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Research Article

Mechanisms for Achieving a Green Economy and Practical Challenges

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Abstract

In light of accelerating environmental degradation, the transition to a green economy is an imperative for achieving sustainable development. This study provides a critical analysis of the international legal and institutional framework governing this transition, revealing a significant gap between normative developments and the institutional framework on one hand, and their practical implementation on the other. The transition faces legal obstacles, including reliance on non-binding voluntary commitments and conflicts between environmental obligations and global trade and investment rules. It also reveals a significant financing gap, as financial flows to developing countries continue to lag behind commitments, in addition to technical barriers related to the costs and transfer of technology. The study further uncovers challenges related to social and distributive justice, where the poorest bear the brunt of the impacts and costs, undermining the principle of common but differentiated responsibilities. These obstacles are attributed to deep-seated structural issues, including the prioritization of short-term national interests over the collective good, the fragmented nature of international commitments, the conflict between economic and environmental systems, and a chronic deficit in financing and equity. The study concludes that genuine progress requires a radical restructuring of the international socio-economic contract, and a shift in global governance from establishing ambitious principles to ensuring their binding, fair, and comprehensive implementation. This is essential to transform the vision of a green economy into a practical reality that achieves sustainability and justice for all.

Keywords

Green Economy, Sustainable Finance, Climate Justice, Global Governance, Financing Gap

1. Introduction

The transition to a green economy—defined as an economic system that enhances human well-being and social equity while significantly reducing environmental risks and resource scarcity—has emerged as a central response to multifaceted planetary crises. Although globally acknowledged, fundamental questions persist regarding the capacity of the international legal framework to facilitate and ensure a just transition. This framework contends with formidable challenges, including the predominance of short-term national interests, vast disparities in state capabilities, and the voluntary nature of numerous commitments, which collectively widen the chasm between international discourse and on-the-ground reality. This study addresses a notable research gap by offering a critical structural analysis that links the shortcomings of legal mechanisms

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with broader global political and economic constraints, thereby furnishing a comprehensive perspective for tackling the dilemma of a "just transition.

2. Research Problem

The core problem investigated in this research is the stark contradiction between the theoretical and normative evolution of the international framework supporting the green economy and its practical inability to achieve a transformation pace commensurate with the scale of environmental challenges. Despite its complexity, the network of principles, agreements, and mechanisms has thus far failed to align global efforts with the objectives of the Paris Agreement. Moreover, the benefits and burdens of this transition are unevenly distributed. This discrepancy stems from a multifaceted interplay of challenges: the non-binding character of many mechanisms [e.g., Nationally Determined Contributions], conflicts between international environmental law and global investment and trade rules, significant financing and technology gaps, and deeply rooted social barriers. This research seeks to unpack this complex problem and analyze its structural underpinnings.

3. Research Methodology

This study adopts a descriptive-analytical approach to examine international legal texts, environmental agreements, and the institutional and financial architecture underpinning the green economy. A critical methodology is also employed to evaluate the challenges and obstacles hindering the practical implementation of these mechanisms. Data are drawn from a range of documentary sources, including international agreements, reports from international organizations, and relevant academic literature.

4. Results and Discussion

4.1. Legal Mechanisms for the Green Economy

Legal mechanisms constitute the regulatory foundation for the green transition and can be categorized into substantive mechanisms [governing principles] and procedural mechanisms [implementation tools].

4.1.1. Substantive Mechanisms [Governing Principles]

(i). The Pollutant Pays Principle

Evolved from an economic recommendation issued by the Organisation for Economic Co-operation and Development [OECD] in 1972 to a firmly established principle, it aims to incorporate environmental costs into polluter accounting through instruments such as green taxes and emissions trading systems. Its early application was demonstrated in the 1975 European Community Directive on Waste [1].

Its effectiveness rests on two pillars: proactive prevention through stimulating pollution-free innovation, and remediation through strict civil liability rules that obligate the polluter to provide compensation and rehabilitation [2].

(ii). The Precautionary Principle

Evolving from an ethical notion in the Stockholm Declaration (1972) to an operational legal mechanism post-Rio Declaration (1992), this principle asserts that "lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures." Its first major application was in the Vienna Convention (1985) and the Montreal Protocol (1987) on ozone-depleting substances—a decision subsequently validated by scientific evidence [3]. Today, it functions not only as a preventive tool but also as an economic driver, steering investments toward safer sectors and fostering clean energy innovation [3].

(iii). The Principle of Common but Differentiated Responsibilities

This constitutes the cornerstone of international environmental justice. Its beginnings were embodied in the Vienna Convention for the Protection of the Ozone Layer and solidified in the United Nations Framework Convention on Climate Change (1992), where Article 4 linked the obligations of developing countries to the fulfillment of financing and technology transfer commitments by developed countries. Its practical application reached its zenith in the Kyoto Protocol, which set binding targets only for industrialized countries, and was subsequently embodied in the Paris Agreement (2015). It rests on two pillars: the common responsibility of all countries for global resources, and differentiated responsibilities, whereby developed countries bear a greater burden due to their historical responsibility [4].

4.1.2. Procedural Mechanisms for the Green Economy

Procedural mechanisms translate broad principles into measurable, monitorable commitments and ensure alignment between national policies and global objectives.

(i). Monitoring and Compliance Mechanisms

These form an interconnected system that ensures transparency, accountability, and commitment, and include:

1) Disclosure and Transparency Procedures:

The Right to Environmental Information: This is a crucial procedural right for effective public participation, as affirmed by the Aarhus Convention (1998). This right translates the theoretical principle into a practical tool that enables the dissemination of environmental impact assessment information, promotes accountability, and directs investments towards green economy prioritie [5].

Transparency and reporting systems: represent the practical application of the right to information and have evolved from traditional monitoring systems to dynamic frameworks such as the enhanced transparency framework in the Paris Agreement [Article 13]. At the legislative level, the European Union's Sustainability Reporting Directive [CSRD] is an advanced model that links environmental and social standards to corporate reporting, thereby promoting transparency and sustainable innovation [3].

2) Monitoring procedures: aim to collect and analyze data to assess progress in implementing commitments. These have evolved from simple national reports to comprehensive systems, such as those stipulated in the Paris Agreement, which are subject to independent technical review reports. Modern technologies [such as satellites and data fusion systems] have also contributed to enhancing the accuracy of monitoring and independent verification of emissions and pollution.
3) Compliance Mechanisms: These represent the final stage, moving from assessment to addressing non-compliance. They have evolved from advisory mechanisms [such as early agreements] to institutional frameworks that combine facilitation [technical and financial support] and enforcement [accountability] dimensions, as seen in the Montreal Protocol and the Kyoto Protocol. This approach continued in the Paris Agreement [Article 15] through a Compliance Committee with a facilitative character [6].

(ii). Planning Mechanisms

Sustainable urban planning relies on an integrated approach that combines environmental, economic, social, and institutional dimensions to translate the principles of the green economy into tangible reality. Environmentally, cities strive to preserve natural capital by incorporating ample green spaces, improving air quality, and enhancing biodiversity. Economically, it seeks to rationalize resource and energy consumption and encourage innovation in sustainable technologies and green investments. Socially, it considers achieving equitable distribution of services, providing affordable housing, and ensuring fair urban transition without excluding any segment of the population. In terms of governance, sustainable planning requires sound management, coordination between different levels, and active participation from all stakeholders, in addition to exchanging experiences with international cities.

There are real-world examples like Curitiba [Brazil] that demonstrate how reliable public transportation [the BRT system since 1974] can reduce car dependency and lower emissions, along with the planting of millions of trees, the creation of dozens of parks, and flood management through green spaces instead of concrete canals. In Freiburg im Breisgau [Germany], particularly in the Vauban district, the city has implemented low-energy building standards since the early 1990s, along with "passive-house" neighborhoods [which produce more energy than they consume], a public transportation network that includes bicycles and pedestrians, and a significant reduction in car use [7].

4.2. Financial Mechanisms for the Green Economy

4.2.1. Sustainable Financing Instruments

Green Bonds: These are defined as investment instruments whose proceeds are allocated to financing environmentally compliant projects [8]. The mechanism began in 2007 with an initiative by the European Investment Bank [EIB] with an issuance of €600 million. The World Bank then issued the first standardized green bond in 2008. Following the adoption of the Paris Agreement, demand for green bonds increased, with cumulative issuances of green and social bonds exceeding $7.5 trillion. For the first half of 2024, issuances reached $636 billion, with green bonds accounting for 60% of the total. Europe accounts for 50% of issuances, followed by Asia Pacific [24%] and North America [7%] [9].

Green loans: an innovative financial instrument, with a global size of approximately US$92 billion in 2021, representing an increase of nearly 80% compared to 2020. They are subject to guidelines approved by the Loan Markets Association [LMA] in 2018 [10].

Green guarantees: a risk-absorbing tool to stimulate private financing. International experience suggests their financing impact can be up to ten times greater than allocated public resources. Globally, The Green Guarantee Company was launched in 2024 with the goal of mobilizing over $6 billion in investments. The European Union's Global Gateway initiative also launched a €6 billion financial guarantee scheme, expected to stimulate investments exceeding €50 billion [11].

4.2.2. Environmental Cost Pricing Tools

Green taxes: are a tool to support green investment by correcting distortions resulting from ignoring the environmental costs of goods and services, such as pollution and its health effects. This fosters incentives to shift towards more sustainable options. Consequently, this system contributes to reducing government spending directed towards addressing pollution effects, thus helping to reshape the economic system to achieve efficiency and fairness [12].

Environmental fees: These are a complementary tool in the environmental pricing package. They impose fees for specific environmental services provided by the state, such as wastewater treatment or waste collection and recycling. While taxes focus on penalizing environmental damage, fees aim to cover the cost of environmental services provided, thus incentivizing companies to improve their environmental performance and invest in more environmentally friendly technologies [13].

Carbon markets: are an innovative economic mechanism that aims to translate the environmental costs of greenhouse gas emissions into financial value. Based on the principle of

"cap and trade," they transform emissions reduction into a tradable commodity. This is achieved by setting maximum emissions limits and allocating trading quotas that allow more efficient entities to sell their surplus to less efficient ones, thus becoming a pivotal tool in the arsenal of global green economy policies. They have evolved since the Kyoto Protocol [1997] and underwent a major transformation with the launch of the European Union's Emissions Trading System in 2005. The Paris Agreement added further momentum, with China launching the largest carbon market in terms of emissions covered in 2021. Its trading value was estimated to exceed $250 billion, although the absence of a binding international framework remains a significant obstacle [14].

4.3. Institutional and Technical Mechanisms for the Green Economy

The green economy relies on an integrated system of institutional and technical mechanisms that mobilize sustainable finance, support technology transfer, and enhance compliance oversight. The effectiveness of these mechanisms is measured by their ability to achieve climate justice, sustainable development, and resilience to climate change.

4.3.1. Institutional Mechanisms: International Institutions Play a Pivotal Role in Financing and Coordination

The World Bank Group: In December 2017, it announced a historic decision to stop financing oil and gas exploration and production projects after 2019, marking a strategic turning point that confirmed the group's commitment to leading the global transition towards low-carbon energy policies, preferring to direct its financing towards a clean energy future [15].

The Global Environment Facility: Established in 1991, it funds approximately 50 climate projects annually. Its activities have contributed to reducing greenhouse gas emissions by 2.7 billion tons, and it has allocated $17.2 billion to green projects.

The Green Climate Fund: Announced in 2009 and operational since 2014, it has allocated $4.6 billion to finance 93 green projects, with $10.3 billion in future pledges. These projects are expected to reduce carbon dioxide emissions by 1.4 billion tons [16].

4.3.2. Technical Mechanisms

Recent decades have witnessed a shift towards a sustainable development model, where environmental protection has become a fundamental pillar of economic planning. The green economy stands out as a practical approach to balancing economic growth with the preservation of natural resources, relying on technological innovation as a key tool.

Energy Efficiency and Renewable Energy

This includes adopting renewable energy technologies [such as solar, wind, and hydroelectric] to reduce emissions, supported by advanced energy storage technologies and smart control systems. The transportation sector is also undergoing a transformation towards electrification and smart technology, with improved traffic flow and reduced consumption through intelligent transportation systems [17].

Sustainable Resource and Waste Management

This relies on technologies such as smart water networks and sensor-assisted irrigation to conserve water, in addition to desalination and wastewater reuse. In waste management, smart sorting and waste-to-energy technologies are implemented, along with advanced composting processes for recycling [18].

Sustainable construction focuses on improving insulation, lighting, and natural ventilation, and using environmentally friendly materials. The environmental performance of buildings is assessed through global systems such as LEED and BREEAM, as well as local systems like Estidama in Abu Dhabi [19].

Green Digitalization and Environmental Governance

Green digitalization is the backbone of the green economy, with smart cities managing their resources through Internet of Things [IoT] networks and artificial intelligence. These platforms proactively improve energy and water efficiency and waste management, and support environmental governance by monitoring emissions and ensuring compliance with green legislation [20].

4.4. Practical Challenges Facing a Just Transition

4.4.1. Legal and Governance Challenges

The fundamental legal dilemma lies in the reliance of the green transition system on voluntary commitments without binding enforcement mechanisms. This makes agreements such as the Paris Agreement more of a pledge-based framework than a legally binding one, as Nationally Determined Contributions [NDCs] remain subject to domestic political will, without effective legal sanctions [21]. This deficiency is exacerbated by its conflict with the international investment protection system, particularly the Energy Charter, which allows investors to sue countries when their profits are affected by environmental policies, creating what is known as the spoiler effect [22].

In addition, international trade rules contribute to widening the gap, as environmental and health standards represent about 65% of non-tariff measures globally, causing losses ranging between 15–20% of the value of developing countries' exports annually, according to UNCTAD reports [23]. Furthermore, the fragmentation of international governance among environmental, economic, and commercial institutions leads to conflicting policies and a lack of a unified strategic vision for the green transition [24].

4.4.2. Economic and Financial Challenges

The financing gap is the most prominent obstacle to a just transition, as the annual need for green investment is estimated at about $1.3 trillion [approximately 2% of global output], while the international pledge to mobilize $100 billion annually has not been implemented, as actual flows have not exceeded $20 billion, a deficit of nearly 80% [25]. The COVID-19 pandemic exacerbated the crisis, increasing global debt by approximately $14 trillion, thus limiting the ability of developing countries to finance the transition. In contrast, the fossil fuel sector faces the risk of stranded assets that could reach $14 trillion, generating widespread political and economic resistance. Confidence in sustainable finance is being undermined by greenwashing, with recorded cases rising from 40 [2018] to 206 [2022] [26].

4.4.3. Technical Challenges

Green technologies suffer from high research and development costs, which limits their adoption in developing countries and small businesses. Furthermore, intellectual property regulations and investment restrictions exacerbate the technology transfer gap, contrary to the Sustainable Development Goals [27]. The negative impact of this is evident in carbon markets, where 15–20% of offsetting projects suffer from environmental integrity imbalances, according to reports from the United Nations Environment Programme.

4.4.4. Social and Cultural Challenges

Emissions data reveals a profound imbalance of justice, with the richest 10% of the world's population contributing approximately 48% of emissions, while the poorest groups bear the brunt of the impacts, contradicting the principle of common but differentiated responsibilities.

Although renewable energy jobs reached 12.7 million [2021], 42% of them are concentrated in China, reflecting an unfair distribution of the gains from the transition [28].

Non-inclusive policies can also lead to green takeovers and the exclusion of local communities. At the consumer level, although 73% of consumers declare their willingness to change their habits, actual practice remains limited due to economic, psychological, and structural barriers [29].

5. Conclusion

This research demonstrates that the just transition to a green economy remains fraught with dilemmas despite advancements in its international legal and institutional framework. A profound gap exists between the aspirations embedded in governing principles and sophisticated mechanisms on one hand, and the reality of implementation setbacks on the other. The core impediment is not a lack of tools, but deep-seated structural issues: the primacy of short-term national interests, the non-binding nature of commitments, conflicts between environmental and economic governance rules, the financing chasm, and social justice deficits. Consequently, a successful transition requires moving beyond technical tweaks to fundamentally restructure the international socioeconomic contract. Global governance must shift from formulating principles to ensuring their equitable and inclusive implementation. Only through such a transformation can the green economy evolve from a slogan that perpetuates the status quo into a genuine collective project that delivers sustainability and justice for all.

Abbreviations

OECD	Organisation for Economic Co-operation and Development
NDCs	Nationally Determined Contributions
EU	European Union
EIB	European Investment Bank
IoT	Internet of Things
SDGs	Sustainable Development Goals
LMA	Loan Markets Association
CSRD	Corporate Sustainability Reporting Directive

Conflicts of Interest

The authors declare no conflicts of interest.

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