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Green Economy in International Trade: New Regulatory Mechanisms and Impact on Competitiveness

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ABSTRACT

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The relevance of the study is due to the rapid greening of international trade, within which carbon standards, circular production models and environmental regulatory mechanisms increasingly determine the competitiveness of states. The aim of the article is a comprehensive study of the transformations of trade regimes under the influence of the green economy. The methodology is based on systemic and comparative analysis, the use of institutional and economic-ecological approaches, as well as on the generalization of international indicators. As a result of the study, it was found that green mechanisms for regulating international trade significantly reformat global trade flows, shifting the emphasis from price parameters to carbon efficiency, technological modernization and institutional transparency. The paper reveals that environmental indicators are becoming tools for redistributing competitive advantages, and the ability of national economies to integrate environmental standards and low-carbon technologies determines their positions in global value chains. The results obtained made it possible to formulate strategic recommendations for increasing the competitiveness of countries based on the decarbonization of industry, the development of clean technologies, the introduction of national carbon accounting systems and the expansion of international cooperation in the field of the green economy. The practical significance of the study lies in the possibility of using its conclusions to develop state trade and industrial strategies, improve climate policy, support exporters in the transition to low-carbon production models and optimize investment decisions in the field of green modernization.

KEYWORDS

carbon standards, circular production model, value chains, investment decisions, climate commitments.



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СОЦІАЛЬНИЙ РОЗВИТОК: економіко-правові проблеми

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Зелена економіка у міжнародній торгівлі: нові механізми регулювання та вплив на конкурентоспроможність

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СТАТТЯ

АНОТАЦІЯ

Дослідницька

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Актуальність дослідження зумовлена стрімкою екологізацією міжнародної торгівлі, у межах якої вуглецеві стандарти, циркулярні моделі виробництва та екологічні регуляторні механізми дедалі більше визначають конкурентоспроможність держав. Метою статті є комплексне дослідження трансформацій торговельних режимів під впливом зеленої економіки. Методологія ґрунтується на системному та порівняльному аналізі, використанні інституційного й економіко-екологічного підходів, а також на узагальненні міжнародних індикаторів. У результаті проведеного дослідження встановлено, що зелені механізми регулювання міжнародної торгівлі суттєво переформатовують глобальні торговельні потоки, зміщуючи акценти з цінових параметрів на вуглецеву ефективність, технологічну модернізацію та інституційну прозорість. У роботі виявлено, що екологічні індикатори стають інструментами перерозподілу конкурентних переваг, а здатність національних економік інтегрувати екологічні стандарти й низьковуглецеві технології визначає їх позиції в глобальних ланцюгах вартості. Отримані результати дали змогу сформулювати стратегічні рекомендації щодо підвищення конкурентоспроможності країн на основі декарбонізації промисловості, розвитку чистих технологій, запровадження національних систем вуглецевого обліку та розширення міжнародної кооперації у сфері зеленої економіки. Практична значущість дослідження полягає в можливості використання його висновків для розроблення державних торговельних і промислових стратегій, удосконалення кліматичної політики, підтримки експортерів у переході до низьковуглецевих моделей виробництва та оптимізації інвестиційних рішень у сфері зеленої модернізації.

КЛЮЧОВІ СЛОВА

вуглецеві стандарти, циркулярна модель виробництва, ланцюги вартості, інвестиційні рішення, кліматичні зобов'язання.

1. Introduction

The global transition to a green economy is changing the rules of international trade, forming a new architecture of regulatory approaches, where environmental standards act not only as tools for environmental protection but also as a lever of economic competition. The strengthening of climate commitments under the Paris Agreement, the implementation of the Carbon Adjustment Mechanism at the border in the European Union, the growing requirements for the decarbonization of global supply chains, and the rapid development of green financial instruments have created a situation in which traditional trade practices are no longer sufficient to ensure access to goods in foreign markets. Under these conditions, countries that do not adapt their production processes and regulatory regimes to the environmental standards of their partners risk losing some of their competitive positions.

2. Literature Review

A review of scientific sources testifies to the gradual formation of the discourse of the “green economy” and its integration into the field of international trade. At the micro and industry levels, A. Datsenko [1] examines the impact of the CBAM mechanism on the competitiveness of the Ukrainian metallurgy, showing that the increase in the “carbon price” for products imported to the EU simultaneously strengthens the incentives for decarbonization and increases the transaction costs of exporters. The author emphasizes that long-term competitive advantages are formed primarily due to technological modernization and transition to low-carbon energy carriers, and not due to temporary compensation of certification costs. The conceptual dimension of the “quality of growth” is revealed by O. M. Verstyak and A. V. Verstyak [2], who show that modern international initiatives in the field of sustainable development shift the emphasis from a simple increase in GDP to a decrease in the material and energy intensity of production. In their opinion, the integration of climate goals into trade regimes entails a redistribution of competitive advantages from “cheap resources” to “clean technologies” and the institutional capacity to comply with environmental standards.

L. M. Horbach and co-authors [3] substantiate the role of the green economy as a tool for achieving the Sustainable Development Goals, emphasizing the decisive importance of natural capital for long-term productivity and investment attractiveness of the economy. P. I. Yukhimenko and a team of authors [4], comparing the world experience and Ukrainian realities, reveal the institutional “bottlenecks” of the green transition – fragmentation of policies, gaps between fiscal incentives, technical regulation and customs procedures. They emphasize that without aligning these elements, environmental trading instruments (such as CBAM or green taxonomies) can exacerbate market access asymmetries. In the work of O. Marchenko and O. Hrabyn [5], the emphasis is placed on the combination of green and digital transformations as a prerequisite for the post-war recovery of the Ukrainian economy: the authors show that digitalized MRV systems, traceability of supply chains and automated carbon accounting reduce information asymmetries in export markets and create the basis for integration into “green” value chains. In addition, L. Horbach et al. [6] demonstrate that sustainable production is built around three key axes – resource efficiency, ecodesign and innovation capacity, and the clustering of “clean” technologies and the development of local supply networks directly affect the export potential.

The theoretical and methodological basis of the “green economy” as a separate direction of economic thought is developed by A. Samoilenko [7], who systematizes approaches to the interpretation of the green economy in the context of sustainable development and proposes structuring its principles for economic policy. K. Kuznetsova et al. [8] study global trends in the green economy and show how they transform international markets: the authors prove that the introduction of environmental standards and climate commitments gradually changes the structure of supply and demand, causing an increase in the share of “green” goods and services. The study by the GMK Center [9] analyzes the macroeconomic consequences of the introduction of CBAM for the Ukrainian economy, in particular, the risks of reducing exports of energy-intensive products and the need for accelerated industrial modernization, which directly links trade policy with climate policy.

A separate block of literature is formed by works on European climate initiatives as a new framework for international trade. A. Uniat et al. [10] consider the expansion of the EU ETS system as a

tool for global emission reduction and show that its extension to cross-border flows actually sets new standards for market access. The European Green Deal document [11] consolidates the EU's transition to a low-carbon growth model and defines a set of regulatory mechanisms (from the emissions trading system to environmental requirements in industrial policy) that have a direct impact on the conditions of international competition. Taken together, these works form a multidimensional vision of the green economy – from theoretical foundations and national strategies to specific trade instruments and sectoral effects.

Despite this, the available literature only fragmentarily covers the issue of how a set of new “green” regulatory mechanisms – from CBAM and EU ETS to complex strategies such as the European Green Deal – reformats the structure of international trade and redistributes competitive advantages between countries with different levels of institutional and technological readiness. The integral effects of these instruments on trade balances, export structure, business costs, and positioning of states in global value chains remain insufficiently studied. It is this conceptual gap that necessitates a comprehensive study on the transformation of international trade under the influence of the green economy and new environmental regulatory mechanisms.

3. Problem Statement

The article is aimed at studying the transformation of international trade under the influence of the green economy and analyzing how the introduction of new environmental regulatory mechanisms changes the competitiveness of states and enterprises in global markets. To achieve this goal, the article solves the following tasks: to clarify the conceptual foundations of the green economy as a factor in the transformation of international trade regimes; to analyze modern mechanisms of environmental regulation of foreign trade; to formulate strategic recommendations for increasing the competitiveness of national economies in the context of global trade greening.

4. Methods and Materials

The material basis of the study was official documents of the EU and Ukraine regulating climate and trade policy (in particular, acts on CBAM and the EU ETS system), statistical data on the structure of foreign trade and carbon intensity of certain industries, as well as analytical reports of international organizations and specialized research centers. Additionally, scientific publications on the green economy and the transformation of international trade are used.

The paper uses analysis and synthesis to identify the key features of “green” regulatory mechanisms and their impact on the competitiveness of exporting countries, a comparative approach to compare European and Ukrainian approaches to the integration of environmental requirements into trade, as well as elements of economic and statistical analysis to interpret data on the structure of exports and potential business costs for adaptation to new rules. This made it possible to combine regulatory, analytical and quantitative perspectives in assessing the impact of the green economy on international trade.

5. Results and Discussion

The concept of “green economy” first appeared in 1989 in the British government report “The Concept of Green Economy”, prepared by scientists D. Pearce, A. Markandya and E. Barbier. This document laid down the idea that economic growth can and should occur without harm to the environment. In official UN materials, the green economy is defined as a development model that contributes to increasing the well-being of the population and social equality, while reducing environmental risks and scarcity of natural resources. The formation of the concept of green economy was an attempt to create a new strategy for the economic development of mankind, based on harmony between man and the natural environment. This idea is closely related to the concept of sustainable development, which seeks to balance economic, social and environmental objectives. Later, tools for quantifying the “greenness” of economic systems appeared. Thus, in 2009, the international organization GRESB developed the first system of indicators for monitoring the sustainable

development of infrastructure projects in the fields of energy, transport, water supply and social infrastructure. Its rating is based on an assessment of the quality of management, the level of risks and transparency of reporting. And already in 2010, the analytical agency Dual Citizen created the Global Green Economy Index (GGEI) – a global index of the “green” economy, which is now used to measure the progress and effectiveness of green transformations in more than 130 countries around the world. This index has become one of the key tools for international comparison and assessment of the level of environmental responsibility of states [7, p. 100].

Along with the development of the “green” economy, the concept of circular (or circular) economy, which offers a new approach to the use of resources, is becoming more and more popular. Unlike the traditional linear model of “take – produce – dispose”, the circular economy is based on the principle of a closed cycle, where materials and energy are constantly returned to production. As the World Economic Forum emphasizes, the main goal of the circular economy is not just recycling, but the prevention of waste generation at all stages of production and consumption, creating a sustainable economic system that works in harmony with nature [8, p. 32]. Its essence lies in the maximum extension of the life cycle of goods, reuse, repair, recycling and recovery of resources, which reduces the need for new materials and reduces the volume of waste.

One of the key tools for the formation of a “green” economy in international trade was the European Emissions Trading System (EU ETS). Its implementation made it possible to create a market-based mechanism for regulating greenhouse gas emissions, within which enterprises buy and sell emission allowances, which stimulates investments in clean technologies and increases energy efficiency. Since its launch in 2005, the EU ETS has contributed to the reduction of industrial emissions in the European Union (EU) by almost 47%, becoming an example of an economic instrument with a powerful climate effect. One of the most important new mechanisms within the EU’s green trade policy is the Carbon Border Adjustment (CBAM) [9]. This instrument imposes a “carbon tariff” on imported products produced with high CO₂ emissions, thereby leveling the playing field between European and foreign companies. CBAM not only protects the EU internal market from carbon leakage but also encourages trading partners to switch to environmentally friendly production standards, which increases the export attractiveness of enterprises that implement low-carbon technologies. The EU ETS system is gradually being integrated into the global context – the EU is expanding cooperation with Norway, Switzerland, Iceland, and also supports green investments in developing countries through the financing of clean energy projects [10]. Such integration forms a new architecture of international green trade, where competitiveness is determined not only by economic indicators, but also by the carbon efficiency of production.

Global instability caused by the war in Ukraine, energy crises and supply chain disruptions has become a powerful catalyst for the “green transformation” of EU energy policy, directly affecting the structure of international trade and the competitiveness of European businesses. In the context of growing geoeconomics risks, the green economy is turning not only into an ecological, but also into a trade and economic strategy, which determines new rules for the participation of countries and companies in world markets. Until 2022, about 40% of natural gas in the EU was supplied from Russia, but already in 2023, this dependence was reduced to less than 10% due to the active diversification of energy supplies from the United States, Qatar and Norway. Such a reorientation not only reduced the energy vulnerability of the European Union, but also changed the structure of foreign trade flows, directing them towards more sustainable partnerships and green investments. The sharp rise in energy prices in 2022 came as a shock to industry, especially for energy-intensive sectors (metallurgy, chemicals, transport), which forced the EU to step up the implementation of the REPowerEU plan, a comprehensive initiative aimed at deploying renewable energy sources (RES), improving energy efficiency and reducing dependence on fossil fuel imports. This strategy has not only an environmental, but also a clear economic and trade dimension, because it allows you to reduce production costs, stabilize energy prices and increase the export attractiveness of “green” goods. By 2030, the EU plans to increase the share of RES in total energy consumption to 42.5%, while in 2023 this figure has already reached 24.5% (against 17.5% in 2017). The Nordic countries are demonstrating the highest rate of transformation: in Sweden, the share of “clean” energy exceeds 50%, which has made it possible to reduce CO₂ emissions and increase its “green competitiveness” in international trade. Such successes shift the emphasis in the global economy – now the value of a product is determined not only by the cost, but also by its carbon footprint, which forms new standards of market advantage. The decisive

tools of this transition were the European Green Deal [11], Fit for 55 [12] and REPowerEU [13] – a strategic framework that combines economic, environmental and trade objectives. They provide for a 55% reduction in emissions by 2030 (compared to 1990) and the achievement of carbon neutrality by 2050, which directly affects trade regulation. In particular, the CBAM mechanism introduces a carbon tax on imports of energy-intensive products (steel, cement, fertilizers, etc.), stimulating EU partners to eco-modernize. Since 2013, the EU ETS emissions trading system has already reduced industrial emissions by 47%, and in 2022 alone by 7.3%, creating an economic incentive for green investment. In total, the EU will invest more than EUR 580 billion by 2030 in the development of renewable energy, smart grids and the modernization of buildings, which consume up to 40% of all energy in the Union [14]. Thus, the green economy within international trade has become a new paradigm of global competitiveness, where benefits are determined by environmental efficiency, technological innovation and the ability to comply with high climate standards. The EU, thanks to the system of “green” regulatory mechanisms, not only reduces its own energy dependence, but also forms new global trade rules that combine economic growth with environmental responsibility.

With the world’s population growing rapidly – projected to reach 9 billion people by 2050 – the global economy faces a double challenge: the need to maintain sustainable economic growth while preserving natural capital as the basis for future development. In this context, the international community is increasingly recognizing that the traditional focus on GDP alone as the main indicator of well-being is outdated and insufficient. The modern development paradigm is shifting towards the “green economy”, which integrates economic dynamics with indicators of environmental sustainability, social justice and efficient use of resources (Table 1).

Table 1. International Systems, Methodological Approaches and Indicators for Assessing the “Green Economy” in the Context of International Trade and Competitiveness of Countries

System	Organization	Purpose of assessment	Main indicators	Impact on competitiveness
Green Growth Indicators (OECD)	OECD	Monitoring the effectiveness of “green growth”	Resource productivity, natural assets, environmental quality, innovations	Gives a comparative assessment of eco-growth, determines the positions of countries in “green” trade
SEEA (System of Environmental-Economic Accounting)	UN	Inclusion of natural resources in national accounts	Accounting for water, energy, forests, minerals, restoration costs	Increases transparency of green accounting, supports investors and trade policy
WAVES (Wealth Accounting and Valuation of Ecosystem Services)	World Bank	Assessment of natural capital and ecosystem services	Value of ecosystems, contribution to GDP, natural assets	Promotes environmentally friendly financial policies and green investments
GGEI (Global Green Economy Index)	Dual Citizen LLC	Comparative assessment of green policies in 160 countries	Climate, ESG investments, decarbonization, eco-health	Determines the eco-positions of states, affects the attractiveness in trade and investment
LCEI (Low Carbon Economy Index)	PwC	Measurement of CO ₂ Emissions Intensity to GDP	Emissions, energy efficiency, structure of the economy	Promotes the implementation of CBAM and the assessment of carbon competitiveness
GCII (Global Cleantech Innovation Index)	Global Cleantech Group	Assessing the potential of clean technologies	Resources for innovation, results (startups, patents)	Determines the technological readiness of countries for green transformation
SWOT analysis of the “green economy”	OECD, UNEP, EU	Analysis of strengths, weaknesses, opportunities and threats	Strong: innovation, image; Weak: funding; Opportunities: employment; Threats: resistance of the “brown” sectors	Provides a strategic assessment of the development of green policy and export potential

Source: Compiled by the authors based on [15–20].

This approach forms new mechanisms for regulating international trade, where the competitiveness of states is determined not only by the volume of production, but also by carbon neutrality, the level of circularity of production and contribution to global environmental goals. Countries that adapt their financial systems, tax incentives and standards to the requirements of the green transition gain an advantage in international markets – from access to ESG investments to the growth of exports of environmentally friendly products [15]. Thus, the change of emphasis from quantitative economic growth to qualitative growth – focused on welfare and long-term ecological balance – becomes a key factor in the new global competitiveness in international trade.

A comparative analysis of international green economy assessment systems reveals that, despite varying institutional approaches and methodological frameworks, all tools concur on the importance of integrating environmental factors into the trade and competition policies of states. Indicators from the OECD, the UN, the World Bank, PwC and independent analytical platforms form a multidimensional assessment system that combines the measurement of resource efficiency, the natural and monetary valuation of natural capital, technological innovations and the level of decarbonization of economies. This allows countries to get a more accurate and structured picture of their readiness to participate in green global trade. At the same time, the results show that environmental indicators act not only as monitoring tools, but also as factors in the formation of new competitive dynamics. The SEEA and WAVES systems reinforce the importance of natural capital in macroeconomic planning, while the GGEI and GCII affect investment attractiveness by demonstrating technological readiness and the effectiveness of public policies. LCEI is directly related to foreign trade regulatory regimes, in particular CBAM, which makes a low-carbon economic model a key condition for product access to EU markets.

Strengthening environmental requirements in international trade necessitates the reorientation of national economies to long-term development models based on low-carbon technologies, innovations and increased resource efficiency. With instruments such as CBAM, ESG-focused regulation of financial markets, and the growing role of green standards in cross-border supply chains, countries' competitiveness is increasingly determined not by traditional cost factors, but by the ability to integrate environmental dimensions into economic policy and industrial strategy. Under these conditions, the formation of effective strategic approaches requires coordination of industrial, trade, financial and innovation policies in the direction of a "green" structural shift.

The key direction is the modernization of production processes based on energy-efficient and low-carbon technologies, since it is the intensity of emissions that becomes the determining criterion for the admission of products to markets with strict environmental barriers. Increasing the technological readiness of enterprises requires large-scale renewal of industrial assets, support for clean technologies, development of smart energy solutions and stimulation of circular production models that reduce dependence on resource imports and reduce environmental costs. In this context, state support for scientific developments and the implementation of applied research results aimed at decarbonizing heavy industry, agri-food chains and the transport sector are of particular importance.

An equally important strategic element is the development of institutional mechanisms of environmental regulation, which ensure predictability, transparency and compliance with international standards. The introduction of national carbon accounting systems, harmonized with EU and OECD approaches, creates conditions for controlling the real carbon intensity of products, as well as strengthening the position of exporters in negotiations with trading partners. The development of digital environmental reporting platforms, the use of MRV (monitoring, reporting, verification) tools, and the integration of ESG principles into corporate governance are becoming not only requirements of global markets but also factors in the formation of investment attractiveness.

An important role is also played by the formation of competitive "green" sectors of the economy capable of providing added value at the global level. The creation of clusters of clean technologies, the development of green engineering, the production of energy-saving equipment, the bioeconomy and renewable energy form a new industrial framework that meets global decarbonization trends. The presence of such sectors not only reduces dependence on traditional industries with a high carbon load, but also allows countries to integrate into new production chains focused on innovation and environmental efficiency.

A significant factor in increasing competitive positions is the expansion of international cooperation through participation in "green" alliances, partnerships with the EU, OECD, World Bank and other institutions that support environmental reforms. Joint decarbonization projects, the development

of transnational energy corridors, environmentally oriented investment platforms, and increased access to climate finance create opportunities to reduce technological and financial barriers inherent in countries seeking to accelerate the green transition.

It is also important to increase the adaptive capacity of enterprises, in particular small and medium-sized ones, through the development of green financing mechanisms, tax incentives, grant programs and advisory support on environmental modernization. Ensuring access to cheap financial resources is critical in the context of the need for large investments in energy efficiency, renewable energy sources and equipment upgrades. The role of the state is to create favorable conditions for the green bond market, develop guarantee mechanisms and involve international financial institutions in supporting environmental projects.

6. Conclusions

Clarification of the theoretical foundations showed that the green economy has evolved from the primary ideas of ecological balancing of production, formulated in the works of D. Peirce, A. Marchandia and E. Barbier, to a comprehensive development paradigm that integrates resource efficiency, innovation, circularity of production and carbon neutrality. Modern approaches of the UN, the OECD, the World Bank and other institutions confirm that environmental indicators are turning into key elements of economic analysis, determining the real capacity of countries to integrate into global value chains. The analysis of modern environmental mechanisms for regulating international trade has shown that tools such as EU ETS, CBAM, Fit for 55 and REPowerEU form a new architectural dimension of the global economy, where not only the price and quality of goods are important, but also their carbon footprint, energy efficiency and technological modernization. The EU, by introducing a comprehensive system of carbon incentives and barriers, is actually transforming trade rules, shifting them in the direction of environmental responsibility and low-carbon competition. This transformation already has a tangible impact on the structure of energy and trade flows, the pace of industrial modernization and investment policy, which confirms the strategic nature of the green economy as a trade model of the future.

The generalization of international systems for assessing the green economy made it possible to determine that green competitiveness is formed at the intersection of three key dimensions: resource and technological efficiency, institutional quality and innovation capacity. These systems not only record progress indicators, but also actively influence the behavior of states and corporations, as they set standards of transparency, responsibility and investment attractiveness. As a result, environmental indicators become a tool for global redistribution of trade advantages. The strategic recommendations formed in the article showed that increasing the competitiveness of national economies in the context of global greening of trade requires systematic modernization of industrial neo-cluster structures, development of low-carbon technologies, harmonization of carbon accounting with EU standards and strengthening of the institutional infrastructure of environmental management. The ability of states to create incentives for green industry, implement circular models, develop markets for green financial instruments and expand international cooperation will determine their position in the global trading system. It is important that the green transformation concerns not only the manufacturing sector, but also financial architecture, logistics flows, energy security, and digital environmental reporting platforms. Prospects for further research are an in-depth analysis of the impact of carbon regulatory instruments on the sectoral structure of exports and modeling scenarios of long-term competitiveness of countries in the context of the global green transition.

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