2021) study the development of Green FinTech in the global environment and identify its role in achieving sustainable development goals and the circular economy. Zinchenko and Filenko (2020) position the change of the technogenic type of economic development to a sustainable one as the basis for preventing global and local environmental crises. This approach, the scientists argue, is unthinkable without applying knowledge-intensive innovative environmental technologies.

Odrekhivskyi and Kohut (2022) actively investigate technological solutions to the outlined concept of eco-innovation policy formation at different levels of the global economic system. The scientists position the optimisation of eco-innovation activities as a factor in stimulating competitiveness.

At the same time, Töbelmann and Wendler (2020) and Truong and Berrone (2022) study sustainable algorithms for green financing and targeted investment in practical, innovative environmental projects. Meanwhile, Shao et al. (2020) summarise the impact of environmental regulation on developing the circular economy in terms of technological, product, system, and environmental innovations.

At the same time, some scientists have analysed the issues of assimilation of sustainable entrepreneurship, innovation and business models during the global transformation of socio-economic processes towards sustainable development, minimisation of destructive impact on the environment and prevention of climate change (Taghizadeh-Hesary & Yoshino, 2020). In

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recent developments, the paradigm of the studied phenomenon has been positioned as a priority for sustainable economic development in the context of the convergence of society, management, and business efforts to achieve high decarbonisation rates shortly (Lüdeke-Freund, 2020).

The conceptual horizons of the studied issues are expanded in the work of scientists (Khan et al., 2020), who focus on developing a model of effective economic incentives for the introduction of environmental innovations into practice based on a system of economic and managerial motivation, as well as raising the level of environmental awareness.

Thus, the vast majority of researchers today interpret the use of the potential of environmental innovation as a basis for minimising the destructive anthropogenic burden and increasing resilience to climate change, ensuring sustainable development within circular economic processes and promising strategic development. At the same time, the issues of practical implementation of innovations in environmental aspects of activity through innovative approaches of motivation and incentives are mostly ignored by the scientific achievements of modern scientists or are insufficiently studied, which makes it necessary to expand the study of the subject of this research.

RESEARCH METHODS

The methods of generalisation, comparison, systematisation, abstraction, analysis, synthesis, and concretisation were used at the theoretical level. Analysis and synthesis methods were utilised in the research process to identify the main opportunities for environmental innovation activity to reduce anthropogenic pressure on the environment and increase resilience to climate change. The inductive method was applied during the study to formulate predictive directions for developing the research process. The work used the deductive method to identify the directions for forming an innovative concept of using environmental innovations and technologies in business practice. Abstraction was employed in the research process to extract theoretical generalisations, identify critical categories and concepts, and form conclusions regarding priority development vectors of the researched phenomenon. A comparison with traditional sources was utilised to identify specific features of the modern innovative paradigm of eco-friendly solutions in production and economic activities, aiming to minimise emissions and enhance climate resilience.

The research was conducted based on the principles of comprehensiveness and systematicity in scientific studies. Such an approach enabled the analysis of the research object as a holistic system with a series of interconnections and interdependencies.
The study is limited by the lack of access to official, reliable data and the difficulty of implementing an empirical verification of theoretical conclusions.

RESULTS

Global environmental pollution, depletion of non-renewable natural resources, and climate change impact economic processes.

The concept of sustainable development implies that economic processes depend on the natural environment. Within this concept's framework, the low-carbon and resource-efficient circular

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economy is based on the principles of natural resource conservation and preventive and regenerative environmental protection.

Against the backdrop of increasing anthropogenic pressure on the environment and the actualisation of global environmental problems, attention to environmental innovations is being developed in academia, business and management (Shevchenko & Sheludko, 2023; Bahorka, 2020). Practical realisation of the potential of modern environmental innovative solutions can ensure the implementation of the concept of responsibility of the business sector and the intensification of its profitability under the conditions of preservation and regeneration of the ecological system (Kovalov et al., 2018; Rahman et al., 2022).

Several specific indicators have been developed to assess environmental innovations' effectiveness informatively. The primary indicator in this field is the Environmental Performance Index, which is positioned as a comprehensive, integrated indicator for assessing the effectiveness of environmental policy (Boiarynova et al., 2020; Komchatnykh et al., 2021). The index is calculated based on performance indicators in ten categories covering ecosystem viability, health indicators, and environmental indicators. The Global Green Innovation Index is identified as a related issue, which is calculated based on an assessment of the available resources for the implementation of innovations and the achieved practical results of their practical implementation (Horbal & Plish, 2021; Kofanov et al., 2023).

Implementing environmental innovations in the practice of Ukrainian business entities will ensure a long-term dimension of competitiveness and a climate-friendly business environment (Töbelmann & Wendler, 2020; Truong & Berrone, 2022). Usually, the process of introducing environmental innovations aims to prevent and mitigate the consequences of environmental impact while maximising profits.

Prioritising measures aimed at stabilising the environmental situation and implementing the concept of sustainable development.

By implementing environmental innovation activities, a market entity positions environmental protection as an integral part of its business strategy (Kharchenko, 2021; Koblianska et al., 2021). Today, the outlined concept has the functionality of a powerful tool for minimising costs and expanding markets. The paradigm of environmental innovation activity involves a set of measures, among which the following areas are considered to be the most effective:

- Develop and implement the latest technological resource use and recovery processes, including waste recycling.
- active implementation of low- and zero-waste technologies, including developing and improving biotechnologies.
- energy saving and intensification of renewable energy sources.
- introduction of new organisational and management forms to improve environmental safety.
- environmentalisation of public opinion, introduction of compulsory environmental education.

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The business sector, in the concept of environmental innovations, sees the characteristic production processes of environmental vectorially, the development of innovative products based on natural components, and the latest management tools to mitigate the risks of environmental pollution in order to implement the principles of sustainable development in practice (Horbal & Plish, 2021; Kofanov et al., 2023; Tymoshenko et al., 2022).

Environmental innovations have a significant potential to increase the productivity of natural resources use and optimise the environment.

The activities of Ukrainian business entities are currently characterised by low innovation activity. Despite the unfavourable conditions of martial law, instability and economic crisis, the introduction of environmental innovations into the practice of enterprise activity is hampered by imperfect mechanisms for stimulating environmentally oriented innovation and the lack of an effective system of support from the state (Dvigun et al., 2022a). However, environmental globalisation, integration of the economic environment, and tightening of international product requirements create axiomatic requirements for the need for environmental innovation transformation of the national economic environment (Pakhnenko & Kolomiiets, 2021; Zinchenko & Filenko, 2020). At the same time, investments in renewable energy sources, climate change mitigation through decarbonisation, and the rational use of land are considered priority investments in developing environmentally friendly technologies. In addition, the production and use of biofuels, biogas, and renewable energy sources are promising (Dvigun et al., 2022b).

Environmental innovations contribute to increasing environmental productivity through an effective coordinated vector of activities aimed at developing green energy and sustainable production, a safe environment, and economical resource use. The mechanisms and tools used to implement the system of stimulating the positive dynamics of using environmental innovations in the business environment are diverse, allowing for adaptive flexibility in achieving strategic goals.

Coastal destinations possess a particular potential in the studied concept, as they represent specific marine areas that include natural, historical-cultural, and recreational-tourist resources and have transport infrastructure and a highly developed tourism industry. Coastal destinations ensure the region's competitiveness, so the strategy for managing them requires using mathematical modelling tools to ensure the region's sustainable development.

A promising aspect in this context is applying a multifactorial approach to the ecological-economic modelling of the management of coastal destinations, which synergises factors of industrial development, environmental protection investments, and structural changes in the economy. This approach will allow the selection of optimal management decisions and the formation of effective proposals for further vectors of scientific and practical research in implementing sustainable development requirements into regional policy practices of ecological innovations.

Ecological-economic modelling within the concept of coastal destinations allows for a comprehensive and qualitative analysis of the state of marine areas, evaluation of processes

ISSN: 2408-7920

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Vol. 10, No. 1 (2024), pp. 454-465
http://www.ajaronline.com
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occurring within the coastal destination, development of forecasts and variations for the regeneration of the ecological-economic system, assessment of the effectiveness of decisions aimed at sustainable regional development, and monitoring of their implementation.

For Ukraine, the practical implementation of the course of developing the concept of implementing innovative solutions continues to be a priority of the strategic management paradigm. The global European Green Deal, which has the functionality of Ukraine's primary focus on European integration, envisages the implementation of some initiatives, the main ones being the practical adaptation of several strategies, including the circular economy and intelligent sectoral integration, the adoption of several new versions of regulations and directives in the areas of environmental taxation and liability limits, and financial incentives.

The Ukrainian business sector should adapt its production conditions to the requirements of the sustainable development concept and the European green course by introducing environmental innovations as a prerequisite for optimising the environmental situation through decarbonisation, waste management, renewable energy and environmental management. Environmental innovations create the basis for the gradual achievement of the principles of sustainable development.

In the case of the implementation of an integrated approach to environmental innovation, there is a gradual transformation of the entire system of functioning of the business entity, with the formation of modern principles of green corporate culture (Kharchenko, 2021; Koblianska et al., 2021). At the same time, the main factor that hinders the intensification of the spread of the concept of environmental innovation is the ineffectiveness of stimulating economic and managerial measures, the underdevelopment of market mechanisms for environmental innovation and the convergence of efforts of the state and business, structures in the outlined direction of the interaction. Negative growth in the market for targeted investments, the complication of technological processes, the increase in the amount and types of waste, and imperfect regulatory support only complicate the current situation.

To effectively motivate the undertaking of environmental innovations in the practical functioning of market participants, it is advisable to implement several measures to improve the quality of infrastructure support for the environmental sphere, improve the mechanisms of functioning of the network of institutional elements, intensify the development of information and communication technologies and digital optimisation, which will lead to a rapid increase in the capitalisation of companies and their globalisation integration (Dudnik et al., 2020). Promising areas of the concept under study include the development of the insurance market, including in terms of ensuring business entities against losses from the development and implementation of environmental innovations; intensification of the renewable energy market; and the formation of an effective programme for the development, support and implementation of environmental innovation projects (Sytnyk et al., 2022; Sotnyk et al., 2023).

The priority vector for optimising economic processes is the formation of vertically integrated associations of environmentally oriented business entities, which should include producers of eco-friendly raw materials, end products, and energy-, resource-saving, and environmentally

ISSN: 2408-7920

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Vol. 10, No. 1 (2024), pp. 454-465
http://www.ajaronline.com
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friendly technologies. Particular attention should be paid to establishing an effective system for monitoring and evaluating the effectiveness of implemented technologies and measures within the framework of the innovative environmental development concept.

Given the stable international support for the transformation processes aimed at optimising the socio-economic environment in Ukraine, it seems advisable to use the maximum potential of the business sector's ability to attract innovative opportunities. This process requires reliable regulatory support adapted to the requirements of the new conceptual framework for strategic development based on the principles of sustainable development. In addition, an effective management paradigm prioritising the principles of publicity and digitalisation of controlling processes is seen as a necessary component of this development vector.

Discussion

In order to achieve the anticipated outcomes of the study and the potential for implementing environmental innovation solutions during the transformation of socio-economic processes, it is essential to consider the scientists' findings on the pivotal concepts of circular economy development. It is important to note that the complex process of developing opportunities and directions for implementing environmental innovation and technology projects has led to different approaches to structuring their functionality and level of prospective feasibility. The practical implementation of the concept proposed in the results of this study will allow Ukraine to move forward confidently on the principles of sustainable development, stimulating the introduction of environmental innovations and increasing economic incentives for their implementation.

In particular, some scientists focus on the importance of waste management technologies and the intensification of renewable energy development. In this context, it is worth highlighting scientists (Awan et al., 2021) who pay special attention to the need to develop waste-free technologies and biofuel production, which they see as an effective tool for ensuring energy autonomy, which corresponds to the conceptual framework for establishing and developing a circular economy proposed in this study. To continue, some scholars (Suchek et al., 2021) focus on analysing the basic principles of using renewable and alternative energy sources, considering them an essential factor that contributes to energy security and prevents destructive impacts on the environment, thus creating various opportunities for the development of energy infrastructure and sustainable economic growth.

Several researchers (Shahzad, 2020; Aftab et al., 2023) argue that innovations based on modern technological capabilities and artificial intelligence are vital for supporting sustainable economic development. According to scientists, innovative technologies protect natural resources from degradation and regenerate their potential. Scientists' beliefs are correlated and consistent with this study's findings, emphasising the role of effective interaction between environmental innovations and economic instruments.

The issues of the methodology for assessing the effectiveness of innovation projects are outlined in the works of several scientists (Feng et al., 2022), whose research focuses on the development and practical testing of modern approaches to analysing the effectiveness of

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innovation activities. At the same time, many modern researchers (Li et al., 2021) are convinced that the priority of environmentally oriented innovation is the implementation of environmentally friendly low-waste technological solutions, installing treatment facilities and focusing on producing eco-products. At the same time, Li et al. (2021) interpret environmental innovation activity as the dynamics of socio-economic development.

Most scientists concur on the need to intensify innovation in greening production activities, foster greater synergy between society and nature, and ensure environmental quality and efficient functioning. These scientists' conclusions align with the current study's results in terms of the necessity to expand the scope of scientific inquiry on this topic. This is because most of the practical mechanisms of environmental innovation in the context of the fundamental principles of sustainable development in socio-economic transformations and global market integration require further in-depth research.

CONCLUSION

As a result of the research implementation, the characteristics of trends in utilising the potential of environmental innovation activity within the framework of sustainable development strategy were analysed. During the work, the conviction was formed that the priority directions of development in the studied field are positioned through implementing a series of measures within a unified national development strategy. The proposed concept reflects the variability of effective use of the potential of environmental innovation activity in optimising Ukraine's socio-economic development, relevant to implementing elements of a sustainable climate course and intensifying renewable energy resource utilisation efficiency.

Environmental innovation activity in the modern economic environment of developed countries is seen as an effective tool for optimising the environmental and socio-economic environment, simultaneously positioning itself as one of the pillars to achieve the full realisation of sustainable development principles. The outlined approach can address the issue of reducing the consumption of exhaustible resource potential, ensuring preventive protection and regeneration of the environment, and stimulating the intensification of profitability of economic entities' activities. The implementation of principles of eco-friendliness in economic-production activities, under an effective system of economic and managerial incentives for enforcing innovative environmental solutions, will enable the realisation of a practical concept of rational natural resource utilisation.

The purpose of researching coastal destinations is to accumulate factual data for further effective regional planning. The research substantiates that the mechanisms of ecological-economic modelling of coastal destination management have significant potential as a tool for aligning expenditures on ecological and social goals, balancing economic feasibility, and ecological efficiency within the framework of implementing the paradigm of sustainable regional development.

Implementing several economic and managerial prerequisites is considered necessary for the intensive development of eco-friendliness in production processes and economic activities. Among them, attention should be focused on the need to improve the quality of infrastructure

provision in the environmental sector and improve the mechanisms of functioning of the institutional elements network, stimulating the development of renewable energy, developing the insurance market, and ultimately forming vertically integrated associations of environmentally oriented enterprises. It has been established that the model of environmental balance envisages equal implementation of priorities of social justice, economic efficiency, and environmental imperative. Given the outline, the research proposes a list of principles to be followed to successfully implement the "greening" strategy of the economy.

Given the trend of globalisation of sustainable natural resource management strategies, a more detailed study of the potential of economic incentives and business motivation to implement environmental innovations is a promising direction for future research on the outlined topic.

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