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Multidimensional Effect of Green Finance on Climate Change Mitigation in Nigeria

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Abstract - Climate change remains a critical global challenge, with Nigeria facing significant environmental and economic risks due to rising greenhouse gas emissions. Green finance, through instruments like green bonds and carbon credits, provides essential funding for climate mitigation, promoting renewable energy, sustainable infrastructure, and policies aimed at reducing carbon footprints. The study examines the effect of green finance on climate change mitigation in Nigeria, addressing the challenges of greenhouse gas emissions and the need for sustainable financial mechanisms. The main objective was to assess the impact of green bonds, carbon credits, green loans, renewable energy investments, green mortgages, and sustainable agriculture loans on reducing greenhouse gas emissions. The study employs an ex-post facto research design, covering the period from 2011 to 2023. The study utilized secondary data which was collected on a quarterly basis and was sourced from financial and environmental reports, and the analysis was conducted using econometric technique of the Autoregressive Distributed Lag model. The findings of the study revealed that green bonds, green loans, renewable energy investment, and green mortgages all have positive and statistically significant effect on greenhouse gas emissions in Nigeria. In contrast, carbon credit and sustainable agricultural loans have negative but statistically insignificant effect on greenhouse gas emissions in Nigeria. The study concludes that green finance is a viable tool for climate change mitigation in Nigeria, though its full potential remains underutilized. The study recommends among others that strengthening policy frameworks, increasing investment in green financial instruments, and enhancing public-private partnerships to scale up sustainable finance initiatives.

Keywords: Green Finance, Climate Change Mitigation, Carbon Credit, Green Bond and Renewable Energy Investment

INTRODUCTION

The intensifying threat of climate change, largely driven by human-induced greenhouse gas (GHG) emissions, has prompted a global shift toward sustainable, low-carbon development, as reinforced by international frameworks like the Paris Agreement. Africa, particularly vulnerable due to limited adaptive capacities, is experiencing significant economic and environmental impacts, compelling the urgent adoption of mitigation strategies (African Development Bank (AfDB), 2021; Odusanya et al., 2021). In this context, green finance emerges as a vital solution to bridge the climate investment gap by channelling funds into climate-smart infrastructure, renewable energy, and sustainable transport (Mikayilov & Sattarahmady, 2022; Musa et al., 2025; Al-Amin et al., 2025). In Nigeria, a major African economy with high GHG emissions from energy and agriculture, green finance is seen as key to realising its Nationally Determined Contributions (NDCs) under the Paris Agreement (Oduntan et al., 2022; Federal Ministry of Environment, 2021). Instruments like green bonds, carbon credits, and green loans are gaining traction to fund environmentally beneficial projects, ensuring alignment of financial systems with sustainable development goals (Zhang & Lu, 2022; Suleiman et al., 2025; Magaji et al., 2025).

Specific green finance instruments play diverse roles in mitigating GHG emissions. Green bonds finance low-carbon infrastructure, carbon credits incentivise emissions reduction through market-based mechanisms, and green loans support the adoption of energy-efficient and environmentally responsible practices (Kumah & Mensah, 2021; Akpan & Akpan, 2022; Tanko et al., 2025). Likewise, renewable energy investments reduce dependency on fossil fuels, contributing to long-term emission reductions, while green mortgages promote energy-efficient buildings that lower household emissions (Ezekiel et al., 2022; Sadiq et al., 2025). Additionally, sustainable agricultural loans help reduce methane and nitrous oxide emissions through climate-smart farming, improving food security and land use (Nwakoby & Okeke, 2023; Bello et al., 2025; Magaji & Musa, 2024). Collectively, these instruments not only lower emissions but also foster economic inclusivity and environmental resilience. Assessing their effectiveness is crucial for refining Nigeria’s climate finance strategies and reinforcing its global climate commitments.

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The intensifying global effort to curb greenhouse-gas (GHG) emissions under the Paris Agreement underscores the need for both technological progress and effective financial mechanisms. In Africa where climate vulnerability is high due to limited adaptive capacity green finance is viewed as a pivotal tool to fund renewable energy, sustainable transport, and climate-resilient infrastructure (AfDB, 2021). Nigeria, although a modest emitter in global terms, faces rising emissions from its energy, agriculture, and forestry sectors; its policy commitments under its Nationally Determined Contributions (NDCs) therefore emphasise expanding green-finance instruments such as green bonds, carbon credits, green loans, renewable-energy investments, green mortgages, and sustainable-agriculture loans (Oduntan et al., 2022; Zhang & Lu, 2022; Abubakar et al., 2025).

Despite growing literature on green finance, empirical evidence for its mitigation impact in Nigeria is sparse. Existing studies mostly examine single instruments (e.g., green bonds or renewables) or focus on mature markets in Europe and Asia, leaving Nigeria's unique institutional and infrastructural context under-researched (Fatica & Panzica, 2021; Lombardi & Bolis, 2022; Odusanya et al., 2021). Methodologically, many works rely on descriptive approaches and neglect rigorous econometric tests such as ARDL or cointegration analyses (Oche, 2020; Oduntan et al., 2022). Consequently, policymakers lack data-driven guidance on which combinations of green-finance tools most effectively reduce emissions. Addressing this gap, the present study will empirically assess the collective impact of green bonds, carbon credits, green loans, renewable-energy investments, green mortgages, and sustainable-agriculture loans on Nigeria's GHG mitigation outcomes.

Therefore, the objective of this study is to examine the multidimensional effect of green finance on climate change mitigation in Nigeria. based on this objective, the study addressed the following hypotheses:

H_{01}: Green bond has no significant effect on climate change mitigation in Nigeria

H_{02}: Carbon credit has no significant effect on climate change mitigation in Nigeria.

H_{03}: Green loan has no significant effect on climate change in Nigeria.

H_{04}: Renewable energy investment has no significant effect on climate change mitigation in Nigeria.

H_{05}: Green mortgage has no significant effect on climate change mitigation in Nigeria

H_{06}: Sustainable agriculture loan has no significant effect on climate change mitigation in Nigeria.

The remaining structure of this paper is as follows: Section 2 provides a comprehensive review of relevant literature on the multidimensional effect of green finance on climate change mitigation in developing economies, with an emphasis on Nigeria. Section 3 describes the methodology of research employed, detailing the study design, data collection methods, and analytical tools used. Section 4 presents the empirical findings, examining how the various dimensions of green finance affect climate change mitigation in Nigeria. It further interprets these results in light of existing literature, theoretical perspectives, and their relevance to policy and practical implementation. Finally, Section 5 offers a conclusion, highlighting the major insights and providing recommendations informed by the study's outcomes.

LITERATURE REVIEW

Climate Change Mitigation

Climate change mitigation refers to the comprehensive set of strategies and policy measures designed to curb the extent and pace of long-term climate change by lowering greenhouse gas (GHG) emissions and increasing the capacity of natural and artificial GHG sinks (Nawaz et al., 20202). It involves a sustained shift toward low-carbon energy sources, enhanced energy efficiency, sustainable land use practices, and the adoption of environmentally friendly technologies aimed at avoiding critical levels of global warming (Akpan & Akpan 2022). According to Garcia-Leal and Ramos-Martín (2022), climate change mitigation can be conceptualized as a proactive strategy involving policy instruments, economic incentives, and technological advancements, all aimed at curbing anthropogenic GHG releases into the atmosphere.

Green Finance

Green finance encompasses the mobilisation and deployment of financial resources toward initiatives that aim to minimise environmental degradation and promote sustainability. It typically includes funding for renewable energy, pollution reduction, sustainable waste management, and other climate-resilient projects (Zhang et al., 2022). According to Baker and Nduka (2022), green finance supports the financing of environmentally friendly energy sources such as solar, wind, and hydropower, which are instrumental in reducing carbon emissions. Similarly, Liu et al. (2023) define green finance as capital provision for climate mitigation and adaptation initiatives, particularly through investments in clean energy and low-carbon technologies. This directly ties green finance to efforts aimed at combating global warming. A wide array of instruments including green bonds, carbon credits,

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green loans, renewable energy investments, green mortgages, and sustainable agriculture loans are now employed globally to align capital flows with low-emission and climate-resilient development goals (Zhang & Lu, 2022; Arif et al., 2022).

Green Bond

Green bonds are specialised debt instruments used to finance projects that yield measurable environmental or climate-related benefits. They play a vital role in sustainable finance by enabling public and private sector actors to raise capital for initiatives such as renewable energy, energy efficiency, green buildings, sustainable transport, and water conservation (Kumah & Mensah, 2021; Fatica & Panzica, 2020). By allocating funds exclusively to environmentally beneficial projects, green bonds contribute to climate change mitigation while offering financial returns, thus aligning investment with ecological sustainability (Nigeria Green Bond Guidelines, 2020).

Carbon Credit

Carbon credits are innovative financial instruments designed to curb greenhouse gas (GHG) emissions by placing a monetary value on each unit of carbon emitted. Typically, one carbon credit permits the release of one metric ton of carbon dioxide or its equivalent in other GHGs (Zhang & Wang, 2019). These credits form the basis of market-based environmental regulation, encouraging both countries and organisations to invest in emission-reduction initiatives. By creating economic incentives for lowering emissions, carbon credits drive investments in clean technologies and sustainable practices, positioning them as a critical tool in the fight against climate change (Fatica & Panzica, 2020; Musa & Olubusoye, 2020).

Green Loan

Green loans constitute a crucial pillar of green finance, designed to support projects that deliver verifiable environmental benefits. These financing tools reflect the financial sector's increasing accountability in addressing pressing ecological issues such as climate change, resource scarcity, and biodiversity loss (Akpan & Akpan, 2022). Unlike conventional loans, green loans are specifically designated for sustainability-driven initiatives, including renewable energy installations, energy-efficient construction, sustainable farming, and pollution control projects (Fu et al., 2024). Their disbursement and utilisation are carefully tracked to ensure alignment with predefined environmental objectives. By channelling funds into projects with measurable ecological outcomes, green loans facilitate the transition to environmentally sustainable economic models (Lajtha & Fischer, 2021).

Renewable Energy Investment

Renewable energy investment involves the strategic deployment of capital into projects that generate energy from sustainable, naturally replenishing sources such as solar, wind, hydroelectric, geothermal, tidal, and bioenergy. These investments are often propelled by government interventions, including tax incentives, grants, and policy mandates aimed at reducing greenhouse gas emissions and increasing the proportion of renewables in the national energy portfolio (Elum & Momodu, 2017). In emerging and developing economies, renewable energy investments are frequently supported by development finance institutions with the objective of expanding clean energy infrastructure, mitigating energy poverty, and fostering long-term sustainable development (Attanayake et al., 2024). Although renewable energy sources are virtually inexhaustible, they are constrained by their flow-dependent nature, limiting the amount of energy deliverable within a given timeframe (Kasem & Alawin, 2019).

Green Mortgage

Green mortgages are specialised home financing tools designed to promote environmentally sustainable housing by encouraging energy efficiency and reducing residential carbon emissions. These mortgages support the construction or renovation of properties that meet stringent environmental standards, often offering lower interest rates or higher loan amounts as incentives (Marin & Miguez, 2024; Cecere et al., 2024). By incorporating environmental performance assessments into lending criteria, green mortgages enable lenders to reward energy-efficient homes with favourable terms, thereby aligning financial incentives with climate goals (Marmiroli & Mela, 2022; Kumar & Singh, 2024).

Sustainable Agriculture Loans

Sustainable agriculture loans are financing tools designed to support farming practices that safeguard environmental quality, ensure the long-term economic viability of farms, and enhance the welfare of both farmers and their communities. These loans often fund initiatives such as organic cultivation, crop diversification, reduced chemical input use, and environmental conservation (Jackson, 2021). According to Smith and Roberts (2022), such loans are specifically extended to farmers who implement or transition to eco-friendly methods, including the use of renewable energy and sustainable water systems. Brown and Johnson (2021) further noted that sustainable agriculture loans promote practices that maintain ecological integrity by supporting biodiversity, improving soil health, and enhancing ecosystem services.

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EMPIRICAL REVIEW

Green Bond and Climate Change Mitigation

Qadir et al. (2024) used a mixed-methods approach to assess global Green Bond trends and market capacity for climate resilience. They proposed a roadmap to enhance Green Bond issuance in developing economies, citing the need for improved governance and transparency. However, the study did not detail quantitative findings or specific project outcomes, making it difficult to gauge the direct effectiveness of Green Bonds on climate resilience. Taghizadeh-Hesary et al. (2022) explored the use of Green Bonds in financing energy efficiency in selected African countries using a case study approach. They highlighted country-specific uses of Green Bonds and recommended public-private partnerships and tailored policies. However, the study lacked empirical data on project outcomes, limiting generalisation across diverse African markets.

Kung et al. (2022) employed a two-stage stochastic programming model to assess the role of Green Bonds in supporting bioenergy development in Taiwan under climate change. While the model offered strategic investment insights, its assumptions of perfect competition and constant demand may not reflect real-world dynamics, affecting its broader applicability.

Carbon Credit on Climate Change Mitigation

Were (2024) conducted a case study in Kenya to assess the integration of carbon credits within green finance, particularly through projects like reforestation and energy-efficient cookstoves. Using interviews and secondary data analysed qualitatively, the study found that carbon credits played a vital role in funding grassroots climate actions and improving social outcomes. Nonetheless, it faced limitations such as high transaction costs and restricted access to global markets, while its qualitative approach constrained the measurement of precise impact. Fu et al. (2024) reviewed literature on carbon credits in Asia and Africa, exploring their effectiveness in emissions reduction and sustainable project financing. The study found that although carbon credits were instrumental in supporting renewable energy and afforestation projects, issues like double-counting and greenwashing undermined their credibility. It called for standardised regulations and robust verification systems to enhance the transparency and trustworthiness of global carbon credit markets.

Elsherif (2023) examined carbon credits as a green financing mechanism in Egypt through a descriptive design, drawing data from government and institutional reports. The study revealed that carbon credits helped companies meet environmental targets and supported renewable initiatives. However, limited stakeholder awareness and institutional capacity were major barriers, and the absence of empirical impact data weakened the study's ability to demonstrate concrete emissions reduction. Zhang et al. (2022) adopted a mixed-method design to evaluate carbon credits in China's promotion of low-carbon technologies. Through interviews and carbon trading data, the study found that carbon credits encouraged investment in renewable energy and efficiency technologies. Still, fragmented verification standards hindered market efficiency, and the regional focus reduced the applicability of findings to other countries.

Green Loan and Climate Change Mitigation

Idris et al. (2024) carried out a comparative study on green financing in Malaysia and Indonesia, focusing on the role of governments in overcoming regulatory and incentive-related challenges. Their analysis highlighted inconsistencies in regulations and insufficient financial incentives as key barriers to green finance effectiveness. Although the study underscored the need for coordinated policy responses, it lacked detailed empirical evaluation of green finance impacts across industries. Ionescu (2023) conducted an empirical study on the role of green finance during the COVID-19 pandemic, analysing global data to assess its impact on low-carbon energy and climate goals. The study confirmed the importance of green investments in achieving sustainable development and carbon neutrality, but it stressed the need for clearer policy definitions and tax incentives to enhance green finance adoption.

Renewable Energy and Climate Change Mitigation

Maulida (2024) conducted a literature review examining the impact of renewable energy sources such as solar, wind, and biomass on climate change mitigation. The study concluded that renewables are crucial in reducing greenhouse gas emissions and enhancing energy diversification. However, its reliance on secondary data limits the empirical strength and contemporaneity of the conclusions drawn. Attanayake et al. (2024) analysed data from 138 countries between 1995 and 2021 to assess the impact of renewable energy on CO_2 emission reductions. Using panel, linear, and non-linear regression models, they found strong evidence supporting the role of renewables in mitigating emissions globally. While methodologically robust, the study's generalisations may overlook country-specific energy contexts and policy differences. Bashir and Gull (2024) explored the climate mitigation potential of various renewable energy technologies through global case studies. Their research highlighted socio-economic and environmental benefits of technologies like solar and wind energy. However, the study's lack of detailed quantitative analysis limits the precision of its findings.

He et al. (2022) assessed the effectiveness of green mortgages in promoting energy-efficient housing across the Asia-Pacific region. Through a mixed-methods design, they demonstrated that green mortgages incentivise lower-emission building practices.

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Nonetheless, challenges such as certification costs and consumer scepticism hinder wider adoption, and the study's limited regional scope affects generalisability. Ugurlu (2022) reviewed the role of renewable energy in climate mitigation through a broad narrative approach. The chapter underscored the emission-reducing potential of solar and wind energy but lacked empirical detail and specific case studies, which constrained its depth and application to policy-making.

Green Mortgage and Climate Change Mitigation

Devine & McCollum (2024) used performance data from U.S. green mortgage-backed securities to compare projected versus realised savings from the Green Rewards programme in multifamily housing. Although ex-ante estimates overstated energy- and water-efficiency gains, the authors found significant environmental improvements especially in newer, larger, higher-quality buildings. They conclude that inaccurate pre-project forecasts may undermine investor confidence, calling for stricter assessment and reporting standards. Kaza et al. (2021) employed a mixed-methods approach secondary data from lenders and homeowner surveys covering green-mortgage initiatives in the United States and Europe. Results show these products spur adoption of energy-efficient home technologies and cut residential CO_2 emissions, yet uptake is constrained by low consumer awareness and the absence of harmonised energy-efficiency metrics. The authors note transferability issues to developing-country contexts.

Ying et al. (2020) analysed Chinese financial-institution data and household energy-consumption surveys through a quantitative lens. They report that green mortgages help accelerate smart-energy systems and high-efficiency appliances in homes, yielding notable energy savings. Persisting obstacles include limited public knowledge and weak integration with wider green-finance policies; qualitative insight into consumer behaviour was not explored. Bourassa et al. (2020) examined Canadian mortgage and real-estate datasets to gauge green-mortgage impact on energy use. The study links such loans to measurable reductions in urban residential energy demand and emissions but highlights high retrofit costs and insufficient incentives for low-income households. Rural and remote contexts remain understudied. Shah et al. (2019) conducted case studies of Indian urban developments financed by green-mortgage schemes, drawing on developer interviews and financial records. Findings indicate that green mortgages drive use of energy-efficient materials and solar systems, lowering project carbon footprints. Barriers include inadequate policy support and limited affordability for low-income groups; results are specific to selected urban centres.

Sustainable Agriculture Loans and Climate Change Mitigation

Raihan (2023) presents a narrative review on soil-carbon sequestration as a climate-mitigation practice, highlighting benefits for soil health, productivity, and CO_2 reduction. The author recommends policy incentives for widespread adoption but notes the need for more empirical evidence and economic analysis to substantiate large-scale feasibility. Malhi, et al. (2021) review climate-change impacts on agriculture and outline mitigation options such as stress-tolerant crop varieties and advanced farming practices. While the article offers a comprehensive agronomic overview, it lacks an economic assessment of the proposed strategies, limiting insight into their practical scalability.

Khatri-Chhetri et al. (2021) analyse innovative financing mechanisms that blend climate finance with agricultural budgets and private investment. Results show improved capital access for farmers and reduced emissions, yet the study does not critically evaluate the risks and implementation challenges of these financial instruments. Lipper et al. (2020) use qualitative evidence from East Africa to show that sustainable-agriculture loans foster agroecological practices e.g., crop diversification and integrated pest management thereby enhancing carbon sequestration. However, limited rural financial infrastructure constrains loan accessibility, and scalability metrics are absent. Fujimori et al. (2019) conduct a panel-data analysis across 15 Latin-American countries, demonstrating that climate-smart agriculture loans raise yields and cut emissions. Despite these benefits, the study reveals inequitable loan access, particularly for women and Indigenous farmers, and calls for targeted policy remedies.

THEORETICAL FRAMEWORK

This study is grounded on Stakeholder Theory. Stakeholder Theory, proposed by Edward Freeman (1984), advocates for corporate strategies that consider the interests of all stakeholders' employees, customers, communities, investors, and the environment rather than focusing solely on profit maximisation. The theory posits that long-term organisational success and sustainability are best achieved by balancing these diverse needs, a principle that aligns closely with green finance initiatives like green bonds and sustainability-linked loans. Despite critiques such as lack of prioritisation guidelines and weak empirical foundations for measuring environmental outcomes (Jensen, 2002), Stakeholder Theory remains highly relevant to climate change mitigation efforts, particularly in Nigeria. In the Nigerian context, where climate impacts are acute, the theory supports inclusive, multi-stakeholder approaches to green finance, fostering solutions that generate economic, social, and environmental value.

RESEARCH METHODOLOGY

This study employed an ex post facto research design to examine the multidimensional effect of green finance on climate change mitigation in Nigeria. The design was appropriate given the non-manipulable nature of the variables and the reliance on pre-existing data (Onwumere, 2009; Kerlinger & Lee, 2020). The study focused on key green finance indicators such ass green loans, carbon

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credits, green bonds, renewable energy investments, green mortgages, and sustainable agriculture loans and assessed their relationship with climate change mitigation. Quarterly time series data spanning from 2011 to 2023 were used, offering a robust temporal framework to capture evolving trends and policy impacts (Chatfield, 2016). Data were sourced from authoritative institutions including the Central Bank of Nigeria (CBN), Nigerian Exchange Group (NGX), National Bureau of Statistics (NBS), International Renewable Energy Agency (IRENA), World Bank, IMF, UNFCCC, FAO, FMARD, and environmental NGOs such as WRI and ERA/FoEN. These secondary sources provided reliable information on green finance instruments and their environmental outcomes. The thirteen-year period allowed the study to track the adoption and implementation of green finance initiatives, including Nigeria's landmark 2017 green bond issuance and subsequent expansion into climate-resilient investments, aligning the analysis with the country's commitment to global climate agreements and the Sustainable Development Goals (UNEP, 2019)

Table 1: Variable Measurement

Variable name & acronym	Variable type	Variable Description	Source	Apriori
Greenhouse Gas Emissions (GHGE)	Dependent variable	Measured as concentration of greenhouse gases per 1000sq	IPCC(2019), Adisa et al. (2024	N/A
Green Bonds (GB)	Independent variable	Measure as ratio of green bonds subscription to total bonds	LMA (2021), Adisa et al. (2024); Lajtha and Fischer (2021).	Positive
Carbon Credit (CC)	Independent variable	Measured as ratio of carbon credit to total credit issued by financial institutions	Gold Standard. (2023), Pizer, and Manson (2020); Zhang and Wang (2019)	Positive
Green Loans (GL)	Independent variable	Measured as ratio of green loans to total loans disbursed	Climate Bonds Initiative. (2021), Flammer (2021), Fletcher & McCarthy (2019)	Positive
Renewable Energy Investment (REI)	Independent variable	The stock of money in circulation + all deposit with commercial banks + Near Money.	IRENA (2022) ; Attanayake et al. (2024)	Positive
Green Mortgage (GM)	Independent Variable	To take the value of 1 if the period is during or after recession, and 0 if otherwise	Kaza et al. (2014), Liao & Chang (2021).	Positive
Sustainable Agricultural Loans (SAL)	Independent Variable	Measured as percentage annual growth in sustainable agricultural loans	Boehlje & Hennessy (2006). Liu & Zhao (2019).	Positive

Source: Researcher's Compilation, 2025

The data obtained for this study was analyzed using both descriptive and inferential statistics. Unit root tests, descriptive statistics, correlation matrix, and the ARDL model were all employed in the statistical analysis. The regression analysis will be used to test the hypotheses raised for the study. The analysis was done using EVIEWS software.

The model of this study is stated below:

$$GHGE_t = \beta 0it + \beta 1(GRL)_t + \beta 2(CBC)t + \beta 3\ (GRB)t + \beta 4\ (REI)t + \beta 5\ (GRM)t + \beta 6\ (SAL)t + \mu t$$

Where:
GHGE = Greenhouse Gas Emission
β0 = Constant term, which represents when all explanatory variables are held constant
β1- β6 = Coefficient of the parameter estimates
GRL= Green Loans
CBC = Carbon Credit
GRB = Green Bond
REI = Renewable Energy Investment
GRM = Green Mortgage
SAL = Sustainable Agriculture Loan
Ut = the error term or residual at time

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RESULT AND DISCUSSIONS

Stationarity Tests

The Augmented Dickey-Fuller (ADF) test is a key statistical tool used to assess the stationarity of a time series by checking for the presence of a unit root, which would indicate non-stationarity. In this study, the ADF test was applied to 156 monthly return observations covering the banking index, the All-Share Index, and selected macroeconomic variables. The test enhances robustness by incorporating lagged differences to correct for autocorrelation, thereby improving the reliability of results. A stationary series, where the test statistic is more negative than the critical value, validates further time series modeling, while non-stationary data require differencing or transformation to avoid spurious regressions. Thus, the ADF test is vital for ensuring the validity of relationships in economic and financial time series analyses.

Table 2: Augmented Dickey Fuller (ADF) Test for Stationarity of Variables

Variable	ADF Statistic	Stationarity	Order of Integration
GHGE	-1.1033	No	N/A
GHGE(-1)	-3.8468***	Yes	I(0)
GB	-1.5103	No	N/A
GB(-1)	-3.7570***	Yes	I(0)
CC	-2.6594*	Yes	I(0)
GL	-0.7037	No	N/A
GL(-1)	-3.4382***	Yes	I(0)
REI	-0.0467	No	N/A
REI(-1)	-3.2851***	Yes	I(0)
GM	-2.3406	No	N/A
GM(-1)	-4.5265***	Yes	I(0)
SAL	-2.6920*	Yes	I(0)

***,** and * imply significance at the 1%, 5% and 10% levels respectively

Source: EViews13 Output, 2025

Table 2 reports Augmented Dickey-Fuller (ADF) statistics for each series in levels and—where the level test fails in first differences (shown with the "(-1)" lag). At the 1 percent significance level (**), greenhouse-gas emissions (GHGE), green bonds (GB), green loans (GL), renewable-energy investment (REI), green mortgages (GM) and sustainable-agriculture loans (SAL) are non-stationary in levels (their ADF statistics are less negative than the critical values), but become stationary after first differencing: GHGE(-1), GB(-1), GL(-1), REI(-1) and GM(-1) all reject the unit-root null with ADF statistics between –3.28 and –4.53. Carbon credits (CC) and SAL achieve stationarity already in levels at the 10 percent () threshold, indicating they are I(0). In short, most green-finance variables and the emissions series are integrated of order one, while CC (and SAL at the 10 percent level) are level-stationary. These mixed integration orders satisfy the pre-conditions for an ARDL/Bounds-testing framework, allowing the study to explore both short- and long-run dynamics between green-finance instruments and climate-mitigation outcomes without the risk of spurious regression.

Table 3: Descriptive Statistics of Variables

	GHGE	GB	CC	GL	REI	GM	SAL
Mean	217.67	0.09	0.01	0.26	11.08	0.43	4.36
Median	217.10	0.05	0.01	0.26	9.01	0.41	3.93
Maximum	257.71	0.28	0.03	0.28	22.14	0.69	8.85
Minimum	176.51	0.00	0.00	0.25	4.66	0.27	1.95
Std. Dev.	23.86	0.09	0.01	0.01	5.86	0.12	1.68
Skewness	-0.04	0.92	1.16	-0.19	0.95	0.55	0.94
Kurtosis	1.86	2.34	3.07	1.74	2.30	2.32	3.39
Jarque-Bera	2.81	8.30	11.72	3.75	8.85	3.61	8.00
Probability	0.25	0.02	0.00	0.15	0.01	0.16	0.02
Observations	52	52	52	52	52	52	52

Source: Eviews13 Output, 2025

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Table 3 presents the descriptive statistics for the variables used in the study, based on 52 quarterly observations. Greenhouse Gas Emissions (GHGE) has a mean of 217.67 with moderate variation (standard deviation of 23.86), and its distribution is nearly symmetrical (skewness = –0.04) with a relatively flat kurtosis (1.86), indicating a platykurtic distribution. Green Bonds (GB), Carbon Credits (CC), Renewable Energy Investment (REI), and Sustainable Agriculture Loans (SAL) exhibit positive skewness, suggesting that their distributions are right-tailed, with CC having the highest skewness (1.16) and the highest kurtosis (3.07), indicating moderate peakedness. Jarque-Bera test results show that CC (p = 0.00), GB (p = 0.02), REI (p = 0.01), and SAL (p = 0.02) significantly deviate from normality, while GHGE, GL, and GM do not (p-values > 0.05). This implies that some green finance variables do not follow a normal distribution, which may necessitate transformation or robust estimation techniques in subsequent regression analysis. Overall, the statistics reflect varied distributions and data spread across green finance indicators and their potential impact on climate mitigation in Nigeria.

Table 4: Correlation Matrix of Variables

	GHGE	GB	CC	GL	REI	GM	SAL
GHGE	1						
GB	-0.57	1					
CC	0.09	0.39	1				
GL	0.91	-0.73	0.04	1			
REI	0.89	-0.49	0.13	0.75	1		
GM	0.56	-0.57	-0.30	0.54	0.37	1	
SAL	0.19	-0.25	-0.27	0.24	-0.02	0.63	1

Source: EViews13 Output, 2025

Table 4 displays the correlation matrix among the study variables, offering insight into the linear relationships between green finance instruments and greenhouse gas emissions (GHGE). GHGE is strongly and positively correlated with Green Loans (GL) at 0.91 and Renewable Energy Investment (REI) at 0.89, indicating that increases in these green finance tools are associated with higher levels of recorded emissions—potentially reflecting increased reporting or transitional emissions during green project implementation. GHGE also has a moderate positive correlation with Green Mortgages (GM) at 0.56 and a weak positive correlation with Sustainable Agriculture Loans (SAL) at 0.19, suggesting relatively limited direct associations. Conversely, GHGE is negatively correlated with Green Bonds (GB) at –0.57, implying that higher investments in green bonds are associated with reduced emissions, supporting their role in climate mitigation. Notably, GL and GB are highly negatively correlated (–0.73), indicating possible substitution or differing policy emphases. Additionally, SAL shows weak or negative correlations with most other variables, including a modest negative relationship with GB (–0.25) and GM (0.63), which may suggest limited interaction or alignment in their implementation. These results provide a foundational understanding for regression analysis, while also highlighting potential multicollinearity concerns for highly correlated variables such as GHGE and GL.

Table 5:ARDL Bounds Test for Co-integration Results

F-Bound test	I(0)	I(1)	t-Bound test	I(0)	I(1)	Cointegration	Model
16.59	2.12	3.23	-6.43	-2.57	-4.04	Yes	ECM
	2.45	3.61		-2.86	-4.38		
	3.15	4.43		-3.43	-4.99		

Source: Eviews13 Output, 2025

Table 5 reports the ARDL-bounds test for long-run relationships between greenhouse-gas emissions and the portfolio of green-finance variables. The joint F-statistic of 16.59 is far higher than the 1 per cent upper-bound critical value (I(1)=3.23), so the null hypothesis of "no level relationship" is decisively rejected. The accompanying t-statistic for the lagged dependent variable (–6.43) is likewise more negative than the 1 per cent upper-bound critical value (–4.04), providing a second confirmation of cointegration. Because both criteria lie beyond their respective upper bounds, the variables share a stable long-run equilibrium; hence an error-correction model (ECM) is appropriate for estimating short- and long-run dynamics. In practical terms, Nigeria's green-finance instruments and greenhouse-gas emissions move together over time, and any short-run deviation from equilibrium will be corrected in subsequent periods.

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Table 6: Lag Selection Results

LR Statistic	FPE Statistic	AIC	SC	HQC
NA	29.13	6.21	6.48	6.30
265.70	0.05	-0.23	0.08	-0.11
28.20**	0.02**	-0.90**	-0.55**	-0.76**

***,** and * imply significance at the 1%, 5% and 10% levels respectively
Source: Source: Eviews13 Output, 2025

Table 6 presents the results of the optimal lag length selection based on multiple information criteria. The Likelihood Ratio (LR) statistic, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn Criterion (HQC) were used to determine the most appropriate lag structure for the ARDL model. The second lag (Lag 2) is consistently preferred across all criteria FPE (0.02), AIC (–0.90), SC (–0.55), and HQC (–0.76) as indicated by the lowest values and double asterisks (**) signifying 5% significance. This suggests that a lag length of two offers the best balance between model fit and parsimony. Therefore, the model will be most reliable and statistically sound when it includes two lags, ensuring accurate estimation of both short- and long-run relationships in the dynamics of green finance and climate change mitigation in Nigeria.

Table 7: Collinearity Test Results

Variable	Centered VIF
GB	3.65
CC	1.73
GL	4.72
REI	2.47
GM	2.71
SAL	2.07
Mean VIF	***2.89***

Source: Eviews13 Output, 2025

Table 7 presents the results of the collinearity diagnostics using the Variance Inflation Factor (VIF), which assesses the degree of multicollinearity among the explanatory variables in the regression model. A VIF value above 10 typically indicates high multicollinearity, while values below 5 are generally acceptable. In this study, all variables—Green Bond (GB = 3.65), Carbon Credit (CC = 1.73), Green Loan (GL = 4.72), Renewable Energy Investment (REI = 2.47), Green Mortgage (GM = 2.71), and Sustainable Agriculture Loan (SAL = 2.07) have VIF values well below the critical threshold of 10. The mean VIF of 2.89 further confirms that multicollinearity is not a serious concern in the model. This suggests that the independent variables are sufficiently distinct and do not distort the regression estimates, thereby validating the reliability of the model in analysing the multidimensional effect of green finance on climate change mitigation in Nigeria.

Regression Analysis Result

Table 8: Long Run Model Results

Variable	*Coefficient/Std. Error*	*t-ratio*
Constant	-304.98 (43.67)	-6.98***
GB(-1)	71.17 (14.89)	4.78***
CC(-1)	-91.52 (115.22)	-0.79
GL(-1)	1858.77 (173.04)	10.74***
REI(-1)	1.86 (0.19)	9.74***
GM(-1)	33.59 (9.39)	3.58***

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SAL(-1)	-0.30 (0.59)	-0.52
R-squared		0.96
Adjusted R^2		0.96
Standard Error		4.90
F-Statistics		182.67***

Source: EViews Regression Output, 2025

The regression results reveal a strong model fit, with an R-squared and adjusted R-squared value of 0.96, indicating that 96% of the variation in greenhouse gas emissions (GHGE) is explained by green finance variables (Green Bonds, Carbon Credit, Green Loans, Renewable Energy Investment, Green Mortgages, and Sustainable Agriculture Loans). The F-statistic (182.67) is highly significant at the 1% level, confirming the joint influence of the explanatory variables on GHGE. A low standard error (4.90) supports the model's predictive accuracy. The significant and negative constant term (-304.98) suggests that in the absence of green finance, GHGE would notably decline, reinforcing the relevance of green financial instruments in climate change mitigation. Overall, the model is statistically robust and offers reliable insights for policymakers to promote green finance strategies in Nigeria.

Hypothesis one: Green bond has no significant effect on climate change mitigation (Greenhouse Gas Emission); in Nigeria.

The result from the test of hypothesis one revealed that green bond has positive and statistically significant effect on climate change mitigation (Greenhouse Gas Emission); in Nigeria. this result is seen from the coefficient value, standard error vale and t-ratio value. Therefore, the hypothesis one which stated that green bond has no significant effect on climate change mitigation (Greenhouse Gas Emission) in Nigeria is hereby rejected. The coefficient for Green Bonds (GB) is 71.17, with a standard error of 14.89 and a t-ratio of 4.78, which is statistically significant at the 1% level (***). This positive coefficient implies that a unit increase in Green Bonds leads to a 71.17-unit increase in Greenhouse Gas Emissions (GHGE) in the long run, holding all other factors constant. The significance of this coefficient suggests that, contrary to the expected negative impact of Green Bonds on GHGE, their issuance may have contributed to projects or activities that increase emissions. The implication is that not all projects financed by Green Bonds necessarily reduce GHGE, especially if these projects involve infrastructure development or other energy-intensive processes.

Hypothesis Two: Carbon credit has no significant effect on climate change mitigation (Greenhouse Gas Emission); in Nigeria.

The result from the test of hypothesis two revealed that carbon credit has negative but statistically insignificant effect on climate change mitigation (Greenhouse Gas Emission) in Nigeria. this result is seen from the coefficient value, standard error vale and t-ratio value. Therefore, the hypothesis two which stated that carbon credit has no significant effect on climate change mitigation (Greenhouse Gas Emission) in Nigeria is hereby rejected. The coefficient for Carbon Credit (CC) is negative, suggesting a potential reduction in greenhouse gas emissions (GHGE), but the result is statistically insignificant (t = -0.79). This indicates that while theoretically sound, Carbon Credits have had a limited measurable impact on GHGE in Nigeria, likely due to poor implementation or low participation. Strengthening regulatory frameworks and encouraging broader adoption are essential for improving the effectiveness of carbon credit mechanisms.

H_{03}: Green loan has no significant effect on climate change mitigation (Greenhouse Gas Emission); in Nigeria

The coefficient for Green Loans (GL) is 1858.77, with a standard error of 173.04 and a t-ratio of 10.74, which is statistically significant at the 1% level (***). This large positive coefficient suggests that a unit increase in Green Loans is associated with a 1858.77-unit increase in GHGE in the long run. This result may appear counterintuitive, as Green Loans are expected to promote sustainable development and reduce emissions. However, it is possible that Green Loans are being channeled into energy-intensive projects that indirectly increase GHGE. The implication is that the projects financed by Green Loans should be evaluated to ensure that they align with climate change mitigation goals.

H_{04}: Renewable energy investment has no significant effect on climate change mitigation (Greenhouse Gas Emission); in Nigeria.

The coefficient for Renewable Energy Investment (REI) is 1.86, with a standard error of 0.19 and a t-ratio of 9.74, which is statistically significant at the 1% level (***). The positive coefficient implies that a unit increase in Renewable Energy Investment leads to a 1.86-unit increase in GHGE in the long run, holding all other factors constant. This result is counterintuitive, as Renewable Energy Investment is expected to reduce GHGE. However, the initial production and construction processes involved in renewable energy projects may temporarily increase emissions before the long-term benefits are realized. The implication is that while investments in renewable energy are critical for climate change mitigation, short-term increases in GHGE may result from the production and installation of renewable energy infrastructure.

H_{05}: Green mortgage has no significant effect on climate change mitigation (Greenhouse Gas Emission); in Nigeria.

The coefficient for Green Mortgage (GM) is 33.59, with a standard error of 9.39 and a t-ratio of 3.58, which is statistically significant at the 1% level (***). This positive coefficient suggests that a unit increase in Green Mortgage is associated with a 33.59-unit increase in GHGE in the long run. This result may reflect the impact of construction-related activities, which are often associated with increased emissions. Green Mortgages may finance projects such as the construction of green buildings, which, despite being more energy-efficient in the long run, may have higher emissions during the construction phase. The implication is that while Green Mortgages promote sustainability in the real estate sector, their short-term impact on emissions should be closely monitored.

H_{06}: Sustainable agriculture loan has no significant effect on climate change mitigation (Greenhouse Gas Emission); in Nigeria

The coefficient for Sustainable Agricultural Loans (SAL) is -0.30, with a standard error of 0.59 and a t-ratio of -0.52, which is not statistically significant. This indicates that SAL does not have a statistically significant impact on GHGE in the long run. The negative sign of the coefficient aligns with expectations, as Sustainable Agricultural Loans are aimed at promoting sustainable farming practices that reduce emissions. However, the lack of statistical significance suggests that the contribution of these loans to GHGE reduction is not robust. The implication is that the impact of Sustainable Agricultural Loans on GHGE may be marginal or delayed.

The long-run model results provide valuable insights into the effects of green finance instruments on climate change mitigation in Nigeria. While some variables, such as Carbon Credit and Sustainable Agricultural Loans, do not have a statistically significant impact on GHGE, others like Green Bonds, Green Loans, Renewable Energy Investments, and Green Mortgages exhibit significant relationships. The positive coefficients for most of the green finance instruments suggest that although these instruments aim to promote sustainability, their short-term implementation may temporarily increase emissions. This underscores the importance of tracking the life-cycle impact of projects financed through green finance.

Table 9: Error Correction Model Results

Variable	*Coefficient/Std. Error*	*t-ratio*
Constant	0.69 (0.14)	4.82***
GB(-3)	2.31 (0.70)	3.30***
CC(-2)	5.83 (2.20)	2.65**
GM(-3)	-2.44 (0.65)	-3.73***
SAL(-3)	0.04 (0.02)	2.29**
ECT(-1)	-0.01 (0.00)	-2.04**
R-squared		0.92
Adjusted R^2		0.86
Standard Error		0.09
F-Statistics		13.86***

***Source*. EViews Regression Output, 2025**

With an R-squared of 0.92 (adjusted $R^2 = 0.86$) and an F-statistic of 13.86 ($p < 0.01$), the error-correction model explains 92 % of the variation in Nigerian GHG emissions, confirming that green-finance variables jointly exert a statistically significant influence and that the equation provides accurate, policy-relevant predictions. The positive and significant constant (0.69) shows there is a baseline upward pressure on emissions even when the measured green-finance variables are held constant, implying that additional economic or structural factors outside the model continue to drive GHG levels.

A three-quarter lag in green-bond issuance is associated with a 2.31-unit rise in emissions ($p < 0.01$), suggesting that projects financed by these bonds initially generate construction-phase emissions before any longer-term environmental benefits emerge.

Carbon credits, lagged two quarters, unexpectedly raise emissions by 5.83 units ($p < 0.05$), indicating that firms may rely on credit purchases to offset rather than reduce actual emissions, underscoring the need for tighter market oversight.

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After three quarters, green-mortgage activity lowers emissions by 2.44 units ($p < 0.01$), confirming that energy-efficient buildings eventually deliver tangible climate benefits once construction-related impacts subside. Sustainable-agriculture lending increases emissions modestly (0.04 units; $p < 0.05$) after three quarters, likely reflecting land-clearing, input use, or mechanisation at project start-up; climate-smart farming practices are needed to reverse this short-term rise.

The error-correction coefficient (–0.01; $p < 0.05$) shows that only 1 % of any short-run disequilibrium is removed each quarter, indicating slow convergence toward the long-run emissions path and implying that policy impacts materialise gradually.

Table 10: Error Correction Model Serial Correlation LM Test Results

	Test Statistic	Prob.
F-statistics	0.88	0.12
Obs*R-squared	1.61	0.13

Source: Eviews13 Output, 2025

The results of the Error Correction Model (ECM) Serial Correlation LM Test, as presented in Table 4.9, indicate that there is no evidence of serial correlation in the residuals of the model. The F-statistic value of 0.88 with a corresponding probability (p-value) of 0.12, and the Obs*R-squared value of 1.61 with a p-value of 0.13, are both above the conventional significance levels (e.g., 0.05). This means that the null hypothesis of no serial correlation cannot be rejected. In other words, the residuals from the ECM are not serially correlated, implying that the model is correctly specified and that the parameter estimates are not biased due to autocorrelation. This strengthens the validity and reliability of the ECM results, confirming that the model's predictions are not influenced by patterns or dependencies in the error terms over time.

Conclusion and Recommendations

The study concludes that while green finance instruments are intended to support climate change mitigation in Nigeria, their actual impact on greenhouse gas emissions (GHGE) varies significantly. Green Bonds, Green Loans, Renewable Energy Investments, and Green Mortgages all showed a positive and significant relationship with GHGE, suggesting that despite their "green" label, many of the financed projects may initially contribute to emissions due to inadequate governance, weak project vetting, and emissions from early-stage activities like construction and infrastructure development. In contrast, Carbon Credits and Sustainable Agricultural Loans exhibited negative but statistically insignificant effects on GHGE, indicating limited effectiveness in practice, likely due to low participation, weak enforcement, and insufficient market or institutional support. These findings underscore the need for stricter project evaluation, enhanced environmental standards, and robust monitoring frameworks to ensure that green finance instruments truly achieve their intended environmental goals in Nigeria.

In line with the findings and the conclusions drawn by this study, the following recommendations are proposed:

i. Policymakers and financial institutions should enhance the governance framework and enforce more stringent eligibility criteria for Green Bonds to guarantee that only genuinely low-emission projects are funded. This can be accomplished by conducting thorough environmental due diligence, improving transparency in the project selection process, and establishing well-defined guidelines on what qualifies as a "green" initiative, thereby ensuring that Green Bonds fulfil their intended environmental objectives.
ii. To improve the effectiveness of Carbon Credits, policymakers should prioritise the enhancement of market structures, enforcement systems, and stakeholder involvement. This can be achieved by reinforcing the regulatory framework governing carbon trading, broadening participation in carbon markets, and investing in capacity-building for both emitters and regulatory authorities. Ensuring that carbon credits are transparently traded, accurately verified, and effectively enforced will help convert the theoretical advantages of carbon pricing into measurable reductions in greenhouse gas emissions.
iii. To ensure Green Loans achieve meaningful emission reductions, financial institutions and policymakers should adopt stronger screening and monitoring frameworks. Loan approval criteria should prioritise projects with clearly defined and verifiable emission reduction targets, while borrowers should be obligated to provide regular reports on environmental outcomes. Performance-based incentives such as lower interest rates or extended repayment terms can be introduced to reward borrowers who meet or surpass environmental benchmarks.
iv. To mitigate the initial emission-heavy stages of renewable energy investments (REI), policymakers and investors should adopt a lifecycle approach that considers the environmental impact from project inception to completion. This includes promoting cleaner supply chains, utilising sustainable materials, and strategically phasing developments to minimise short-term emissions. Moreover, offering training, technical assistance, and financial incentives to companies that employ low-emission practices in equipment production and installation can enhance the overall effectiveness of REI.
v. To ensure that Green Mortgages fulfill their intended role in reducing emissions, developers, lenders, and policymakers should incorporate strict environmental standards into mortgage eligibility criteria. This may involve mandating green building certifications, promoting low-emission construction practices, and using sustainable materials. Authorities can also offer tax incentives or lower interest rates for projects that demonstrate measurable emission reductions over time.

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vi. Policymakers and financial institutions should enhance the conditions attached to Sustainable Agricultural Loans to make them more impactful in reducing emissions. Providing technical assistance, farmer training in climate-smart agriculture, and requiring measurable environmental benchmarks for loan eligibility can improve their effectiveness.

REFERENCES

[1] Abubakar, A., Magaji, S. & Ismail, Y. (2025) Bridging The Adaptation Gap: Barriers and Opportunities for Climate-Resilient Irrigation Farming in Dutse LGA, Jigawa, Nigeria. International Journal of Progressive Sciences and Technologies (IJPSAT). 52(2), 229-241. http://dx.doi.org/10.52155/ijpsat.v52.2.7454
[2] African Development Bank (AfDB). (2021). Climate change and green growth in Africa: 2021 report.
[3] Akpan, G. E., & Akpan, U. S. (2022). Green finance and climate change mitigation in Nigeria: Opportunities and challenges. Journal of Sustainable Finance & Investment, 12(3),458–475.
[4] -Amin, I. A., Magaji, S., & Ismail, Y. (2025) Strengthening Climate Finance and ESG Practices to Foster Sustainable Energy Development in Nigeria. Global Journal of Economic and Finance Research 02(9):835-845. DOI: 10.55677/GJEFR/11-2025-Vol02E9
[5] Arif, M., Kumar, R., & Usman, M. (2022). Green finance and sustainable development: Evidence from emerging economies. Environmental Science and Pollution Research, 29(34), 51918–51936. https://doi.org/10.1007/s11356-021-14489-6.
[6] Attanayake, H., Fernando, P., & Jayasinghe, M. (2024). Renewable energy and CO_2 emissions: Evidence from 138 countries (1995–2021). International Journal of Environmental Research, 21(1), 45–67.
[7] Attanayake, H., Fernando, P., & Jayasinghe, M. (2024). Renewable energy and CO_2 emissions: Evidence from 138 countries (1995–2021). International Journal of Environmental Research, 21(1), 45–67.
[8] Baker, M., & Nduka, E. (2022). Financing renewable energy for sustainable development: The role of green finance in emerging economies. Journal of Sustainable Finance & Investment, 12(3), 456–470.
[9] Bashir, M., & Gull, M. (2024). Renewable energy and climate mitigation: Global insights and technology perspectives. Energy and Environment Studies, 19(2), 115–132.
[10] Bello, J. A., Magaji, S. & Ismail, Y. (2025) Sustaining Rural Livelihoods: Assessing The Impact of Agricultural Growth On SDG 8 (Decent Work) In Rural Areas of Adamawa State, Nigeria. ISRG Journal of Agriculture and Veterinary Sciences 2 (5), 21-30. DOI: 10.5281/zenodo.17412359
[11] Bourassa, S., Hoesli, M., & Scognamiglio, D. (2020). Green mortgages and residential energy efficiency in Canada. Journal of Real Estate Finance & Economics, 61(3), 505–528.
[12] Cecere, G., Corrocher, N., & Gossart, C. (2024). Encouraging energy efficiency through green mortgages: Evidence from European housing markets. Energy Economics, 124, 106752. https://doi.org/10.1016/j.eneco.2024.106752.
[13] Devine, A., & McCollum, J. (2024). Measuring what we finance: Post-retrofit outcomes in Green Rewards multifamily mortgages. Journal of Sustainable Housing Finance, 6(1), 28–45.
[14] Elsherif, M. (2023). Carbon credits as a climate mitigation mechanism in Egypt's green finance landscape. Journal of Environmental Policy and Finance, 18(3), 211–229.
[15] Elum, Z. A., & Momodu, A. S. (2017). Climate change mitigation and renewable energy for sustainable development in Nigeria: A discourse approach. Renewable and Sustainable Energy Reviews, 76, 72–80. https://doi.org/10.1016/j.rser.2017.03.040
[16] Ezekiel, O., Okeke, P., & Idris, S. (2022). Green mortgages and energy-efficient housing markets in West Africa. Sustainable Cities and Society, 78, 103543.
[17] Fatica, S., & Panzica, R. (2021). Green finance in Europe: Development and perspectives. Journal of Sustainable Finance & Investment, 11(3), 213–232.
[18] Federal Ministry of Environment [Nigeria]. (2021). Nigeria's nationally determined contribution (NDC) update. Abuja.
[19] Freeman, R. E. (1984). Strategic management: A stakeholder approach. Boston: Pitman. Green Finance Taskforce. (2018). Accelerating green finance: A report to the government. UK Government.
[20] Fu, Y., Chen, Z., & Adepoju, M. (2024). Global dynamics of carbon credits in climate change mitigation: A systematic review across Asia and Africa. Environmental Finance Review, 12(1)
[21] Fujimori, S., Oka, K., & Delgado, R. (2019). Economic and environmental impacts of sustainable agriculture loans in Latin America. Journal of Agricultural Economics, 70(4), 955-972.
[22] Garcia-Leal, D., & Ramos-Martín, J. (2022). Climate change mitigation and sustainable development: A systemic policy approach. Journal of Cleaner Production, 367, 132967. https://doi.org/10.1016/j.jclepro.2022.132967
[23] He, J., Tan, L., & Wong, M. (2022). Green mortgages and energy efficiency: A study from the Asia-Pacific region. Journal of Sustainable Finance, 12(4), 234–252.
[24] Idris, M., Sulaiman, A., & Prasetyo, H. (2024). Green finance challenges and regulatory frameworks in Malaysia and Indonesia: A comparative study. Asian Journal of Environmental Policy, 11(1), 55–70.
[25] Ionescu, L. (2023). Green finance and sustainable economic recovery during the COVID-19 era: An empirical investigation. International Journal of Climate Finance, 14(2), 99–115.
[26] Jackson, R. (2021). Sustainable agriculture and green lending: Financing the future of farming. Agricultural Economics Review, 12(3), 55–68.
[27] Jensen, M. C. (2002). Value maximization, stakeholder theory, and the corporate objective function. Business Ethics Quarterly, 12(2), 235–256.
[28] Kasem, M. A., & Alawin, M. (2019). Renewable energy resources: A review on their classification and future prospects. International Journal of Energy Economics and Policy, 9(5), 268–276. https://doi.org/10.32479/ijeep.8170
[29] Kaza, N., Hamin, E., & Dunn, S. (2021). Green mortgages as climate-mitigation tools: Evidence from the United States and Europe. Energy Policy, 156, 112447.
[30] Khatri-Chhetri, A., Aggarwal, P., & Thornton, P. (2021). **Financing climate-smart** agriculture: Investment cases and policy insights. Climate Policy, 21(6), 838-856.
[31] Kumah, A., & Mensah, J. (2021). Carbon credit markets and emission mitigation in Sub-Saharan Africa. Environmental Economics Review, 15(2), 30–48.
[32] Kumar, S., & Singh, R. (2024). Green finance and sustainable housing: The role of green mortgages in low-carbon transitions. Journal of Sustainable Finance & Investment, 14(1), 33–49. https://doi.org/10.1080/20430795.2023.2186789
[33] Kung, C.-C., Chen, C.-H., & Chang, C.-L. (2022). Assessing green-bond financing for bioenergy under climate-uncertainty scenarios: A two-stage stochastic model. Energy Economics, 113, 106164.
[34] Lajtha, C., & Fischer, L. B. (2021). Financing the transition: How green loans are reshaping sustainable finance. Journal of Environmental Management, 295, 113055. https://doi.org/10.1016/j.jenvman.2021.113055
[35] Lipper, L., Bonilla-Findji, O., & Jarvis, A. (2020). Sustainable agriculture loans and climate-smart farming in East Africa. Agricultural Finance Review, 80(3), 407-425.
[36] Liu, Y., Wang, J., & Li, S. (2023). The role of green finance in promoting low-carbon technologies and climate resilience. Journal of Cleaner Production, 399, 136582. https://doi.org/10.1016/j.jclepro.2023.136582.
[37] Lombardi, R. & Bolis, I. (2022). Mapping the global landscape of green bonds: A systematic review. Journal of Cleaner Production, 330, 129915.
[38] Magaji, S & Musa, I. (2024). Analysis of Farmers' Awareness on the Effect of Climate Change on Food Security in Nigeria. International Journal of Humanities, Social Science and Management. 4(3),439-454

[39] Magaji, S., Tanko, Y., & Musa, I. (2025). The Effect of Green Loan and Green Mortgage on Climate Change Mitigation in Nigeria. International Journal of Current Science Research and Review. 8 (6), 3124-3138.
[40] Malhi, G. S., Kaur, M., & Kaushik, P. (2021). Climate change and agriculture: Impacts, mitigation strategies, and socio-economic considerations. Sustainability, 13(7), 3882.
[41] Marin, P., & Miguez, A. (2024). Green mortgages as instruments for residential decarbonization: Market mechanisms and climate implications. Environmental Economics and Policy Studies, 26, 201–217. https://doi.org/10.1007/s10018-024-00362-2.
[42] Marmiroli, B., & Mela, G. (2022). Assessing the environmental risk profile of properties: Implications for green mortgage pricing. Journal of Property Research, 39(4), 358–375. https://doi.org/10.1080/09599916.2022.2056348
[43] Maulida, S. (2024). The role of renewable energy in climate change mitigation: A review of international literature. Environmental Sustainability Review, 18(3), 89–102.
[44] Mikayilov, J. & Sattarahmady, H. (2022). Green bonds and renewable energy finance in African capital markets. Journal of Environmental Finance, 6(3), 120–139.
[45] Musa, I., Olanipekun, O., E., & Magaji, S. (2025). Evaluating the Impact of Climate Finance on Food System Resilience in Niger State, Nigeria. MRS Journal of Accounting and Business Management, 2 (10), 28-36.
[46] Nawaz, M. A., Iqbal, S., & Ali, M. (2020). Nexus between green finance and climate change mitigation in N-11 and BRICS countries: Empirical estimation through difference in differences (DID) approach. Environmental Science and Pollution Research, 28(6), 6504–6519. https://doi.org/10.1007/s11356-020-10920-y
[47] Nigeria Green Bond Guidelines. (2020). Guidelines for Issuance of Green Bonds in Nigeria. Securities and Exchange Commission Nigeria. https://sec.gov.ng/guidelines-for-the-issuance-of-green-bonds-in-nigeria.
[48] Nwakoby, I., & Okeke, A. (2023). Sustainable agricultural loans and climate-smart farming in Nigeria. African Journal of Agricultural Economics, 14(2), 55–71.
[49] Oche, M. (2020). Financial market maturity and green finance effectiveness in West Africa. African Journal of Economic Policy, 27(2), 45–61.
[50] Oduntan, T., Bello, R., & Chukwu, H. (2022). Fossil-fuel dependence and decarbonisation pathways in Nigeria. Energy & Environment, 33(7), 1278–1295.
[51] Odusanya, O., Aboje, A., & Adewuyi, A. (2021). Climate vulnerability and finance gaps in West Africa. Climate Policy and Development, 10(4), 211–229.
[52] Qadir, J., Rahman, A., & Khalid, S. (2024). Green bonds for climate resilience: Global trends, barriers, and enabling conditions. Climate Policy, 24(1), 59–78.
[53] Raihan, S. (2023). Soil carbon sequestration as a sustainable agricultural practice for climate mitigation: A comprehensive review. Journal of Environmental Management, 328, 116865.
[54] Sadiq, I. A., Magaji, S. & Musa, I. (2025) Analysing The Indirect Employment And Business Opportunities From The Shift To Renewable Energy-Powered Transportation In Abuja, Nigeria. Journal of Emerging Technologies and Innovative Research (JETIR), 12(9) 541-552
[55] Shah, R., Mehra, P., & Khan, M. (2019). Green-mortgage financing for sustainable urban housing in India: A case-study assessment. Sustainable Cities and Society, 47, 101483.
[56] Smith, A., & Roberts, L. (2022). Green credit for farmers: The role of sustainable agriculture loans in environmental protection. International Journal of Agricultural Sustainability, 20(1), 45–60. https://doi.org/10.1080/14735903.2021.1936724
[57] Suleiman, H., Magaji, S. & Musa, I. (2025). Assessing the Effect of Green Loans and Carbon Finance on Sustainable Cities and Community Development in Nigeria: An Analysis of Urban Sustainability Indices. International Journal of Innovative Science and Research Technology 10 (5)
[58] Taghizadeh-Hesary, F., Yoshino, N., & Shimizu, S. (2022). Financing energy-efficiency projects in Africa: The emerging role of green bonds. Energy Policy, 162, 112808.
[59] Tanko, Y., Magaji, S., & Musa, I. (2025). Effect of green finance on climate change mitigation in Nigeria. International Journal of Economic Perspectives, 19(7), 1–22.
[60] Ugurlu, T. (2022). Renewable energy for climate change mitigation. In B. Özdemir (Ed.), Climate Change and Sustainable Energy (pp. 135–150). Springer
[61] Were, S. (2024). Carbon credits and green finance integration in Kenya: A case study of community-based offset projects. African Journal of Green Economy, 9(2), 88–104.
[62] Ying, Y., Liu, X., & Zhang, W. (2020). Green mortgages and China's low-carbon transition: Empirical evidence from residential energy consumption. Journal of Cleaner Production, 276, 123328.
[63] Zhang, D., & Lu, J. (2022). Green finance instruments: A global review and future research agenda. Journal of Cleaner Production, 351, 131581**.**
[64] Zhang, L., Wang, H., & Li, J. (2022). Carbon credit systems and low-carbon technology adoption in China: A mixed-method analysis. Journal of Sustainable Finance & Investment, 10(4), 387–403.
[65] Zhang, W., Chen, L., & Yang, X. (2022). Evaluating the impact of green loans on low-carbon technology in China: A case study of financial institutions. Chinese Journal of Environmental Economics, 9(4), 203–218.
[66] Zhang, Y., & Wang, Y. (2019). Carbon credit pricing: Insights from market behaviour. Environmental Economics and Policy Studies, 21(4), 681–706. https://doi.org/10.1007/s10018-019-00243-6.