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EXAMINING THE INFLUENCE OF DIGITAL FINANCIAL INSTITUTION ON GREEN GROWTH AND INDUSTRIAL OUTPUT NEXUS IN NIGERIA: A STRUCTURAL VAR APPROACH

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ABSTRACT: *In achieving the Sustainable Development Goals (SDGs) between 1983 and 2024, this study looks at how digital financial institutions impact Nigerian manufacturing and green economic growth. The Central Bank of Nigeria (CBN) Statistical Bulletin, the National Bureau of Statistics (NBS), and the World Development Indicators (WDI) were the sources of the data. The analysis employed a Structural Vector Autoregression (SVAR) model, which is well-suited for identifying the structural effects of economic shocks. The findings suggest that digital financial institutions positively influence green economic growth. However, manufacturing output contributed the least to the observed variations, showing that the sector's GDP contribution responds only marginally and positively to changes in digital financing. Based on these findings, the study recommends strengthening the digital financial infrastructure by developing a more inclusive and efficient digital finance access framework to better support green economic growth.*

KEYWORDS: Digital financial institution, manufacturing output, green economic growth, trade openness and financial sector development.

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INTRODUCTION

The conservation of ecosystems is a fundamental objective in achieving the Sustainable Development Goals (SDGs), these goals are closely tied to the pursuit of green economic growth, which asserts that economic advancement is intertwined with environmental conservation (Ahmed et al., 2022; Yin et al., 2022). However, in their pursuit of development, countries have contributed to environmental pollution, including carbon emissions, among other issues. Additionally, this drive for growth has led to challenges such as climate change, land degradation, biodiversity loss, and deforestation. (Hasnat et al., 2019). Although Lawal and Odetokun (2022) noted that industrialization remains a central pillar of Nigeria's economic policy, The manufacturing sector's performance has not met expectations, particularly when evaluated in terms of its potential and in comparison, to global benchmarks. The results of early development plans and industrialization strategies have been varied. Although the initial import substitution industrialization (ISI) strategy did drive growth in the capital goods sub-sector it also fostered an import-dependent industrial structure. This dependency made the sector vulnerable to economic shocks, contributing to a significant decline in capacity utilization during periods of economic instability. According to Chete et al. (2019), the broad assistance given to the manufacturing sector during the period of import substitution, which included policies like high import tariffs, depressed wages, and low interest rates, and an overvalued exchange rate ultimately constrained the sector's capacity to develop sustainable growth dynamics. These policies limited its ability to establish an independent and resilient growth trajectory, preventing it from keeping pace with the industrialization progress observed in other developing economies.

Despite the export promotion, financial liberalization, and the emerging globalization associated with SAP, the intensity and performance of industrialization in Nigeria remained lackluster. The structure of Nigeria's GDP shows a slow pace, with the manufacturing sector contributing minimally to GDP and manufacturing capacity utilization remaining alarmingly low, averaging just 54% in the 2000s. During the SAP period, Nigeria's per capita value-added in manufacturing was significantly low, about 10% of Botswana's level and less than 50% of that of Ghana and Kenya (Soderbom and Teal, 2002). While the negative impact of this policy is widely acknowledged, financial institutions remain debated, as the anticipated "big push" appears to have been minimal.

Emerging technologies have significantly transformed various facets of entrepreneurship, innovation, and growth. For example, artificial intelligence has the potential to reshape how we generate new ideas, address complex challenges, and enhance creative projects, offering substantial benefits for fostering growth (Aghion et al., 2018). Technological advancement which is a major driver of output. For example, the emergence of wireless Internet technology has reduced the reliance on physical office spaces, while the expansion of telecommuting has lessened the need for work-related travel and shopping, thereby decreasing overall energy consumption (Toffel & Horvath, 2004). In addition, the convergence of technology and finance plays a vital role in stabilizing green growth (Guo et al., 2017; Yang et al., 2021; Zhang et al., 2021). Leveraging big data, the internet, and artificial intelligence, digital finance or fintech offers substantial benefits through technological innovation. As a technology-driven financial service, digital finance encompasses various components such as digital currencies, credit markets, digital payment systems, and the rollout of cashless policy initiatives (Pazarbasioglu et al., 2020; Thakor, 2020).

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As a form of technological advancement, digital finance has the potential to transform financial systems by improving the delivery and accessibility of financial services changes that can significantly influence business operations and, by extension, the environment (Ahmed & Huo, 2021). State-owned businesses in Nigeria usually have limited access to credit due to the prevalence of privately held conventional financial institutions (Wu & Xu, 2020). These businesses, which are typically involved in traditional heavy industries, are known for their high energy consumption, limited levels of technical innovation, and strong reliance on natural resources. As a result, they contribute substantially to environmental degradation and increased resource use, which undermines green economic growth (Hao et al., 2020; Song et al., 2011). Furthermore, resource-dependent companies are particularly vulnerable to economic cycles, which can cause fluctuations in product prices and outputs, leading to broader economic instability (Xie & Zhai, 2020). Although prior studies recognize the role of digital finance in driving economic growth and affecting carbon emissions (Bhattacharya et al., 2017; Karim et al., 2022; Salman et al., 2019), its direct impact on green growth has received limited attention (Ahmed et al., 2022). This research aims to address this gap by investigating how digital financial institutions contribute to fostering green economic growth and boosting manufacturing output in Nigeria.

The period of this investigation coincides with the recent experience of rising carbon emissions in Nigeria, and the establishment of industries by both foreign and local entrepreneurs has turned Nigeria into a “pollution haven” due to weak environmental regulations (Adu & Denkyirah, 2017; Adegboye et al., 2020: Osadume & University, 2021). Again, poor digital financial institutions have made Nigeria the underdogs in the international community which made Nigeria lag behind major competitors in Africa and Asia in key policy areas. Thus, taken accounting of the policy environment in Nigeria, this paper explores the plausible impact of indicators of digital financial institution in Nigeria and proffer some policy imperatives to enhance Nigeria’s green economy and industrialization output. After the introduction, the literature review is presented in part two, and the data analysis approach is described in section three. The results and a discussion of the findings are presented in Section Four. The paper is finally concluded in Section Five.

LITERATURE REVIEW.

The evolution of sustainability theory has revealed that conventional national accounting measures are inadequate for assessing sustainable income, as they do not consider environmental degradation. Recent studies proposed viewing natural resources as part of a nation’s capital stock, similar to manufactured capital. A foundational concept in environmental economics is that nature serves as a form of capital essential to sustaining economic activity. Early studies in this field established foundational theories linking sustainable revenue in the face of natural resource depletion. Hartwick (1977) proposed revenues from the exploitation of reinvesting in natural resources in capital assets to maintain stable consumption over time. Daly (1990) challenged the notion by arguing that true sustainability depends on preserving the combined stock of both. In response to these ideas, international bodies have made notable progress in formulating environmental accounting systems and calculating green GDP for emerging countries.

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The effects of digital money on socioeconomic growth and ecological sustainability have been investigated empirically (Sarkodie & Adams, 2018). Ahmed et.al 2022), for example, found that in South Asia, digital finance and broader financial sector development play a vital role in supporting growth. Similarly, Osabohien et al. (2022) demonstrated that environmental sustainability importantly contributes to improved welfare and overall economic performance. Salman et al. (2019), analyzing data from Indonesia, South Korea, and Thailand, identified three main insights: (1) technological innovation is essential for promoting growth while minimizing carbon emissions; (2) digital finance, energy use, and trade openness are critical drivers of manufacturing output; and (3) both in the short and long term, there is a unidirectional relationship between digital finance and economic growth, as well as between carbon emissions and energy consumption (Osadume & University, 2021; Youmanli, 2017).

In a cross-country study, Lau et al. (2014a, 2014b) opined that in Malaysia, robust financial sector significantly contributed to reducing carbon emissions while promoting economic growth. Similarly, Abid (2017) observed that across 41 EU countries and 58 nations in the Middle East and Africa, digital finance and technological innovation played a pivotal role in driving economic expansion and lowering carbon emissions. Supporting these conclusions, Bhattacharya et al. (2017) emphasized the role that robust financial institutions play in boosting manufacturing production and reducing carbon emissions in 85 developed and developing nations. Sarkodie and Adams (2018) further highlighted that in South Africa, both macro and micro-level factors such as energy consumption, economic progress, urbanization, and technological advancement significantly influence environmental quality.

Thus, majority of the literature on the impact of digital finance in Nigeria focuses on issues like consumption and business. It emphasizes how digital finance can boost consumption (Mollaahmetoğlu and Akçalı, 2019; Bassey and Effiong, 2020), enhance banking stability (Banna & Alam, 2021), lessen financial exclusion (Ren et al., 2018; Zhang et al., 2021), decrease income inequality (Ali, 2018), promote business innovation (Wen et al., 2021), boost total factor productivity (Chen et al., 2022), and strengthen the financing environment for businesses overall (Klapper et al., 2019; Yin et al., 2019). By leveraging technology, digital finance expands access to financial services for individuals and enterprises through inclusive solutions, thereby mitigating financial exclusion. Greater financial access boosts the creditworthiness and borrowing capacity of households and businesses, which can lead to increased consumption of energy-intensive goods and shifts in energy usage patterns. Alleviating household energy poverty has been shown to enhance well-being and support green development, though such outcomes are often contingent on rising household income levels (Banerjee et al., 2021). Furthermore, fintech-driven innovation stimulates entrepreneurship and job creation by lowering risk barriers, broadening social networks, and providing new channels for credit access—all of which contribute to higher household income (Yin et al., 2019).

Nwidobie (2019) analyzed Nigeria's financial inclusion index, and contended that most reliable indicators are the number of bank branches in rural areas, the deposits in rural banks, the volume of loans and advances made to rural account holders, and the volume of transactions made through online banking platforms, Point of Sale (POS) systems, and Automated Teller Machines (ATMs). He maintained that alternative mobile platforms are less effective for measuring financial inclusion. Similarly, Afam, Ige, and Olumoye (2021) explored the link between inclusive financing and a sustainable digital economy, concluding that digital financial services are vital to economic growth, especially in developing economies like Nigeria. They highlighted that consistent access to digital financial tools among the unbanked

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population accelerates the transition from cash to electronic value, thereby strengthening the long-term sustainability of the digital economy.

The empirical literature clearly indicates that developed financial institution impact positively on green economy and environmental performance but the impact of digital finance on the green economic growth and manufacturing output nexus has been insufficiently explored. In fact, no study has yet combined these two variables, again, many scholars have relied on aggregate time series data for their analyses but have often overlooked the potential for structural breaks in the data. Ignoring such breaks when testing relationships can significantly undermine the validity of their conclusions. To address this gap, this paper contributes to the existing literature by examining the relationship between digital financial institutions, manufacturing output, and green economic growth. Additionally, the study advances understanding of green economic growth by employing a newly developed indicator that integrates both economic and environmental factors, providing a more comprehensive and reliable measure of economic prosperity.

MATERIALS AND METHOD

Data Sources and Measurement of Variables

Secondary data gathered from several published sources is used in this investigation. We used data from the World Development Indicators to determine green economic growth (WDI, 2023). Data on capital investment, labor force participation, and industrial output were gathered from the National Bureau of Statistics (NBS, 2023), while digital finance indicators were taken from the Central Bank of Nigeria's Statistical Bulletin (CBN, 2023). Additionally, data from the Central Bank's Annual Statistical Bulletin (2023) was used to extract indicators for financial sector development and trade openness (TOPEN).

Green economic growth is quantified by GDP per capita combined with education expenditure, adjusted to account for the monetary costs of mineral depletion, forest depletion, and carbon dioxide emissions. The study also considers various innovations in the financial sector particularly in banking operations commonly referred to as agency banking. Web Services (WBS) were used to measure the digital financing institution. Also manufacturing output was measured from the neoclassical production function to the endogenous growth model. Capital and labour have remained the dominant factors of production and the basis to derive total factor productivity (TFP) output growth overtime. Among the control variables highlighted in the literature, the total value of imports and exports divided by GDP is the measure of trade openness, banks' domestic lending to the private sector, which is also reported as a proportion of GDP, is used to measure financial development (FD). This research focuses on a time of significant macroeconomic volatility, such as a negative balance of payments, volatile exchange rates, high commodity prices, and declining revenue sources. Economic rigidity, which made the nation more vulnerable to global shocks.

This study employs the Structural Vector Autoregression (SVAR) technique to analyze the dynamic interactions among the key determinants of green economic growth, manufacturing output, and digital financing in Nigeria. The VAR framework is particularly suited for examining both short- and long-run causal relationships, in the event that the variables are cointegrated (Ang & McKibbin, 2007). VAR models have the significant benefit of not

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distinguishing between exogenous and endogenous variables.; instead, all variables are treated as endogenous, and no a priori restrictions are imposed on the structural relationships. Additionally, SVAR allows for the identification of the effects of structural shocks while accounting for underlying economic theory, making it possible to assess the net impact of an unexpected change in one variable on others within the system (Ang & McKibbin, 2007). Moreover, once the model is estimated, the relative contribution of each variable to the variation in others can be analyzed using impulse response functions (IRF) and variance decomposition.

The following equation represents the dependent variable in this study, green economic growth, which is quantified using the approach described by Ahmed et al. (2022),

$GECGPC_{it}$= $GDPC_{it}$ + EDU_{it}- MIN_{it}-FOR_{it}- CO_{2it}--- (1)

Where EDU_{it} is the education expenses, MIN_{it} indicates the depletion of minerals like coal, crude oil, and natural gas in terms of monetary value; the depletion of forests in terms of monetary value is represented by FOR_{it}; and the carbon dioxide emissions in terms of monetary value is represented by $CO2_{it}$.

This study employs the methodology developed by Johansen, Mosconi, and Nielsen (Johansen et al., 2000). In applying the JMN procedure, the optimal maximum lag length for long-run estimations was initially determined, and dummy variables were introduced to capture the structural breaks identified during the stationarity tests. Afterwards, cointegration tests were conducted after performing unit root tests to address the impact of structural breaks in the data series, which can significantly distort standard inference outcomes.

$$:y_t = \mu + \theta DU_t + \beta_t + \gamma DT_t^* + \delta D(T_1)_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-1} + e_t ; e_t \; \square \; iid.(0, \sigma_e{}^2 ------------(2)$$

Where $DU_t = 1; DT_t^* = t - T_1 = t - T_1$ if $t > T_1$ and 0 otherwise; the T_1 represents the significant Break points.

For this study, Zivot and Andrews (1992) was utilized, A key aspect of traditional structural break tests is the trend behavior of the variables. Sen (2003) emphasized that when data exhibit an upward trend, the likelihood of rejecting the alternative hypothesis diminishes because the critical values increase when a trend component is included. Building on Sim's (1990) seminar paper, the Vector Autoregressive (VAR) model has become a widely used approach for analyzing dynamic economic interactions. This study adopts the VAR model to investigate both the short- and long-run effects of digital financial institutions on green economic growth and manufacturing output in Nigeria. The VAR methodology is based on Granger's (1969) concept of causality, where causality is inferred if the lagged values of a variable X have significant explanatory power in predicting another variable Y, beyond the information contained in Y's own past values.

$GREECG_t$=β_0+$\beta_1 GREECG_{t-1}$+$\beta_2 ATM_{t-1}$+$\beta_3 POS_{t-1}$+$\beta_4 WBS_{t-1}$+$\beta_6 TOPEN_{t-1}$+$\beta_7 FD_{t-1}$+ $\beta_6 MANO_{t-1} + \mu_t$-- (3)

also the impact of digital financial institution on green economic growth can be presented in the model as follows:

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$GREE\_Lit = C_1 + C_2DGI_{it} + \sum_{i=0}^{p} \beta_i X_{it} + d_i + \varphi_i + \varepsilon_{it}$-- (4)

RESULT AND DISCUSSION

Table 1: Descriptive statistics

	GRECG	ATM	POS	WEB	TOPEN	MANO	FD
Mean	8.720	3.190	5.503	1.662	5.996	2.771	2.332
Median	4.230	1.450	-1.120	6.901	5.150	3.189	7.112
Maximum	59.3	6.9	13.081	32.512	105.909	112.256	47.122
Minimum	-10.7	0.67	1.442	7.1	-1.055	11.331	0.203
Std. D	5.328	1.413	1.731	4.278	19.531	7.181	9.165
Skewness	0.652	1.327	0.143	1.352	4.171	1.020	3.22
Kurtosis	4.129	2.138	1.381	7.134	5.239	0.1000	2.181
Jaque-Bera	5.134	104.342	92.139	81.482	17.392	14.225	21.150
Probability	0.003	0.000	0.001	0.000	0.000	0.001	0.000

Source: *Author's computation. (2025)*

Table 1 presents the descriptive statistics, offering a summary of digital financial institutions, green economic growth, and manufacturing output in Nigeria. It highlights key variables, including green economic growth (GRECG), the number of Automated Teller Machines (ATM), Point of Sale (POS) terminals, and web banking account holders (WEB). Manufacturing output (MANO), trade openness (TOPEN), and financial sector development (FD). The mean values, which represent the average across observations, and the medians, indicating the midpoint in the data distribution, offer valuable insights. For example, the mean of GRECG is approximately 8.720, higher than its median of 7.112, suggesting a positive skew in green economic growth data. Similarly, for ATM, POS, WEB, trade openness, and financial sector development, the means exceed the medians, indicating that these variables are positively skewed due to a few high-value observations.

It is evident that the trade openness has the highest standard deviation value of 19.531. This suggests that the trade openness of the Nigerian economy deviate most widely from its expected values. This has lends credence to the fact that the economy of the country needs to be open. Openness of boarder to trade with other countries will go a long way in improving the country's foreign direct investment. Noting that the economy has widely been affected by series of global economic and financial dynamics that has affected sustainable flows of financial resources into the country over the years. Green economic growth and web banking account have kurtosis values that exceed the 3.0 threshold values and are considered leptokurtic while all other variables have kurtosis values below the 3.0 threshold values and are considered platykurtic in distributions. However, the theoretical test of Jarcque-bera statistics suggests only the manufacturing output has skewness and kurtosis values that tend towards normal distribution. The simple reason is that the null hypothesis of non-normal distribution is rejected for manufacturing output as the probability of Jarcque-bera results are below the significance level of 0.05.

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Table 2: Unit root with structural break test (Zivot and Andrews)

Variable	break date	at level	1 *difference	critical V	remarks
GREECG	1997	-3.131	-3,841	-3.251	I(1)**
ATM	-	-2.450	-4.670	-4.311	I(1)**
POS	-	-1. 214	-3.226	3.018	I(1)**
MANO	1998	-2. 522	-3.815	-3.330	I(1)**
WEB	-	-2.252	-3.782	-3.481	I(1)**
TOPEN	2018	-1.417	-3.511	-3.210	I(1)**
FD	2010	-2.301	-3.815	-3.318	I(1)**

Source: *Author's computation. (2025)*

The unit root test results in table 2 reveal that several variables experienced significant structural shocks. Notably, the manufacturing sector index (MANO) saw a substantial increase following the implementation of the Structural Adjustment Programme (SAP) in July 1986. The industrial policies and incentives introduced under SAP contributed to the growth of manufacturing output after that period. Similarly, financial sector development gained momentum with the increased use of quasi-money around 2010 and the introduction of Automated Teller Machines (ATMs). Incidentally, all the indicators of digital financial institution exhibit same pattern. The implication is that these variables have multiple breaks. It suggests that there has been many instances that the Nigerian economy have been confronted with many institutional disturbances and distortions.

The result of the structural VAR estimated as presented in the table 3 which covers from k (1) through k (15) represent the impact of a shock on the index of the green economic growth lagged by a period. From the result, the value 1.423 with z-score 2.552 shows that the index of the green economic growth responds positively and significantly to shocks from itself. The level of digital financial institution proxied by (atm, pos, web) positively induced the level of green economic growth as presented by the green economic growth index k (8), k(7), k (6) with coefficient of 1.255, 1.235 and 0.532 respectively though not statistically significant confirm to apriori expectations. Also, financial sector development positively influences the green economic growth as presented by the green economic growth index k (11) with the coefficient of 1.271 even through not statistically significant as well.

One of the most dynamic indices of the digital financial institution in Nigeria is the availability of credit faculties to both small and medium scale enterprises. Over the years, the industrial sectors have been unable to access adequate credit facilities that will upsurge market demand, this is largely due to high interested rate of the financial institutions with its upward swings. As expected theoretically, variations is the manufacturing output due to poor credit facility and high interest rate as captured by k (12) shocked of the green economic growth to the tune of 1.223 and statistically significant (0.049). This may not be unconnected to with the high interest rate charged by the financial institution in Nigeria. Including the bank of industry (BOI) whose credit facilities process are fraught with series of beau acratic bottlenecks and several political intrigues. Trade openness as designated by k (13) has a marginal positive of (0.232) impact on index of the green economic growth against the theoretical expectations, though not statistical insignificant.

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Table 3: Structural VAR estimate

Variables	Coefficient	Standard error	Z-scores	Pro-val
K (1)	3.016	0.421	0.341	0.631
K (2)	-0.576	0.236	-0.064	0.086
K (3)	-0.264	0.707	-0.164	0.114
K (4)	-1.282	1.006	-0.084	0.201
K (5)	-1.254	0.134	-0.088	0.049
K (6)	0.532	0.064	0.243	0.741
K (7)	1.235	0.643	0.264	0.439
K (8)	1.255	0.361	1.413	0.438
K (9)	0.848	0.932	0.454	0.583
K (10)	-1.465	0.487	-3.252	0.486
K (11)	1.271	0.532	0.221	0.053
K (12)	-1.223	0.451	-3.352	0.049
K (13)	0.232	0.837	1.337	0.433
K (14)	0.632	0.461	2.476	0.045
K (15)	1.423	0.417	2.552	0.022

Source: *Author's computation. (2025)*

Table 4: Impulse Response Function

Response of the green economic growth index to itself and other variables

Period	GREECG (-1)	ATM	POS	WEB	FSD	TOEPN	MANO
1	9.852	0.598	6.215	0.425	1.3 19	1.418	-1.726
2	3.344	1.759	3.630	5.120	2.401	3.185	-3.171
3	7.564	-3.543	2.313	1.586	1.857	2.402	1.230
4	4.843	3.811	0.491	3.581	2.716	3.960	0.525
5	3.215	-0.954	1.527	5.318	1.514	-1.301	-0.473
6	0.731	3.265	0.845	0.469	0.255	0.718	0.286
7	0.551	0.518	0.539	1.571	0.592	0.614	0.353
8	-0.641	-1.518	0.031	0.537	0.001	0.8370.	0.051
9	0.451	-1.538	1.519	3.652	0.527	0.853	0.274
10	0.391	1.416	0.317	0.732	1.005	0.021	0.073

Source: *Author's computation. (2025)*

Table 4 indicates that in Period 1, the green economic growth index is predominantly autoregressive, recording the highest value of 9.652 among the contemporaneous variables in the model. However, this positive effect diminishes progressively over time. The impact of Automated Teller Machines (ATM) on green economic growth appears mixed, fluctuating between positive and negative values, with a tendency toward negative effects. Meanwhile, the response of green economic growth to financial sector development is generally positive but highly unstable, ranging between 0.001 and 2.716. The positive relationship suggests that financial development particularly credit provision to the private sector can stimulate investment in environmentally friendly technologies, thereby enhancing green economic

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growth. The point of sales otherwise known as agency banking also has some appreciable impacts on the green economic growth, though it falls progressively. The response of green economic growth to manufacturing output is negligible as most of the value lies between 0.051 and 2.171. The response of the green economic growth index to topen is also mixed with positive and negative values oscillate between 0.021 and 3.960. Interestingly, industries' value-added is seen as a key indicator of wealth created by industries in Nigeria, which may influence green economic growth. This finding is supported by numerous studies, including Zahid et al. (2022) and Khan et al. (2020). The green economic growth index shows a positive response to web services, although this effect diminishes gradually over time.

Variance Decomposition Analysis

Variance decomposition serves as a tool to assess the relative contribution of each independent variable in explaining the variations in the dependent variable. In other words, once structural shocks are identified, the Variance Decomposition Analysis (VDA) reveals the proportion of forecast error variance in the green economic growth index that can be attributed to the various shocks represented by the model's included variables. The VDA results, covering a 10-year time horizon, are summarized in Table 5.

From Table 5, it can be inferred that the majority of the forecast error variance in the green economic growth index is explained by its own shocks. Specifically, about 71% of the variation in green economic growth over a 10-year period is attributed to its own influence, though this contribution decreases gradually over time. Interestingly, all variables used to represent digital financial institutions namely ATM, POS, and WEB also play a significant role in shaping green economic growth in Nigeria. On average, 23.33% of the variation in green economic growth is driven by changes in the number of Automated Teller Machines (ATMs). This suggests substantial year-to-year fluctuations in ATM deployment, warranting a closer examination of the factors behind these changes and their implications for the banking sector. For instance, the decline in ATM numbers observed in 2019 this may indicate changing banking strategies or a shift toward alternative digital channels. The trend aligns with the emergence of the COVID-19 pandemic, which likely drove higher demand for cash withdrawals while decreasing the use of in-branch services. More generally, the expansion of the green economy could also be fueling increased demand for banking services, including ATM usage.

Table 5: Variance decomposition of green economic growth and other variables

Period	S.E	GEECG(-1)	ATM	POS	WEB	FSD	TOPE	MANO
1	5.521	71.000	8.364	0.145	3.297	2.382	3.202	0.376
2	7.126	61.142	9.265	0.4121	1.025	4.642	7.208	1.381
3	9.238	64.375	9.385	0.367	1.387	1.624	3.845	0.354
4	10.231	64.376	11.764	2.317	2.016	1.375	1.274	2.275
5	13.021	61.242	10.274	1.653	2.072	4.835	1.374	0.524
6	14.154	33.163	13.053	1.175	3.840	0.745	1.275	0.853
7	13.365	5.471	24.853	2.416	2.486	3.572	2.481	0.584
8	10.257	51.382	10.374	0.373	1.285	1.414	10.254	0.851
9	12.252	49.386	16.753	8.641	4.358	4.632	2.473	0.637
10	14.354	45.386	47.373	2.213	4.182	2.716	6.431	0.315

Source: *Author's computation. (2025)*

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On average, approximately 2.602% of the variation in the green economic growth index is attributed to shocks from web banking, which has been a key driver of digital financing in many developing economies, including Nigeria. The number of web banking accounts represents a critical aspect of digital financial institutions, enabling users to access banking services online. A notable surge occurred in 2009, reflecting Nigeria's early adoption of web banking. This upward trend has continued, in line with the global shift toward digital banking solutions.

Point of Sale (POS) machines in Nigeria, accounting for 1.414% of the variation in green economic growth, reflect the evolution of digital financial institutions and their growing impact on the country's green economy. Over the period under review, the number of POS machines steadily increased, signaling the rising adoption of electronic payment methods. This was followed by a sharp surge, indicating a growing reliance on cashless transactions. The widespread deployment of POS machines carries multiple implications: it enhances the reach of digital financial services, promotes financial inclusion by extending payment access to underserved populations, and supports green economic growth by reducing dependence on cash-based transactions. Additionally, increased availability of POS terminals improves customer convenience and satisfaction, contributing to greater loyalty toward digital financial institutions.

The influence of trade openness and financial sector development on the green economic growth index appears relatively modest, averaging 2.79 and 1.325 units respectively. This result is in line with expectations, indicating that improvements in global trade and the knowledge spillover effects from non-export sectors support technical innovation and the growth of human capital. These elements in turn promote job creation, raise environmental awareness, and aid in Nigeria's industrial restructuring. Manufacturing output stood at 0.689 accounting for the least contribution to observed variation. Indicating that output of the manufacturing sector to GDP responds marginally and positively to changes in digital financing. The outcome suggests that digital financial institution in Nigeria execute staunchly their major role of financial intermediation involving credit provision to the real sector.

CONCLUSION AND POLICY IMPLICATION

A strong base of green economic growth is essential to achieving sustainable development goals. Few studies have particularly looked at how digital financial institutions affect manufacturing production and green growth, despite recent empirical evidence showing that financial institutions contribute to growth. This disparity emphasizes the significance of this current study, which examines how digital financial institutions affect Nigeria's green economic growth between 1983 and 2024. Applying a Structural VAR (SVAR) model, the analysis makes use of data from the National Bureau of Statistics, the Central Bank of Nigeria, and the World Bank's Development Indicators.

The findings indicate a positive alliance between digital financial institutions and green growth, suggesting that an expansion in digital financial services contributes to improved environmental and economic outcomes. Importantly, while digital financial institutions significantly impact green economic growth, the relationship is also reciprocal green growth can stimulate innovation in financial technology. These results carry important policy implications for governments and policymakers. For developing countries like Nigeria,

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strengthening the digital financial infrastructure is critical for advancing green economic objectives. In particular, the transition from pollutant-based energy sources to cleaner, renewable alternatives is essential for achieving sustainable growth and improving quality of life. However, access to renewable energy technologies remains costly, largely due to reliance on imports from developed countries. To reduce these costs, financial institutions should play a key role in funding the establishment of local research and development centers focused on renewable energy and clean technologies.

To achieve and sustain green economic growth in Nigeria, it is therefore recommended that greater access to finance be prioritized particularly financing aimed at supporting non-polluting technologies and infrastructure. Closing the financial access gap is essential for driving the green transition and fostering long-term economic and environmental sustainability.

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