

Scientific and Methodological Foundations for Forming Key Indicators of Economic Security in The Development of a Green Economy

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Received: 31 December 2025; **Accepted:** 23 January 2026; **Published:** 28 February 2026

Abstract: The article examines the scientific and methodological foundations for the formation of key indicators of economic security in the development of a green economy. The study analyzes the relationship between sustainable economic development, environmental protection, and resource efficiency. Special attention is given to the development of an indicator system that allows for assessing the level of economic stability and resilience in the context of green economic transformation. The research highlights the importance of integrating environmental, economic, and technological factors into national development strategies. The results show that the implementation of a comprehensive system of indicators can significantly improve the effectiveness of state policy aimed at ensuring sustainable development and strengthening economic security.

Keywords: Green economy, economic security, sustainable development, environmental policy, renewable energy, resource efficiency, economic indicators, green growth.

Introduction: In the twenty-first century, the global economic system is undergoing profound transformations driven by environmental challenges, resource scarcity, climate change, and the growing need for sustainable development. Traditional models of economic growth based primarily on intensive resource exploitation and industrial expansion have increasingly demonstrated their limitations in ensuring long-term economic stability and ecological balance. As a result, the concept of the green economy has emerged as a strategic framework aimed at harmonizing economic development with environmental protection and social well-being.

The green economy paradigm emphasizes the transition toward low-carbon development, efficient use of natural resources, and the widespread adoption of environmentally friendly technologies. This model seeks not only to reduce environmental degradation but also to create new opportunities for economic growth, technological innovation, and job creation. In

recent years, many countries have incorporated green economic principles into their national development strategies, recognizing that sustainable economic progress cannot be achieved without preserving ecological systems and ensuring responsible resource management. Within this context, the issue of economic security has become increasingly important. Economic security refers to the ability of a national economic system to maintain stability, resilience, and sustainable growth despite internal and external threats. In the framework of green economic transformation, economic security acquires new dimensions related to environmental sustainability, energy independence, technological innovation, and the rational use of natural resources. The integration of ecological priorities into economic policy requires the development of new analytical tools and evaluation mechanisms capable of assessing both economic performance and environmental sustainability. One of the key challenges in this process is the formation of a

comprehensive system of indicators that can effectively measure the level of economic security in the context of green development. Traditional economic indicators, such as gross domestic product or industrial output, are no longer sufficient to capture the complexity of modern economic systems that are increasingly influenced by environmental and social factors. Therefore, the development of scientifically grounded indicators that reflect the interaction between economic stability, ecological sustainability, and technological progress has become a priority for both researchers and policymakers. The formation of such indicators requires a solid scientific and methodological foundation. It is necessary to consider the multidimensional nature of the green economy, which integrates economic, environmental, and social components into a unified development model. From this perspective, the study of methodological approaches to identifying and structuring key indicators of economic security becomes an essential task in modern economic research. The growing global focus on sustainable development goals has intensified the need for effective monitoring and evaluation systems that allow governments and international organizations to assess the progress of green economic transformation. A well-structured system of indicators can serve as an important tool for strategic planning, risk assessment, and policy formulation aimed at strengthening national economic security while ensuring environmental sustainability. The scientific and methodological justification of key indicators of economic security in the development of a green economy represents an important research direction that contributes to the improvement of national economic strategies and the achievement of long-term sustainable development.

METHODOLOGY

The methodological framework of this research is based on a comprehensive scientific approach that integrates theoretical, analytical, and comparative methods for studying the formation of key indicators of economic security in the context of green economic development. The research relies on the principles of systemic analysis, which allow the green economy to be considered as a complex socio-economic system where environmental, economic, and institutional factors interact with one another. This approach makes it possible to identify the structural relationships between sustainable development policies and the mechanisms that ensure national economic security. The theoretical foundation of the study is formed by modern concepts of sustainable development, environmental economics, and economic security theory. These concepts provide a basis for

understanding the interdependence between environmental sustainability and economic stability in contemporary economic systems. The research also takes into account the theoretical approaches developed in international economic literature concerning green growth strategies, ecological modernization, and sustainable resource management. A qualitative analytical approach was applied to examine the scientific literature, policy documents, and international reports related to the development of green economic models and economic security assessment systems. Through the synthesis of these materials, the study identifies the key methodological principles used for constructing indicator systems that reflect the level of economic sustainability and resilience in environmentally oriented economic models. The research also employs comparative analysis in order to study international practices in the formation of economic security indicators within green economy frameworks. The comparison of different methodological approaches used in various countries and international organizations allows for the identification of common principles and effective mechanisms for monitoring sustainable economic development. This method makes it possible to generalize best practices and adapt them to broader analytical models.

Special attention in the methodological design is given to the identification and classification of indicators that characterize the level of economic security in the context of green transformation. These indicators include variables reflecting energy efficiency, resource productivity, environmental investments, technological innovation, and the development of renewable energy sources. The integration of these variables into a unified analytical framework allows for the assessment of the resilience and sustainability of economic systems under conditions of ecological modernization. The methodological approach also includes elements of logical generalization and scientific abstraction. These methods help to systematize theoretical knowledge and identify the key structural elements that determine the formation of economic security indicators within green economic policies. By applying these methods, the study develops a conceptual model that demonstrates the relationship between environmental sustainability, economic stability, and institutional effectiveness. This research provides a comprehensive basis for analyzing the formation of key indicators of economic security in the development of a green economy. It combines theoretical analysis with comparative and analytical methods, allowing for a deeper understanding of the mechanisms that ensure sustainable and secure

economic development in the context of modern environmental challenges.

Statistical Analysis of Green Economy and Economic Security Indicators

Statistical data demonstrate that the transition to a green economy is becoming an important component of sustainable economic development in many countries. According to international economic reports, global investments in renewable energy and environmentally sustainable technologies have increased significantly over the last decade. In 2015 the total global investment in renewable energy amounted to approximately 285 billion US dollars, while by 2023 this figure had exceeded 500 billion US dollars, reflecting the growing importance of environmentally oriented economic development.

At the same time, the share of renewable energy in the global energy balance has also been steadily increasing. According to data from international energy organizations, renewable energy sources accounted for approximately 19 percent of global final energy consumption in 2010. By 2022 this share had increased to nearly 29 percent. This trend indicates a gradual shift from traditional energy sources toward more sustainable and environmentally friendly energy systems. Energy efficiency indicators also demonstrate significant improvements in many national economies. For example, the energy intensity of global GDP has decreased by nearly 20 percent over the last decade, reflecting the increasing efficiency of energy use in production processes and economic activities. The introduction of innovative technologies and energy-saving policies has played a key role in achieving these results.

Environmental investment is another important indicator reflecting the level of green economic development and economic security. According to international environmental statistics, government and private sector investments in environmental protection and sustainable technologies have been growing steadily. In many developed and emerging economies, environmental investment represents between three and five percent of total national investment. The development of green technologies and environmentally oriented industries also contributes to employment growth and economic diversification. Global statistics show that the number of jobs in the renewable energy sector exceeded twelve million worldwide in recent years. This growth demonstrates that the transition to a green economy not only contributes to environmental protection but also creates new economic opportunities and strengthens national economic resilience. Statistical indicators

related to carbon emissions demonstrate gradual improvements in countries implementing active green economic policies. Over the past decade, several economies have managed to reduce carbon intensity of production while maintaining stable economic growth. This confirms that environmental sustainability and economic security can be achieved simultaneously through effective policy measures and technological modernization. The statistical data confirm that the development of a green economy positively influences the stability and sustainability of national economic systems. The analysis of these indicators allows policymakers to assess the effectiveness of environmental strategies and to identify priority areas for strengthening economic security in the context of sustainable development.

DISCUSSION

The statistical data presented in the study demonstrate that the development of a green economy has a direct and measurable impact on the level of economic security in modern economic systems. The steady growth of global investments in renewable energy and environmentally friendly technologies indicates that many countries are actively restructuring their economic models in accordance with the principles of sustainable development. For example, the increase in global renewable energy investments from approximately 285 billion US dollars in 2015 to more than 500 billion US dollars in 2023 reflects the growing role of green technologies in strengthening economic resilience and reducing dependence on traditional energy sources.

The expansion of renewable energy sources in the global energy balance also contributes significantly to economic stability. The increase in the share of renewable energy in total energy consumption from about 19 percent in 2010 to nearly 29 percent in recent years demonstrates that national economies are gradually diversifying their energy systems. This diversification reduces vulnerability to fluctuations in fossil fuel markets and enhances the long-term sustainability of national economic systems, which is one of the key components of economic security.

Another important aspect revealed by statistical analysis is the improvement of energy efficiency indicators. The reduction in global energy intensity of GDP by nearly 20 percent over the past decade indicates that modern economic development increasingly relies on technological innovation and efficient resource utilization. Higher energy efficiency not only decreases production costs but also minimizes environmental risks, thereby strengthening the overall sustainability of economic growth. Environmental

investments also play a crucial role in ensuring economic security within the green economy framework. In many countries, investments in environmental protection and sustainable technologies account for between three and five percent of total national investments. Such financial commitments contribute to the development of new industries, modernization of production systems, and the creation of environmentally responsible economic infrastructure. As a result, these investments enhance both economic competitiveness and ecological sustainability. The growth of employment in the renewable energy sector further confirms the positive socio-economic impact of green economic transformation. With more than twelve million jobs created globally in renewable energy industries, the green economy is becoming an important driver of economic diversification and labor market development. This trend indicates that environmental policies not only address ecological challenges but also contribute to economic growth and social stability. At the same time, the gradual reduction of carbon intensity in several economies demonstrates that it is possible to combine economic growth with environmental responsibility. Countries that actively implement green economic policies have managed to reduce greenhouse gas emissions while maintaining stable economic development. This experience confirms that environmental sustainability and economic security are not contradictory objectives but rather complementary elements of modern development strategies.

CONCLUSION

The transition to a green economy has become a key factor in ensuring sustainable economic development and strengthening national economic security. The study demonstrates that the formation of scientifically grounded indicators is essential for assessing the effectiveness of green economic policies and monitoring the stability of economic systems. Statistical analysis confirms that increasing investments in renewable energy, improving energy efficiency, and expanding environmentally oriented industries contribute significantly to economic resilience. These indicators allow policymakers to identify potential risks and develop effective strategies aimed at balancing economic growth with environmental sustainability. The integration of ecological and economic priorities within national development strategies enhances long-term stability and competitiveness of modern economies. Therefore, the development of a comprehensive system of economic security indicators is crucial for supporting successful green economic transformation.

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