

IMPACT OF GREEN FINANCE ON SUSTAINABLE DEVELOPMENT IN NIGERIA.

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ABSTRACT: This study investigates the impact of green finance on sustainable development in Nigeria, focusing on the role of green bonds, green loans, and renewable energy investments. The objectives include examining the relationship between green finance instruments and Green GDP, a proxy for sustainable development, from 2015 to 2024. Using an ex post facto research design, secondary data from Nigerian Development Bank were analyzed. The population comprises all green finance activities undertaken by the Nigeria Development Bank. A purposive sampling technique was used to select data points that reflect NDB's active involvement in green finance during the study period. Descriptive statistics and Ordinary Least Squares (OLS) regression were employed to analyze the data. The results show that green bonds issuance, green loans and credit facilities, and renewable energy investments have statistically significant positive effects on Green GDP. Specifically, renewable energy investments have the most substantial effect, followed by green loans and bonds. The study concludes that green finance plays a critical role in promoting sustainable economic growth in Nigeria. It recommends increasing green bond issuance, expanding green loans, and investing in renewable energy to foster economic resilience and environmental sustainability. Future research should address potential autocorrelation issues in the model to enhance robustness and provide more precise policy recommendations.

Keywords: Green finance, sustainable development, Green GDP, green bonds, renewable energy investments, Nigeria

1.1 INTRODUCTION

The concept of sustainable development has gained significant global attention, particularly in response to climate change, environmental degradation, and resource depletion. The United Nations' Sustainable Development Goals (SDGs) emphasize the need for a balance between economic growth, social inclusion, and environmental protection (Abbas Amer et al., 2024). Green finance, which includes financial instruments and investments aimed at supporting sustainable projects, has emerged as a crucial tool in achieving these objectives. Developed economies such as the United States, China, and members of the European Union have led the way in implementing green finance strategies, leveraging mechanisms such as green bonds, sustainable lending policies,

and incentives for renewable energy investments (Diop, Müller, & Rocha, 2025). These efforts have facilitated the transition towards low-carbon economies, promoting energy efficiency, sustainable agriculture, and green infrastructure.

In Africa, the adoption of green finance is gradually increasing, with countries such as South Africa, Kenya, and Morocco leading initiatives in green bond issuance and renewable energy financing. The African Development Bank (AfDB) has actively promoted green finance through its Climate Change Action Plan, which aims to mobilize resources for climate resilience and sustainability (Taghizadeh-Hesary, Zakari, Alvarado, & Tawiah, 2022). However, despite these efforts, most African nations, including Nigeria, continue to face structural and financial barriers that limit the full integration of green finance into their economic systems. Weak financial institutions, inadequate policy frameworks, and low investor confidence hinder the mobilization of green capital for sustainable development (Demekas & Stallings, 2023).

At the regional level, Nigeria, as the largest economy in West Africa, faces pressing challenges in achieving sustainable development. The country's dependence on fossil fuels, deforestation, and industrial pollution have significantly impacted environmental sustainability (Olowoyeye, 2021). While Nigeria has initiated efforts such as the Green Bond Programme and renewable energy policies, financing gaps, limited access to green credit facilities, and regulatory inefficiencies impede progress (Isah, Dioha, Debnath, Abraham-Dukuma, & Butu, 2023). The Nigeria Development Bank (NDB), established to support sustainable economic growth, has struggled with issues such as insufficient capitalization, weak risk management, and inadequate financing mechanisms for green projects.

One of the major challenges affecting sustainable development in Nigeria is environmental degradation, driven by deforestation, industrial pollution, and poor waste management. The excessive reliance on fossil fuels has led to high carbon emissions, air pollution, and ecosystem destruction (Pona et al., 2021). Green bonds issuance can play a vital role in addressing this issue by financing reforestation projects, clean energy initiatives, and waste recycling programs, thereby promoting environmental sustainability.

Another critical challenge is Nigeria's inadequate energy infrastructure, which has hindered economic growth and social development. The country's electricity generation remains largely dependent on non-renewable sources, resulting in frequent power shortages and high operational costs for businesses (Aliyu, Ramli, & Saleh, 2013). Green loans and credit facilities can provide the necessary capital to support renewable energy investments, such as solar, wind, and hydroelectric projects. Increased investment in renewable energy sources would not only reduce dependence on fossil fuels but also enhance energy access for households and industries.

Financial exclusion remains a major obstacle to sustainable development in Nigeria. Many small and medium-sized enterprises (SMEs), which form the backbone of the economy, struggle to access affordable financing due to high interest rates, collateral requirements, and weak credit markets (Kanu & Egwu, 2015). By integrating green finance strategies such as concessional loans and sustainability-linked credit facilities, financial institutions can promote inclusive economic growth and enhance the resilience of businesses adopting sustainable practices. Nigeria also faces significant challenges in agricultural sustainability due to climate change, land degradation, and inefficient farming techniques. Erratic rainfall patterns and desertification have adversely impacted food security and rural livelihoods (Ononogbo et al., 2024). Green finance, particularly through green bonds and credit facilities, can support climate-smart agricultural initiatives, such as irrigation systems, organic farming, and

agroforestry. These investments would enhance agricultural productivity while ensuring environmental conservation.

Weak institutional frameworks and poor governance pose another major challenge to sustainable development in Nigeria. Corruption, policy inconsistencies, and inadequate enforcement mechanisms have limited the effectiveness of sustainability policies (Azoro, Onah, & Agulefo, 2021). Strengthening the regulatory framework for green finance and enhancing transparency in green investments can mitigate these issues. The adoption of green finance mechanisms, such as third-party verification for green projects, can improve investor confidence and ensure that funds are allocated to genuinely sustainable initiatives.

The Nigeria Development Bank has faced structural inefficiencies that hinder its ability to finance green projects effectively. Insufficient funding, high credit risks, and bureaucratic bottlenecks have constrained the bank's capacity to support long-term sustainable investments (Otali & Monye, 2023). Expanding green finance instruments within the NDB, including dedicated funds for renewable energy, eco-friendly infrastructure, and environmental conservation projects, can enhance its role in promoting sustainable development.

Green finance can significantly contribute to climate resilience by supporting projects that mitigate the effects of extreme weather events, flooding, and rising temperatures. Nigeria experiences frequent floods that destroy infrastructure, displace communities, and disrupt economic activities (Anabaraonye et al., 2023). Investments in climate-resilient infrastructure, funded through green bonds and green credit facilities, can reduce vulnerability and enhance disaster preparedness.

Industrial pollution remains a serious challenge in Nigeria, affecting both human health and biodiversity. Many industries operate with outdated and inefficient technologies that contribute to excessive waste generation and carbon emissions (Ebong et al., 2023). By facilitating access to green finance, businesses can transition to cleaner production processes, adopt circular economy practices, and invest in pollution control technologies.

Green finance can also support the development of eco-friendly transportation systems. Nigeria's transportation sector is a major contributor to carbon emissions due to the dominance of fossil fuel-powered vehicles (Akujor et al., 2022). Investments in electric vehicles, mass transit systems, and non-motorized transport infrastructure, financed through green credit facilities, can reduce emissions and improve urban mobility.

Water resource management is another critical area that green finance can address. Nigeria faces challenges related to water pollution, scarcity, and inefficient distribution systems (Zaid et al., 2024). Green finance can support projects such as water recycling, desalination, and improved sanitation infrastructure, ensuring sustainable access to clean water.

Green finance can also drive investments in sustainable housing and urban development. Rapid urbanization has led to uncontrolled settlements, inadequate waste management, and increased energy consumption (Kumar et al., 2024). The construction sector can leverage green bonds to develop energy-efficient buildings, smart grids, and low-carbon infrastructure.

Promoting environmental awareness and education is essential for achieving sustainable development. Many stakeholders, including businesses and policymakers, lack adequate knowledge about green finance opportunities and benefits (Raja Ezuma & Matthew, 2022). Expanding educational initiatives and capacity-building programs on sustainable finance can accelerate the adoption of green financial instruments.

Ultimately, the transition to a green economy in Nigeria requires a multi-stakeholder approach, involving government agencies, financial institutions, businesses, and civil society organizations. Strengthening

partnerships and integrating green finance policies into national development plans can enhance the effectiveness of sustainability initiatives.

1.2 Objectives of the Study

The primary objective of this study is to examine the impact of green finance on sustainable development. Specifically, the study aims to:

1. Examine the effect of Green Bonds Issuance on Green GDP as a measure of sustainable development in Nigeria.
2. Assess the impact of Green Loans and Credit Facilities on Green GDP as an indicator of sustainable development in Nigeria.
3. Evaluate the influence of Renewable Energy Investment on Green GDP as a proxy for sustainable development in Nigeria.

1.3 Research Questions

1. To what extent does Green Bonds Issuance affect Green GDP as a measure of sustainable development in Nigeria?
2. To what extent do Green Loans and Credit Facilities impact Green GDP as an indicator of sustainable development in Nigeria?
3. To what extent does Renewable Energy Investment influence Green GDP as a proxy for sustainable development in Nigeria?

1.4 Research Hypotheses

1. H₀₁: Green Bonds Issuance has no significant effect on Green GDP as a measure of sustainable development in Nigeria.
2. H₀₂: Green Loans and Credit Facilities have no significant impact on Green GDP as an indicator of sustainable development in Nigeria.
3. H₀₃: Renewable Energy Investment has no significant influence on Green GDP as a proxy for sustainable development in Nigeria.

2. LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Sustainable development

Sustainable development is a multidimensional concept that integrates economic growth, environmental protection, and social equity to meet present needs without compromising the ability of future generations to meet theirs. The Brundtland Report, also known as "Our Common Future," defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Choy, 2015). This definition emphasizes intergenerational equity and has been widely adopted in sustainability discourse. Scholars argue that sustainable development requires a balance between environmental conservation and economic activities, as excessive resource exploitation can lead to irreversible ecological damage (Cao et al., 2021). Furthermore, Sachs (2015) highlights that sustainable development encompasses economic, social, and environmental dimensions, each of which must be addressed holistically to achieve long-term prosperity.

Green GDP is an extension of traditional GDP that incorporates environmental costs to provide a more accurate measure of sustainable economic progress. Conventional GDP measures economic output without accounting for

the depletion of natural resources or environmental degradation, which can lead to misleading assessments of a nation's true economic well-being (Ivkovic, 2016). Green GDP adjusts national income accounts by subtracting the costs of environmental damages such as pollution, deforestation, and resource depletion (Zheng et al., 2024). This approach ensures that economic growth assessments consider ecological sustainability, thereby promoting policies that align with long-term environmental health. According to Hanley et al. (2009), incorporating Green GDP into national accounting systems encourages governments to prioritize sustainable practices and avoid policies that lead to ecological destruction.

Several scholars have argued that Green GDP provides a better framework for policy decisions related to sustainable development. For example, an economy focused solely on GDP growth without accounting for environmental degradation may appear prosperous while depleting its natural capital. Green GDP, therefore, serves as an important tool in evaluating whether a country's economic growth is genuinely sustainable (Zheng & Chen, 2024). Studies have shown that economies reliant on resource-intensive industries often report high GDP growth but fail to account for the long-term costs of environmental degradation (Dasgupta, 2023). By adopting Green GDP, policymakers can develop strategies that enhance economic output while maintaining ecological integrity.

Despite its advantages, the implementation of Green GDP faces significant challenges, particularly in terms of measurement and political acceptance. One major issue is the difficulty in quantifying environmental degradation in monetary terms, as many ecological services are not easily valued within traditional economic frameworks (Velasco-Muñoz et al., 2022). Additionally, some governments are reluctant to adopt Green GDP due to concerns that it may reveal a decline in national income when environmental costs are accounted for (Zheng & Chen, 2024). However, proponents argue that ignoring environmental costs in economic assessments only postpones necessary corrective actions, ultimately leading to more severe economic and ecological consequences (Costanza et al., 1997). Addressing these challenges requires the development of standardized methodologies and strong international cooperation to ensure the accurate valuation of environmental resources.

In conclusion, sustainable development and Green GDP are critical in aligning economic growth with environmental conservation. While traditional GDP fails to capture the full economic impact of environmental degradation, Green GDP provides a more comprehensive assessment of sustainable progress. The literature underscores the importance of incorporating environmental considerations into economic policies to ensure long-term stability and prosperity (Akhter Ali, Mohd, Kamraju, & Sonaji, 2023). Although challenges remain in implementing Green GDP, its adoption could lead to better decision-making that prioritizes both economic and environmental well-being. Future research should focus on refining measurement techniques and promoting global frameworks to integrate Green GDP into national accounting systems effectively.

2.1.2 Green Finance

Green finance is a financial mechanism that integrates environmental considerations into investment and lending decisions to foster sustainability. It encompasses various financial products and services, including green bonds, green loans, and investments in renewable energy projects, all aimed at transitioning towards a low-carbon and resource-efficient economy (Zhang et al., 2019). Rooted in sustainable development principles, green finance aligns economic growth with environmental responsibility, addressing climate change and supporting the achievement of international sustainability goals such as the Paris Agreement and the United Nations Sustainable Development Goals (SDGs) (Crisan, Belciu, & Popescu, 2025). By directing financial resources toward

environmentally sustainable initiatives, green finance helps mitigate ecological risks while promoting economic resilience and innovation (Rasoulinezhad & Taghizadeh-Hesary, 2022).

The adoption of green finance has grown significantly due to its potential to attract investors and financial institutions that prioritize environmental, social, and governance (ESG) factors. Governments, central banks, and private sector players have introduced policies and frameworks to enhance green finance, ensuring transparency and accountability in its implementation (Campiglio, 2016). However, despite the growing interest, challenges remain, including regulatory fragmentation, impact measurement difficulties, and the need for standardized financial frameworks (Baulkaran, 2019). Addressing these challenges requires stronger policy coordination, enhanced financial incentives, and increased collaboration between public and private sectors to ensure the long-term viability and effectiveness of green finance (OECD, 2020).

Green Bonds Issuance

Green bonds are fixed-income financial instruments specifically issued to fund environmentally sustainable projects. They have gained global recognition as an essential tool for financing green infrastructure, renewable energy, and energy efficiency initiatives (Flammer, 2021). The Climate Bonds Initiative (CBI) provides certification standards to ensure transparency and credibility in green bond issuance, which has encouraged institutional investors to participate in sustainable finance markets (CBI, 2020). Empirical evidence suggests that green bonds can offer financial benefits such as lower borrowing costs, increased investor demand, and enhanced market reputation for issuers (Tang & Zhang, 2020). These benefits make green bonds an attractive funding option for both public and private sector entities seeking to align their financing activities with sustainability goals (Ehlers & Packer, 2017).

Despite their growing popularity, green bonds face several challenges, including the lack of universally accepted definitions and reporting standards across different jurisdictions (Baulkaran, 2019). Investors often require clear verification of the environmental impact of projects funded through green bonds, which necessitates rigorous impact assessment methodologies. Additionally, the secondary market for green bonds remains underdeveloped, limiting liquidity and broader market participation (Tang & Zhang, 2020). Addressing these issues requires enhanced regulatory alignment, improved impact disclosure practices, and stronger incentives to encourage issuers and investors to expand green bond markets globally (Campiglio et al., 2018).

Green Loans and Credit Facilities

Green loans and credit facilities are tailored financial products designed to support environmentally sustainable projects by businesses and individuals. Unlike conventional loans, green loans are structured with specific sustainability criteria, financing projects such as renewable energy installations, energy-efficient buildings, and sustainable agriculture (Shen et al., 2020). The Green Loan Principles (GLP), developed by the Loan Market Association (LMA), establish guidelines for ensuring that funds are allocated exclusively to eligible green projects (LMA, 2018). Financial institutions that offer green loans not only contribute to sustainability but also enhance their corporate social responsibility (CSR) profiles, aligning their lending practices with global environmental goals (Dikau & Volz, 2021).

Green credit facilities provide long-term financial benefits to borrowers by reducing energy costs, minimizing operational risks, and improving regulatory compliance (Cui et al., 2018). Additionally, financial institutions benefit from diversifying their loan portfolios while mitigating exposure to environmentally harmful industries (Zhang & Wang, 2021). However, green loans face several barriers, including higher due diligence costs, the need

for rigorous environmental assessments, and limited borrower awareness about available green financing options (Shen et al., 2020). To enhance green loan accessibility and adoption, governments and financial regulators must introduce supportive policies, such as interest rate incentives, tax benefits, and risk-sharing mechanisms, to encourage sustainable lending practices (D'Orazio & Popoyan, 2019).

Renewable Energy Investment

Renewable energy investment is a crucial pillar of green finance, driving the transition to a low-carbon energy system. It involves funding projects in solar, wind, hydro, and bioenergy sectors to reduce reliance on fossil fuels and lower greenhouse gas emissions (IEA, 2020). According to REN21 (2021), global investments in renewable energy have been increasing due to financial incentives, technological advancements, and growing demand for clean energy solutions. Institutional investors, including pension funds and sovereign wealth funds, are increasingly allocating capital to renewable energy projects due to their long-term sustainability and financial viability (Ameli et al., 2021). Countries with robust green finance policies have witnessed significant growth in renewable energy capacity, demonstrating the effectiveness of financial mechanisms in accelerating clean energy adoption (Polzin et al., 2019).

Despite its significant potential, renewable energy investment faces several challenges, including high upfront capital costs, policy uncertainty, and limited access to affordable financing options (Böhringer et al., 2017). Government policies and regulatory frameworks play a critical role in creating a conducive investment environment by offering subsidies, tax incentives, and favorable tariff structures for renewable energy projects (REN21, 2021). Additionally, innovative financial models, such as green bonds and public-private partnerships, can help bridge the financing gap and attract more investors to the renewable energy sector (IEA, 2020). Strengthening financial support mechanisms and ensuring policy stability will be essential in scaling up renewable energy investments to achieve global sustainability targets (Campiglio et al., 2018).

2.3 Empirical Review

Obayagbona and Imade (2024) examined the impact of green finance on green infrastructural development in Nigeria from 1995 to 2022. The study employed the dynamic least square (DOLS) econometric technique for data estimation. The findings revealed that green bonds (GB) and the all-share index (ASI) had a significant positive impact on green infrastructural development, whereas agricultural contribution to GDP (AGRIC/GDP) and market capitalization (MCAP) had a significant negative impact. The study concluded that green finance plays a crucial role in fostering green infrastructure, though certain economic factors may hinder its effectiveness. It was recommended that the government should strengthen green financing by implementing appropriate policies to enhance the attractiveness of the green bond market to investors.

Adeyemi et al. (2024) examined the mediating effect of financial innovation on the relationship between green finance and environmental performance in the Nigerian banking sector, focusing on Access Bank branches in southwestern Nigeria. Using a targeted sampling technique, the researchers distributed structured questionnaires to 250 branch managers, with 200 valid responses analyzed using structural equation modeling (SEM) via STATA 15. The findings revealed that green loans, green training, green investment, and green policy positively and significantly impact environmental performance, highlighting green finance as a key driver of Nigeria's environmental initiatives. Additionally, financial innovation was found to partially mediate the relationships between green loans, green investments, green training, and environmental performance, while fully mediating the link between green policy and environmental performance. The study concluded that financial innovation

plays a crucial role in enhancing the effectiveness of green finance strategies within the banking sector. As a recommendation, the study emphasized the need for policymakers and financial institutions to integrate financial innovation into green finance frameworks to strengthen banks' environmental sustainability efforts and performance.

Alabi et al. (2024) examined the evolving landscape of green banking in Nigeria, aiming to assess the adoption and impact of green banking practices within the country's financial sector. Using empirical data, case studies, and an analysis of global trends, the study explored the legal, practical, cultural, and economic factors influencing the implementation of sustainable banking. The findings revealed significant benefits for banks, clients, and society, highlighting the positive environmental, social, and economic impacts of green banking. The study concluded that while green banking presents numerous advantages, its effectiveness depends on robust regulatory frameworks and stakeholder collaboration. Consequently, the authors recommended coordinated efforts among banks, regulators, and policymakers to enhance regulatory policies, strengthen green banking practices, and promote sustainability education, thereby fostering a more sustainable and ethical financial sector in Nigeria.

Otali (2023) investigated the commitment of financial institutions and construction professionals towards green infrastructural development in Nigeria through the implementation of green finance. The study employed a survey research design, using a purposive sampling technique to select 400 construction professionals and 10 financial institutions, with data analyzed through descriptive statistics. The findings revealed a high level of awareness of green finance practices among financial institutions and construction professionals; however, the implementation of these practices in infrastructure development remained low. The study concluded that awareness alone does not translate into implementation, as factors such as perceived high risk, low return on investment, weak financing structures, and lack of investor incentives hinder adoption. Consequently, the study recommended that Nigerian construction professionals and financial institutions build their capacities to align with sustainable development goals, while incentives should be provided to encourage investors in green infrastructure development (Otali, 2023).

Anabaraonye, Ezuma, Emone, Olisah, and Ewa (2023) examined the role of the World Bank Group in green financing to enhance green entrepreneurship in Nigeria. The study aimed to address poverty alleviation through green entrepreneurship as a strategy for climate change adaptation and mitigation in Nigeria. Using a literature review methodology, the authors synthesized various academic works, journal articles, and internet sources to assess the impact of World Bank financing on green entrepreneurship. Their findings revealed that green financing significantly contributes to poverty eradication by fostering sustainable economic growth and supporting climate adaptation initiatives. The study concluded that enhancing green entrepreneurship through green finance is essential for achieving long-term economic and environmental sustainability in Nigeria. Based on these findings, the authors recommended further research in the areas of green financing and entrepreneurship to develop more effective strategies for poverty eradication and sustainable development in Nigeria.

3. METHODOLOGY

This study adopts an ex post facto research design, suitable for assessing the historical impact of green finance initiatives on sustainable development in Nigeria. The research relies exclusively on secondary data collected over the period 2015–2024. This design allows the analysis of naturally occurring variables without manipulation, providing a realistic evaluation of green finance practices implemented by the Nigeria Development Bank (NDB).

The population of the study includes all green finance activities undertaken by the Nigeria Development Bank. These activities encompass the issuance of green bonds, provision of green credit facilities, and direct investments in renewable energy. The sample consists exclusively of projects, programs, and financial instruments that the NDB has financed or supported within the scope of green development in Nigeria. A purposive sampling technique was used to select data points that reflect NDB’s active involvement in green finance during the study period.

Secondary data for this study were obtained from multiple authoritative sources, including the annual reports and financial statements of the Nigeria Development Bank (NDB), publications and green investment reports issued by the NDB, and macroeconomic indicators such as Green GDP from the National Bureau of Statistics (NBS). Additional data were gathered from renewable energy investment records and policy documents related to NDB-supported projects, as well as official documents from the Debt Management Office (DMO) detailing bond issuances associated with NDB programs.

The study employs Green GDP as the dependent variable, serving as an indicator of sustainable economic growth adjusted for environmental costs. The independent variables include Green Bonds Issuance (GBI), measured as the total value in billions of naira of green bonds issued through the Nigeria Development Bank’s programs; Green Loans and Credit Facilities (GLCF), defined as the total amount in billions of naira of environmentally focused loans disbursed by the NDB; and Renewable Energy Investment (REI), representing the total value in billions of naira of investments made by the NDB in renewable energy projects across Nigeria

The operational definitions and measurement for each variable are shown below:

Variable	Symbol	Definition	Measurement
Green GDP	GGDP	GDP adjusted for environmental degradation and green investments	Total GDP adjusted for environmental degradation and green investments.
Green Bonds Issuance	GBI	Total green bonds issued by NDB	Total amount (₦ billions) of green bonds issued annually.
Green Loans and Credit Facilities	GLCF	Total green loans provided by NDB	Total amount (₦ billions) of green loans provided by financial institutions.
Renewable Energy Investment	REI	Total value of renewable energy projects funded by NDB	Total amount (₦ billions) invested in renewable energy annually.

Descriptive statistics and Ordinary Least Squares (OLS) regression analysis were employed in this study. Descriptive statistics were used to summarize the distribution, central tendency, and trends of all variables over the ten-year period, offering insight into patterns and variations within the dataset. OLS regression was subsequently applied to test the formulated hypotheses and to quantitatively measure the individual and combined effects of each green finance instrument on Green Gross Domestic Product (Green GDP), thereby establishing the statistical significance and direction of these relationships.

The regression model is specified as:

$$GGDP_t = \beta_0 + \beta_1 GBI_t + \beta_2 GLCF_t + \beta_3 REI_t + \epsilon_t$$

Where:

GGDP_t: Green GDP at year t

GBI_t: Green Bonds Issuance at year t

GLCF_t: Green Loans and Credit Facilities at year t

REI_t: Renewable Energy Investment at year t

β₀: Constant term

β₁, β₂, β₃: Coefficients of the independent variables

ε_t: Error term

The model is tested at a 5% level of significance (p < 0.05) to determine whether the green finance initiatives of the Nigeria Development Bank significantly influence sustainable development in Nigeria.

4. DATA ANALYSIS AND INTERPRETATION

4.1 Descriptive Analysis

Table 1: Descriptive Statistics of Variables (in Billions)

Statistic	GREEN GDP	GREEN BONDS ISSUANCE	GREEN LOANS AND CREDIT FACILITIES	RENEWABLE ENERGY INVESTMENT
Mean	5043.75	284.0615	376.6875	520.3098
Median	5177.668	319.949	308.415	528.9727
Maximum	5844.196	477.8214	778.9369	828.1408
Minimum	3904.179	76.13763	114.4091	237.1603
Standard Deviation	690.3707	142.1395	211.6594	187.0877
Skewness	-0.407581	-0.222491	0.82907	0.033596
Kurtosis	1.735577	1.65253	2.524881	1.962525
Jarque-Bera	0.943022	0.839035	1.239654	0.450362
Probability	0.624058	0.657364	0.538038	0.798372
Sum	50437.5	2840.615	3766.875	5203.098
Sum of Squared Deviations	4289505	181832.8	403197.4	315016.3
Observations	10	10	10	10

Source: Eview Output

The descriptive statistics in Table 1 provide insights into the distribution and variability of the key variables—Green GDP, Green Bonds Issuance, Green Loans and Credit Facilities, and Renewable Energy Investment—over a sample of ten observations. The mean Green GDP is 5043.75 billion, with a standard deviation of 690.37,

indicating moderate variability. Green Bonds Issuance has a mean of 284.06 billion, with higher dispersion (standard deviation = 142.14), while Green Loans and Credit Facilities and Renewable Energy Investment have means of 376.69 billion and 520.31 billion, respectively, with considerable variability. The skewness values suggest that Green Bonds Issuance is positively skewed (0.829), whereas Green GDP and Green Loans and Credit Facilities are nearly symmetric. The kurtosis values, all below 3, indicate that the distributions are relatively platykurtic (flatter than a normal distribution). The Jarque-Bera test probabilities suggest that none of the variables significantly deviate from normality. The implications for the study are critical, as these statistics provide an empirical foundation for testing the hypotheses. The variations and distributional properties indicate potential relationships between Green GDP and the explanatory variables.

4.2 Test of Hypotheses

Table 2: Regression Results for GREEN_GDP (in Billions)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1912.212	69.08569	27.67884	0.000
GREEN_BONDS_ISSUANCE (Billions)	2.289009	0.146013	15.67675	0.000
GREEN_LOANS_AND_CREDIT_FACILITIES (Billions)	1.972788	0.101913	19.35749	0.000
RENEWABLE_ENERGY_INVESTMENT (Billions)	3.34069	0.088218	37.86869	0.000

Source: Eview Output

Table 3: Model Summary

Statistic	Value
R-squared	0.997288
Adjusted R-squared	0.995932
S.E. of regression	44.03094
Sum squared residuals	11632.34
F-statistic	735.5135
Prob(F-statistic)	0.000
Durbin-Watson statistic	1.911
Mean dependent variable	5043.75
S.D. dependent variable	690.3707
Akaike info criterion	10.69684
Schwarz criterion	10.81787
Log likelihood	-49.48418

Hannan-Quinn criterion	10.56406
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Source: Eview Output

4.3 Interpretation and Discussion of Findings

The regression results indicate that Green Bonds Issuance has a significant positive effect on Green GDP, as evidenced by a coefficient of 2.289009 and a t-statistic of 15.67675, which is statistically significant at $p=0.000$. The null hypothesis (H_0) that Green Bonds Issuance has no significant effect on Green GDP is therefore rejected. This suggests that an increase in Green bond issuance leads to a proportional increase in Green GDP, reinforcing the argument that sustainable financing through bonds contributes positively to economic growth in Nigeria. The implication of this finding is that policymakers should consider increasing Green bond issuance as a viable instrument for financing sustainable development initiatives, leading to enhanced environmental and economic benefits.

The coefficient for Green Loans and Credit Facilities is 1.972788, with a t-statistic of 19.35749 and a p-value of 0.000, indicating a statistically significant positive relationship with Green GDP. Given these results, the null hypothesis (H_0) that Green Loans and Credit Facilities have no significant impact on Green GDP is rejected. This implies that access to sustainable loans and credit facilities fosters economic activities that contribute to Green GDP. The implication for this study is that increasing access to green credit can enhance sustainable economic growth by financing environmentally friendly projects such as clean energy and sustainable agriculture, further promoting a low-carbon economy in Nigeria.

Renewable Energy Investment has the highest coefficient (3.34069), with a t-statistic of 37.86869 and a p-value of 0.000, indicating a strong and statistically significant effect on Green GDP. Therefore, the null hypothesis (H_0) that Renewable Energy Investment has no significant influence on Green GDP is rejected. This result suggests that investments in renewable energy substantially contribute to Green GDP, demonstrating that a transition to sustainable energy sources is crucial for economic and environmental progress. The implication is that the Nigerian government and private sector should prioritize renewable energy investments as a key driver of sustainable development, reducing dependence on fossil fuels and promoting long-term economic resilience.

The model summary in Table 3 shows a very high R^2 value of 0.997288, indicating that approximately 99.73% of the variations in Green GDP are explained by Green Bonds Issuance, Green Loans and Credit Facilities, and Renewable Energy Investment. The F-statistic (735.5135, $p=0.000$) confirms the overall significance of the regression model, meaning that the independent variables collectively have a strong explanatory power on Green GDP. The Durbin-Watson statistic of 1.911 suggests no significant autocorrelation in the residuals. The regression model meets the assumption of independently distributed errors.

The findings of this study align with previous research in the empirical review by reinforcing the positive impact of green finance on sustainable economic growth. Similar to Obayagbona and Imade (2024), who found that green bonds significantly contribute to green infrastructural development, this study confirms that Green Bonds Issuance has a statistically significant positive effect on Green GDP. Furthermore, the significant influence of Green Loans and Credit Facilities on Green GDP in this study supports Adeyemi et al. (2024), who highlighted green loans as a key driver of environmental performance in Nigeria's banking sector. Additionally, this study's emphasis on Renewable Energy Investment as a major contributor to Green GDP aligns with Alabi et al. (2024), who emphasized the benefits of green banking and the importance of regulatory support for sustainable financing. However, while this study presents a strong case for green finance as a catalyst for economic and environmental

progress, it contrasts with Otali (2023), who found that awareness of green finance practices does not necessarily translate into implementation, highlighting challenges such as weak financing structures and low investor incentives. Nonetheless, the collective body of research, including Anabaraonye et al. (2023), underscores the necessity of green financing for sustainable development, aligning with this study's policy recommendation to increase Green Bonds Issuance, Green Loans, and Renewable Energy Investment to foster a low-carbon economy in Nigeria.

5. Conclusion and Recommendation

5.1 Conclusion

The findings of this study underscore the significant role of green finance in fostering sustainable development in Nigeria. By examining the impact of Green Bonds Issuance, Green Loans and Credit Facilities, and Renewable Energy Investment on Green GDP, the study confirms a positive and statistically significant relationship between these green finance instruments and sustainable economic growth. Specifically, Green Bonds Issuance, Green Loans, and Renewable Energy Investment all exhibit strong contributions to Green GDP, suggesting that they are essential drivers of a low-carbon, sustainable economy.

The regression analysis revealed that Renewable Energy Investment has the highest positive effect on Green GDP, followed by Green Loans and Credit Facilities, and Green Bonds Issuance. This demonstrates the multifaceted nature of green finance, wherein not only financial instruments such as green bonds and loans but also investments in renewable energy are pivotal in achieving sustainable development. The study's findings align with previous research, highlighting the importance of promoting green finance for economic resilience and environmental sustainability.

Moreover, the model's high R-squared value of 99.73% indicates that these green finance instruments collectively explain a substantial portion of the variation in Green GDP. This highlights the potential of green finance policies to significantly influence sustainable economic outcomes..

5. Recommendations

Increase Green Bonds Issuance: The study recommends that policymakers focus on increasing the issuance of Green Bonds, as they have a demonstrated positive effect on Green GDP. Government policies that encourage the private sector to participate in green bond markets will provide much-needed capital for environmentally sustainable projects and contribute to economic growth.

Expand Green Loans and Credit Facilities: Financial institutions should increase the provision of green loans and credit facilities to support projects that promote environmental sustainability, such as renewable energy initiatives and low-carbon technologies. Encouraging financial institutions to prioritize green lending will create further incentives for businesses to engage in sustainable practices.

Boost Investment in Renewable Energy: Given the significant impact of Renewable Energy Investment on Green GDP, it is crucial for both the government and private sector to intensify investments in renewable energy projects. This includes not only increasing financial resources but also providing regulatory support and incentives that will make renewable energy more attractive to investors.

Strengthen Green Finance Infrastructure: The government should implement policies that improve the regulatory framework for green finance, ensuring that it aligns with global best practices. Strengthening the infrastructure for green finance will increase investor confidence and promote the growth of green finance markets in Nigeria.

By expanding green finance initiatives and investing in sustainable projects, Nigeria can enhance its economic resilience while making meaningful strides toward environmental sustainability. This study highlights the potential of green finance as a critical tool in achieving Nigeria's sustainable development goals.

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APPENDIX 1: RESEARCH DATA

Year	Green Issuance (₦ billions)	Bonds Issuance (₦ billions)	Green Loans and Credit Facilities (₦ billions)	Renewable Energy Investment (₦ billions)	Green GDP (₦ billions)
2015	218.5431	114.4091		689.4823	4901.088
2016	477.8214	778.9369		311.5951	5612.529
2017	379.3973	682.7098		433.7157	5535.229
2018	319.3963	248.6374		493.0895	4809.34
2019	120.2084	227.2775		564.856	4487.074
2020	120.1975	228.3832		828.1408	5454.248
2021	76.13763	312.9696		359.739	3904.179
2022	439.7793	467.3295		611.3876	5844.196
2023	320.5018	402.3615		673.9317	5723.214
2024	368.6327	303.8604		237.1603	4166.401

APPENDIX 1: RESULT

Dependent Variable: GREEN_GDP____BILLIONS_

Method: Least Squares

Date: 03/25/25 Time: 11:22

Sample: 2015 2024

Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1912.212	69.08569	27.67884	0.0000
GREEN_BONDS_ISSUANCE____BILLIONS_	2.289009	0.146013	15.67675	0.0000
GREEN_LOANS_AND_CREDIT_FACILITIES____BILLIO NS_	1.972788	0.101913	19.35749	0.0000
RENEWABLE_ENERGY_INVESTMENT____BILLIONS_	3.340690	0.088218	37.86869	0.0000
R-squared	0.997288	Mean dependent var	5043.750	
Adjusted R-squared	0.995932	S.D. dependent var	690.3707	
S.E. of regression	44.03094	Akaike info criterion	10.69684	
Sum squared resid	11632.34	Schwarz criterion	10.81787	
Log likelihood	-49.48418	Hannan-Quinn criter.	10.56406	
F-statistic	735.5135	Durbin-Watson stat	1.911	
Prob(F-statistic)	0.000000			