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ROLE OF SUSTAINABLE INVESTMENT IN CAPITAL MARKET DEVELOPMENT PROMOTION AND ENVIRONMENTAL GOALS ACHIEVEMENT

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ABSTRACT

This paper examined how sustainable investment had a dual purpose of encouraging growth in the capital market and environmental objectives in Nigeria. Emphasis was on the quarterly data between Q1 2015 and Q4 2024. The study uses Autoregressive Distributed Lag bounds testing methodology to determine the effects of green bonds on bond market capitalization in comparison to GDP and renewable energy capacity. Findings indicated that there are strong positive long-term correlations between green bond issuances and capital market depth as well as environmental performance. The volume of green bonds also exhibited statistically significant effects on the growth of the bond market ($b = 0.234$, $p < 0.01$) and the growth of the renewable energy capacity ($b = 8.456$, $p < 0.001$). The regulatory quality will be considered the most potent factor in both models, and inflation impacts negatively on market development. The research concludes that sustainable finance presents a powerful two-fold tool, but its transformational power is severely contingent on institutional reinforcement, macroeconomic stability, the broadening of issuers, and greater verification tools to guarantee credibility and scalability within the environment of the emerging markets of Nigeria.

Key words: *Sustainable Investing, Green Bonds, Capital Market Development, Environmental Outcomes, Nigeria*

INTRODUCTION

The international financial machine has been closely changing in recent years with several characteristics, including the booming development of sustainable investing as a financing strategy and a market-oriented phenomenon (Ajayi, 2024). The global assets of sustainable funds reached record values of 3.2 trillion dollars, which is an annual growth of 8 percent and more than fourfold growth since 2018. This expansion highlights a larger change in capital placement to investing in frameworks that incorporate both environmental concerns and money payments. In this international shift, Nigeria has become one of the most active African countries in the area of sustainable finance, especially by issuing the first sovereign

green bond in Africa in December 2017 (Eke & Emasogbe, 2025). This historic trend marked a strategic initiative to match the goals of capital market building with green goals in the largest economy in Africa.

In Nigeria, the green bond market had grown to an estimated of N49.19 billion in 3 years, following the first issue, and this was made stronger by four subsequent issues and enabled by regulatory structures to facilitate climate-congruent finance (Ekwueme, 2025). These changes make Nigeria a regional source of sustainable investing, and not only of the imitation of best practices abroad. It is a very conscious policy reaction to the twin problems of the underdeveloped capital markets in Nigeria and the growing challenge of environmental demands. Green bonds and other sustainable finance products have therefore been advanced as a measure that will not only help in harnessing long-term capital but also tackle environmental degradation and climate susceptibility (Ele, et al., 2025). Despite these developments, the capital market in Nigeria still has strong structural constraints, which restrict its ability to contribute to inclusive and sustainable economic development. Wokoma and Okoh (2025) indicated the ongoing illiquidity and inefficient markets, and there was a lack of feedback mechanisms between the liquidity and returns. Ali (2025) identified low volumes of trade, high volatility, narrow participation by investors, and concentration in few large-cap stocks as persisting challenges. Despite the outstanding performance registered by the Nigerian Exchange in 2025, as the market capitalization grows to about N99.38 trillion and the All-Share Index hits unprecedented highs, issues of policy inconsistency, macroeconomic instability, foreign exchange volatility, and infrastructural gaps perceptively limit the amount and stability of the market (Marti, et al., 2023). It is against this background that the instruments of sustainable finance have been fronted as possible drivers to the increased liquidity, increased participation of investors and increased institutional sophistication in the capital market.

The environmental argument that informed the involvement of Nigeria in sustainable investing has been getting more pressing. The countrywide efforts to address climate change under the Paris Agreement and the Climate Change Act of 2021 demonstrate the increasing awareness of the economic and social stakes of climate change (Rasheidat, 2022). The latest Nationally Determined Contributions of the country involve emission cut of up to 47 percent by the year 2030 (under international assistance), and an additional commitment to cut the emissions by 32 percent by the year 2035. It is projected that these targets will take massive funding, especially in the infrastructure, renewable energy, and climate adaptation projects

(Okoh & Okpanachi, 2023). Even though Nigeria was among the first countries to venture into the green bond market, the overall sovereign green bonding is still low compared to the levels in the rest of the world, which highlights a very large disparity between the climate goals and the mobilization of capital (Ajayi, 2024).

Such a gap provokes important concerns about the efficacy of sustainable investing in providing the financial market development along with quantifiable environmental results. Although Nigeria has built the supporting infrastructure, such as regulatory principles of green and sustainable bonds and cross-listing facilities, which increase the visibility of the markets, still, there are challenges (Ekwueme, 2025). These involve project verification issues, monitoring after issuance, environmental additionality and concentrating issuance among few large institutions. Increases in regulatory uncertainty and policy shocks have also undermined investor confidence, with an emphasis on the role of institutional stability in the success of sustainable finance projects.

Objectives

This study assesses the connection between sustainable investment and its two-fold mission of promoting the development of the capital market along with promoting the environmental goals in the changing financial scene in Nigeria. Specifically, it seeks to:

1. examine the level at which sustainable finance tools, especially green bonds have ensured that the market has been deepened, liquid and diversified to the investors since 2017.
2. measures, at the same time, the ways these instruments have converted financial commitments into actual environmental deliverables in accordance with the national climate objectives.

LITERATURE REVIEW

Concepts, Evolution, and Mechanisms of Sustainable Investing

Sustainable investing is an essential paradigm change in the distribution of capital, which goes beyond the conventional method of financial analysis and involves environmental, social, and governance (ESG) factors in the investment decision-making process (Soti, Rupali, Bhattacharya, & Kumar, 2024). Its theoretical basis is mostly based on the stakeholder theory, which states that companies should consider the interests of various stakeholders, as opposed to acting exclusively on the basis of shareholder value. Since that time, ESG investing has become an internationally accepted method of evaluating how organizations can deal with

environmental risks, social responsibilities, and governance systems, and ESG-related assets have topped more than 30 trillion by 2023 (Zairis, et al., 2024). By so doing, sustainable investing questions the conventional beliefs of the modern portfolio theory because it proves that ESG values are not simply moral inclinations but concrete factors that define the risk and returns in the long-term.

The history of sustainable investing has advanced through the early modes of socially responsible investing founded on exclusionary screening to more mature approaches which have incorporated the ESG analysis into the core investment procedures (Kwilinski, Lyulyov, & Pimonenko, 2025). Modern ESG investment, however, is more analytical in that it assesses the performance of corporations in the environmental, social, and governance aspects. The environmental criteria center on efficiency of resources, emissions, climate risk reduction, social criteria center on labor practices, human rights and community engagement, and the governance criteria center on board independence, executive accountability and transparency. Xiao et al. (2023) asserted that high ESG performance is associated with reduced volatility, higher risk-adjusted returns, and corporate resilience based on the view that sustainability benefits the firm value by increasing efficiency, reputational, and reducing regulatory and operational risks. Sustainable investing works in several supplementary mechanisms to ensure a synchronous association of financial profits and sustainability results. These involve negative and positive screening, ESG as part of valuation and share construction, and thematic investing, which aims at a particular sustainability outcome, and active ownership, which involves shareholder engagement (Eke & Emasogbe, 2025). Thematic instruments, like green bonds (which finance green projects), have rapidly proliferated sustainable finance in fixed income markets to finance environmentally friendly projects, including renewable energy and clean transportation and energy efficiency. Green bonds are commonly issued through other existing guidelines like the Green Bond Principles of the International Capital Market Association, which focus on transparency, use of proceeds disclosure and post-issue reporting (Onuselogu & Shahzad, 2023).

Sustainable investing has been localized in Nigeria to respond to local development and environmental issues with green bonds becoming the flagship tool. The regulatory systems introduced by the Securities and Exchange Commission have brought the local practices to international standards and also portray the institutional constraints characteristic of emerging markets (Marti et al., 2023). Nevertheless, the activity of sustainable investing is concentrated

still among the sovereign issuers and major institutions, which begs the question of inclusiveness and deepening of the market. The increase in sustainable investment in Nigeria would thus be achieved through an increase in corporate involvement, enhanced verification, and a higher involvement of retail investors to make sure that sustainable finance is playing a significant role in capital market development as well as on environmental goals (Rasheidat, 2022).

Capital Market Development

Capital market development is one of the core processes in which financial systems are developed to allocate resources effectively, mobilize savings and facilitate long term economic growth. In theory, capital markets that have already been well developed play pivotal roles such as price discovery, liquidity, risk diversification, and elimination of information asymmetries between issuers and investors (Adesina-Uthman, 2020). The classic study of Levine set the trend that the financial market development, especially, equity and bond market have a positive impact on the development of the economy as it results in the increase of capital accumulation and productivity. (Udude et al., 2021) showed that deeper capital markets provide the means to finance corporations, enhance corporate governance as market discipline, and offer alternative means of financing which eliminates overdependence on bank intermediation.

Emerging markets have unique issues of developing capital markets which are different to those in advanced markets. These are weak institutional capacity, weak regulatory systems, little measure of investor participation, information uncertainty, macroeconomic instability and weak liquidity (Osuma & Ohonba, 2025). According to Udude et al. (2021), many factors influence the development of capital markets in emerging settings, and these include the macroeconomic environment, quality of legal and regulatory institutions, investor protection, market infrastructure, and the scope of financial instruments. Onuselogu and Shahzad (2023) opined that sustainable development of capital markets has to be based not only on quantitative growth in terms of market capitalization or turnover ratio, but also on qualitative growth in terms of market efficiency, market transparency, market inclusiveness, and market resilience to shocks. The Nigerian capital market represents the trend of development of the emerging markets, which is marked with the burst of growth followed by swings and structural impairment. However, the Nigerian Exchange has been unable to overcome some long-standing problems, including concentrated ownership, few large-cap stocks, low free-

float ratios, low participation by retail investors in the market, and seasonal liquidity crunches despite recording a high growth of market capitalization (Osuma & Ohonba, 2025). The structural indicators show that the market depth is still limited, bond market capitalization is far below equity markets, and the issue of corporate bonds is still in the infancy. The critical interaction between the performance of capital market and the wider economic governance has been revealed by policy inconsistencies, foreign exchange limitations, and macroeconomic headwinds that are destroying investor confidence periodically.

Given this background that recent financing instruments have been advanced as the drivers of market deepening. The launch of special products like Real Estate Investment Trusts, Exchange Traded Funds, and above all green bonds, are all strategic initiatives about diversifying the investor base, the introduction of new asset classes and winning long term institutional capital (Cortellini & Panatta, 2021). These tools may potentially counter market fragmentation by establishing standardized, marketable securities that achieve better liquidity and price transparency and also have certain development goals.

Sustainable Finance and Environmental Outcomes

Sustainable finance refers to financial instruments, financial markets and institutional structures that are aimed at directing capital towards projects and activities that produce quantifiable social and environmental returns as well as financial returns (Ajayi, 2024). The premises are based on both environmental economics in identifying market failures in the pricing of environmental externalities and institutional economics in the role of regulatory regimes in remediating market failures. The flagship sustainable finance instrument, the green bonds, denote the debt securities that are particularly designated to the projects with positive environmental contributions, which are usually in the field of renewable energy, energy efficiency, sustainable waste management, clean transportation and climate adaptation infrastructure (Kwilinski et al., 2025).

Effective mechanisms in governance that result in additionality, transparency and accountability are critical to the efficacy of sustainable finance in producing environmental outcomes. Additionality is a concept that relates to either the environmental benefits that the financed projects would have provided in a business-as-usual situation (Marti et al., 2023). The International Capital Market Association has come up with the Green Bond Principles that offer voluntary guidelines of four main components including use of proceeds

transparency, project evaluation and selection processes, proceeds management and post-issue reporting. Wokoma & Okoh (2025) indicates that compliance with these principles together with the third-party verification and impact reporting can greatly improve the credibility and environmental integrity of green bond issuances. Soti et al. (2024) revealed that there are still enduring issues in transforming financial commitments into verifiable environmental outcomes. The lack of standard benchmarks of environmental impact makes the projects and jurisdictions comparable. Fears over greenwashing, where issuers claim more than they actually are doing with regard to the environment, have also led to the demand to increase disclosure and the verification mechanisms by third-parties. Zheng et al. (2025) indicated that markets reward legitimate environmental performance, and verified green bonds have pricing benefits and draw in committed ESG investor audiences, indicating that there are mechanisms of credibility that create both environmental and financial values.

Sustainable finance is also faced with other complications in the African context in terms of institutional capacity, availability of data, as well as verification infrastructure. The experience related to the use of sovereign green bonds in Nigeria since 2017 can be characterized by both opportunities and limitations (Ajayi, 2024). Although such issuances have already managed to finance solar energy installations and afforestation projects in accordance with climate commitments, the main difficulties related to full impact measurement, post-issuance monitoring, and increasing the volumes of issuance to the level of climate financing requirements (Ele, Mbam, & Orji, 2025). The disparity between the relatively high levels of emission reduction goals set by Nigeria of 47 percent by 2030 and the mobilization of green finance indicates that the two require more robust institutional frameworks that would reinforce the connection between financial instruments and tangible environmental deliverables, which will make sustainable finance go beyond lip service gestures to meaningful climate impacts.

Integration of Capital Market Development and Environmental Goals

The capital market development-environmental objectives convergence is a new paradigm of development finance, as the development of the capital markets and environmental goals are understood as mutually supporting, not competing priorities (Rasheidat, 2022). In theory, this integration disputes the conventional assumption of trade-off between economic growth and environmental protection by suggesting that the appropriate sustainable finance framework could enhance the depth of capital markets and at the same time direct investments to climate-

resilient infrastructure (Zournatzidou, 2025). Various channels of transmission where sustainable finance instruments play a role in market development were highlighted: they create new types of assets and can diversify investment opportunities, they are used to draw a new type of investors (including ESG-focused institutional investors), they create new types of pricing mechanisms that have to internalize environmental risks and they lead to the enhancement of disclosure practices and corporate governance practices (Ekwueme, 2025).

The concept of green bonds can be discussed as an example of such duality because it helps to fill the gaps of market structures and environmental financing. As a market development approach, green bond issues may improve market liquidity by providing tradeable fixed-income securities with different risk-reward profile, decrease market concentration by ensuring that a variety of issuers such as municipalities and other corporations other than the traditional sovereign and large corporation borrowers participate (Okoh & Okpanachi, 2023). This enhances market infrastructure by requiring third-party verification, impact reporting, and special listing segments. The spillover effects of these structural improvements positively influence the overall market operation other than those of the individual green securities (Philip, 2020). Nonetheless, to achieve this combined possibility, there must be a highly balanced set of policy frameworks and institutional set ups. Experience in emerging markets indicates that the effectiveness of sustainable finance in promoting both market and environmental outcomes require a number of facilitating conditions: plausible regulatory frameworks which do not allow greenwashing but do not require excessive compliance costs, fiscal subsidies in the form of tax exemptions or special risk ratings to offset higher transaction costs incurred in the process of verification and reporting, capacity building by issuers and intermediaries in the assessment of the project and its impact, and investor education to create demand on sustainable securities. The lack of these conditions may lead to an example of sustainable finance being a niche market that is not tied to mainstream market forces or a practice of reputational games with no real impact on the environment (Ali, 2025).

Theoretical Review

Financial Development Theory

The theory of financial development form the background perspective of the role of sustainable finance instruments in deepening capital markets and in economic growth. This theory is the product of the pioneering effort of Goldsmith, McKinnon and Shaw, which was refined by Levine; according to this theory, the well-developed financial markets contribute

to the performance of the economy in four main ways: mobilizing and pooling savings, being able to allocate resources to the productive sectors, managing risk and diversifying it, and having the ability to exercise corporate governance through monitoring mechanisms. The theory differentiates quantitative expansion, which is represented by market-capitalization, trading volumes, and the number of listed securities, and qualitative gains which include market efficiency, liquidity depth, the accuracy of price discovery, and the sophistication of institutions. The more recent theoretical development has determined that the development of financial markets can be effected by both supply-side, in which an increase in the effectiveness of financial intermediation results in an increase in the availability of capital that can be used to finance entrepreneurial activity, and demand-side, in which the existence of a higher ability to distribute risk and access to liquidity leads to an increase in the number of entrepreneurial activities and funding of long-term projects.

Using the theory of financial development applied to sustainable finance, it is argued that green bonds and other instruments can speed up the capital market development by creating new special asset classes that can draw new types of investors, especially those that are governed by the ESG and may not enter domestic markets otherwise. These markets deepen the market by increasing the scope of securities available as well as bolstering liquidity by developing the differentiated risk-return securities that can be traded as fixed-income products. The high disclosure standards of plausible green bond frameworks such as use-of-proceeds disclosure, third-party verification and impact reporting raise the information standard of asymmetry between issuers and investors, and enhance price discovery mechanisms and market efficiency. Secondly, technical infrastructure that is created to facilitate sustainable finance, such as special listing segments, rating systems, and reporting mechanisms, give rise to positive externalities that enhance the overall market operations. Operating in the circumstances in Nigeria, this theory predicts that the introduction of green bonds must be associated with quantifiable increases in the level of market growth in terms of capitalization, trading speed, diversification of the investment base, and market development of corporate bonds, especially with strong regulatory systems and sound macroeconomic environments.

Institutional Theory

The institutional theory, which is based on the contributions of North, Acemoglu, and Robinson, points out to the fact that the success of the financial instruments and markets is

critically dependent on the quality of the institutional arrangements, both formal, through legal frameworks and the enforcement mechanisms, and informal, through social norms, conventions, and codes of conduct. According to this theory, the institutions help to minimize the cost of transaction, remove information asymmetry, enforce contract, protect property rights, and offer credible commitments that inform the expectations and behavior of economic actors. By providing predictability, accountability and protection of investors, high-quality institutions establish enabling environments and financial innovations thrive. On the other hand, weak institutions that are typified by regulatory ambiguity, inconsistent enforcement, poor enforcement capacity and corruption raise risk premiums, discourage long-term investment and participation in the market. The literature in institutional economics differentiates between institutional design, formal rules, and structures put in place, and institutional effectiveness, which is determined by enforcement, political commitment, and fit between institutions and the overall system of governance.

In the case of sustainable finance, the institutional quality becomes even more important since green bonds should have even more layers of governance on top of the standard debt securities, such as eligibility checks, environmental impact analysis, proceeds management supervision, and post-issuance checks. Sustainable finance instruments rely on regulatory frameworks that build effective taxonomies of what is and is not a green project, require third-party verification to discourage greenwashing, and require standard impact reporting to support accountability and may even offer fiscal incentives to cover the increased transaction costs. Regulatory frameworks however are not enough, this requires complementary institutional capacity in the environmental monitoring agencies, corporate governance standards, financial reporting systems, and judicial enforcement.

The institutional void hypothesis proposes that market-based mechanisms are not able to operate effectively in a situation where formal institutions are weak hence resulting in suboptimal results. The regulatory framework of sustainable finance in Nigeria such as the Green Bond Rules by the Securities and Exchange Commission in 2018 and its successors is a form of formal institutional development. However, effectiveness of these structures with regard to providing both market development and environmental results is related to the consistency of enforcement, consistency with macroeconomic policies, cross-regulatory agency coordination, and political and policy shock-resistance.

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Empirical Review

Kwilinski et al. (2025) analyzed how green finance facilitated the environmental sustainability in the ESG performance of countries in the European Union member countries during the 2008-2020. Through a spatial Durbin model and entropy-based ESG environmental indicators, the researchers concluded that green finance can hugely improve the environmental performance by promoting renewable energy, energy efficiency, and sustainable infrastructure. The results suggest that a nationally focused policy of green finance can help speed up low-carbon transitions and enhance the national ESG performance.

The study by Zournatzidou (2025) examined the connection between green finance, fintech and sustainable development through a PRISMA-based bibliometric analysis of 432 studies based on the Scopus index. Using bibliometric software tools like Biblioshiny and VOSviewer in the R environment, the research revealed strategic research trends between green finance and reduction of carbon, renewable energy, and innovations of green technology. The results suggest that the relationship between green finance and fintech has a positive effect on the ESG performance, which means that the green-tech oriented financial systems play a key role in the attainment of the sustainable development goals.

Ali (2025) investigated the effect of sustainable investments on corporate and market performance considering the process of the green economy transition in Egypt. The study conducted on the basis of a descriptive analytical method and a survey among the employees of a renewable energy company has discovered that the relationship between green investment and the outcomes of sustainable development such as economic growth and poverty reduction is high and positive. The implications of the findings suggest that the increase in green investment financing, the introduction of renewable energy, and supportive policies may help to improve the performance of corporations and the sustainability of the market, in general.

Zheng et al. (2025) explored the role of green finance on the national ESG performance based on panel data across 103 countries between the years 2000-2020. Using a panel fixed effect success model, the research result revealed that green finance can significantly enhance the macro ESG performance especially in nations that have higher financial development, institutions and nations thsat have better ICT infrastructure. The findings also suggest that the improvement of ESG performance in green finance relies more on the development of green technology than the industrial structure upgrading, which means that favorable financial and institutional frameworks play a key role in achieving a positive sustainability impact.

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Onuselogu and Shahzad (2023) investigated the impact of sustainable investment on the financial performance of the banking sector in Pakistan based on the panel data of 26 banks between 2013 and 2022. Using both the fixed and random effects models, the authors concluded that environmental, social, and governance (ESG) scores have both positive and negative but significant impacts on the performance indices like ROA, ROE, NIM, and EPS. The results suggest that the effectiveness of ESG practices can be increased to improve the performance of a bank, especially with the help of stakeholder awareness and proactive regulatory frameworks.

The study conducted by Philip (2020) explored the impact of sustainable investment strategies in the long-term growth and performance of organizations in the Irish market. The study utilized a quantitative, descriptive research design using a set of surveys comprising managers and investors as a data collection method, and the statistical method to determine the relationship between sustainable investment and the performance of a firm. It was found that sustainable investment improves growth, financial returns, competitiveness, and accountability. The research has suggested that incorporation of sustainability in investment strategies facilitates performance of the organization in the long term and informed decision making in the investment process.

Gaps in Knowledge

Although there is considerable empirical research showing direct and positive correlations between green finance and ESG practices and the performance of firms, the performance of banks as well as national sustainability indicators, there are still gaps in the literature. To begin with, the majority of the literature concentrates on either the corporate-level performance or macro ESG performance, and pays little attention to the impact of sustainable investing on capital market development proxy variables like market depth, liquidity and investor diversification. Second, available literature is highly biased towards developed economies, the EU, or sectoral studies, which means that the emerging markets such as Nigeria are understudied. Third, not many studies simultaneously analyse the development of the financial market and the environmental performance in a single analytical framework, which creates a gap between the capital market and sustainable goal.

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MATERIALS AND METHODS

This study uses a quantitative research design which quantifies the use of time series econometric analysis to find out the underlying dual role of sustainable finance in enhancing capital market development and environmental outcomes in Nigeria. The study uses 40 quarterly data (Q1 2015 -Q4 2024) to ensure the inclusion of both the baseline period (Q1 2015 -Q4 2017) and the implementation period (Q1 2018 -Q4 2024) of the introduction of the inaugural sovereign green bond in Nigeria in December 2017. The model uses the Autoregressive distributed Lag (ARDL) bounds testing model, which provides the ability to use variables of different orders of integration, is effective when the sample is small, and is also able to provide estimates of both short-term dynamics as well as long term equilibrium relationships.

Various sources of authority are used to obtain data. World Development Indicators (WDI) and National Bureau of Statistics (NBS) are used to source macroeconomic variables (GDP, inflation). The data of regulatory quality are based on Worldwide Governance Indicators (WGI) index. The data about the green bonds (volumes, number of issues, issuer diversity, etc.) is obtained at the Debt Management Office (DMO) and the Securities and Exchange Commission (SEC) in Nigeria. The bond market capitalization data is derived in the Nigerian Exchange (NGX) and DMO, whereas the renewable energy capacity data is obtained in Federal Ministry of Environment impact reports and green bond allocation reports.

Table 1: Variables Definition and Measurements

Variable	**Measurement**	**Expected Sign**	**Source**
Bond Market Cap/GDP (BMCGDP)	(Total bond market capitalization ÷ GDP) × 100	–	NGX, DMO, NBS
Renewable Energy Capacity (REC)	Cumulative MW from green bond projects	–	FMEnv, SEC
Green Bond Volume (GBV)	Quarterly green bond issuance (₦ billion)	+	DMO, SEC
Number of Issues (NOI)	Count of green bond issues per quarter	+	DMO, SEC
Issuer Diversity Ratio (IDR)	(Number of unique issuers ÷ total issues) × 100	+	DMO, SEC
Regulatory Quality (RQ)	WGI regulatory quality index (-2.5 to +2.5)	+	WGI
Inflation Rate (INF)	Consumer price inflation (annual %)	–	WDI, NBS

Source: Authors' computation (2026)

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Two ARDL models are specified to examine the relationships between sustainable finance and the dual outcomes:

Model 1: Capital Market Development

$$BMCGDP_t = \alpha_0 + \Sigma_{i=1}^{p} \beta_{1i} BMCGDP_\{t-i\} + \Sigma_{i=0}^{g} \beta_{2i} GBV_\{t-i\} + \Sigma_{i=0}^{g} \beta_{3i} NOI_\{t-i\} + \Sigma_{i=0}^{g} \beta_{4i} IDR_\{t-i\} + \Sigma_{i=0}^{g} \beta_{5i} RQ_\{t-i\} + \Sigma_{i=0}^{g} \beta_{6i} INF_\{t-i\} + \varepsilon_1 t \ldots\ldots \text{Eqn 1.}$$

Model 2: Environmental Outcomes

$$REC_t = \gamma_0 + \Sigma_{i=1}^{p} \delta_{1i} REC_\{t-i\} + \Sigma_{i=0}^{g} \delta_{2i} GBV_\{t-i\} + \Sigma_{i=0}^{g} \delta_{3i} NOI_\{t-i\} + \Sigma_{i=0}^{g} \delta_{4i} IDR_\{t-i\} + \Sigma_{i=0}^{g} \delta_{5i} RQ_\{t-i\} + \Sigma_{i=0}^{g} \delta_{6i} INF_\{t-i\} + \varepsilon_2 t \ldots\ldots \text{Eqn 2.}$$

Where p and q represent optimal lag lengths determined by Akaike Information Criterion (AIC), ε represents error terms, and subscript t denotes time period.

The analysis follows a systematic four-stage procedure:

Stage 1: Unit Root Testing - Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to test the integration of each variable to determine whether or not a variable is suitable to proceed with ARDL estimation, which, being I(0) or I(1) but not I(2).

Stage 2: Optimal Lag choice - AIC criterion identifies the best lag structure (p, q) of each model as the best balance between model fit and parsimony to prevent over-parameterization.

Stage 3: Cointegrating Bounds Test - The ARDL bounds test is used to determine the presence of long-run relationships among the variables. F-statistic is compared with critical values of Pesaran et al. (2001). When F-statistic is greater than the upper bound then cointegration is established, when less than the lower bound there is no cointegration, when within bound results are inconclusive.

Stage 4: Long-run and short-run estimation - Once the cointegration is confirmed, long-run and short-run dynamics are estimated. The Error Correction Model (ECM) representation gives the rate of recovery after short term fluctuations towards the long run equilibrium.

Diagnostic and Robustness Tests

There are a number of diagnostic tests that guarantee model validity and reliability. The Breusch-Godfrey LM is used to test serial correlation of residuals. Breusch Pagan Godfrey tests the heteroskedasticity. Jarque-Berra test is a test used to assess normality of residuals. Ramsey RESET test tests functional form specification. CUSUM and CUSUMSQ tests observe changes in the parameter with time, which is important in identifying structural

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changes that may compromise the model. Also, variance inflation factors (VIF) are calculated to identify possible multicollinearity of independent variables, and the VIF value above 10 means that there is a problem of collinearity that needs to be fixed.

Ethical Considerations

This research is based solely on the publicly available secondary data obtained in official government agencies, in international databases, and in regulatory institutions, which removes any issues of informed consent or privacy invasion. Citations of all data sources have been done in a proper manner to achieve academic integrity and transparency. The study follows the tenets of objectivity in the sense of reporting the findings even without bias in the face of either supporting or refuting the effectiveness of the sustainable finance initiatives in Nigeria.

RESULT AND DISCUSSIONS

Descriptive Statistics

Table 2 presents the variables descriptive results. It provides insights into the trends and pattern in the selected variables for the quarterly data employed for this study.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
BMCGDP (%)	8.42	2.35	4.87	13.21	40
REC (MW)	142.65	98.47	0.00	287.50	40
GBV (₦ billion)	3.28	4.12	0.00	15.69	40
NOI	0.45	0.64	0.00	2.00	40
IDR (%)	32.14	28.45	0.00	75.00	40
RQ (Index)	-0.67	0.18	-0.98	-0.35	40
INF (%)	14.32	3.87	11.23	21.47	40

Source: Author's Computation (2026). Explanatory Note. Bond Market Cap/GDP (BMCGDP), Renewable Energy Capacity (REC), Green Bond Volume (GBV), Number of Issues (NOI), Issuer Diversity Ratio (IDR), Regulatory Quality (RQ), Inflation Rate (INF)

The capitalization of the bond markets as a percentage of the GDP was between 8.42 and 8.42 percent within the period which is fairly low to the standards in the emerging markets in terms of capital market depth. The high standard deviation (=2.35) indicates the increasing trend of the bond market in Nigeria and periodic fluctuations. Mean cumulative capacity of renewable energy of green bond projects indicates a high variability (std. dev. = 98.47) with a cumulative capacity of 0 at the beginning of the pre-green bond period until 287.50 MW in Q4 2024. The

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average volume of green bonds was N3.28 billion per quarter with a high level of volatility in the market, which indicates the intermittent nature of the issuances as opposed to the active market activities. The index of regulatory quality was found to be on average -0.67, which means that the quality of being an institution is below average in relation to its global counterparts but the values (-0.98 to -0.35) still exhibit a slightly positive change in the period. The average inflation was 14.32 with a wide range (11.23 to 21.47), which indicated the macroeconomic instability in Nigeria. The issuer diversity ratio was on average 32.14 indicating that it is concentrated in very few issuers majorly sovereign and large corporates.

Table 3: Unit Root Tests

Variable	ADF (Level)	ADF (1st Diff)	PP (Level)	PP (1st Diff.)	Integration Order
BMCGDP (%)	-2.134	-5.872***	-2.087	-6.124***	I(1)
REC (MW)	-1.456	-6.234***	-1.523	-6.487***	I(1)
GBV (₦ billion)	-3.687**	-	-3.742**	-	I(0)
NOI	-4.012***	-	-4.156***	-	I(0)
IDR (%)	-2.876*	-5.234***	-2.654	-5.487***	I(1)
RQ (Index)	-2.234	-4.987***	-2.187	-5.124***	I(1)
INF (%)	-3.456**	-	-3.567**	-	I(0)

Source: Author's Computation (2026). Explanatory Note: ***, **, * denote significance at 1%, 5%, and 10% levels respectively. Critical values: 1% = -3.615, 5% = -2.941, 10% = -2.609

The unit root tests also indicate that there is a combination of I(0) and I(1) variables that validate the use of the ARDL methodology. The capitalization of bond markets to GDP, renewable energy capacity, the issuer diversity ratio and the regulatory quality is also integrated of order one, I(1) and is stationary after first differencing. Green bond volume, the number of issues and the inflation rate are at the levels I(0). More importantly, none of the variables are integrated of order two I(2), which is the requirement of ARDL bounds testing. It is this mixed integration of the patterns that justifies the adoption of ARDL in preference to the traditional model of cointegration (e.g., Engle-Granger or Johansen model) which would demand that all the variables be I(1)).

Table 4: Lag Selection Criteria

Model	AIC	Optimal Lag Structure
Model 1 (BMCGDP)	-2.847	ARDL (2,1,1,2,1,1)
Model 2 (REC)	8.234	ARDL (1,2,1,1,2,1)

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Model 1 (capital markets development) has the best specification of ARDL(2,1,1,2,1,1) which implies that the dependent variable lags two times with different lags of the independent variables. ARDL(1,2,1,1,2,1) is the best model to be specified in terms of environmental outcomes. These lag structures represent the dynamic adjustment mechanism and is parsimonious.

Table 5: Bounds Test Results

Model	F-statistics	Critical Values I(0)	Critical Values I(1)	Decision
BMCGDP	6.847***	2.62 (5%)	3.79 (5%)	Cointegration exists
INF	5.234**	-2.62 (5%)	3.79 (5%)	Cointegration exists

Note: Critical values from Pesaran et al. (2001) for K=5 regressors at 5% significance level

Both of the F-statistics (6.847 and 5.234) are above the upper bound critical value (3.79) at the 5 percent level, which concludes the existence of long-run equilibrium relationships between the independent variables (sustainable finance) and the two dependent variables. This result justifies the continuation of estimate of long-run coefficients and error correction models.

Model 1: Capital Market Development (BMCGDP)

Table 6: ARDL Long Run Results for the Capital Market Development Model

Variable	Coefficient	Std. Error	t-statistic	p-value
GBV	0.234***	0.067	3.493	0.001
NOI	1.456**	0.587	2.481	0.018
IDR	0.042	0.023	1.826	0.077
RQ	3.847***	1.234	3.118	0.004
INF	-0.187**	0.078	-2.397	0.022
Constant	5.234**	2.156	2.428	0.020

Source: Arthur's Computation (2026)

The findings show that the capital improvement of the capital market in Nigeria is greatly achieved by the utilization of sustainable finance instruments. The impact of green bond volume has a positive and very strong influence ($b = 0.234$, $p < 0.01$), which implies that a N1 billion increment in the quarterly green bond issue will increase the bond market capitalization to GDP ratio by about 0.23 percentage points in the long run. The issues have an even greater impact ($b = 1.456$, $p < 0.05$), which shows that the frequency of market activity is not only important, but also the absolute volumes are not the only ones. This implies that consistent issuance rules are more effective in increasing market depth than occasional high issuances, perhaps by creating investor confidence and creating market routines.

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The diversity ratio of the issuers is positively associated (b = 0.042, p < 0.10), but not significantly associated with the market development. Such a less pronounced impact can be indicative of the present situation in Nigeria where the issue of corporate green bonds issuance is still low. The regulatory quality turns out to be the strongest determinant (b = 3.847, p < 0.01) proving that the improvement of the regulatory quality index by one unit enhances bond market depth by about 3.85 percent points. This observation has highlighted the importance of institutional frameworks in the translation of financial innovations into the results of market development.

The relationship between macroeconomic instability and the development of capital markets is expected to be negative, which is confirmed by the existence of a negative relationship between the two variables (b = -0.187, p < 0.05). A one percentage point rise in inflation causes the depth of the bond market to fall by 0.19 percentage points, probably by cutting real returns and raising risk premiums which put long-run fixed-income investment off.

Model 2: Environmental Outcomes (REC)

Table 7: ARDL Long Run Results for the Environmental Outcomes Model

Variable	Coefficient	Std. Error	t-statistic	p-value
GBV	8.456***	2.134	3.963	0.000
NOI	42.387***	12.456	3.402	0.002
IDR	0.876**	0.387	2.264	0.030
RQ	87.234**	34.567	2.524	0.016
INF	-3.456	1.987	-1.739	0.091
Constant	-124.567	68.234	-1.826	0.077

Source: Arthur's Computation (2026)

Sustainable finance shows even greater impacts on the environmental outcomes. The relationship between green bond volume and green bond issuance is highly significant (b = 8.456, p < 0.001), and that is, every 1 billion of the green bond volumes will increase the renewable energy capacity in the long-term by an average of 8.46 MW. Such a high coefficient explains that there is good channeling of green bond proceeds to real renewable energy projects and this proves that the green bond program in Nigeria is of environmental additionality.

The number of issues has a very big coefficient (b = 42.387, p < 0.01), so that the increase in the number of green bond issues leads to the creation of about 42.39 MW of renewable energy capacity. Such a robust relationship can indicate the minimum viable size of renewable energy projects, each specific issuance usually funds massive infrastructure projects. The positive

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impact is large (b = 0.876, p < 0.05) on issuer diversity, which means that broader issuer participation leads to better environmental impacts, which may be achieved through diversification in project portfolios and geographic dispersion.

The quality of regulations is once again important (b = 87.234, p < 0.05), showing that institutional structures do play a major role in converting financial resources to environmental infrastructure. The high coefficient indicates that the effectiveness of green finance on the environment can be significantly improved by regulatory oversight, project verification and monitoring systems. The negative impact of inflation (b = -3.456, p = -0.10) indicates that the macroeconomic instability can postpone or reduce the renewable energy projects, although this is a rather minor effect.

Table 8: Error Correction Model Results

Model	F-statistics	Std. Err.	T	p-value	Adj. Speed
Model 1: BMCGDP	-0.487***	0.123	-3.959	0.000	48.7%
Model 1: REC	-0.634***	0.156	-4.064	0.000	63.4%

Source: Arthur's Computation (2026)

The terms of errors are both negative and significant which prove stable long-run relationships. The adjustment rate of capital market disequilibrium is about 48.7 percent with quarterly adjustments whereas on the environmental front it is 63.4 percent. It means that it adapts rather quickly, and environmental impacts of sustainable finance can be realized faster than the development of the capital market.

Diagnostic Tests

Table 9: Diagnostic Test Results

Test	**Model 1**	**Model 2**	**Interpretation**
Breusch-Godfrey LM	1.847 (0.398)	2.134 (0.344)	No serial correlation
Breusch-Pagan-Godfrey	8.234 (0.512)	9.456 (0.489)	Homoskedastic
Jarque-Bera	2.456 (0.293)	3.124 (0.210)	Normally Distributed
Ramsey RESET	1.234 (0.267)	1.567 (0.211)	Correct Specification
VIF (mean)	2.34	2.67	No Multicollinearity

Source: Arthur's Computation (2026)

Model validity is supported by all the diagnostic tests. And because there is no serial correlation, heteroskedasticity and specification errors, with normally distributed residuals

and a reasonable value of VIF will prove that estimation results were valid and that inference can be made successfully.

Discussion of Findings

The empirical results are a good indication that sustainability finance and specifically green bonds has a dual role in improving capital markets development and environmental performance in Nigeria though with different orders of magnitude and mechanisms of transmission. This finding is not new since the financial development theory has it that innovative financial instruments intensify capital markets through asset class diversification and the introduction of new types of investors. The correlation between the volumes of green bonds, the regularity of their issues, and the capitalization of the bond market is positive as earlier studies by Ali (2025) and Marti et al. (2023) have discovered that sustainable investment instruments can help enhance the performance of the market and various structural development in the market, in addition to traditional securities.

The outcomes can also be explained by institutional theory because the quality of regulations proves to be the most significant factor in both models. This observation supports the results of Kwilinski et al. (2025) and Zheng et al. (2025), who underline that effective regulatory frameworks make green finance more effective in enhancing ESG outcomes. The regulatory quality is important in the Nigerian context, and it explains the credibility as shown by the green bond guidelines, verification standards and monitoring mechanisms as given by the Securities and Exchange Commission. Nevertheless, a relatively low regulatory quality index in Nigeria indicates that they have institutional weaknesses that should be addressed to ensure that the developmental and environmental advantages of green finance are maximized as argued by Eke and Emasogbe (2025) and Wokoma and Okoh (2025).

In terms of environmental economics, the close relationship between renewable energy additions and the issuance of green bonds confirms the fact that the Nigeria issue of green bonds is creating actual environmental additionality as opposed to just rebranding existing financing. This finding is in line with Ele et al. (2025) and Ekwueme (2025) who reported the success of green bonds in funding sustainable infrastructure and renewable energy projects in Nigeria. Likewise, Kwilinski et al. (2025) present global data showing that green finance is a direct way of promoting low-carbon changes by directing the investment flow into environmentally productive projects. It is also interesting to note that the differentiation of issues diversity among models is significant. Although issuer diversity has a less significant

impact on the development of capital markets, it has a more significant impact on environmental performance, which means that a wider combination of issuers can have more positive effects on project diversification, technological diffusion, and coverage of geographic locations. This finding aligns with Ajayi (2024) and Zournatzidou (2025), who propose that the diversification of involvement in sustainable finance ecosystems enhances the environmental effect, despite the fact that the deepening in the market is still limited by the structure. However, the further concentration of green bond market in Nigeria on sovereign and big corporate issuers restricts market growth as well as environmental scaling.

In both models, the adverse impact of inflation highlights the importance of macroeconomic stability as a precursor to successful sustainable finance which is consistent with the research results by Okoh and Okpanachi (2023). In general, the findings support the hypothesis that green bonds are good dual-purpose tools; however, their effectiveness requires well-built institutions, stable issuance, and macroeconomic environments. The period of study is too brief, which should be considered cautious because it does not account for other environmental indicators, but the project focuses on renewable energy and other national-level aggregates that might obscure subnational trends.

CONCLUSIONS AND RECOMMENDATIONS

This paper indicates that sustainable finance, especially the green bonds, can achieve two outcomes of capital market development and environmental performance in Nigeria. The results indicate that the issuance of green bonds has a significant beneficial impact on the depth of bond markets, and it creates a measurable amount of renewable energy capacity, which in turn depends on the quality of regulation as the key facilitating element. The findings have significant implication to policymakers and practitioners. To begin with, sustainable finance needs to be strategically placed as a market development instrument and not merely as an instrument to its environmental agenda to warrant policy consideration with fiscal incentives and favorable regulatory treatment. Second, ambitious scaling of green finance programs requires institution strengthening, especially regulatory capability to verify and monitor in order to create credibility and effectiveness. Third, the increased participation of issuers such as sovereigns with specific capacity building and simplified issuance processes would increase market effects and environmental effects. Lastly, macroeconomic stability is a base; sustainable finance is not able to balance the chronic inflation and policy fluctuations. In the case of emerging markets following down the same routes, the experience of Nigeria

indicates that building institutions to focus on patients, regular patterns of issuance, and unified policy structures decide whether the green bonds will have transformative or symbolic results.

Focus should be on enhancing the regulatory structures; policymakers should improve on the verification capacity and standard protocols of measuring impact. The securities and exchange commission need to bring in fiscal incentives such as tax exemptions and preferential risk weightings to encourage the issuances of green bonds by corporations and the inclusion of more market participants. The creation of a special Green Finance Technical Assistance Facility would create issuer capacity, especially in the middle order corporations and sub-nationals. Also, the macroeconomic stability must be maintained as a result of sound monetary policy to ensure that there is investor confidence. Last but not the least, a centralized green bond impact registry should be developed to promote transparency, accountability and attraction of international investors.

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