EXPLORING THE RELEVANCE OF GREEN GDP: A MULTIDIMENSIONAL TOOL FOR ASSESSING ECONOMIC PROGRESS AND ENVIRONMENTAL PROTECTION

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ABSTRACT

This research paper explores the relevance of Green GDP as a multidimensional tool for assessing the complex relationship between economic progress and environmental protection. The hypothesis posits that while Green GDP is an essential instrument for monitoring interactions between political, economic, environmental, and social forces, it must not be limited to a single dimension. The research evaluates the necessity of such a concept, reviewing the identification, assessment, and selection of Green GDP indicators, and the challenges in data collection and measurement. The GDP has long served as the primary indicator of a country's economic health, reflecting the total monetary value of all goods and services produced within a nation. However, its limitations, particularly its failure to account for environmental degradation and social welfare, have led to the growing call for more comprehensive measures. Green GDP emerged as one such alternative, aiming to include the environmental costs of economic activities, such as pollution and resource depletion. A discussion of the advantages and limitations of Green GDP such as the absence of standardized methodologies and the complexity of quantifying social costs is presented, alongside an exploration of its relationship to economic, social, and environmental domains. Additionally, the paper evaluated key differences between the Green Growth Index and Green GDP. The central hypothesis of this paper is that Green GDP serves as a valuable instrument for monitoring the complex relationships between political, economic, environmental, and social forces. However, it should not be confined to a single-dimensional interpretation but should be seen as part of a broader framework for assessing sustainable development. We explore the necessity for such a measurement, the challenges in its application, and its potential as a critical indicator of sustainable progress.

Keywords: *Green GDP, Green Growth Index, green growth, sustainability, economic indicators, cross-country*

1. INTRODUCTION

The attainment of targeted sustainability levels has largely depended on the capacity of individuals and communities to adapt to emerging challenges, embrace transformative initiatives, and integrate innovations effectively. This involves leveraging advanced technologies, robust databases, systemic frameworks, and efficient information and communication channels. Efforts are directed toward achieving precise, quantifiable objectives designed to eliminate barriers and reduce delays in the transition toward green growth. These initiatives are grounded in the principles of environmental ethics, emphasizing the equitable treatment and respect for all forms of life and non-living entities within the ecological system (Ekonomou and Halkos, 2023). Green GDP emerged as an alternative economic indicator designed to address the shortcomings of traditional Gross Domestic Product (GDP) in accounting for environmental degradation. This research examines the critical need for the Green GDP concept by exploring its identification, assessment, and selection of indicators, as well as addressing the challenges associated with data collection and measurement.

While GDP has traditionally been the primary metric for assessing a country's economic performance capturing the total monetary value of goods and services produced it falls short in accounting for environmental degradation and social well-being. These shortcomings have spurred demand for more holistic measures, with Green GDP emerging as a promising alternative. Green GDP incorporates the environmental costs of economic activities, such as pollution and resource depletion, providing a more nuanced understanding of economic growth's impact. The study highlights both the benefits and limitations of Green GDP, including issues such as the lack of standardized methodologies and the complexity of quantifying social costs. It also explores how Green GDP interconnects with economic, social, and environmental dimensions, emphasizing its role in fostering sustainable development. Furthermore, the research enters into a comparative analysis of Green GDP and the Green Growth Index, shedding light on their distinct approaches and contributions to measuring sustainable progress. This paper hypothesizes that Green GDP provides a valuable tool for monitoring complex, multidimensional relationships between economic growth, environmental health, and social well-being. The goal is to assess the necessity of this new measurement framework, evaluate the Green GDP indicator, and identify its core challenges and limitations.

2. THEORETICAL BACKGROUND

The concept of Green GDP

Green GDP integrates economic and environmental dimensions into a single metric. By adjusting GDP to account for the environmental costs of economic activities such as air and water pollution, deforestation, and loss of biodiversity Green GDP provides a more holistic assessment of a nation’s well-being. Traditional GDP measures only market transactions and economic activity but overlooks the negative externalities associated with these activities (Tomić, 2024; Zheng and Chen, 2024). Green GDP seeks to remedy this by subtracting environmental costs from traditional GDP, thereby presenting a more accurate picture of sustainable economic growth (Stjepanović, Tomić and Škare, 2017). The theoretical foundation of Green GDP lies in its ability to address the "threshold effect" of economic growth. While increasing GDP improves living standards to a certain point, further growth often leads to diminishing returns in terms of social welfare and environmental quality (Tomić, 2024). The Green GDP metric, therefore, challenges the conventional wisdom that economic growth alone can lead to sustainable development. Instead, it emphasizes the need for balanced progress that considers environmental protection and social well-being alongside economic prosperity.

Historical development and applications

The Green GDP concept has gained traction as environmental awareness has increased globally. Over time, international organizations such as the United Nations and the World Bank have adopted Green GDP as part of their sustainability agendas (Nahman, Muhumani and de Lange, 2016). Green GDP's primary advantage is its ability to internalize environmental costs into national accounts. This provides policymakers with a more realistic tool for crafting sustainable development policies. However, significant disadvantages persist, including the complexity of assigning monetary values to non-market environmental goods like clean air and ecosystem services. This challenge is compounded by the lack of a standardized methodology, leading to inconsistencies in cross-country comparisons (Zheng and Chen, 2024). In general, there is a high degree of ambition and political support for the green economy and green growth policies, particularly when these can lead to enhanced social well-being without hindering economic progress. Well-being itself, however, is a controversial and multidimensional concept (Menegaki, 2021).

Today, global economic growth patterns, sustainability issues, perspectives on wealth distribution, concerns about ecological capital degradation, and the lack of international environmental negotiations have become fundamental considerations for policymakers and the political community in understanding the green growth perspective. In recent years, the concept of green growth a term once rarely mentioned, has emerged on the international stage and now occupies a significant place in the political discourse of global economic and development institutions (Jacobs, 2013). Few concepts, following the blueprint of sustainability, have so rapidly entered political and academic discussions as the notion of 'green'. Nevertheless, discussions on green growth in the context of international experiences alleviate concerns about the practical 'greening' of national economies and the priorities agreed upon at the international level. Determining the exact scope of green growth remains a significant challenge for many organizations tasked with promoting it. Currently, numerous indicators tend to link economic, political, social, and environmental aspirations to identify potential synergies, trade-offs, and future prospects revolving around the green economy and growth. It is well known that single-digit aggregate indicators designed for international rankings are not universally applicable. However, until various indicators are integrated into a comprehensive measurement framework, leveraging knowledge from relevant data and statistics essential for tracking progress will not yield satisfactory answers regarding the advancement toward green growth. Without an appropriate measurement framework and robust statistics, the assessment of the green economy is open to subjective interpretations. Reviewing 'green performance' requires reliable statistical data. The task of obtaining relevant information critical for tracking progress and measuring outcomes is further complicated by the lack of recognized methodological principles.

The average difference between Green GDP and GDP across 160 countries, amounting to 7.23%, demonstrates that over a 50-year period, GDP growth was, on average, over 7% higher than Green GDP growth. This indicates that the global economy has indeed been relentless in neglecting environmental concerns, with the ecological dimension of growth largely overlooked in the context of international preoccupation with economic growth. As the statistics reveal, the green perspective has yet to alter global growth patterns and their far-reaching implications for the conventional perception of growth versus green growth (Stjepanović, Tomić and Škare, 2022). The conclusion drawn by Stjepanović, Tomić and Škare (2019) in their study is that the quality of the environment and the levels of economic growth and development vary across stages of development. Specifically, less developed countries tend to achieve higher growth rates at the expense of sustainable economic development. This also implies that not all countries are on the path toward greener growth, regardless of whether their economies are growing in terms of real GDP. In Europe, the picture is clearer: the advanced economies of Northern and Western Europe exhibit very low Green GDP bias, below the average for developed economies in general, while Eastern and Southern Europe show relatively higher bias. Finally, Oceania displays an average difference of 4.87% between Green GDP and GDP, largely due to the disparity in development levels among countries in the region. For instance, Australia and New Zealand have recorded a satisfactory Green GDP bias of 2.30%.

Overview of relevant literature

The empirical literature on Green GDP is growing but remains fragmented. This section reviews key studies on the topic. Numerous international frameworks complement Green GDP by measuring various aspects of the green economy:

- Global Green Economy Index (GGEI): Evaluates 130 countries based on leadership, climate change, market performance, and environmental impact. The index combines expert perception surveys and performance data (GGEI, 2018).

- Green Growth Index (GGI): Developed by the Global Institute for Green Development, this index assesses 115 countries across four dimensions: resource efficiency, natural capital protection, green economic opportunities, and social inclusion. It aligns with global goals like the Sustainable Development Goals (SDGs) and the Paris Agreement (GGGI, 2019).
- OECD Green Growth Indicators: Tracks environmental productivity and quality of life using 26 indicators that span resource use, natural asset base, and economic opportunities (OECD, 2017).
- United Nations Green Economy Progress (GEP): Measures progress using sustainability indicators and weighted comparisons to guide countries toward greener growth (PAGE, 2017).
- European Environmental Indicators: The European Union's Environmental Indicator Report outlines 29 metrics addressing ecological resilience, sustainable growth, and environmental health (Environmental Indicator Report, 2018).

These frameworks, though conceptual and lacking legal mandates, offer valuable tools for addressing global environmental challenges. Methodological diversity ensures their adaptability to national and regional contexts, fostering localized sustainability solutions. Numerous studies have explored Green GDP's development and applications, thus these are just some of the relevant for our study:

- Stjepanović, Tomić, and Škare (2022): Calculated Green GDP for 160 countries, revealing discrepancies between Green GDP and traditional GDP growth rates. They established a methodological foundation for monitoring Green GDP dynamics.
- Qi, Xu, and Coggins (2001): Analyzed environmental damage across 103 countries, noting parallels between GDP and Green GDP growth trends despite varying growth rates.
- Kalantaripor and Alamdario (2021): Studied fossil fuel impacts on Green GDP in China, highlighting fossil fuels' disproportionately larger negative impact compared to renewables.
- Wu and Han (2020): Examined sectoral Green GDP in China, identifying sectors with decreasing environmental impacts over time.
- Islam and Asad (2021): Showed that GDP growth in South Asia could align with Green GDP growth without exacerbating environmental harm.
- Liu (2021): Proposed city-level Green GDP metrics using analytic hierarchy processes (AHP), emphasizing urban-level planning and forecasting as a next step in Green GDP's evolution.

3. DISCUSSION ON THE LIMITATIONS OF THE GREEN GDP INDICATOR

One of the primary advantages of Green GDP is its ability to incorporate the costs of environmental degradation and resource depletion into national accounting. This enables policymakers to better assess the trade-offs between economic growth and environmental sustainability. According to Vimochana (2017), Green GDP helps clarify the role of environmental accounting in economic decisions, promoting policies that enhance long-term sustainability. Additionally, Green GDP can highlight inefficiencies in resource use and encourage the adoption of cleaner technologies, thus fostering green growth.Therefore, we can say that Green GDP is bounded by these challenges:

- *Data availability and quality*: One of the primary challenges in the empirical application of Green GDP is data availability. Many countries lack the detailed environmental data required to calculate Green GDP accurately. Additionally, the quality of data is often uneven, with developed nations having more reliable data than developing countries (Tomić, 2024).

- *Normalization of Variables and Aggregation*: One of the biggest challenges in calculating Green GDP is normalizing diverse environmental and economic variables to make them comparable. Different countries use varying units and methods to measure environmental degradation, making it difficult to aggregate data into a unified framework (Stjepanović, Tomić and Škare, 2022).
- *Lack of standardized methodology*: The absence of a globally standardized methodology for Green GDP is a significant limitation. Without a consistent approach to measuring environmental costs, it is difficult to compare Green GDP figures across countries. This lack of standardization also raises questions about the reliability and accuracy of Green GDP as an economic indicator (Nahman, Muhumani and de Lange, 2016).
- *Subjectivity in assigning weights and values*: Assigning monetary values to environmental goods, such as clean air, water, and biodiversity, introduces a high degree of subjectivity. Different methodologies lead to different results, reducing the objectivity of Green GDP estimates (Zheng and Chen, 2024). This subjectivity undermines the credibility of the indicator, particularly when used for policy-making purposes.
- *Political and institutional resistance*: Green GDP faces resistance from political and institutional actors, particularly in countries where economic growth is prioritized over environmental sustainability. Politicians often prefer to focus on traditional GDP metrics, which show more favourable growth rates, while ignoring the long-term environmental costs of their policies (Tomić, 2024).
- *Trade-offs between economic growth and environmental sustainability*: Green GDP highlights the inherent trade-offs between economic growth and environmental sustainability. While economic growth is essential for improving living standards, it often comes at the expense of environmental health. This trade-off is particularly pronounced in developing countries, where rapid industrialization has led to significant environmental degradation (Stjepanović, Tomić and Škare, 2022).
- *Difficulty in addressing long-term environmental impacts*: Green GDP primarily focuses on current economic activities and their immediate environmental impacts. However, it struggles to capture long-term environmental consequences, such as climate change, biodiversity loss, and ecosystem collapse, which may only become apparent decades after the initial economic activity (Zheng and Chen, 2024).

Despite these challenges, Green GDP offers several advantages over traditional GDP. It provides a more comprehensive measure of economic health by accounting for the externalities of economic activities. This allows policymakers to make more informed decisions that balance economic growth with environmental protection and social welfare. Furthermore, Green GDP can help identify trade-offs between short-term economic gains and long-term environmental sustainability, making it a valuable tool for guiding sustainable development policies (Zheng and Chen, 2024).

4. DIFFERENCES BETWEEN THE GREEN GROWTH INDEX AND GREEN GDP

The differences between the Green Growth Index (GGI) and Green GDP are observed in their specific focuses, methodologies, and purposes in sustainable development analysis. The Green GDP documentation emphasizes the importance of statistical monitoring systems and methodological standards to enable a realistic assessment of green growth in comparison to conventional GDP.

Green Growth Index characteristics

Focus: The Green Growth Index measures countries' progress toward sustainable development through four main dimensions: efficient resource use, natural capital conservation, green economic opportunities, and social inclusion. It aims to assess the level of achievement in alignment with sustainable development goals and international agreements such as the Paris Climate Agreement. *Methodology*: As a composite index, the Green Growth Index integrates various indicators and results from economic, environmental, and social domains. The analysis combines quantitative and qualitative data to provide a comprehensive insight into a country's overall progress toward green growth. *Application*: The index aids in analyzing sustainable development policies by offering a framework for comparing countries in terms of their advancement toward green growth. It enables the identification of synergies and areas requiring further action.

Green GDP characteristics

Focus: Green GDP represents an adjusted version of GDP that incorporates costs associated with environmental degradation and natural resource depletion. It portrays more realistic economic growth by accounting for ecological costs. *Methodology*: The methodological framework for Green GDP involves adjusting traditional GDP by deducting estimated costs of CO_2 emissions, soil degradation, biodiversity loss, and resource depletion. According to research, the calculation of Green GDP uses coherent statistical data on economic and environmental factors to enhance its relevance for sustainable development. *Application*: Green GDP serves as an indicator of economic sustainability, reflecting the extent to which environmental costs are embedded in economic growth. This approach enables policymakers to make decisions that minimize the environmental impact of economic development and ensure the sustainability of natural capital for future generations.

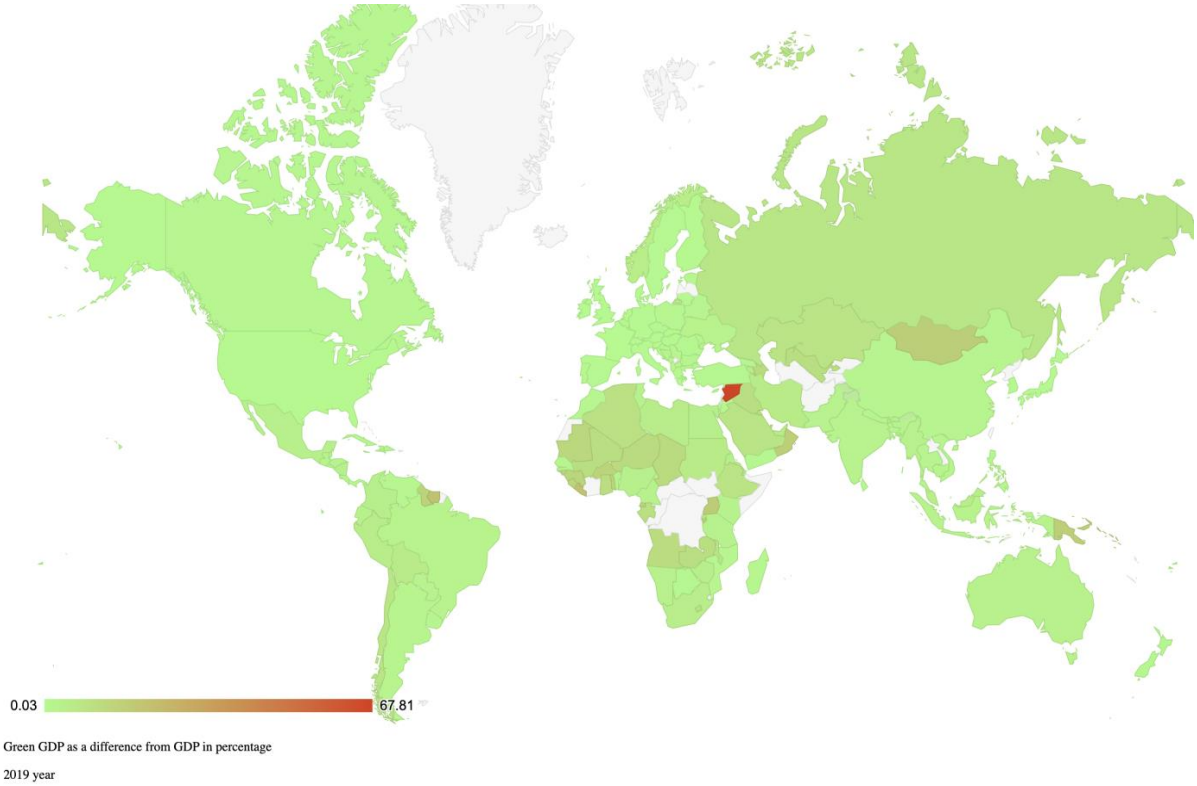
Table 1. Key differences between Green Growth Index and Green GDP

Characteristic	**Green Growth Index**	**Green GDP**
Focus	Green growth and sustainable development	Economic growth adjusted for ecological costs
Methodology	Composite index with multiple indicators	Adjusted GDP reduced by ecological costs
Application	Comparative analysis and evaluation of green policies	Analysis of economic growth with ecological adjustments

Source: Author’s systematization.

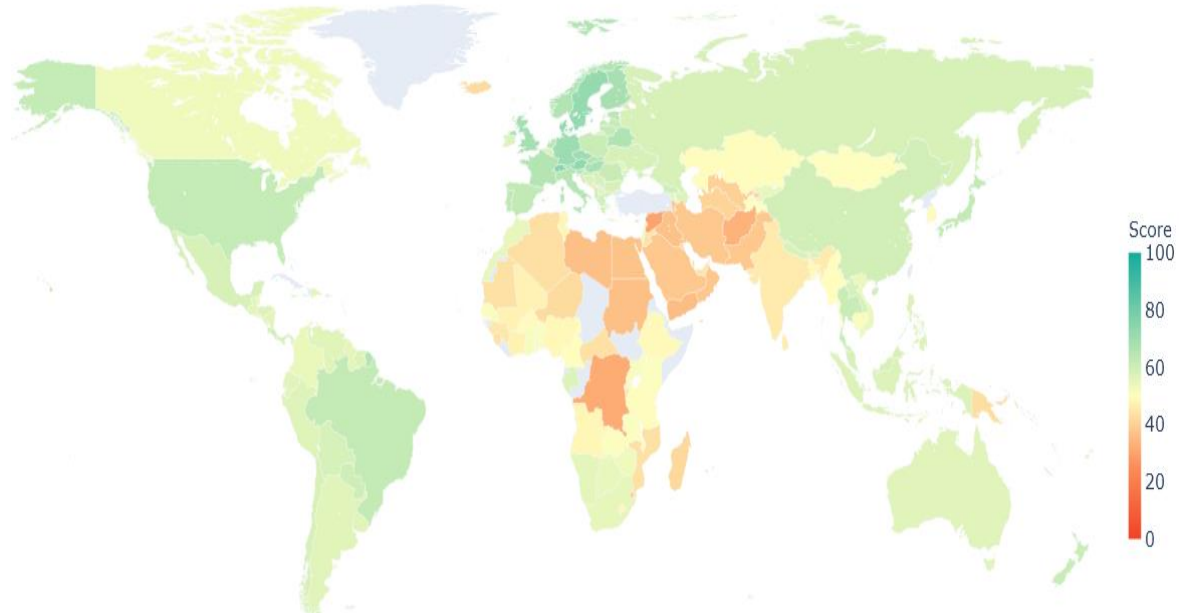
The Green Growth Index is primarily used to monitor progress toward specific sustainable development goals, facilitating cross-country comparisons in their green growth policies. Its purpose involves assessing integrated economic, social, and environmental performance across four dimensions: efficient resource use, natural capital conservation, green economic opportunities, and social inclusion. As such, the Green Growth Index provides a framework for sustainable development and policy evaluation, contributing to the global efforts toward reducing environmental degradation.

Figure 1. Green GDP; cross-country comparison (2019)



Source: Stjepanović, Tomić and Škare (2022).

Figure 2. Green Growth Index; cross-country comparison (2019)



Source: Global Green Growth Index (2019).

A comparison of these indicators for 2019 (and across time) reveals significant alignment in their assessments across countries, reflecting shared trends. Developed countries, such as those in Europe and North America, consistently score higher on both the Green Growth Index and Green GDP. These nations have more resources to invest in clean technologies, enforce strict environmental regulations, and promote sustainable practices. In contrast, developing and underdeveloped countries tend to rely more heavily on natural resources for economic growth, resulting in lower scores for both indicators. For instance, nations in Sub-Saharan Africa and parts of Asia exhibit substantial environmental degradation relative to their GDP output. This relationship underscores a global inequality: wealthier nations generally achieve greater environmental sustainability, while poorer nations face trade-offs between economic advancement and ecological preservation. Bridging this gap requires international cooperation and sustainable development strategies tailored to local contexts.

5. CONCLUDING REMARKS

This paper has explored the relevance of Green GDP as a multidimensional tool for assessing the relationship between economic progress and environmental protection. Green GDP offers significant advantages over traditional GDP by internalizing environmental costs, but it also faces several limitations, including the lack of standardized methodologies and the complexity of measuring social and environmental costs. The widespread adoption of Green GDP would require substantial reforms in how economic and environmental data are collected, measured, and reported. To overcome these challenges, future research should focus on developing more standardized approaches to calculating Green GDP, improving data collection methods, and promoting international cooperation to facilitate cross-country comparisons. Policymakers must balance the short-term gains of economic growth with the long-term benefits of environmental sustainability. Green GDP provides a critical tool for making these trade-offs more transparent and actionable. Additionally, policymakers must recognize the importance of balancing economic growth with environmental sustainability and social well-being to ensure long-term prosperity. Green GDP, despite its limitations, holds the potential to become a critical indicator of sustainable development and should be further refined and adopted as part of a broader framework for assessing national progress. Future research should focus on developing standardized methodologies for calculating Green GDP, improving data availability and quality, and addressing the subjectivity involved in assigning values to environmental goods. Additionally, more empirical studies are needed to test the applicability of Green GDP in diverse economic contexts, particularly in developing countries where environmental degradation is most severe. This topic highlights the need for a newly redefined approach to GDP assessment that incorporates green sustainable development. As a starting point, we focus on the perspective of policymakers, specifically the government of a country, which can leverage the insights from Green GDP to establish far more effective environmental protection policies and address both local and global environmental degradation and climate change. This indicator would provide governments with a clearer picture of real economic development that is not detrimental to ecology and the environment. From the perspective of society and local communities, there is a need to calculate local or regional GDP, including a so-called "live Green GDP," which would enable local governments to respond more quickly and efficiently to specific segments of their local industries and their environmental impact. Green GDP at global, regional, and local levels would also have a significant effect on individuals and consumers. From an individual perspective, consumers could become more aware of the direct impact and scale of their production choices on the environment, potentially influencing their purchasing decisions toward goods that have a lower environmental footprint. Green GDP is not a perfect solution, but it represents a critical step toward addressing the limitations of traditional economic indicators and fostering a more sustainable global economy.

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