Educational Administration: Theory and Practice
2024, 30(3), 3131 - 3144
ISSN: 2148-2403
https://kuey.net/
Research Article

Green Financing and Economic Sustainability in Nigeria: Assessing the Impact of Green Credit, Green Securities, and Carbon Finance

Halima Femi Pat-Natson[1*], Saji George[2], Hauwa Lamino Abubakar[3]

[1*]Department of Business Administration, Nile University of Nigeria, Abuja, FCT, Nigeria
[2]Department of Business Administration, Nile University of Nigeria, Abuja, FCT, Nigeria
[3]Department of Business Administration, Nile University of Nigeria, Abuja, FCT, Nigeria

***Corresponding author:** Halima Femi Pat-Natson
*Email: lima.patnatson@gmail.com

Citation: Halima Femi Pat-Natson et al. (2024), Green Financing and Economic Sustainability in Nigeria: Assessing the Impact of Green Credit, Green Securities, and Carbon Finance, *Educational Administration: Theory and Practice*, 30(3) 3131 - 3144
Doi: 10.53555/kuey.v30i3.9187

ARTICLE INFO

ABSTRACT

Economic sustainability is a fundamental pillar of a country's growth and development, yet it faces several challenges, including green credit, security, and carbon finance. This study examines the impact of green financing on Nigeria's economic sustainability from 2009 to 2023. Specifically, it evaluates the effects of green credit, green security, and carbon finance on Nigeria's economic stability. The study employs descriptive and inferential statistical methods, including unit root tests, co-integration tests, panel cointegration analysis, and panel cointegration regression estimation. Additionally, a dynamic fixed-effect model is used to assess the impact of green financing on economic sustainability. The findings indicate that carbon finance (CO2F) and electricity production from hydroelectric sources (EPH) have negative predictive values for GDP growth (GDPG), implying a negative impact. In contrast, green loans (GRL) exhibit a positive predictive value, suggesting a beneficial effect on economic sustainability. This is further reinforced by an R-squared value of 0.8279, indicating that green financing variables collectively influence GDPG by approximately 83%. The model derived from this study is represented as GDPG = -2.485 - 4.68E-11(CO2F) + 0.698(GRL) - 7.10E-05(EPH). The study concludes that green credit, security, and carbon finance significantly impact Nigeria's economic sustainability. Based on these findings, it is recommended that Nigeria substantially increase investment in research and development (R&D) in clean energy technologies while developing local expertise in renewable energy solutions. Such efforts are crucial to addressing current climate challenges, achieving renewable energy targets, and ensuring long-term economic resilience.

Keywords: Green Financing, Economic Sustainability, Green Credit, Green Security, Carbon Finance, Renewable Energy, Sustainable Development, Clean Energy Investment, Climate Change Mitigation, Financial Sustainability

INTRODUCTION

The strategy for funding projects and development is shifting from focusing solely on profit maximisation to a more comprehensive emphasis on fostering integrated values that promote green growth and technology (Olawoye-Mann, 2022). This transition aims to reduce carbon emissions and advocate for renewable energy sources. Recent publications indicate that global efforts to address climate change have intensified the focus on green finance (Enejo & Idoko, 2023). Implementing the Paris Climate Agreement and the United Nations Sustainable Development Goals represents significant commitments to long-lasting environmental sustainability (Bergougui et al., 2024). Green finance goes beyond merely pursuing investment returns; it encompasses a dual objective of profit generation while enhancing human welfare and environmental sustainability. In light of the growing financial challenges associated with climate change, it is vital to explore green funding alternatives (Anabaraonye et al., 2023). Since climate change affects both financial and non-

Copyright © 2024 by Author/s and Licensed by Kuey. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

financial sectors, green financing is essential in mitigating these risks by encouraging investments in environmentally sustainable projects. This approach can significantly lower greenhouse gas emissions and other pollutants, positively influencing economic stability and fostering sustainable development (Chen et al., 2019)

Zheng et al. (2023) state that several countries aspire to achieve a 70% reduction in greenhouse gas emissions by 2030, featuring some of the cleanest environments worldwide. Despite significant efforts over the past decade to transition from coal to primarily gas and electricity to mitigate air pollution from outdated and inefficient coal boilers, coal consumption in sectors outside of power generation and steel production in China remains substantial (Temitope et al., 2022). In Indonesia, despite a commitment to transitioning to clean energy and reducing dependence on coal, growth in renewable energy production and an increasing share of gas-fired power generation have counterbalanced the decline in coal-fired output. The Just Energy Transition Package, amounting to USD 20 billion, supports this transition, and energy production continues to be robust despite rising gas prices in 2022. Furthermore, these countries exhibit expertise in waste management, air quality, sanitation, access to potable water, and initiatives to combat climate change. Qamruzzaman (2023) asserts that pollution stemming from commercial activity results from ineffective production methods. Green finance encompasses any investment that enhances these processes, including renewable energy, efficiency, clean water initiatives, recycling, biodiversity conservation, pollution management in organisations, and proactive environmental protection measures (Baz et al., 2020).

Nigeria's notable market progress demonstrates its dedication to integrating sustainability into its financial and investment sectors, per global trends (Ozili, 2022). The September 2023 report on the Nigeria Green Bond Programme underscores significant advancements in the nation's green bond market. This strategy has enabled the issue of company green bonds totalling ₦32.83 billion and government green bonds amounting to ₦25.69 billion (Otali & Monye, 2024). Additionally, five issuers, including both sovereign and corporate entities, have received assistance in green bond verification, reporting, and post-issuance impact evaluations. A qualified verifier has received specialised training to assist these issuers, positively influencing 928 participants in the capital markets (Kadiri, 2021). The Nigeria Green Bond Programme is administered by FMDQ (Debt Management Office of Nigeria, 2023). The North-South Power Company Limited issued the country's inaugural corporate green bond via its special-purpose vehicle, NSP-SPV Power Corp. The company's sustainable energy initiative experienced a 160 per cent oversubscription of its series 1 green bond, amounting to N8.5 billion, with commitments from institutional investors, including pension funds (Anukwonke & Abazu, 2022). Furthermore, Access Bank's N15 billion green bonds obtained endorsement from the Climate Bonds Initiative, establishing it as the inaugural corporate green bond in Africa. To develop a robust green finance market in Nigeria, it is crucial to foster diverse creative financing alternatives within the private sector, particularly in the banking industry (Isah et al., 2023; Oyewole et al., 2024). The impending policy implementation aims to incentivise banks to provide green credits, hence promoting the expansion of the green finance market (Lee, 2020). A plethora of environmentally sustainable investment options exist within many sectors of the Nigerian economy, encompassing energy, agriculture, transportation, housing, manufacturing, and others (Adewuyi et al., 2020; Ajayi et al., 2022; Nwokolo et al., 2023). The nation should allocate resources towards advancing and implementing climate-smart farming methods (Agbenyo et al., 2022). This strategy seeks to improve food production on current agricultural land while concurrently protecting wooded regions. Agriculture accounts for 19–29 per cent of world greenhouse gas emissions. Human activities, including land degradation and deforestation, profoundly harm the environment in Nigeria and other developing countries (Adenle et al., 2020), impacting their environmental and economic sustainability. This research examines the influence of green financing on Nigeria's economic sustainability.

Study Objectives

i. To examine the impact of green credit on Nigeria's economic sustainability.
ii. To investigate the impact of green security on Nigeria's economic sustainability.
iii. To explore the impact of carbon finance on Nigeria's economic sustainability.

Research Questions

i. What is the impact of green credit on Nigeria's economic sustainability?
ii. Does green security have any impact on Nigeria's economic sustainability?
iii. Does carbon finance impact Nigeria's economic sustainability?

LITERATURE REVIEW

Economic Sustainability

Sustainable development embodies a forward-thinking strategy prioritising advantageous social, economic, and environmental transformations. Yunita and Sopiana (2023) identify the primary objectives of sustainable development as economic progress, environmental conservation, and social justice. This notion is based on three essential pillars: "economic sustainability," "social sustainability," and "environmental sustainability." Glavič (2021) provides a historical perspective and an analysis of Sustainable Development Goal 12, which promotes sustainable consumption and production methods. Economies are established through markets where transactions occur. Mazzucato (2024) observes that although economic governance identifies several difficulties and proposes specific remedies, it frequently overlooks examining fundamental causes. The economy primarily performs three fundamental functions: production, distribution, and consumption. The SEEA Ecosystem Accounting (SEEA EA) framework standardises terminology, principles, and methodologies pertinent to ecosystem accounting and physical accounts while offering insights and recommendations for the financial assessment of ecosystem services and assets (Zabel et al., 2024).

Economic sustainability, a crucial aspect of sustainable development, guarantees that economic progress does not jeopardise environmental and social well-being (Onoja et al., 2018). This involves creating robust, equitable, sustainable, and attainable economic systems through diverse tactics and frameworks. The System of Environmental-Economic Accounting (SEEA), established by the United Nations, is a crucial framework for economic sustainability. The SEEA was first developed in 1993 to fulfil the obligations set at the Rio Conference in 1992, and it experienced substantial improvements in 2003 and 2012, with additional advancements in 2013 marked by the introduction of the SEEA Experimental Ecosystem Accounting (SEEA-EEA). This methodology seeks to enhance the National Accounts framework by establishing internationally accepted standards for generating comparable data on the environment and its economic interactions. The SEEA is intended to precisely assess and track natural resources in conjunction with other physical assets and income streams, functioning as an essential instrument for promoting sustainable economic growth within environmental constraints. The System of Environmental-Economic Accounting (SEEA) and related standards are supported by multiple collaborations designed to improve capacity and understanding (Swargiary, 2024). The Partnership for Wealth Accounting and the Valuation of Ecosystem Services (WAVES) is a significant partnership established by the World Bank. This collaboration encompasses UN agencies, civil society leaders, and national governments, providing technical support to several principal implementing countries. Moreover, initiatives like the Economics of Ecosystems and Biodiversity Initiative (TEEB) and the Natural Capital Initiative by the Global Legislators Organization underscore the integration of knowledge, capacity building, and the distribution of legal and policy frameworks pertinent to natural capital accounting.

To address the problems of sustainable development, national governments must quantify and manage natural resources with the same rigour as other tangible assets and income streams (Musselli et al., 2020). This procedure entails the compilation of inventories of natural assets, delineating the interrelations between national well-being and local ecosystems alongside non-renewable resources, and evaluating their present statuses and trends. Systematic accounting for natural capital is essential for advancing economic development while recognising environmental constraints. Moreover, it aids in attaining both national and international goals focused on promoting a more sustainable future. In summary, economic sustainability is a multifaceted notion that requires the integration of economic, environmental, and social dimensions. The SEEA and various international frameworks, policies, and standards are crucial for enabling this integration, providing stakeholders with the necessary tools and benchmarks for assessing and monitoring the sustainability of economic activities (Marron et al., 2019). By implementing these principles and tackling the essential issues of sustainable development, nations can endeavour to create economic systems that are both profitable and equitable for all.

Green Innovation and Carbon Dioxide Emissions

Green innovations involve technology developments that substantially decrease carbon dioxide emissions and mitigate environmental risks. Implementing this plan is a judicious approach to controlling detrimental atmospheric emissions while promoting economic development. Multiple studies demonstrate that green innovation is essential for mitigating environmental degradation in diverse economies. Lee et al. (2022) examined the effect of green investment on carbon dioxide emissions by evaluating a decade of data from Japanese manufacturing firms. Their findings indicated an inverse correlation between sustainability improvements and carbon emissions in Japan. Research by Yii and Geetha (2017) yielded comparable findings for Malaysia, demonstrating that advancements in the manufacturing sector generally enhance the nation's environmental conditions. The authors utilised an error correction model to achieve the aims of their investigation. Research on Turkey employing the Bootstrap Autoregressive Distributed Lag model reveals that advancements in green technologies and investments favourably impact environmental quality (Shan et al., 2021).

Zhang et al. (2017) demonstrate that the transition from traditional manufacturing methods to advanced green technologies has resulted in enhanced pollution levels across 30 provinces in China at the regional level. Hashmi and Alam (2019), Ganda (2019), and Paramati et al. (2021) employed diverse panel data approaches on OECD regional data and concluded that the implementation of green technical innovations in the industrial sector markedly diminishes the release of detrimental pollutants into the environment. Although the beneficial effects of green innovation on environmental health are broadly recognised, preliminary research indicates that its impact may be negligible. Wang et al. identified a slight association between carbon emissions and energy technology patents, which signify green innovation, in Chinese regions. Furthermore, Weina et al. (2016) asserted that green innovation may indirectly influence ecological production and foster a sustainable environment in Italy. Similarly, Du et al. (2019) revealed that using eco-friendly technologies in the industrial sector had little effect in lower-income nations. The research underscores the absence of conclusive findings concerning the diverse factors affecting carbon dioxide emissions. Furthermore, whereas many studies have concentrated on G7, BRI, G20, or MENA nations, there has been no targeted analysis of the South Asian region. Geographical constraints limit green innovation, financial development, and renewable energy consumption, and there is a significant lack of linear correlations among these factors.

Empirical Review of Related Studies

Mohanty et al. (2024) studied the influence of green finance in advancing sustainable development goals in India's tourist sector. The research, based on data from 576 participants and employing structural equation modelling via SPSS and AMOS software, demonstrated that awareness of green finance, coupled with incentives, initiatives, and technological advancements, is essential for enhancing the green sector. The authors promote heightened awareness and incentives for green financing, the advancement of breakthrough green technology, and successful green marketing strategies to facilitate sustainable development in India and worldwide.

Ramzani et al. (2024) examined the influence of AI-driven green finance techniques on advancing the renewable energy sector in Germany and Denmark. The study analysed the impact of these techniques on renewable energy investments in 2019 and 2020, utilising Analysis of Variance (ANOVA), paired sample t-tests, and regression analysis. The findings demonstrated that AI-driven green finance solutions substantially advanced renewable energy, with Denmark demonstrating significant development and Germany displaying a high association between AI tactics and sustainable financial practices. The paper advocates for the worldwide implementation of AI-driven green finance policies to foster sustainable development and tackle climate change issues.

Lai (2023) analysed the impact of green money on sustainable development in China. The study employed data from 2016 to 2022 from the China Banking Regulatory Commission and the National Research Network Industrial Statistics Database. The investigation included components such as green credit, interest costs in energy-intensive sectors, green securities, loan balances, green insurance, and public fiscal expenditures for environmental protection, utilising Eviews 7.0 for regression analysis. The findings indicate that the Green Finance Development Index positively influences economic growth and reconfigures China's industrial structure. The report promotes the creation of policy-oriented green financial institutions to enhance green initiatives. It emphasises the need for strong governmental oversight to realise the complete potential of green finance in supporting sustainable economic development.

Ma et al. (2023) similarly examined the significance of green financing in advancing sustainable development within China's regional economies, emphasising the necessity of comprehending its mechanisms of effect. This study focused on regional inequalities and the interplay between green finance and sustainable development. The study included panel data from 30 regions in China spanning 2016 to 2020, utilising the entropy approach, Pearson correlation tests, and panel data regression analysis (OLS, RE, FE models). Additionally, it encompassed examinations of regional variability and robustness assessments. The results indicate that the correlation between green finance and sustainable development is more significant in the eastern coastline than inland locations. Increased green financing and sustainable development levels improve coupling coordination, but diminished levels impair it. The influence of green finance on sustainable development varies by geography, with substantial positive effects in areas with extensive green finance and less pronounced effects elsewhere. The study advocates for enhancing green finance policies in areas characterised by underdevelopment but with significant potential for technological innovation.

Tiawon and Miar (2023) investigated the impact of renewable energy generation, energy efficiency, and green finance on promoting sustainable economic development in Indonesia. The research, utilising time series data from 1990 to 2019 and adopting the Autoregressive Distributed Lag (ARDL) model, demonstrated that these factors significantly contribute to economic growth and the reduction of carbon emissions. The authors promote the adoption of energy efficiency measures, synchronising growth objectives with climate change mitigation, and augmentation of investments in renewable energy and green finance programs.

Yu et al. (2023) examined the dynamic impacts of renewable energy consumption, financial development, and progress in green technologies on carbon dioxide emissions. This research is based on data from specific Asian nations from 1990 to 2019. The research utilises the Cross-Sectional Augmented Distributed Lag model to tackle problems associated with slope heterogeneity and cross-sectional dependency in the panel data. Long-term data demonstrate that the development of the financial sector is associated with a rise in carbon emissions.

In contrast, green innovation and using renewable energy facilitate emissions reduction. The influence of these two variables on emission reduction varies considerably, with green innovation having a more substantial effect. While the short-term outcomes are comparable, the coefficients are comparatively less. The error correction term exhibits a significantly negative value, indicating a 25% adjustment rate in reaction to deviations from steady-state equilibrium. These findings suggest incorporating renewable energy and green technology innovation in the banking sector could alleviate its adverse effects.

Majeed and Mazhar (2020) examined the impact of trade's ecological footprint across a sample of 20 high-income nations, 36 middle-income countries, and 20 low-income countries from 1991 to 2018. The Fully Modified Ordinary Least Squares (FMOLS) analysis indicates that trade improves environmental conditions in both high- and low-income nations; however, it adversely affects the environment in middle-income countries.

RESEARCH METHODOLOGY

Research Design

The study used an ex-post facto approach consistent with the positivist perspective. This perspective prioritises the gathering and examination of numerical information, with a significant emphasis on reliability and regulation (Goodman-Scott et al., 2021). This design integrates secondary data from the World Governance Indicators (WGI) and the CBN. The primary goal is to establish a theoretical foundation for evaluating the feasibility of different forms of information and ensuring their trustworthiness and sufficiency. We used a retrospective research methodology, relying on past events and requiring data from the studied nations' World Governance Indicators (WGI) and Central Banks.

Study Population

The population is the broader context in which researchers aim to apply their findings, and its characteristics determine the scope and significance of the study's results. This study's population comprises Nigeria's green finance, including green credit, green security, carbon financing, and economic sustainability, from 2009 to 2024.

Sources and Methods of Data Collection

The data used in the study is secondary. It uses existing information that may be useful for specific surveys. The data for this study was derived from reliable institutions such as the National Bureau of Statistics, the annual report on green finance, and the CBN statistical bulletin from 2009 to 2024. These were sourced from the World Bank development indicator and CBN Statistical Bulletin, which lists various issues from 2020, the year of the monetary authority.

Instruments of Data Collection

The researcher utilised annual time series data from various sources, including the World Bank Annual Report, the National Bureau of Statistics, annual reports on exchange rates, and the CBN statistical bulletin on Nigerian green finance. The data covered the period from 2009 to 2024 and focused on aspects such as green finance, including green credit, green security, carbon financing, and economic sustainability of Nigeria.

Method of Data Analysis and Model Specification

This study used descriptive statistics to provide a summary of the dataset. This encompasses various statistical measures, such as the mean, median, and mode for central tendency and the standard deviation, variance, minimum, maximum, kurtosis, and skewness for variability for descriptive statistics. For the inferential statistics, unit root tests, co-integration tests, panel cointegration, and estimation of panel cointegration regression are applied. In contrast, the dynamic fixed effect model is applied to get the impact. This study utilised the model proposed by (Kwilinski et al., 2023) Moreover, Ewubare et al. (2019) analysed sustainable development, represented by economic and economic sustainability, concerning green finance, including green credit, security, and carbon financing. Herein, the functional relationship between sustainable development and green finance is defined as follows.

ECOSUS = f (GRECRE, GRESEC, CARFIN) .... (3.1)

Therefore, the econometrical form of the equation becomes:

The model is formulated to capture the relationship between the effect of green finance and sustainable development during the period under review. The model is explicitly expressed as:

$ECOSUS_t = \alpha + \beta_1 GRECRE_t + \beta_2 GRESEC_t + \beta_3 CARFIN_t + \mu_t$................. (3.2)

The transformed model shows.

Model: $GDPG_t = \alpha + \beta_1 GRL_t + \beta_2 EPH_t + \beta_3 CO_2F_t + \mu_t$. .... (3.3)

Were.

ECOSUS = Economic Sustainability = GDPG = GDP Growth (Annual %)

GRECRE = Green Credit = GRL = IBRD loans and IDA credits (DOD, current US$)
GRESEC = Green Securities = EPH Electricity production from hydroelectric sources (% of total)
CARFIN = Carbon Finance = CO_2F = Adjusted net savings, including particulate emission damage (current US$).
α = Constant term
μ = error term
t= time
β_1- β_4 = Coefficient of the variables

4.0 ANALYSIS AND RESULTS

Descriptive Statistics

The descriptive statistics for the variables considered in this study are indicated in Table 1, which includes GDPG, GRL, EPH, and CO_2F. It indicates that the highest and lowest mean values within the period under review are 2.9141 and 19.1516 for GDPG and EPH, respectively. In contrast, the highest and lowest values for the range are equally entailed. The minimum value for the minimum statistics includes -1.79 for GDPG, and the maximum value for all the variables is indicated by CO2F as 7.8E+10. At the same time, the highest and lowest sums are 43.71 and 287.27 for GDPG and EPH, respectively. The highest and lowest SD for the variables shows 43.71 and .54602 for both GDPG and EPH, whereas the variance is witnessed in the 5.723E+20 in the CO_2F. The least variance value is denoted by 4.472 as EPH, while the skewness is indicated at .248 for GDPG, and Kurtosis has the least factor at -1.229 outlined for the GDPG.

Table 1: Study's Descriptive Statistics

Statistics	GDPG	GIRL	EPH	CO_2F
Mean	2.9141	8.2E+09	19.1516	2.9E+10
Range	9.83	2.8E+10	6.81	7.8E+10
Minimum	-1.79	.00	17.59	38735.93
Maximum	8.04	2.8E+10	24.40	7.8E+10
Sum	43.71	1.3E+11	287.27	4.32E+11
SD	0.858	1.6E+09	.54602	2.4E+10
Variance	11.042	4.2E+19	4.472	5.723E+20
Skewness	.248	2.066	1.735	.985
Kurtosis	-1.229	5.845	1.854	.098

Source: Researcher's Computation, (2024)

Test of Multicollinearity using Variance Inflation Factor (VIF)

Table 2 presents the variance inflation factor (VIF) result used to check for multicollinearity among the variables of interest.

Table 2: Test of Multicollinearity

	Collinearity Statistics	
Model Coefficients	**Tolerance (1/VIF)**	**VIF**
GIRL	.820	1.06
EPH	.571	4.05
CO2F	.216	1.17

a. Dependent Variable: GDPG

Source: Author's Computation, (2024)

From the table, multicollinearity is considered an econometric issue where a robust correlation is observed between two or more regressors, making it almost impossible to distinguish the effect of each of the concerned regressors on the response variable (Muhammed & Adindu, 2023). It simply captures the movement of two or more regressors moving simultaneously in the same direction and rate. Accordingly, seeing that all the regressors show a VIF value of less than 6 each, which is well below the benchmark of less than 10 (Agubata et al., 2022), which means that a robust outcome is expected by applying the panel least square estimators without necessarily logging the variables.

Unit Root test

Table 3 shows the results for both the raw and the differenced data after they were subjected to the Augmented Dickey-Fuller and Phillips Perron tests.

Table 3: Results of Augmented Dickey-Fuller Test & Phillips Perron at the level and first difference

Variables	T-Statistics	Lag Order	P-Value	Alterlocal Hypothesis	Remark
ADF at First Difference					
GDPG	-2.2844	2	0.4619	Stationary	Not Stationary
GIRL	-2.2850	2	0.4616	Stationary	Not Stationary
EPH	-2.0291	2	0.4914	Stationary	Not Stationary
CO_2F	-2.2849	2	0.4616	Stationary	Not Stationary
Phillips Perron Test at Level					
GDPG	-30.140	3	0.3140	Stationary	Not Stationary
GIRL	-30.042	3	0.3312	Stationary	Not Stationary
EPH	-46.019	3	0.3727	Stationary	Not Stationary
CO_2F	-30.980	3	0.3881	Stationary	Not Stationary
ADF at First Difference					
Variables	**T-Statistics**	**Lag Order**	**P-Value**	**Alterlocal Hypothesis**	**Remark**
GDPG	-3.5996	2	0.04602	Stationary	Stationary
GIRL	-3.5857	2	0.04709	Stationary	Stationary
EPH	-4.0502	2	0.01812	Stationary	Stationary
CO_2F	-3.5854	2	0.04711	Stationary	Stationary
Phillips Perron Test at First Difference					
GDPG	-31.071	3	0.01	Stationary	Stationary
GIRL	-31.437	3	0.01	Stationary	Stationary
EPH	-47.628	3	0.01	Stationary	Stationary
CO_2F	-31.434	3	0.01	Stationary	Stationary

Source: Researcher's Computation, (2024).

As previously stated, analysis based on time series requires the data to be stationary, as non-stationary data leads to misleading inference. So, the unit root test is employed to test for the data's stationary nature through the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests. The series is expected not to contain unit roots to find relationships among the variables in the long run. The test is carried out at the level and first difference using a 5% Mackinnon Critical value (Iwegbu et al., 2019). The ADF and PP test results show that all the variables are not stationary at levels, as the absolute value of their respective t-statistics values is less than the absolute 0.5% critical value inboth tests. However, after testing them at their first difference, they were all stationary as all the variables are integrated in the same order of 2. The result is consistent with findings from Muhammed (2023), whose variables became stationary at first difference. Therefore, the co-integration test is necessary to check the long-term relationship among the variables further (Iwegbu et al., 2019).

Co-integration Test

Table 4 shows the Eigen normalised cointegration relations and Eigen weights loading matrix in the Johansen Cointegration analysis.

Table 4: Johansen Test for Co-integration

Values of Test Statistics and Critical Test					
	Test	**10pct**	**5pct**	**1pct**	
r <= 4	0.15	6.50	8.18	11.65	
r <= 3	9.86	15.66	17.95	23.52	
r <= 2	27.30	28.71	31.52	37.22	
r <= 1	46.73	45.23	48.28	55.43	
r = 0	72.00	66.49	70.60	78.87	
Eigen Normalized Cointegration Relations					
GDPG	0.09842796	-0.00170223	0.09842796	-1.00170223	3.212276e+02
GIRL	-2.26269956	0.0984279616	7.190007492	2.635706e+02	1.212376e+02
EPH	-0.00170223	-0.0009931287	0.001297502	4.070976e-04	-3.25904e-04
CO2F	-0.20648718	0.0751322215	-0.686281351	-1.864070e+01	-8.9172e+00
Eigen Weights Loading Matrix					
GDPG	90.82181	110.6837	-12.241738	30.02113	-9.41356
GRL	-19.32974	15.70237	-4.902729	0.5921169	-0.6963618
EPH	98.82181	328.05318	-449.670120	-1.8916763	-5.4921012
CO2F	-274.97971	223.39939	-69.758759	8.4613450	-9.9094210

Eigenvalues (lambda): 0.400250946, 0.368052165, 0.225553304, 0.003827619 and 0.09842796 for the six variables considered in this study.

Source: Researcher's Computation, (2024).

The Johansen test for Cointegration was employed to test the long-run relationship among the variables. When two or more time series data are cointegrated, it means a long-run statistical relationship (Selva, 2019). The procedure for the cointegration test began with the null hypothesis that there is no cointegration among the systems of equations in the VAR model. A rejection of this hypothesis implies the existence of Cointegration among some or all the equations. Consequently, the second part of the divide indicates the existence of a run relationship among all 5 equations in the model, which shows the rejection of the null hypothesis at a 5% level of significance, depicting that the series is cointegrated because the individual time series has an integration order that is more than the linear combination of the time series. The Linear combination of the six-time series variables is **s = 0.20841780*GDPG - 2.26269956*GRL - 0.00170223*EPH - 0.20648718*CO_2F.** The linear combination shown above indicated the ADF value of -3.786, a Lag order of 3 and a p-value of 0.03121, posting that there is enough evidence to reject the null hypothesis since the p-value is less than the 0.05 significance level. This shows a relationship between the variables considered for this study for the period under review.

Diagnostic Test

To ensure the efficiency of the VAR model and its correlation with the white noise assumption, a residual-based test of Breusch-Godfrey L-M test for autocorrelation, Jarqui Berra test for normality, Lagrange multiplier (LM) test, and Hausman test were conducted for the employed model.

Residual Autocorrelation Test

The LM Serial Correlation Test was employed for the system model to test for residual autocorrelation among the variables, as indicated in Table 5.

Table 5: Residual Serial Correlation LM Tests

Covariance Matrix of the Residual						
GDPG	1.39	0.005086	0.6924	4.555	9.852	96.1135
GRL	192.89	0.692393	96.1135	632.210	1367.517	129.852
EPH	1268.80	4.554501	632.2101	4158.519	8995.182	138.211
CO2F	2744.51	9.851868	1367.5170	8995.182	19457.244	1268.80
Correlation Matrix of Residuals						
GDPG	.9904	1.0000	.9903	.9903	.9903	1.0000
GRL	1.0000	.9903	1.0000	1.0000	1.0000	.9903
EPH	1.0000	.9903	1.0000	1.0000	1.0000	.9903
CO2F	1.0000	.9903	1.0000	1.0000	1.0000	1.0000

Source: Researcher's Computation (2024).

The LM Serial Correlation Test was employed to test for residual autocorrelation among the variables. It shows the rejection of the null hypothesis that no autocorrelation exists among the residuals. The probability of the observed LM statistics must be greater than 5%. The result depicts a rejection of the null hypothesis for all the lags, implying the inexistence of serial correlation among all the variables in the VAR model.

Normality Test

The multivariate normality test result for the VAR model is depicted in Table 6 below.

Table 6: Multivariate Normality Test

Jarque-Bera Test		
Chi-Squared	**df**	**p-value**
353.69	10	<2.2e-16
Skewness		
63.126	5	2.742e-12
Kurtosis		
290.56	5	<2.2e-16

Source: Researcher's Computation (2024).

According to the table, the result indicates the rejection of the null hypothesis, which is the residuals or error terms in the VAR System. It shows that they are generally distributed with the combined p-values of Jarque-Bera, skewness, and Kurtosis probability statistics, which is less than the 5% significance level. The result posited that all five equations in the model are normally distributed.

Serial Test

Table 7 outlines the Portmanteau test output for the equation. The probability of the p-value of 0.000212, which is less than the 0.05 significance level, implies the rejection of the null hypothesis that the residual value is serialised; therefore, we can conclude that the residual value of the dependent variable is not correlated with the error term.

Table 7: The Portmanteau test (asymptotic)

Chi-Squared	**df**	**p-value**	**Significance Level**
234.04	175	0.000212	0.05

Source: Researcher's Computation (2024).

Lagrange Multiplier Test (LM)

Table 8 illustrates the LM test for the considered variables for GDPG. Using GDPG as the measure of economic sustainability supports the presence of random effects in the cross-section, invariably nullifying the validity of adopting the common effect estimated output for testing the proposed hypothesis in the current study. This is shown by the p-value (.000). Thus, the study further applies the Hausman test to determine the most appropriate estimator between the fixed and random effect estimators.

Table 8: Lagrange Multiplier Test (LM) for GDPG

	Vars	**Sqrt (Var)**
GDPG	49830.02	223.2264
e	25701.33	160.3164
you	15708.48	125.3335

Breusch and Pagan Lagrangian multiplier test for random effects
GDPG [CROSSID, t] = Xb + u[CROSSID] + e [CROSSID, t]
Estimated results:
Test: Var(u) = 0; chibar2(01) = 48.70; Prob> chibar2 = .0000

Hausman Test

The Hausman test for the variable GDPG is indicated in Table 9, which shows that the Hausman test for the model using the GDPG has a p-value of 0.8190, which is statistically insignificant at all levels of significance, thereby implying that the random effect estimate is more appropriate for the data in the current compared to the fixed effect and common effect estimators. Thus, the study utilises the random effect estimate to test the proposed hypothesis.

Table 9: Hausman Test for the GDPG Model

	Coefficients (b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E
GDPG	.5615132	2.065815	-1.5043	2.262924
GRL	.8775111	1.267082	-.38957	0.151765
EPH	-.538320	-.705647	.167327	0.027998
CO2F	.6256086	.261152	.354457	0.132829

b = consistent under Ho and Ha; obtained from strong
B = inconsistent under Ha, efficient under Ho; obtained from strong
Test: Ho: difference in coefficients not systematic
chi2(5) = (b-B)'[(V_b-V_B) ^ (-1)] (b-B) = 2.94
Prob>chi2 = 0.6191
Source: Researcher's Computation (2024).

From the table, the Hausman test for the model using the GDPG has a p-value of 0.6080, which is statistically insignificant at all significance levels. This implies that the random effect estimate is more appropriate for the current data than the fixed effect and common effect estimators. Thus, the study utilises the random effect estimate to test the proposed hypothesis.

Regression Model

Table 10 presents the regressed results from the common, fixed, and random effect estimators with GDPG (dependent variables) representing Nigeria's economic sustainability measures. The model estimate in italics is the selected estimate for hypothesis testing as validated by the ML and Hausman tests. Thus, the random effect estimate is presented for discussion in the current study for the GDPG models.

Table 10: Estimated Results

GDPG	Pooled Effect Model			Fixed Effect Model			Random Effect Model		
	Coef.	T	P>|t|	Coef.	T	P>|t|	*Coef.*	*Z*	*P>|z|*
CO2F	-4.68E-11	-.091	0.787	-4.68E-11	-.091	-7.10E-05	*-4.68E-11*	*-.091*	*0.005*
GRL	.698	-.398	0.420	.698	-.398	-2.485	*.698*	*-.398*	*0.048*
EPH	-7.10E-05	.952	0.010	-7.10E-05	.952	0.323	*-7.10E-05*	*.952*	*0.024*
_cons	-2.485	-.532	0.015	-2.485	-.532	0.187	*-2.485*	*-.532*	*0.083*
Number of groups	5			5			*5*		
Number of obs	70			70			*70*		
F (5, 69)	6.21			7.33			*NA*		
Prob > F	.000			.000			*.698*		
R-squared	.7130			.7441			*.8279*		
Adj R-squared	.6811			.5700			*.6168*		

note: selected model in italics

Source: Researcher's Computation (2024)

From the table, the GDPG has coefficients of -4.68E-11, .698 and -7.10E-05 for CO2F, GRL and EPH, correspondingly meaning that the CO2F and EPH have negative predictive values for GDPH, denoting that they impact it negatively. In contrast, GRL, which has a positive predictive value, is depicted as having a positive impact on it. Consequently, with a Sig (<0.05) signifying the rejection of all the hypotheses, such as the H_{01}, H_{02}, and H_{03}, of this study while the regression line for the GDPG model indicates GDPG = -2.485 - 4.68E-11(CO_2F) + .698(GRL) - 7.10E-05(EPH) in line with the outcome of this study, meaning that their impact is significant and minimal as delineated by their coefficient values. This is reinforced by their R-Square value of .8279, representing an impact of about 83 per cent on the GDPG.

Discussions

This study's findings demonstrate a significant impact of green credit, green security, and carbon financing on Nigeria's economic sustainability. This influence may arise from the nation's dependence on foreign financial aid, particularly from China and the United States, instead of capitalising on its resources or efficiently employing borrowed capital, resulting in the acceptance of the economic consequences of such borrowing. The findings indicate that a strong financial infrastructure can improve economic sustainability and concurrently decrease CO_2 emissions (Zhang et al., 2023). The study asserts a positive correlation among green credit, green security, and carbon financing, as well as the reduction of CO_2 emissions, suggesting that these variables substantially influence emission levels. This association can be elucidated by various factors: the evolution of the stock market assists publicly traded companies in reducing financing costs, expanding financing options, mitigating operational risks, and enhancing their asset-liability equilibrium. Consequently, these companies can allocate resources towards new equipment and initiatives, potentially resulting in elevated energy usage and increased carbon emissions. Nigeria's financial systems have drawn foreign direct investment, fostered economic expansion and increased carbon emissions during the investigated period, as indicated by an 83 per cent significant impact. Thus, a dynamic and effective financial system promotes consumer borrowing, enabling the purchase of high-value goods such as vehicles, residences, and appliances, which are common in Nigeria, ultimately leading to heightened CO_2 emissions (Nawaz et al., 2020). Further study substantiates the considerable correlation between financial sustainability and CO_2 emissions, resulting in fluctuations in emission levels (D'Adamo et al., 2022; Aggarwal, 2023; El-Katiri, 2022).

Ragged (2020) discovered that an increase in carbon finance positively affects CO_2 emissions, which contradicts this study's findings that demonstrate a negative impact of carbon finance on CO_2 emissions in Nigeria, as indicated by the negative coefficient of CO_2F (-0.0367631). This research underscores Nigeria's dependence on fossil fuels intensifies environmental degradation by markedly increasing CO_2 emissions. A robust correlation exists between electricity consumption and carbon emissions, indicating that an increase in the utilisation of cleaner energy sources, such as electricity, decreases atmospheric carbon emissions, as evidenced by the positive coefficient of EPH (0.0265807). Using fossil fuels influences CO_2 emissions, per capita GDP, and the square of per capita GDP. Research conducted by Kayani (2021) and Raihan & Tuspekova (2022) demonstrated that fluctuations in economic growth and energy consumption positively correlate with carbon dioxide emissions in Indonesia, Malaysia, and Thailand; however, the link is negative in Singapore. The reaction of energy consumption to economic growth shocks is uniformly positive in all four ASEAN countries, signifying that economic expansion positively affects carbon dioxide emissions in these nations (Mitić, 2023). Moreover, economic growth in Malaysia, Thailand, and Indonesia positively responds to energy consumption shocks, while in Singapore, such shocks adversely impact economic growth (Destiartono & Ekananda, 2023). Moreover, researchers have determined that all types of energy consumption exert detrimental environmental impacts, both in the short and long term, demonstrating a consistently positive correlation between wealth and the outcome variable (van Niekerk, 2024).

Nigeria must devise ways to mitigate emissions. Possible strategies include implementing carbon capture technology, transitioning to solar and wind energy, decreasing domestic energy subsidies, and creating energy storage systems for energy conservation (Wan et al., 2023). This study's findings indicate that the coefficient of CO_2 emissions is positive and statistically significant, implying that an increase in per capita CO_2 emissions is associated with a rise in national GDP. Energy consumption is typically associated with economic expansion, resulting in increased CO_2 emissions; thus, a robust and affirmative correlation is anticipated between these two variables (Han et al., 2023). The long-term impact of carbon emissions on income surpasses the short-term effects, suggesting that more wealth correlates with elevated CO_2 emissions in the nation. Energy consumption's substantial and advantageous effect on economic growth highlights its significance for development. The rising CO_2 emissions underscore the pressing necessity for alternative energy sources and developmental methods to safeguard Nigeria's environment. Furthermore, research conducted by Cai et al. (2018) has demonstrated a correlation between energy use, CO_2 emissions, and economic development. Majeed et al. (2021) analysed the disparate effects of energy consumption and economic growth on Pakistan's ecological footprint from 1971 to 2014, indicating that the environmental consequences differed according to the energy type utilised. Although oil consumption adversely impacts the environment, gas usage benefits environmental conditions. Empirical research often produces inconclusive outcomes shaped by the specific econometric methodologies utilised, the economic characteristics of the nations examined, and the temporal contexts analysed. Katircioğlu and Taşpinar (2017) examined the correlation between financial development and other parameters related to environmental deterioration in Turkey. Their findings suggest that although financial growth promotes economic progress, the economy's expansion and energy consumption predominantly propel CO_2 emissions.

5.0 CONCLUSION AND RECOMMENDATIONS

This study, which investigated the impact of green financing on Nigeria's economic sustainability, concludes that the CO2F and EPH have negative predictive values for GDPH, denoting that they impact it negatively. GRL, which has a positive predictive value, is depicted as having a positive impact on it, which is emphasised by their R-Square value of .8279, representing about 83 per cent impact, respectively, on the GDPG. This study recommended that.

1. Increase Investment in Renewable Energy and Strengthen Green Financing Policies The Nigerian government should significantly enhance investments in renewable energy research and development while fostering expertise in sustainable energy technologies. Implementing tax incentives, low-interest green loans, and green bonds will encourage private sector participation and drive economic sustainability.
2. Enhance Carbon Finance and Expand Green Securities Nigeria should strengthen its carbon credit trading system, introduce carbon taxes, and improve green bond market regulation to attract domestic and foreign investments. Encouraging businesses to adopt green securities and disclose sustainability efforts will boost corporate responsibility and long-term environmental sustainability.
3. Develop Sustainable Infrastructure and Promote Green Technology The government must prioritise clean energy infrastructure projects, promote climate-smart agriculture, and encourage industries to adopt eco-friendly production processes. This will reduce carbon emissions, enhance economic resilience, and position Nigeria as a leader in sustainable industrialisation.
4. Strengthen Institutional Capacity and Improve Green Credit Access Establishing a dedicated Green Finance Agency will ensure effective policy implementation, regulation, and monitoring of green finance initiatives. To support sustainable economic activities, financial institutions should expand access to green credit, especially for SMEs and rural businesses.
5. Encourage Public-Private Partnerships (PPPs) and Attract Foreign Direct Investment (FDI) The government should facilitate stronger collaborations between the public and private sectors to fund large-scale renewable energy and environmental sustainability projects. Providing investment-friendly policies and regulatory stability will attract foreign direct investment (FDI) in clean energy and green technology, boosting Nigeria's long-term economic sustainability.

REFERENCES

1. Adenle, A. A., Eckert, S., Adedeji, O. I., Ellison, D., & Speranza, C. I. (2020). Human-induced land degradation dominance in the Nigerian Guinea Savannah between 2003–2018. *Remote sensing applications: society and environment*, *19*, 100360.
2. Adewuyi, Oludamilare Bode, et al. "Challenges and prospects of Nigeria's sustainable energy transition with lessons from other countries' experiences." *Energy Reports* 6 (2020): 993–1009.

3. Agbenyo, W., Jiang, Y., Jia, X., Wang, J., Ntim-Amo, G., Dunya, R., ... & Twumasi, M. A. (2022). Does the adoption of climate-smart agricultural practices impact farmers' income? Evidence from Ghana. *International Journal of Environmental Research and Public Health*, *19*(7), 3804.
4. Aggarwal, K. (2023). Effect of company characteristics and board structure on human resource disclosure index in Indian corporate sector. *International Journal of Monetary Economics and Finance*, *16*(5), 348–396.
5. Ajayi, O. O., Mokryani, G., & Edun, B. M. (2022). Sustainable energy for national climate change, food security and employment opportunities: Implications for Nigeria. *Fuel Communications*, *10*, 100045.
6. Anabaraonye, B., EZUMA, S., EMONE, E., OLISAH, N., & Beatrice, E. W. A. (2023). The Role of The World Bank Group in Green Financing to Enhance Green Entrepreneurship in Nigeria. *Covenant Journal of Entrepreneurship*, 4-4.
7. Anukwonke, C. C., & Abazu, C. I. (2022). Green Business through Carbon Credits. In *Climate Change Alleviation for Sustainable Progression* (pp. 315-332). CRC Press.
8. Baz K, Xu D, Ali H, Ali I, Khan I, Khan MM, Cheng J (2020). Asymmetric impact of energy consumption and economic growth on ecological footprint: using asymmetric and nonlinear approach. Sci Total Environ 718:137364
9. Bergougui, B. (2024). Moving toward environmental mitigation in Algeria: Asymmetric impact of fossil fuel energy, renewable energy and technological innovation on CO2 emissions. Energy Strategy Reviews 51. https://doi.org/10.1016/j.esr.2023.101281
10. Cai, Y., Sam, C. Y., & Chang, T. (2018). Nexus between clean energy consumption, economic growth and CO2 emissions. *Journal of cleaner production*, *182*, 1001-1011.
11. Chen, Z., Huang, W., & Zheng, X. (2019). The decline in energy intensity: Does financial development matter? Energy Policy, 134, 110945.
12. D'Adamo, I., Lupi, G., Morone, P., & Settembre-Blundo, D. (2022). Towards the circular economy in the fashion industry: the second-hand market as a best practice of sustainable responsibility for businesses and consumers. *Environmental Science and Pollution Research*, *29*(31), 46620-46633.
13. Destiartono, M. E., & Ekananda, M. (2023). Deforestation-induced the EKC framework: The role of corruption control and trade openness in Southeast Asia. *Jurnal Ekonomi & Studi Pembangunan*, *24*(1), 81-99.
14. Du, K., Li, P., & Yan, Z. (2019). Do green technology innovations contribute to carbon dioxide emission reduction? Empirical evidence from patent data. Technological Forecasting and Social Change, 146, 297–303.
15. El-Katiri, L. (2022). *SUNNY SIDE UP: MAXIMISING THE EUROPEAN GREEN DEAL'S POTENTIAL FOR NORTH AFRICA AND EUROPE*. European Council on Foreign Relations.
16. ENEJO, D. O. W., & IDOKO, G. J. (2023). ASSESSING GREEN FINANCE SOLUTIONS TO MITIGATE CLIMATE CHANGE RISKS FOR FARMERS IN NORTHERN NIGERIA.
17. Ganda, F. (2019). The impact of innovation and technology investments on carbon emissions in selected organisations for economic Cooperation and development countries. Journal of Cleaner Production, 217, 469–483.
18. Han, Y., Cao, L., Geng, Z., Ping, W., Zuo, X., Fan, J., ... & Lu, G. (2023). Novel economy and carbon emissions prediction model of different countries or regions in the world for energy optimisation using improved residual neural network. *Science of The Total Environment*, *860*, 160410.
19. Hashmi, R., & Alam, K. (2019). Dynamic relationship among environmental regulation, innovation, CO2 emissions, population, and economic growth in OECD countries: A panel investigation. Journal of Cleaner Production, 231, 1100–1109
20. Kadiri, M. (2021). Nigeria as a Global Hub for Traditional and Islamic Green Financing. *Available at SSRN 3862687*.
21. Katircioğlu, S. T., & Taşpinar, N. (2017). Testing the moderating role of financial development in an environmental Kuznets curve: empirical evidence from Turkey. *Renewable and Sustainable Energy Reviews*, *68*, 572-586.
22. Kayani, F. N. (2021). Renewable energy and economic growth nexus: A case of United Arab Emirates. *International Journal of Energy Economics and Policy*, *11*(5), 504-509.
23. Isah, A., Dioha, M. O., Debnath, R., Abraham-Dukuma, M. C., & Butu, H. M. (2023). Financing renewable energy: policy insights from Brazil and Nigeria. *Energy, Sustainability and Society*, *13*(1), 2.
24. Lai, J. (2023). Green Finance and Sustainable Development: An Empirical Study Based on Chinese Data. *Open Journal of Social Sciences*, *11*(11), 263–273. https://doi.org/10.4236/jss.2023.1111017
25. Lee, C. C., Yahya, F., & Razzaq, A. (2022). Greening South Asia with Financial Liberalization, Human Capital, and Militarization: Evidence from the CS-ARDL Approach. Energy and Environment, 25(1). https://doi.org/10.1177/0958305X221105863
26. Lee, J. W. (2020). Green finance and sustainable development goals: The case of China. *Lee, Jung Wan (2020). Green Finance and Sustainable Development Goals: The Case of China. Journal of Asian Finance Economics and Business*, *7*(7), 577–586.

27. Ma, H., Miao, X., Wang, Z., & Wang, X. (2023). How does green finance affect the sustainable development of the regional economy? Evidence from China. *Sustainability*, *15*(4), Article 3776. https://doi.org/10.3390/su15043776
28. Majeed MT, Tauqir A, Mazhar M, Samreen I (2021). Asymmetric effects of energy consumption and economic growth on ecological footprint: new evidence from Pakistan. Environ Sci Pollut Res:1–17.
29. Marron, R. K., Naughton, D., & Oaks, S. (2019). Monitoring progress towards SDG target 4.7 in Europe: Proposed framework and tools.
30. Mitić, P., Fedajev, A., Radulescu, M., & Rehman, A. (2023). The relationship between CO2 emissions, economic growth, available energy, and employment in SEE countries. *Environmental Science and Pollution Research*, *30*(6), 16140-16155.
31. Muhammed, A. O. (2023). Exchange Rate Volatility and Material Prices of Selected Building Materials in North-Central Nigeria Projects. A Thesis Submitted to the Postgraduate School, Federal University of Technology, Minna, Nigeria, in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Technology in Project Management Technology.
32. Musselli, I., Brugger, F., Bürgi, E., Giger, M., & Obrecht, A. (2020). Monitoring of Policy Coherence for Sustainable Development in a North-South Context. Synthesis Report, Including Application to IFFs.
33. Nawaz, M. A., Ahmad, T I., H., M. S, & Bhatti, M. A. (2020). How do energy use, financial development, and economic growth affect carbon dioxide emissions in selected associations of South Asian nations? *Paradigms, SI* (1), 159-164.
34. Nwokolo, S. C., Meyer, E. L., & Ahia, C. C. (2023). Credible pathways to catching up with climate goals in Nigeria. *Climate*, *11*(9), 196.
35. Olawoye-Mann, S. (2022). A green mandate: The Central Bank of Nigeria and sustainable development. In *Central Banking, Monetary Policy and the Environment* (pp. 219-233). Edward Elgar Publishing.
36. Onoja, A. O., Achike, A. I., & Enete, A. A. (2018). Climate Change and Sustainable Green Growth in Nigeria: Challenges and Opportunities. *Nigerian Agricultural Policy Research Journal (NAPReJ)*, *4*(1), 1-12.
37. Otali, M., & Monye, C. IMPLEMENTATION OF GREEN FINANCE AS A CATALYST FOR GREEN INFRASTRUCTURE DEVELOPMENT IN NIGERIA.
38. Oyewole, A. T., Adeoye, O. B., Addy, W. A., Okoye, C. C., & Ofodile, O. C. (2024). Enhancing global competitiveness of US SMES through sustainable finance: a review and future directions. *International Journal of Management & Entrepreneurship Research*, *6*(3), 634–647.
39. Ozili, P. K. (2022). Green finance research worldwide: A literature review. *International Journal of Green Economics*, *16*(1), 56–75.
40. Paramati, S. R., Mo, D., & Huang, R. (2021). Financial deepening and green technology's role in carbon emissions: Evidence from major OECD economies. Finance Research Letters, 41, 101794.
41. Qamruzzaman, M. (2023). Does financial innovation foster financial inclusion in the Arab world? Examining the nexus between financial innovation, FDI, remittances, trade openness, and gross capital formation. Plos one, 18(6), e0287475.
42. Raggad, B. (2020). Economic development, energy consumption, financial development, and carbon dioxide emissions in Saudi Arabia: new evidence from a nonlinear and asymmetric analysis. *Environmental Science and Pollution Research*, *27*(17), 21872–21891.
43. Ramzani, S. R., Konhaeusner, P., Olaniregun, O. A., Abu-Alkheil, A., & Alsharari, N. (2024). Integrating AI-Driven Green Finance Strategies for Sustainable Development: A Comparative Analysis of Renewable Energy Investments in Germany and Denmark. *European Journal of Business and Management Research*, *9*(2), 43-55. http://dx.doi.org/10.24018/ejbmr.2024.9.2.2277
44. Shan, S., Genc¸, S. Y., Kamran, H. W., & Dinca, G. (2021). Role of green technology innovation and renewable energy in carbon neutrality: A sustainable investigation from Turkey. Journal of Environmental Management, 294, 113004. https://doi.org/10.1016/j.jenvman.2021.113004
45. SWARGIARY, K. Eco-Environmental Economic Accounting and Its Policy Application in India in 2024.
46. Temitope, A., Emmanuel, O., & Amadi, S. N. IMPACT OF GREEN FINANCE ON SUSTAINABLE DEVELOPMENT IN NIGERIA.
47. Tiawon, H., & Miar, M. (2023). The role of renewable energy production, energy efficiency and green finance in achieving sustainable economic development: evidence from Indonesia. *International Journal of Energy Economics and Policy*, *13*(1), 250-260. https://doi.org/10.32479/ijeep.13915
48. Van Niekerk, A. J. (2024). Economic Inclusion: Green Finance and the SDGs. *Sustainability*, *16*(3), 1128.
49. Wan, Y., Sheng, N., Wei, X., & Su, H. (2023). Study the spatial spillover effect and path mechanism of green finance development on China's transformation of energy structure—Journal *of Cleaner Production*, *415*, 137820.
50. Weina, D., Gilli, M., Mazzanti, M., & Nicolli, F. (2016). Green inventions and greenhouse gas emission dynamics: A close examination of provincial Italian data. Environmental Economics and Policy Studies, 18(2), 247–263.
51. Yii, K. J., & Geetha, C. (2017). The nexus between technology innovation and CO2 emissions in Malaysia: Evidence from Granger causality test. Energy Procedia, 105, 3118–3124.

52. Yu H., Nazir, R., Huang, J. & Li, H. (2023). Linkages between renewable energy, financial development, and environmental sustainability in Asian countries. Economic Research-Ekonomska Istraživanja Vol. 36, No. 3.
53. Zhang, Z., Zhao, Y., Cai, H., & Ajaz, T. (2023). Influence of renewable energy infrastructure, Chinese outward FDI, and technical efficiency on ecological sustainability in Belt and Road node economies. *Renewable Energy*, *205*, 608–616.
54. Zhang, B., Wang, B., & Wang, Z. (2017). Role of renewable and non-renewable energy consumption on EKC: Evidence from Pakistan. Journal of Cleaner Production, 156, 855–864.