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ECONOMIC ANALYSIS OF ECOLOGICAL CHANGE TRENDS THROUGH THE IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS

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ЕКОНОМІЧНИЙ АНАЛІЗ ТЕНДЕНЦІЙ ЕКОЛОГІЧНИХ ЗМІН КРІЗЬ РЕАЛІЗАЦІЮ ЦІЛЕЙ СТАЛОГО РОЗВИТКУ

Achieving ecological sustainability in the functioning of economies at the macro- and micro levels is one of the key priorities of most countries in the implementation of the Sustainable Development Goals. To accelerate the achievement of the Sustainable Development Goals, it is worth focusing on the formation of quality institutions for the development of an ecological type of economy. The purpose of the article is to analyze current trends in ecological change through the implementation of the Sustainable Development Goals and to provide a reasoned analysis of the achieved ecological transformations in the context of countries of the world by income level.

To achieve the outlined goal, the article uses methods of description, measurement, formalization, generalization, systemic and complex analysis, and cluster analysis of the data processing method, which made it possible to fully process the existing scientific achievements on the issues of greening economies, solve the tasks set for researchers, and outline the prospects for future research.

The results consist of substantiating and revealing the trends of changes in achieving the ecological Sustainable Development Goals in the context of groups of countries of the world by income level. It's indicated that in upper-middle-income and high-income countries, the main ecological challenges remain, but there is a moderate increase in the pace of progress in the areas of access to clean water, sanitation, and renewable energy. The authors noted that the unresolved issue in the field of water purification and proper sanitation remains the scarce water consumption embodied in the import and withdrawal of fresh water. It's argued that the consistent practice of greening testifies to the further development of various forms of entrepreneurial activity, which becomes possible in the coordinate system of forming the basis of a circular and "net zero" economy.

The practical value of the study lies in the fact that the authors expressed the opinion that accelerating the implementation of greening issues requires coordination or harmonization of efforts at the sectoral, regional, and national levels. Scientists insist on the fact that ecological development is ensured by technical and technological changes observed in industry and production.

Досягнення екологічності у функціонуванні економік на макро- і мікрорівні є одним із пріоритетів країн в ході реалізації Цілей сталого розвитку. Для пришвидшення досягнень цих Цілей варто зосередити увагу на формуванні якісних інститутів розвитку екологічного типу економіки.

Мета статті полягає в тому, щоб проаналізувати сучасні тенденції екологічних змін крізь реалізацію Цілей сталого розвитку та надати аргументований аналіз досягнутих екологічних трансформацій в розрізі країн світу за рівнем доходу в 2024 році в порівнянні з 2023 роком. Для досягнення окресленої мети в статті застосовано методи опису, вимірювання, формалізації, узагальнення, системного та комплексного аналізу, кластерний аналіз методу обробки даних, що дало змогу в повній мірі опрацювати наявні наукові здобутки з питань екологізації економік, розв'язати поставлені перед дослідниками завдання і окреслити перспективи майбутніх досліджень.

Результати полягають в розкритті тенденцій змін у досягненні екологічних Цілей сталого розвитку у розрізі груп країн світу за рівнем доходу. В країнах з доходом вище середнього і з високим рівнем доходів екологічні виклики залишаються, але простежується помірне зростання темпів в частинні питань наявності чистої води, використання відновлювальної енергії. Не вирішеним питанням щодо очищення води і належних санітарних умов залишається дефіцитне споживання води, втілене в імпорті та заборі прісної води. Аргументовано, що послідовна практика екологізації засвідчує розвиток підприємницької діяльності, який стає можливий в системі координат формування базису циркулярної та "чистої нульової" економіки.

Практична цінність дослідження полягає у тому, що пришвидшення реалізації питань екологізації вимагає координації або гармонізації зусиль на галузевому, регіональному та національному рівнях. Науковці наполягають, що екологічний розвиток забезпечується техніко-технологічними змінами,

що спостерігаються в промисловості і виробництві. Варто екологічне відновлення реалізувати шляхом створення якісної екосистеми національних економік та розвитку інклюзивної цифрової екоінфраструктури.

Key words: *greening, economic effects, ecological footprint, ecological restoration, responsible consumption, renewable energy.*

Ключові слова: *екологізація, економічні ефекти, екологічний слід, екологічне відновлення, відповідальне споживання, відновлювальна енергія.*

Statement of the problem in general terms. The implementation of the Sustainable Development Goals (SDGs) is one of the priority policies that government officials strive to adhere to. The issue of ecological sustainability in the course of economic reconstruction and the development of entrepreneurship and business remains one of the key ones for Ukraine. It's ecological sustainability and technological progress that are the basis on which economic growth and innovation of economies are built. The implementation of the SDGs through technological modernization and social justice is important. The formation of ecosystems of national economies that develop on the basis of the SDGs are priority tasks for most countries in the world.

Energy use is a critical component of both economic growth and ecological sustainability. The transition to renewable energy sources is important for reducing greenhouse gas emissions and mitigating the effects of climate change. But this transition must be made in a way that supports economic growth and social development [1, p. 2]. Technology and engineering open up new opportunities for achieving the SDGs, but at the same time they exert socio-economic pressure on society and the economy. Green and disruptive social innovations aim to shape a new socio-economic and ecological order for entrepreneurship and business. It's necessary to analyze the achievements that have already been actually implemented in order to have an idea of what needs to be done in the near future to achieve the effective implementation of the SDGs.

Analysis of recent research and publications. We consider the scientific achievements of S. Parvathy and V. Kolil to be valuable, as the researchers presented the integration of the SDGs in understanding the life cycle of business and entrepreneurship. We are talking about the life cycle from raw materials, its production, transportation, and disposal to the calculation of various indicators for decision-making, which is recorded in the process of diversity in business, namely: technical, ecological, social, and taking into account geographical parameters and territorial boundaries for entrepreneurship [2, p. 4]. Foreign scientist H. Islam devoted his scientific research to clarifying the role of technological progress and green innovations through the prism of the relationships between the SDGs and ecological and socio-economic factors [3].

The development of climate change measures and the SDGs was undertaken by A. Dagnachew, A. Hof and D. Vuuren [4]. They concluded that "in all regions of the world, there are significantly more synergies than trade-offs between climate action and other SDGs. However, the extent of these synergies and trade-offs varies depending on the regional and socio-economic context" [4, p. 4]. Scientists F. Campos and P. Cabral conducted an in-depth analysis of the ecological and economic benefits and benefits that can result from the preservation of ecosystems for the protection of services [5]. Ecological restoration for future sustainability in a changing environment was studied by scientists Y. Choi, E. Allen and K. Torok [6].

The focus of our scientific attention was drawn to the studies devoted to the contribution of governance, energy, and growth through the lens of the SDGs and ecological efficiency by foreign scholars M. Naseer, A. Hunjra and T. Bagh [1]. They considered potential endogeneity problems using advanced econometric methods and investigated the different impacts of energy sources, governance structures, and economic factors on ecological sustainability [1, p. 1]. The study of the level of public awareness and perception of the ecological impact and responsibility for plastic pollution was carried out by scientists M. Ibrahim, A. Saba and A. Ojewole [7]. Scientists argue that it is urbanization, industrialization

and illiterate waste management, inefficient infrastructure that are the cause of high levels of ecological pollution.

Researchers V. Fiore, M. Borrello and L. Roselli provided a reasoned assessment of the food production system, emphasizing the need for balance and the necessity between short-term economic goals and long-term economic, social, and ecological goals [8, p. 30]. Scientists A. Dobson, S. Pimm and J. Ahumada published an article devoted to the issue of wildlife conservation through the prism of economics and ecological sustainability [9]. The study of ecological economics as a science of sustainable development and transformation through the prism of the integration of entropy, sustainable scale, and justice was previously studied by researchers B. Haddad and B. Solomon [10].

The scientific achievements of the actors K. Kraus, N. Kraus and Ye. Kyryliuk in the work "Entrepreneurship. Industry. Economy: Imperatives of Institutional Change and Phenomenology of Digital Transformation" deserves attention, where scientists emphasize the need to solve the modernization of businesses in terms of greening and digitalization of their activities [11]. The works of Yu. Radzikhovska [12], N. Kraus and K. Kraus [13] are devoted to revealing the socio-economic effects of the functional interaction of the biogrowth economy and the "green" economy in the context of digitalization and ecologization, and the peculiarities of the development of ecological franchising.

Formulation of the article's goals. The purpose of the article is to conduct an in-depth analysis of trends in ecological changes through the implementation of the SDGs, to present their ecological update; to indicate the characteristic features of the implementation of the SDGs by income level in 2024 compared to 2023 in terms of groups of countries in the world; to identify individual indicators that reflect countries' compliance with the ecological SDGs in terms of regions of the world and groups of countries by income as of 2024; to present the status and dynamics of changes in the main indicators of the countries of Eastern Europe and Central Asia in terms of some ecological SDGs as of 2024.

In pursuit of the goal of the article, a thorough publication database was taken as a basis. A significant role belongs to theoretical developments presented in scientific articles of rated publications indexed in the Scopus database, which are characterized by high quality of articles and their openness. The information sources of data for the study were the reporting materials of Dublin Press, "Sustainable Development Report 2024. The SDGs and the UN Summit of the Future" [17], which cover information by country on the implementation of the SDGs through the prism of ecological friendliness. This made it possible to carry out a qualitative comparative analysis by countries and regions regarding their ecological orientation, namely: clean water and proper sanitation, use of renewable energy, responsible consumption, protection of the planet, ensuring life underwater, ensuring life on land. The presented materials of the Sustainable Development Report 2024 provide an idea of the actual state of affairs in the field of greening economies, laying the foundation for meaningful research.

The article uses various methods, in particular dialectical, which allows substantiating the cause-and-effect relationships between economic growth and ecological and digital development; to indicate the quality of the processes of differentiation and integration of ecological processes into business and economies in general. Such theoretical methods as formalization and generalization allowed to present the process of formation of common properties and features of the SDGs for different groups of economies. Cluster analysis of the data processing method helped to present trends in ecological changes in the economies of groups of countries by income as of 2024. Description and measurement methods made it possible to provide indicators of the regional SDGs Compliance Index and indicate a statistical efficiency index by regions of the world and groups of countries by income as of 2024. Methods of systemic and comprehensive analysis were applied in revealing the SDGs through the prism of ecological issues.

Presentation of the main research material. Ecological restoration is a tool for climate change mitigation and adaptation, but its outcomes are themselves vulnerable to the impacts of climate change [14, p. 300]. Ecological restoration has

the potential to become an integral component of sustainable natural capital management in production systems [15, p. 7]. “Good governance plays a key role in the successful implementation of sustainable development initiatives. Good governance ensures effective policy implementation, efficient resource allocation and appropriate stakeholder engagement” [1, p. 2]. It’s digital technologies such as artificial intelligence, the Internet of Things, and blockchain that have every chance of improving data analysis and transparency in sustainable business practices [2, p. 26]. Climate change poses a significant challenge to the long-term effectiveness of ecological restoration initiatives. For this reason, assessing climate change risks is vital in the design and implementation of ecological restoration [14, p. 307].

Most countries in the world strive to fully comply with the SDGs. The priorities are issues of ecological friendliness, socialization, and innovation. However, it will take two or even three decades to achieve the desired results. We proceed from the fact that a comparison of trends in the achievement of ecological SDGs in the context of groups of countries of the world by income level in 2024 compared to 2023 shows slow progress (Table 1). The balance of economic and ecological values can be useful for improving the results of nature conservation [8]. The most studied ecosystem types are forests, peatlands, grasslands, lakes, and wetlands. The four less studied ecosystem types are marine, coastal, riverine, and tundra [16, p. 8] in most countries of the world.

Table 1. Trends in the achievement of ecological SDGs by income group of countries in the world in 2024 compared to 2023*

SDGs	Country groups by income level			
	Low-income	**Above average income**	**High income**	**World average**
Goal 6 – Clean water and sanitation	MCR, S	MCR, MI	MCR, MI	MCR, S
Goal 7 – Affordable and clean energy	MCR, S	MCR, MI	MCR, MI	MCR, MI
Goal 12 – Responsible consumption and production	SDGA, on track	MCR, S	SCR, S	MCR, S
Goal 13 – Climate action	SDGA, MI	MCR, S	SCR, S	MCR, S
Goal 14 – Life below water	MCR, D	SCR, S	MCR, S	SCR, S
Goal 15 – Life on land	MCR, S	SCR, S	SCR, S	SCR, S

Source: compiled based on source data [17, p. 23].

**MCR – Major challenges remain; SCR – Significant challenges remain; MI – moderately increasing; S – stagnation; D – decreasing; SDGA – SDG achievement.*

Thus, in upper-middle-income and high-income countries, the main challenges remain, but there is a moderate increase in the pace of progress in the areas of access to clean water, sanitation, and renewable energy. In lower-middle-income countries, the critical issues are responsible consumption and participation in protecting the planet. Stagnation is characteristic of these countries in ensuring life on earth and maintaining sanitation. In the group of low-income countries, progress is observed in the areas of responsible consumption and protecting the planet. Stagnation is evident in sanitation, renewable energy, and underwater living conditions (Table 1). But "new integrated landscape approaches to land and water conservation and restoration have every chance of providing opportunities for broader implementation of ecological restoration" [15, p. 8].

Currently, there's a positive relationship between renewable energy consumption and the quality of governance with ecological sustainability, while there's a negative relationship with non-renewable energy consumption. Economic growth is becoming a crucial factor affecting both ecological sustainability and the achievement of the SDGs [1, p. 1]. However, the impact of technological progress and green innovation on the implementation of the SDGs is moderated in most countries of the world. At the same time, "the moderation of green innovation leads to a negative relationship between economic factors and the SDGs, but a positive relationship between social factors and the SDGs, which highlights the complexity of achieving quality sustainable development" [3, p. 1].

An analysis of trends in the achievement of the ecological SDGs by group of countries in the world by region in 2024 compared to 2023 shows progress in addressing the issues of renewable energy use and planetary protection by Latin American and Caribbean countries; OECD member countries on the issue of adequate sanitation and water purification; sub-Saharan African countries on the issue of renewable energy distribution; and Oceania countries in their participation in planetary protection (Table 2).

A number of threats to the natural environment are directly linked to climate change, including more intense and frequent extreme weather events and rising sea

surface temperatures. Other threats are the result of tangible human actions, while some are the result of deliberate actions that are then further exacerbated by climate change, such as invasive species and the spread of diseases [14, p. 304].

The ecological component of life support underwater and the ecological component of life support on land remained unchanged in 2024 compared to 2023 in all countries in the following world regions, namely: East and South Asia, Latin America and the Caribbean, Middle East and North Africa, Oceania, OECD members, Small Island Developing States, and Sub-Saharan Africa (Table 2).

Table 2. Trends in the achievement of the ecological SDGs by group of countries in the world by region in 2024 compared to 2023*

SDGs	Regions of the world							
	BRICS+	**East and South Asia**	**Eastern Europe and Central Asia**	**Latin America and the Caribbean**	**Middle East and North Africa**	**Oceania**	**OECD members**	**Sub-Saharan Africa**
Goal 6 – Clean water and sanitation	SCR, MI	SCR, MI	SCR, S	SCR, MI	SCR, MI	MCR, S	CR, MI	MCR, S
Goal 7 – Affordable and clean energy	SCR, MI	SCR, MI	MCR, S	CR, on track	MCR, S	MCR, S	SCR, MI	MCR, S
Goal 12 – Responsible consumption and production	SCR, S	SCR, S	SCR, S	SCR, MI	SCR, MI	DA	SCR, S	SDGA, on track
Goal 13 – Climate action	SCR, S	SCR, S	SCR in, S	CR, on track	MCR, MI	CR, on track	MCR, S	CR, on track
Goal 14 – Life below water	MCR, S	MCR, S	DA	MCR, S	MCR, S	MCR, S	SCR, S	MCR, MI
Goal 15 – Life on land	MCR, S	MCR, S	MCR, S	MCR, S	MCR, S	MCR, S	MCR, S	MCR, S

Source: compiled based on source data [17, p. 23].
**MCR – Major challenges remain; SCR – Significant challenges remain; MI – moderately increasing; S – stagnation; CR – Challenges remain; DA – Data not available; SDGA – SDG achievement.*

Compliance with the ecological SDGs by countries by world regions and income groups as of 2024 (Table 3) demonstrates the fact of leadership in the

observance of ecological values by the countries of Eastern Europe and Central Asia (70.6), Latin America and the Caribbean (70.2), and OECD members (77.2). The statistical performance index shows that the worst state of affairs in compliance with ecological issues and implementation of the SDGs is in the countries of Oceania (48.0); small island developing states (58.2); and sub-Saharan Africa (60.5).

Table 3. Selected indicators reflecting countries' compliance with the ecological SDGs by world regions and income groups as of 2024

World regions / country groups by income	Regional SDGs Compliance Index	Statistical efficiency index	Missing data in the SDGs Index
BRICS	67.9	69.0	1%
BRICS +	67.0	69.0	1%
East and South Asia	66.5	69.5	0%
Eastern Europe and Central Asia	70.6	77.1	6%
Latin America and the Caribbean	70.2	73.8	0%
Middle East and North Africa	65.6	64.5	3%
Oceania	52.5	48.0	31%
OECD members	77.2	90.3	1%
Small Island Developing States	64.6	58.2	20%
Sub-Saharan Africa	53.7	60.5	0%
Low-income countries	*51.0*	*55.9*	*0%*
Lower-middle-income countries	*63.2*	*71.7*	*0%*
Upper-middle-income countries	*71.0*	*68.3*	*0%*
High-income countries	*77.6*	*89.9*	*0%*
World average	*66.3*	*72.0*	*0%*

Source: compiled based on source data [17, c. 470–498].

Economic growth can drive investment in sustainable development of territories and technologies. However, it poses significant risks to ecological quality if not managed properly. Effective policies that promote the development of disruptive and green technologies, increase energy efficiency, and ensure compliance with sound ecological standards. Effective laws are essential to harness the benefits of economic growth while mitigating its negative ecological impacts [1, p. 5]. Green innovation promotes the adoption of environmentally friendly technologies and practices, accelerating the transition to a more sustainable future and creating an economically prosperous, ecological sustainable and socially inclusive world [3, p. 4].

In the transport sector, additional spending on improving fuel efficiency or promoting zero-emission electric vehicles can help achieve the SDGs. "Fiscal

incentives, improved consumer information, fare discounts, low-emission zones, and charging infrastructure support schemes" can help achieve the SDGs faster [4, p. 45].

Analyzing dynamics of changes in the main indicators of the countries of Eastern Europe and Central Asia in the context of some ecological SDGs according to the recorded data for 2024, it is worth noting that the unresolved issue in the water purification and proper sanitation sector remains the scarce water consumption embodied in imports (1,213.5 m^3 H^2O per capita) and freshwater withdrawal (30.8% of available freshwater resources). According to the Renewable Energy Goal (Table 4), a stagnation trend in these countries is observed in the share of CO^2 emissions from fuel combustion per total amount of electricity generated (2.9 $MtCO^2$/TWh) and the share of renewable energy in total final energy consumption (9.3%).

Table 4. Status and dynamics of changes in the main indicators of the countries of Eastern Europe and Central Asia in the context of some ecological SDGs as of 2024*

SDGs	Indicator value	Year	Status in achieving the SDGs	Trends of change
Goal 6 – Clean water and sanitation				
Population using at least basic drinking water services (%)	94.7	2022	CR	On track
Population using at least basic sanitation services (%)	88.9	2022	CR	On track
Freshwater withdrawal (% of available freshwater resources)	30.8	2021	CR	S
Anthropogenic wastewater that receives treatment (%)	14.9	2020	MCR	DA
Scarce water consumption embodied in imports (m^3 H^2O eq/capita)	1.213.5	2024	CR	S
Goal 7 – Affordable and clean energy				
Population with access to electricity (%)	99.7	2021	SDGA	On track
Population with access to clean fuels and technology for cooking (%)	77.6	2021	CR	Slowing down
CO^2 emissions from fuel combustion per total electricity output ($MtCO^2$/TWh)	2.9	2022	MCR	S
Renewable energy share in total final energy consumption (%)	9.3	2021	MCR	S

SDGs	Indicator value	Year	Status in achieving the SDGs	Trends of change
Goal 12 – Responsible consumption and production				
Municipal solid waste (kg/capita/day)	0.9	2019	SDGA	DA
Electronic waste (kg/capita)	8.8	2019	SCR	DA
Production-based air pollution (DALYs per 1,000 population)	8.3	2024	SCR	S
Nitrogen emissions associated with imports (kg/capita)	27.0	2024	CR	MI
Exports of plastic waste (kg/capita)	9.4	2024	SDGA	S
Municipal solid waste (kg/capita/day)	0.5	2023	SDGA	DA
Goal 13 – Climate action				
CO^2 emissions from fossil fuel combustion and cement production (tCO^2/capita)	6.9	2022	MCR	S
GHG emissions embodied in imports (tCO^2/capita)	1.7	2021	CR	S
CO^2 emissions embodied in fossil fuel exports (kg/capita)	5.384.9	2023	SCR	DA
Goal 14 – Life below water				
Mean area that is protected in marine sites important to biodiversity (%)	DA			
Ocean Health Index: Clean Waters score (worst 0 – 100 best)	DA			
Fish caught from overexploited or collapsed stocks (% of total catch)	DA			
Fish caught that are then discarded (%)	DA			
Marine biodiversity threats embodied in imports (per million population)	DA			
Mean area that is protected in marine sites important to biodiversity (%)	0	2018	SDGA	DA
Goal 15 – Life on land				
Mean area that is protected in terrestrial sites important to biodiversity (%)	38.0	2023	MCR	S
Mean area that is protected in freshwater sites important to biodiversity (%)	39.6	2023	MCR	S
Red List Index of species survival (worst 0 – 1 best)	0.94	2024	SDGA	On track
Permanent deforestation (% of forest area, 3-year average)	0	2022	SDGA	S
Imported deforestation (m^2/capita)	3.5	2022	SDGA	On track

Source: compiled based on source data [17, p. 477].
**MCR – Major challenges remain; SCR – Significant challenges remain; MI – moderately increasing; S – stagnation; CR – Challenges remain; DA – Data not available; SDGA – SDG achievement.*

The implementation of SDG 12 "Responsible Consumption" by the countries of Eastern Europe and Central Asia (Table 4) in terms of ecological performance is characterized by stagnation in industrial air pollution (8.3 DALYs per 1,000 population); air pollution related to imports (2.8 DALYs per 1,000

population); and nitrogen emissions related to imports (9.4 kg/capita). Under SDG 13 “Protect the planet”, the countries of Eastern Europe and Central Asia haven’t made any positive progress in reducing CO^2 emissions from fossil fuel combustion and cement production (6.9 tCO^2/capita); and greenhouse gas emissions embodied in imports (1.7 tCO^2/capita). SDG 14 “Ensuring life below water” in the Sustainable Development Report 2024. The SDGs and the UN Summit of the Future isn’t fixed as of 2024. An analysis of the components of SDG 15 “Ensuring life on land” showed that stagnation was observed in the indicators of the average area protected in terrestrial areas important for biodiversity (38.0%), the average area protected in freshwater areas important for biodiversity (39.6%), and continued deforestation (0.0% of forest area, average over 3 years).

“The ratio of biocapacity to ecological footprint provides a single descriptor of reserves (greater than unity), equilibrium (equal to unity), or deficit (less than unity) in the ability of a region to support its existing ecological economy” [10]. Ecosystems are dynamic and constantly changing their structure, composition and function due to complex interactions between species, climate change and its variability [15, p. 10]. Ecological economics provides an opportunity for alternative intellectual directions for solving the problem of sustainable development. The biophysical realities of planet Earth and the human desire for justice should shape and influence the structure and outcomes of ecological economics [10]. Eco-schemes provide significant increases in soil organic carbon compared to cross-compliance. Practices that include plant covers are more effective than using pruning residues for mulching. Organic carbon accumulation increases rapidly during the first five to ten years and then slows down. Cost-benefit ratios of implementing eco-scheme policies are greater than unity when considering organic carbon alone [18, p. 1]. Increasing soil organic carbon in cropping systems consistently leads to increased yields, although the magnitude of this increase depends on the specific practice and agroclimatic conditions [15, p. 13].

Mitigating climate change requires coordination or harmonization of efforts at sectoral, regional, and national levels. For example, emissions in some industrial sectors may be difficult to reduce due to technological features and the need for high-temperature heating, such as in the cement, steel, and chemical industries. In most regions, space heating and water supply account for the largest share of final energy consumption in buildings, and most of this energy is still produced from fossil fuels. This offers great potential for reducing emissions in buildings by phasing out the use of oil-fired boilers in old and new buildings. Existing technologies such as heat pumps, electric boilers, solar heating systems, and district heating are obvious alternatives [4, pp. 6, 9–10].

In the near term, it is worth focusing on "integrating the economic perspective of ecological services into some ecological interface, providing a practical way to integrate biodiversity issues into land-use planning" [5]. Ecological restoration improves the supply of many ecosystem goods and services, significantly expanding the range of beneficiaries beyond traditional local land management perspectives [15, p. 25]. There's an urgent need for targeted educational and policy interventions for quality waste management, overcoming inequalities influenced by socio-demographic factors. Effective collaboration between government agencies, businesses, NGOs, and local communities is essential for developing inclusive ecological infrastructure, implementing enabling policies, and promoting responsible waste management practices [7, p. 15].

"Economic growth is a key driver of both ecological and sustainable development. Understanding how economic growth impacts ecological performance and the achievement of the SDGs is critical for developing sustainable development models" [1, p. 2] for all countries in the world. "Technological innovation enables the development of sustainable solutions that increase resource efficiency, reduce ecological impact, and improve the quality of life" [3, p. 4]. Convinced that by fully implementing the SDGs, every country would receive economic benefits from recycling and reusing plastic waste in the

short term, resulting in job creation, income generation and new markets for recycled products [7, p. 20].

Conclusions and prospects for further exploration in this direction. Summarizing the analysis of trends in ecological changes in groups of different countries by income level, it can be argued that for a number of the SDGs, ecological changes are occurring too slowly, which is caused by the short period chosen for analysis; the lack of high-quality, appropriate rules to support ecological activities; insufficient funding and awareness of the population regarding the urgent need to comply with ecological standards; political challenges and wars.

The implementation of the SDGs plays an important role in the formation of high-quality national ecosystems within the framework of existing ecological and innovation policies of countries. On the other hand, compliance with the ecological framework in the course of entrepreneurial activity in various sectors of the economy requires governments to have effective institutional policies in particular digitalization, greening, and innovation. It should not be forgotten that green and breakthrough innovations are the tools that accelerate the implementation of the SDGs. Ecological development is ensured by technical and technological changes observed in industry and production. Consistent practice of greening shows that further development of various forms of entrepreneurial activity is possible in the coordinate system of the formation of a circular and "net zero" economy.

Further scientific research should be conducted in part to search for high-quality integration of AI into the full implementation of the SDGs. In this direction, we believe that research on the impact of technology and engineering on the accelerated achievement of the SDGs would be valuable for the economy; clarifying the role of green innovations for the greening and innovation of the country's economy. An analysis of technical and technological progress in various sectors of the economy with the aim of developing ways and tools for economic growth, social, and ecological recovery would be of scientific value.

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