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EFFECT OF GREEN BANKING INITIATIVES ON ECONOMIC GROWTH IN NIGERIA USING FINANCIAL TECHNOLOGY APPROACH

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Abstract

This study investigates the effect of green banking on economic growth in Nigeria using a financial technology perspective over the period 2013–2023. Quarterly time-series data were analysed using the Augmented Dickey–Fuller and Phillips–Perron unit root tests, alongside the Johansen cointegration technique, a parsimonious error correction model, and the fully modified ordinary least squares method. Model reliability was assessed through diagnostic tests, including the ARCH heteroskedasticity test, histogram normality test, and CUSUM stability test. The findings reveal that point-of-sale (POS) transactions exert a positive and statistically significant effect on gross domestic product (GDP), whereas mobile banking and web-based payments display negative but insignificant effects on economic growth. Automated teller machine (ATM) transactions were found to have a negative and significant impact on GDP at the 5 per cent level. In conclusion, green banking initiatives, supported by financial technology innovations have the potential to drive sustainable economic growth in Nigeria. Consequently, the study recommends that the Central Bank of Nigeria intensify efforts to expand POS infrastructure, particularly in underserved and rural areas, to promote financial inclusion and economic growth.

Keywords: Carbon footprint, economic growth, financial innovation, green banking, sustainable banking.

Introduction

Rising concerns over climate change and environmental degradation have intensified global advocacy for sustainable practices across economic sectors, including the financial system. In response, international institutions such as the World Bank and the United Nations have introduced initiatives

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aimed at integrating environmental considerations into financial decision-making. Notable among these efforts are the World Bank Carbon Fund, the United Nations Environment Programme Finance Initiative, and the Equator Principles, all of which promote environmentally responsible financing and risk management within the banking sector (Gbanador, 2018; Gbanador & Okeke, 2023).

Green banking refers to environmentally responsible banking practices that minimise carbon footprints and promote sustainability. It serves as a strategic tool for banks to lower their environmental impact while increasing awareness about ecological preservation (Gbanador, 2021). Essentially, green banking ensures that financial activities contribute positively to environmental protection and sustainable development. A deposit money bank can adopt green banking by restructuring its operations to align with eco-friendly principles (Gbanador & Okeke, 2023).

Conversely, financial technology (fintech) involves the application of technological innovation to enhance and automate financial services. It encompasses a broad range of activities such as mobile payments, online banking, peer-to-peer lending, investment platforms, and blockchain technology (Devaraju et al., 2025). Fintech plays a crucial role in advancing environmental sustainability by leveraging technologies like big data and artificial intelligence to create scalable, cost-effective financial solutions that merge traditional finance with modern information technology (Miled, 2025).

By conducting environmental impact assessments before financing projects, green banking also aligns with corporate social responsibility (CSR) principles. Banks approve loans only when environmental safety standards are met. The effective implementation of green banking relies on appropriate technology and regulatory frameworks (Bihari, 2011).

Green banking has become an essential aspect of the global financial ecosystem, as it emphasises sustainable financial operations, eco-friendly investments, and the funding of environmentally beneficial projects. Meanwhile, fintech has transformed traditional banking by making financial services more accessible, efficient, and inclusive through digital innovations (Cirappa & Suryaprasada, 2025). However, the effective integration of fintech and green banking depends significantly on the availability of robust digital infrastructure. In developing economies, limitations in broadband access, mobile networks, and digital literacy pose challenges to adopting fintech-driven green banking services. Additionally, the expansion of fintech solutions to manage complex financial instruments such as green bonds or environmental impact assessments requires sophisticated technological systems that may be underdeveloped in certain markets (Liu et al., 2020).

According to Lalon (2015), green banking encompasses all forms of banking that generate environmental benefits for the nation. A bank attains green status by conducting its operations in a manner that contributes positively to the environment. Similarly, Gbanador (2023) views green banking as a practice aimed at minimising carbon emissions through eco-friendly operations, consistent with the principles of sustainable banking. Prathima and Hebbar (2017) further note that green banking promotes environmental awareness by offering electronic banking services, such as online and mobile banking, to reduce physical branches and associated carbon emissions. Although banks have relatively minimal direct environmental impacts compared to manufacturing or extractive industries, their indirect influence through the financing of industrial projects is substantial.

The banking sector provides funding for industries such as steel, cement, power, and chemicals, major contributors to carbon emissions (Meena, 2013). Supporting this view, Aasa, Adepoju, and Aladejebi (2016) argue that banks play a pivotal role in promoting sustainable development through green banking initiatives despite their limited direct environmental footprint.

A practical way for banks to embrace green banking is by ensuring that their products and services are environmentally sustainable. This includes offering electronic banking channels such as mobile, internet, and paperless banking to reduce waste and pollution (Gbanador, 2018). In Nigeria, however, research on green or sustainable banking remains scarce, and existing studies have not examined the role of fintech in promoting green banking and its potential impact on economic growth. This study seeks to fill that gap by evaluating the effect of fintech-based green banking initiatives on economic growth in Nigeria.

Literature Review

Green banking encompasses banking practices that integrate environmental sustainability into core operations by minimizing carbon emissions and promoting eco-friendly activities (Lalon, 2015; Gbanador, 2023). It emphasizes reducing the environmental impact of banking operations while enhancing awareness of sustainable practices. Economic growth in this study is proxied by real gross domestic product (GDP), which reflects inflation-adjusted output within an economy over a given period.

Mobile banking enables customers to conduct financial transactions through bank-approved applications on mobile devices using secure authentication methods. Internet banking enables customers to access routine banking services online through a bank’s website without physical interaction. Automated Teller Machines (ATMs) provide self-service access to basic banking functions, while Point of Sale (POS) terminals facilitate electronic payments for goods and services using bank cards Gbanador, 2021).

The theories upon which this work hinges are the Bank Focused Theory and the Solow-Swan Neo-Classical Growth Model. Proposed by Kapoor in 2010, the Bank-Focused Theory posits that banks use cost-effective, non-traditional channels such as online banking, mobile banking, point-of-sale systems, and ATMs to deliver financial services. These platforms enable customers to access banking services without physically visiting branches (Gbanador, 2023). The theory is relevant to this study as it highlights financial technology systems as critical tools for the adoption and implementation of green banking initiatives.

Developed by Robert Solow and Trevor Swan in 1956, the Neo-Classical Growth Model asserts that economic growth is influenced by capital accumulation, technological innovation, and labour force expansion. It provides a theoretical foundation for examining the link between fintech-driven green banking and economic growth, as technological progress and energy efficiency contribute to sustainable economic development through increased productivity and innovation.

Pervaiz et al. (2025) examined how financial technology influences economic growth across G20 countries by relying on quantitative secondary data. In their model, economic development served as the explanatory variable, while indicators such as inflation, availability of automated teller machines, internet penetration, deposits, fund transfers, and mobile money usage were employed as measures of financial technology. The study applied multiple regression analysis using the ordinary least squares technique. The results indicate that variables including ATM penetration, inflation, deposits, internet access, economic development, and money transfer systems exert a positive and statistically significant impact on economic growth.

Miled (2025) explored the relationship among financial technology, green finance, natural resource rents, and economic growth in the pursuit of environmental sustainability within BRICS economies. The study employed a cross-sectionally augmented autoregressive distributed lag (CS-ARDL) technique for empirical analysis. The results demonstrate that financial technology plays a key role in improving the efficiency of financing green initiatives while simultaneously reducing carbon emissions. Furthermore, the expansion of fintech supports environmentally sustainable economic growth by accelerating the development of green finance mechanisms.

Using the panel unit root test, the panel cointegration test and the pairwise Dumitrescu-Hurlin panel causality tests, Ibrahim et al. (2024) assessed the influence of green finance, fintech and the digital economy on environmental sustainability from 2013 to 2023 in Middle Eastern countries: Saudi Arabia, Turkey, Kuwait, United Arab Emirates and Qatar. Environmental sustainability was employed as the dependent variable, while green finance, fintech and the digital economy were used as indicators for the independent variable. The finding reveals that green finance, the digital economy, and financial technology are closely interrelated. Therefore, the study recommends that policymakers should formulate feasible and energy system-compatible policies to provide green funding to the energy systems of Middle Eastern countries with maximum convenience.

Nenavath and Mishra (2023) analysed the impact of green finance and financial technology on sustainable economic growth in India over the period 2010–2021. The study utilised panel regression techniques alongside a two-step generalised method of moments (GMM) approach for estimation. The results indicate that green finance contributes to economic growth through its influence on financial structure, financial efficiency, and the improvement of environmental quality. In contrast, financial technology was found to significantly affect green finance, financial structure, and environmental quality, while no meaningful association was observed between green finance and economic efficiency.

Gbanador and Okeke (2023) explored how green banking practices impact the performance of Deposit Money Banks in Nigeria over the period 2012 to 2021. They used Deposit Money Bank Assets as the dependent variable, while factors like ATMs, mobile banking, web payments, and point-of-sale systems served as the independent variables. For their analysis, they applied the Johansen cointegration test, a parsimonious error correction model, and the fully modified least squares method. Their findings reveal a long-term connection between green banking and the performance of these banks. Consequently, the study recommends that the Central Bank of Nigeria develop and enforce policies to promote the widespread adoption of green banking practices.

Zhuo et al. (2022) investigated how innovations in financial technology influence green growth in China over the period 2011 to 2018. Utilizing a panel regression approach, their results highlighted that both fintech advancements and green finance play a significant role in fostering environmentally sustainable economic growth.

Risal and Joshi (2018) explored the impact of green banking practices on the environmental performance of banks in Nepal. Using a survey-based research design and convenience sampling, they gathered responses from 189 staff members across five commercial banks. Analysis through simple and stepwise multiple regression revealed that while energy-efficient equipment and green policies significantly enhance environmental performance, green loans and green projects do not have a significant effect.

Gbanador (2018) explored how green banking is being adopted in Nigeria. The paper delved into the fundamentals of green banking and identified several challenges hindering its implementation, such as Nigeria's developing economy, technological limitations, low literacy rates, a fragile legal framework, and inadequate infrastructure. The study concluded that banks can drive both economic growth and environmental sustainability by embracing green banking practices. It also recommended that the government play a role in raising awareness, providing essential infrastructure, overseeing banking operations, strengthening legal frameworks, and establishing an environmental trust fund.

Islam and Das (2013) examined the state of green banking in Bangladesh. Utilizing historical data and focusing on secondary sources, the study highlighted elements like mobile banking, online banking, green financing, and guidelines for green banking practices. The findings indicated that green banking in Bangladesh remains underdeveloped, largely because the concept is still emerging and has not yet gained traction, unlike in developed countries where green banking is more mature.

Methodology

The study employed the historical data research design, driven by the nature and sources of the required data. Quarterly time-series data covering the period from 2013 to 2023 were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin. Gross Domestic Product (GDP) was adopted as a measure of economic growth, while Mobile Banking (MOB), Web Pay (WEP), Automated Teller Machines (ATM), and Point-of-Sale (POS) transactions served as proxies for green banking.

Model Specification

The functional specification of the model is given as;

GDP = f (MOB, WEP, ATM and POS) (1)

Where;

GDP = Gross Domestic product

MOB = Mobile banking

WEP = Web Pay

ATM= Automated teller machine

POS = Point of sales

$$GDP = \beta_0 + \beta_1 MOB + \beta_2 WEP + \beta_3 ATM + \beta_4 POS + \mu_t \quad (2)$$

GDP, MOB, WEB, ATM and POS are as specified in equation (1) while:

β_0 = Constant

β_1, β_2, β_3, β_4 = Coefficients of the independent variables

μ_t = Error term

If equation (2) is tested in its logarithmic form (Log-linear) it becomes:

$$GDP = \beta_0 + \beta_1 LMOB + \beta_2 LWEP + \beta_3 LATM + \beta_4 LPOS + \mu_t \quad (3)$$

β_1 , β_2 ,β_3 , $\beta_4 > 0$

Where:

Log = Logarithmic Form

Results and Data Analysis

The study's data analysis involved various statistical tests, which are presented here along with their outcomes.

Pre-estimation tests

This study utilized both the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) and the Phillips-Perron (PP) test (Phillips & Perron, 1988) to investigate the presence of unit roots in the data, aiming to determine the integration order of the variables. If all variables are identified as integrated of order one, or I(1), then the Johansen cointegration method (Johansen, 1988) is considered appropriate for the analysis. Furthermore, the study employs a parsimonious error correction model (ECM) and the fully modified least squares (FMOLS) method as the core analytical techniques within the multiple regression framework.

Table 1: Unit Root (Stationarity) Test: Augmented Dickey-Fuller

Variables	Augmented Dickey-Fuller Test Statistic	Mackinnon's Critical Values at 1%, 5% & 10% respectively			Order of Integration	Prob.
LGDP	-2.328186	-2.625606	-1.949609	-1.611593	(1)	0.0210
LMOB	-6.319350	-2.621185	-1.948886	-1.611932	(1)	0.0000
LWEP	-6.710410	-2.621185	-1.948886	-1.611932	(1)	0.0000
LATM	-6.764802	-2.621185	-1.948886	-1.611932	(1)	0.0000
LPOS	-4.441947	-3.632900	-2.948404	-2.612874	(1)	0.0012

Source: Authors computation using Eviews 10

As shown in Table 1, the Augmented Dickey-Fuller test results indicate that all the variables are stationary at first difference I [(1)]. This result supports the application of the Johansen Cointegration.

Table 2: Unit Root (Stationarity) Test: Phillips-Peron

Variables	Phillips-Peron Test Statistic	Mackinnon's Critical Values at 1%, 5% & 10% respectively			Order of Integration	Prob.
LGDP	-10.35006	-2.621185	-1.948886	-1.611932	(1)	0.0000
LMOB	-6.319350	-2.621185	-1.948886	-1.611932	(1)	0.0000
LWEP	-6.710410	-2.621185	-1.948886	-1.611932	(1)	0.0000
LATM	-6.762174	-2.621185	-1.948886	-1.611932	(1)	0.0000
LPOS	-5.861480	-3.596616	-2.933158	-2.604867	(1)	0.0000

Source: Authors computation using Eviews 10

As reported in Table 2, the Phillips–Perron unit root test reveals that all variables attain stationarity after first differencing, that is, they are integrated of order one, I(1). This outcome justifies the application of the Johansen cointegration technique for further analysis.

Table 3: Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.840611	111.9236	69.81889	0.0000
At most 1	0.344469	34.79449	47.85613	0.4589
At most 2	0.198206	17.05750	29.79707	0.6358
At most 3	0.168493	7.779542	15.49471	0.4893
At most 4	0.000711	0.029874	3.841466	0.8627

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.840611	77.12913	33.87687	0.0000
At most 1	0.344469	17.73698	27.58434	0.5171
At most 2	0.198206	9.277963	21.13162	0.8094
At most 3	0.168493	7.749668	14.26460	0.4047
At most 4	0.000711	0.029874	3.841466	0.8627

Source: Authors computation using Eviews 10

The Johansen cointegration results presented in Table 3 reveal that the trace statistic confirms the existence of at least one cointegrating equation at the 5 per cent level of significance. This outcome indicates the presence of a long-run equilibrium relationship between green banking initiatives and economic growth in Nigeria.

Table 4: Parsimonious Error Correction Model Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPOS)	0.008793	0.041116	0.213861	0.8320
D(LPOS(-1))	-0.041741	0.043366	-0.962541	0.3428
D(LMOB)	0.014059	0.011441	1.228835	0.2278
D(LMOB(-1))	0.009609	0.010938	0.878537	0.3860
D(LATM)	0.010174	0.042422	0.239823	0.8120
D(LATM(-1))	0.055896	0.042379	1.318961	0.1963
D(LWEP)	-0.006259	0.013316	-0.470009	0.6414
D(LWEP(-1))	-0.014144	0.012879	-1.098262	0.2800
ECM(-1)	-0.913103	0.189624	-4.815346	0.0000
R-squared	0.550012	Mean dependent var		0.006727
Adjusted R-squared	0.440924	S.D. dependent var		0.092629
S.E. of regression	0.069260	Akaike info criterion		-2.314496
Sum squared resid	0.158298	Schwarz criterion		-1.942138
Log likelihood	57.60442	Hannan-Quinn criter.		-2.178012
Durbin-Watson stat	1.878176			

Source: Researcher's computation using Eviews 10

The short-run results from the parsimonious error correction model reveal that the differenced coefficients of LPOS, LMOB, LATM, and LWEP, including their lagged values, are statistically insignificant at the 5 per cent level. This outcome indicates that short-term variations in green banking indicators do not have an immediate impact on the dependent variable. The lack of short-run significance implies that the effects of these explanatory variables materialize gradually rather than instantaneously. Furthermore, the error correction term (ECT) reported in Table 4 provides strong support for the Johansen cointegration result. The ECT carries a negative and statistically significant coefficient of −0.913103 with a probability value of 0.0000, indicating a rapid speed of adjustment. This suggests that approximately 91.31 per cent of short-run deviations from the long-run equilibrium are corrected within a quarter, thereby confirming the existence of a stable long-run relationship among the variables and ensuring that the system quickly returns to equilibrium following any short-run disturbance.

Table 5: Fully Modified Least Squares Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPOS	0.041314	0.007586	5.446006	0.0000
LMOB	-0.001162	0.003138	-0.370246	0.7133
LATM	-0.035445	0.004520	-7.842562	0.0000
LWEP	-0.001246	0.002800	-0.444852	0.6590
C	16.67247	0.047082	354.1155	0.0000
R-squared	0.287191	Mean dependent var		16.67723
Adjusted R-squared	0.212159	S.D. dependent var		0.079051
S.E. of regression	0.070166	Sum squared resid		0.187082
Long-run variance	0.000980			

Source: Researcher's computation using Eviews 10

Table 5 presents the results of the Fully Modified Ordinary Least Squares (FMOLS) analysis, which examines the long-run impact of green banking initiatives on economic growth in Nigeria through a financial technology lens. The results show that Point of Sale (POS) transactions have a positive and statistically significant effect on GDP, with a t-value of 5.45 and a probability value of 0.0000. The POS coefficient of 0.041314 implies that a 1% improvement in POS performance is associated with a 4.13% increase in GDP. In contrast, mobile banking (MB) exhibits a negative and statistically insignificant effect on GDP, with a t-value of -0.370246 and a probability value of 0.7133. Its coefficient of -0.001162 suggests that a 1% increase in MB activity corresponds to only a 0.12% decline in GDP.

Automated Teller Machines (ATM) show a positive and significant relationship with GDP, with a t-value of 1.43 and probability value of 0.0000, while the coefficient of -0.035445 indicates that a 1% increase in ATM transactions increases GDP by 3.54%. Web payment (WEP) demonstrates a negative but statistically insignificant effect, with a t-value of -0.444852, probability value of 0.6590, and a coefficient of -0.001246, implying a 0.12% decrease in GDP for a 1% rise in WEP. The R-squared value of 28.72% reflects the overall correlation between the explanatory variables and GDP, while the adjusted R-squared of 21.22% indicates that about 21% of the variations in GDP can be explained by variations in green banking initiatives.

Post-estimation Diagnostic Tests

To assess the model's effectiveness, several post-estimation diagnostic test were conducted, including the ARCH test for heteroskedasticity, histogram normality test, and the Cusum. These tests provide insights into the model's reliability.

Table 6: Heteroskedasticity Test: ARCH

F-statistic	1.386408	Prob. F(1,39)	0.2461
Obs*R-squared	1.407472	Prob. Chi-Square(1)	0.2355

Source: Researcher's computation using Eviews 10

The ARCH test for heteroskedasticity also confirmed the absence of the problem of heteroskedasticity in the result as indicated in Table 6.

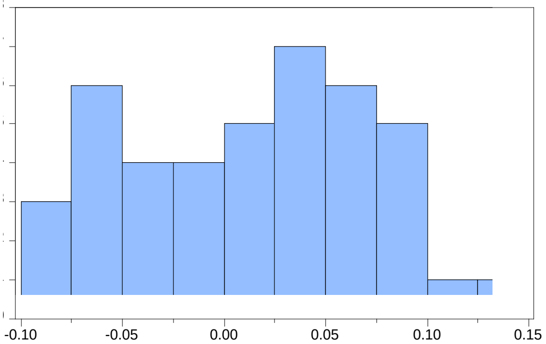

Figure 1: Histogram-Normality Test

Source: Researcher's computation using Eviews 10

Figure 1, shows the Histogram-Normality test result. The Jarque-Bera probability indicates that the variables are normally distributed.

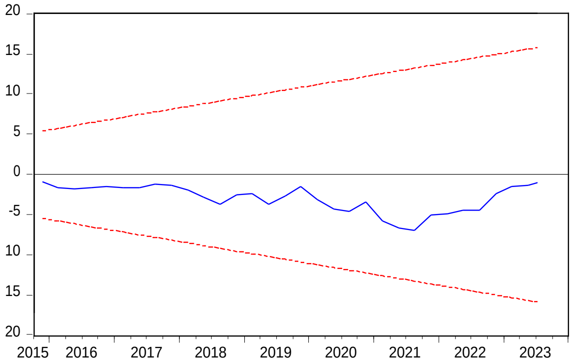

Figure 1: CUSUM test result

Source: Researcher's computation using Eviews 10

The CUSUM test confirms that the model is structurally stable, and the estimated coefficients do not change significantly over the study period.

Discussion of Findings

This study investigates the impact of green banking initiatives on economic growth in Nigeria from 2013 to 2023, employing a financial technology perspective. The Error Correction Term (ECT) indicates a speed of adjustment coefficient of -0.913103 with a p-value of 0.0000, significant at the 5% level, suggesting that roughly 91.31% of deviations from the long-run equilibrium are corrected each quarter. This confirms a stable long-term relationship among the variables and shows that short-term shocks do not disrupt the system. The R-squared of 55% demonstrates the overall correlation between the independent variables and GDP, while the adjusted R-squared of 44.09% indicates that variations in GDP are largely explained by the performance of POS, mobile banking (MOB), ATMs, and web payments (WEP).

The findings of the study reveal diverse long-run effect of fintech as a green banking tool on economic growth. The results from the FMOLS estimation show that Point of Sale (POS) transactions exert a notably positive influence on economic growth. Conversely, Automated Teller Machine (ATM) transactions have a negative and significant effect, while mobile banking (MOB) and web-based electronic payment (WEP) channels exhibit insignificant long-run effects on GDP. Overall, the discussion indicates that not all electronic payment channels contribute equally to economic growth. The positive long-run effect of POS transactions highlights their role as a driver of financial inclusion and formal sector expansion. In contrast, ATM, mobile, and web-based channels either weaken or fail to stimulate long-run growth, mainly due to infrastructural, regulatory, and behavioral challenges. Strengthening the digital payments ecosystem, ensuring security, and enhancing public trust are essential to maximizing the growth benefits of financial technology innovations.

Conclusion and Recommendations

The study's findings lead to the conclusion that green banking initiatives, supported by financial technology innovations have the potential to drive sustainable economic growth in Nigeria. Based on this, the study proposes the following recommendations:

i. Policymakers should strengthen mobile network infrastructure and regulatory frameworks to boost trust, efficiency, and usage of mobile banking services for greater economic contribution.
ii. Efforts should focus on improving cybersecurity, internet reliability, and user awareness to enhance the effectiveness of web-based payment platforms in driving economic growth.
iii. Banks should reduce excessive reliance on cash-based ATM operations by promoting cashless alternatives and enhancing digital payment adoption to reverse the negative growth effect.

iv. The government and financial institutions should expand and modernize POS infrastructure to deepen financial inclusion and sustain its positive impact on economic growth.

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