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REVIEW ARTICLE

THE ROLE OF DIGITALIZATION AND GREEN TECHNOLOGICAL INNOVATION ON ECONOMIC GROWTH IN NIGERIA (1990–2023)

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ABSTRACT

This study investigates the role of digitalization and green technological innovation in influencing economic growth in Nigeria over the period 1990 to 2023. Using the Autoregressive Distributed Lag (ARDL) model, the study evaluates the impact of high-tech exports, renewable energy consumption, foreign direct investment and CO_2 emissions on real GDP. The analysis reveals that foreign direct investment has a significant and positive impact on economic growth in both the short and long run while high-tech exports and renewable energy consumption show negative or insignificant effects. This suggests that despite the growing global emphasis on digital and green technologies, Nigeria has yet to effectively integrate these innovations into its economic development strategy. The findings underscore the importance of enhancing digital infrastructure, fostering local innovation and addressing institutional and regulatory challenges hindering the productive use of renewable energy. It is recommended that the government promote innovation-driven policies, strengthen coordination among sectors and align digitalization and sustainability efforts with national development goals. Addressing these gaps will help Nigeria leverage the full potential of technological advancement and green innovation for sustainable economic growth. The study contributes to policy debates on the need for a balanced approach to economic planning that integrates environmental sustainability and technological progress as key drivers of long-term development.

KEYWORDS

Digitalization, Green Technological Innovation, Economic Growth, Renewable Energy, Environmental Degradation.

1. INTRODUCTION

Digitalization and green technological innovation have become crucial drivers of economic growth worldwide. For Nigeria, embracing these technologies offers a pathway to diversify the economy, reduce environmental degradation and promote sustainable development. Despite increasing investments in technology and renewable energy, the country's economic growth has not fully reflected these advancements. This study examines the impact of digitalization and green innovation on Nigeria's economic growth from 1990 to 2023. By analyzing key variables such as high-tech exports, foreign direct investment, renewable energy consumption and CO_2 emissions the research aims to provide insights that can inform effective policy-making.

1.1 Background to the Study

The contemporary global economy is increasingly influenced by the dual forces of digitalization and environmental sustainability. In developing nations like Nigeria, these trends have the potential to drive inclusive and sustained economic growth. Digitalization characterized by increased adoption of ICT tools and high-tech exports has been linked to improved productivity, innovation diffusion, and competitiveness (Okoh 2025). At the same time, green technological innovation, especially in the area of renewable energy consumption is vital for achieving long-term growth while mitigating environmental degradation caused by CO_2 emissions (Khan et al 2025). Nigeria's economic structure remains vulnerable to external shocks, partly due to its overreliance on fossil fuels and limited diversification in high-tech manufacturing. Moreover, while foreign direct investment (FDI) could potentially bridge technological gaps and promote green infrastructure, its impact has been inconsistent due to policy and institutional weaknesses (Adeleke, 2021). As such, examining the combined effect of digital and green innovations on real GDP becomes imperative. This study covers the period from 1990 to 2023 and applies the ARDL framework to explore both short- and long-term dynamics between these variables and Nigeria's economic growth, contributing to policy discussions on innovation-led development.

1.2 Problem Statement

Despite notable advances in digital infrastructure and renewable energy initiatives, Nigeria's economic growth remains unstable and vulnerable to both internal and external shocks. While digitalization and green technological innovation are expected to drive inclusive and sustainable growth, their actual impact on Nigeria's economy is still uncertain. High-tech exports, a key indicator of digital progress, remain limited and their contribution to productivity and competitiveness is often underestimated. Similarly, although renewable energy consumption has grown, its influence on macroeconomic performance is not well understood. Foreign direct investment, which could enhance the adoption of these innovations, has not consistently translated into meaningful economic gains. This disconnect highlights a gap in understanding the economic value of digital and green technologies in Nigeria. Therefore, this study investigates the individual and combined effects of digitalization and green technological innovation on economic growth from 1990 to 2023.

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1.3 Objectives of the Study

The main objective of this study is to examine the impact of digitalization and green technological innovation on economic growth in Nigeria between 1990 and 2023. Specifically, the study seeks to:

i. Assess the effect of digitalization, proxied by high-tech exports (% of manufactured exports), on Nigeria's real GDP.

ii. Investigate the impact of green technological innovation, represented by renewable energy consumption, on economic growth.

iii. Examine the combined influence of digitalization, green innovation, foreign direct investment (FDI), and CO_2 emissions on economic growth in Nigeria using the ARDL approach.

1.4 Scope of the Study

This study focuses on the impact of digitalization and green technological innovation on Nigeria's economic growth from 1990 to 2023. It examines key variables including real GDP, high-tech exports, foreign direct investment, renewable energy consumption and CO_2 emissions to analyze their short- and long-term effects.

1.5 Structure of the paper

The paper begins by providing background and context on the importance of digitalization and green technological innovation for economic growth in Nigeria followed by a clear statement of the research problem. It then reviews relevant literature, covering key concepts, theoretical frameworks and previous empirical findings. The methodology section details the data sources, variable descriptions and the ARDL model used for analysis. This is followed by the presentation of results, including unit root tests, cointegration bounds, short-run and long-run estimates, and diagnostic tests. The findings are discussed in relation to their implications for Nigeria's economic growth. Finally, the paper offers policy recommendations to enhance digital infrastructure, green innovation and integration into national development plans before concluding with a summary of the study's key insights and suggestions for future actions.

2. Literature Review

The relationship between innovation and economic growth has been widely examined in economic literature. Digitalization, particularly through high-tech exports, has been shown to enhance productivity, encourage knowledge spillovers, and improve competitiveness in emerging economies (Asongu and Odhiambo, 2020). Countries that have integrated digital tools into manufacturing and services tend to experience faster economic transformation. In the Nigerian context, the digital economy has expanded but its full contribution to GDP remains underexplored. High-tech exports still represent a small portion of total manufactured exports, signaling limited technological depth. However, with the right infrastructure and investment environment, digitalization can serve as a catalyst for long-term growth. On the other hand, green technological innovation especially renewable energy adoption has become central to sustainable development debates. Green innovation reduces reliance on fossil fuels, mitigates environmental degradation, and supports energy security (Okoh 2025). In Nigeria, the transition toward renewable energy is gaining momentum but its economic implications remain poorly documented. Furthermore, the role of FDI in promoting both digital and green technologies adds another layer of complexity as its effectiveness depends on absorptive capacity and regulatory quality. Thus, exploring the combined impact of these innovations is crucial for shaping Nigeria's growth strategy.

2.1 Conceptual Clarification

Digitalization refers to the integration of digital technologies into economic systems to enhance productivity, efficiency and service delivery. In economic analysis it is often measured using proxies such as high-tech exports which indicate the extent to which a country engages in and benefits from technology-intensive manufacturing and trade. High-tech exports reflect a nation's capacity for innovation and its position within global value chains dominated by advanced technologies (Omachi 2015). In this study, high-tech exports as a percentage of manufactured exports are employed to represent Nigeria's progress in digital transformation and the economic relevance of its digital infrastructure. Green technological innovation encompasses the development and deployment of technologies that reduce environmental degradation, improve energy use, and promote sustainable development. Renewable energy consumption including sources like solar, wind and hydroelectric power is widely accepted as a measure of green innovation due to its potential to lower dependence on fossil fuels and mitigate climate change (Ayoola 2025). CO_2 emissions on the other hand are used to reflect the environmental footprint of industrial and economic activities. Foreign Direct Investment (FDI) is understood as an important inflow of capital, knowledge and technology that can support both digitalization and green innovation, depending on a country's institutional framework and absorptive capacity (Adeleke, 2021). Real Gross Domestic Product (GDP) serves as the dependent variable, indicating overall economic growth.

2.2 Theoretical Framework

This study is grounded in the endogenous growth theory, which emphasizes the role of technology, innovation and human capital as drivers of long-term economic growth (Romer, 1990). Unlike traditional growth models that treat technological progress as exogenous, endogenous growth theory posits that innovation activities such as digitalization and green technology are influenced by economic incentives and policy environments thereby directly impacting productivity and output. Digitalization aligns with this framework by fostering innovation through knowledge spillovers and improved information flows which enhance production efficiency and competitiveness (Aghion and Howitt 1998). Similarly, green technological innovation contributes to growth by promoting sustainable resource use and mitigating negative externalities associated with environmental degradation (Acemoglu 2012).

Foreign direct investment (FDI) is also integral to this framework as it facilitates the transfer of technology and managerial expertise supporting the adoption of both digital and green innovations in the host economy (Borensztein et al 1998). This study applies the ARDL model to empirically test these theoretical relationships in the context of Nigeria's economic growth from 1990 to 2023.

2.3 Empirical Literature Review

Empirical studies examining the effects of digitalization, green innovation and related economic factors show consistent but nuanced patterns across developing countries. Asongu and Odhiambo (2020) found that in Sub-Saharan Africa, high-tech exports have a strong positive effect on economic growth. Their analysis showed that digitalization, when well supported by institutional frameworks and education, enhances knowledge diffusion and boosts productivity. For Nigeria, this suggests that expanding high-tech manufacturing and digital services can contribute meaningfully to GDP growth, provided the infrastructure and human capital are in place.

The study further reinforce the relevance of green innovation (Omachi 2025). Using data from Pakistan, they show that renewable energy consumption is a significant positive driver of economic growth, while CO_2 emissions have an adverse impact. Their study supports the argument that economies can achieve growth while maintaining environmental sustainability especially when renewable energy is integrated into the national energy mix. This evidence is highly relevant to Nigeria given its growing population, energy needs and commitments to carbon reduction. However, foreign direct investment (FDI) presents a mixed empirical picture. Adeleke (2021) emphasizes that while FDI can introduce capital skills and technologies into host countries its benefits are conditional. Specifically, the institutional quality, regulatory environmentand absorptive capacity of the host country are essential determinants of success. In the Nigerian context, challenges such as policy inconsistency, inadequate infrastructure and weak enforcement mechanisms have limited the transformational potential of FDI in supporting digital and green technological innovation. Despite the significance of these variables, few studies have jointly analyzed the combined impact of digitalization, renewable energy, CO_2 emissions and FDI on economic growth within the Nigerian setting. This study addresses this gap by employing the ARDL approach to assess both short-run and long-run relationships using updated data from 1990 to 2023. It provides a more integrated view of how digital and environmental factors intersect with macroeconomic growth trends in Nigeria.

3. Methodology

This study employs the Autoregressive Distributed Lag (ARDL) approach to analyze the relationship between economic growth and the selected variables from 1990 to 2023. Data on real GDP, high-tech exports, CO_2 emissions, FDI and renewable energy consumption were collected from reliable sources. The ARDL method allows for examining both short-run and long-run dynamics among variables accommodating variables integrated of different orders. Diagnostic tests were conducted to ensure model stability and absence of serial correlation. The results provide insights into the impact of digitalization and green technological innovation on Nigeria's economic growth.

3.1 Data Sources and Variable Description

This study uses annual time series data from 1990 to 2023. The dependent variable is real Gross Domestic Product (GDP) which measures the overall economic performance of Nigeria. The key explanatory variables include high-tech exports as a percentage of manufactured exports, representing digitalization renewable energy consumption, capturing green technological innovation CO_2 emissions, reflecting environmental impact and foreign direct investment (FDI), serving as a control variable influencing technology transfer and economic growth. All variables are expressed in natural logarithms to stabilize variance and interpret elasticities. The data were compiled from reputable national and international databases to ensure accuracy and consistency.

3.2 Model Specification

The study specifies an Autoregressive Distributed Lag (ARDL) model to examine both short-run and long-run relationships between economic growth and the selected variables. The general model is expressed as:

$$RGDP_t = \alpha_0 + \Sigma\beta 1\ HGT_t + \Sigma\beta_1 REC_t + \Sigma\beta_2 C02_t + \Sigma\beta_3 FDI_t + \varepsilon_t$$

Where:

- RGDP = Real Gross Domestic Product
- HTE = High-tech exports (% of manufactured exports)
- REC = Renewable energy consumption
- CO2 = Carbon dioxide emissions
- FDI = Foreign direct investment
- εt is the error term

3.3 Estimation Procedure

The study employs the ARDL bounds testing approach to investigate the existence of a long-run relationship among the variables. First, the order of integration for each variable is determined to ensure none is integrated of order two or higher. Next, the optimal lag length is selected based on information criteria such as AIC or SIC. The ARDL model is then estimated to test for cointegration using the bounds test. If a long-run relationship is established both long-run coefficients and short-run dynamics including the error correction term are estimated. Diagnostic tests for serial correlation, heteroscedasticity and model stability are conducted to validate the results. The analysis is performed using statistical software suitable for time series econometrics.

Table 1: Summary of ADF unit root test result

VARIABLE NAME	ADF TEST	CRITICAL VALUES			LEVEL	CONCLUSION AT 5% S.L
		1%	5%	10%		
RGDP	-3.005054	-3.653730	-2.957110	-2.617434	**1st DIFF**	**STATIONARY**
HGT	-8.315774	-3.653730	-2.957110	-2.617434	**1st DIFF**	**STATIONARY**
REC	-5.652754	-3.653730	-2.957110	-2.617434	**1st DIFF**	**STATIONARY**
FDI	-6.998537	-3.653730	-2.957110	-2.617434	**1ST DIFF**	**STATIONARY**
C02	-6.36618	-3.653730	-2.957110	-2.617434	**1ST DIFF**	**STATIONARY**

Source: Researcher's computation, (Eviews-10) 2025

The table presents the results of the Augmented Dickey-Fuller (ADF) unit root test used to determine the stationarity of the variables in the study. All variables Real GDP (RGDP), High-Tech Exports (HGT), Renewable Energy Consumption (REC), Foreign Direct Investment (FDI), and Carbon Dioxide Emissions (CO_2) were found to be non-stationary at level but became stationary after first differencing. This is evident as the ADF test statistics for each variable at first difference are more negative than the 5% critical value of -2.957110, leading to the rejection of the null hypothesis of a unit root. Therefore, all variables are integrated of order one, I(1), making them suitable for the ARDL estimation approach, which accommodates a mixture of I(0) and I(1) variables but not I(2).

Table 2: Summary of Cointegration Bound Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	2.979637	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Researcher's computation, (Eviews-10) 2025

The results of the ARDL bounds test for cointegration, which tests the null hypothesis of no long-run relationship among the variables. The computed F-statistic is 2.979637 while the critical values for various significance levels are provided for both I(0) and I(1) bounds. At the 5% level, the lower bound (I(0)) is 2.56 and the upper bound (I(1)) is 3.49. Since the F-statistic falls between the lower and upper bounds at the 5% significance level, the result is inconclusive—meaning we cannot definitively confirm or reject the existence of a long-run cointegration relationship among the variables. As such, further analysis or alternative cointegration tests may be needed to support the presence of a long-run relationship.

Table 3: Summary of ARDL Short-run

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RGDP(-1)	0.637559	0.052749	12.08670	0.0000
HGT	-0.640098	2.114807	-0.302674	0.7651

Table 3 (Cont.): Summary of ARDL Short-run				
HGT(-1)	-3.810777	2.337446	-1.630317	0.1179
REC	-27.00634	7.283965	-3.707643	0.0013
FDI	3.85E-09	6.02E-09	0.639451	0.5294
FDI(-1)	1.57E-08	6.61E-09	2.371222	0.0274
FDI(-2)	1.61E-08	6.74E-09	2.395286	0.0260
C02	-2.001736	1.561423	-1.281995	0.2138
C02(-1)	1.597072	1.220771	1.308248	0.2049
C	2838.431	764.1656	3.714419	0.0013
@TREND	7.889039	2.967392	2.658576	0.0147
ECT	-0.362441	0.038303	-9.462341	0.0000

Source: Researcher's computation, (Eviews-10) 2025

The short-run results of the ARDL model estimating the impact of digitalization, green technological innovation, and control variables on Nigeria's economic growth. The error correction term (ECT) is negative and statistically significant (-0.362441, p = 0.0000), indicating a stable adjustment toward long-run equilibrium with about 36% of deviations corrected each year. Among the explanatory variables renewable energy consumption (REC) and the trend variable are statistically significant at the 5% level with REC having a large negative short-run effect on real GDP. Foreign direct investment (FDI) is also significant in its lagged forms (at lag 1 and lag 2), showing a positive impact on growth. However, high-tech exports (HGT) and carbon dioxide emissions (CO_2) are not statistically significant in the short run suggesting their limited immediate effect on economic output. The constant term is positive and significant, reflecting the baseline growth level. Overall, the model captures meaningful short-run dynamics with the ECT confirming a valid long-run relationship.

Table 4: Summary of ARDL coefficients for long-run				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
HGT	-12.28028	7.133091	-1.721594	0.0998
REC	-74.51243	20.52308	-3.630665	0.0016
FDI	9.84E-08	1.52E-08	6.473126	0.0000
C02	-1.116496	5.139330	-0.217245	0.8301

Source: Researcher's computation, (Eviews-10) 2025

The long-run ARDL coefficient estimates showing the impact of digitalization, green technological innovation and control variables on Nigeria's economic growth. Renewable energy consumption (REC) has a statistically significant and large negative coefficient (-74.51243, p = 0.0016) suggesting that in the long run increased use of renewable energy is associated with a decline in real GDP possibly reflecting inefficiencies or underdeveloped infrastructure in the sector. Foreign direct investment (FDI) shows a strong positive and highly significant effect on economic growth (coefficient = 9.84E-08, p = 0.0000) highlighting its crucial role in enhancing long-run output. High-tech exports (HGT) have a negative coefficient (-12.28028) and are marginally significant at the 10% level (p = 0.0998) indicating a weak and potentially adverse long-run relationship with GDP, which may be due to limited domestic capacity to benefit from high-tech trade. Carbon dioxide emissions (CO_2) on the other hand are statistically insignificant (p = 0.8301), implying no meaningful long-run impact on Nigeria's economic growth within the study period.

Table 5: Summary of Heteroskedasticity test			
Heteroskedasticity Test: ARCH			
F-statistic	0.636443	Prob. F(1,29)	0.4315
Obs*R-squared	0.665725	Prob. Chi-Square(1)	0.4145

Source: Researcher's computation, (Eviews-10) 2025

The Heteroskedasticity Test (ARCH) results in the table assess whether the variance of the residuals is constant over time which is a key assumption in regression analysis. The F-statistic value is 0.636443 with a corresponding probability of 0.4315, and the Obs*R-squared statistic is 0.665725 with a p-value of 0.4145. Since both p-values are greater than 0.05, the null hypothesis of no heteroskedasticity is not rejected. This indicates that the residuals have a constant variance and thus the model does not suffer from heteroskedasticity confirming the reliability of the estimated standard errors and supporting the model's overall robustness.

3.4 Empirical Results and Discussion

The findings from the ARDL model provide insight into both the short-run and long-run dynamics between economic growth and the selected independent variables. In the short run, the error correction term is negative and statistically significant indicating a stable adjustment toward equilibrium. Renewable energy consumption shows a significant negative effect on real GDP suggesting that short-term investments in green technology may not yet be yielding productive economic returns. Foreign direct investment on the other hand demonstrates a positive and statistically significant influence through its lagged effects highlighting its role in boosting short-term growth. High-tech exports and CO_2 emissions were found to be statistically insignificant in the short run, suggesting minimal immediate impact on GDP during the study period.

In the long run, the results reveal that renewable energy consumption continues to exert a significant negative influence on economic growth potentially due to inefficiencies in green energy infrastructure or transitional costs in the Nigerian context. Foreign direct investment maintains a strong and positive effect underlining its importance in sustaining economic development over time. High-tech exports have a negative and marginally significant impact, implying that digitalization efforts may not yet be fully integrated into the broader economy. CO_2 emissions, however, remain statistically insignificant, suggesting that environmental degradation has not been a decisive factor in long-run output trends within the period under review. Overall, the results reflect the complex and evolving role of digitalization and green innovation in Nigeria's growth trajectory.

4. Policy Implications

The findings of this study have important policy implications for Nigeria's pursuit of sustainable economic growth through digitalization and green technological innovation. The negative long-run effect of renewable energy consumption suggests the need for improved investment efficiency and better integration of renewable technologies into the national grid. Policymakers should focus on enhancing infrastructure, incentivizing private sector participation and building local technical capacity to ensure green technologies yield economic returns (Adeniyi 2024). The positive impact of foreign direct investment highlights the importance of creating a stable macroeconomic environment and transparent regulatory framework to attract more inflows. Furthermore, the limited impact of high-tech exports calls for policies that strengthen research and development, support local innovation ecosystems and bridge the digital divide (Oyelaran-Oyeyinka and Adebowale, 2012). A coordinated strategy that combines green innovation, digital transformation and investment-friendly reforms will be crucial to achieving inclusive and sustainable growth in Nigeria.

4.1 Implications for Digital Policy and Infrastructure

The empirical findings underscore the need for a strategic overhaul of Nigeria's digital policy and infrastructure to maximize the economic benefits of digitalization. The negative and insignificant impact of high-tech exports on growth suggests that digital tools are not yet contributing meaningfully to economic transformation. This highlights the need for targeted investment in digital infrastructure including broadband connectivity, ICT education and innovation support systems (Onyeiwu and Liu, 2007). Nigeria must prioritize digital inclusion through nationwide policies that reduce the digital divide especially between urban and rural areas (Odufuwa, 2022). Additionally, the government should strengthen digital regulations, data governance and cybersecurity frameworks to foster trust and attract digital FDI. Supporting local digital startups and promoting public-private partnerships for technology development will

further strengthen the digital ecosystem (Idoko 2024). A robust and inclusive digital infrastructure is essential for positioning Nigeria to benefit from the global digital economy and enhance long-term economic growth.

4.2 Green Innovation and Environmental Sustainability

The long-run negative impact of renewable energy consumption on economic growth observed in this study suggests that while green innovation is crucial its implementation in Nigeria remains suboptimal. Many renewable energy initiatives are either poorly integrated into the national grid or lack the capacity to meet industrial and economic demands (Sambo, 2009). To correct this policymakers must focus on increasing investment in research and development tailored to local environmental conditions. Supporting local firms and universities in the innovation ecosystem will also promote technology transfer and improve the adaptability of clean energy solutions (Adenle, 2020). Furthermore, a strong regulatory framework is needed to align green technologies with national development goals. Environmental sustainability policies should promote efficient energy use, reduce emissions and encourage eco-friendly industrial practices (Akindotei 2024). Incentives for green innovation such as tax relief, subsidies and public-private partnerships can stimulate adoption while ensuring long-term sustainability (Ameh and Ogundipe, 2021). An integrated approach to environmental policy and innovation will help balance economic growth with ecological preservation.

4.3 Integration into National Development Plans

Integrating digitalization and green technological innovation into Nigeria's national development plans is essential for achieving inclusive and sustainable economic growth. The study's findings emphasize the need for alignment between technological policy initiatives and long-term economic objectives. National frameworks such as the Nigeria Vision 2050 and the National Development Plan (2021–2025) must mainstream digital transformation and renewable energy as core pillars of economic diversification (Eboh, 2022). A coordinated policy approach involving ministries of science, energy, environment and planning can facilitate the implementation of cross-cutting programs that link innovation with job creation, industrial productivity and environmental protection. Moreover, integrating green and digital strategies into national planning will promote resource efficiency reduce dependency on fossil fuels and create an enabling environment for sustainable infrastructure investment. Strong institutional coordination, fiscal incentives and monitoring mechanisms are needed to ensure effective policy delivery (Olayemi and Akinbinu, 2020). Embedding innovation-driven development in strategic documents will not only guide public investment but also attract global partnerships and funding opportunities (Ebika 2024).

5. Conclusion And Recommendations

This study investigated the impact of digitalization and green technological innovation on economic growth in Nigeria between 1990 and 2023 using the ARDL approach. The analysis revealed that foreign direct investment positively influences economic growth while renewable energy consumption and high-tech exports have either negative or insignificant effects. These findings indicate that although Nigeria is adopting digital and green technologies, their contributions to growth remain limited due to poor integration, inadequate infrastructure and insufficient policy support. Based on the results, it is recommended that the Nigerian government improve digital infrastructure and foster innovation-driven exports. More attention should be given to enhancing the capacity and efficiency of renewable energy systems to ensure they support industrial productivity. Furthermore, policies should promote skills development, encourage research and development and provide incentives for private sector investment in green and digital sectors. Integrating these measures into national planning frameworks will help position Nigeria for inclusive and sustainable economic growth.

5.1 Summary of Findings

The study explored the impact of digitalization and green technological innovation on economic growth in Nigeria from 1990 to 2023 using variables such as real GDP, high-tech exports, CO_2 emissions, foreign direct investment and renewable energy consumption. The ARDL analysis showed that foreign direct investment has a significant and positive impact on economic growth, both in the short and long run. However, high-tech exports and renewable energy consumption displayed negative or insignificant relationships with economic growth, indicating that Nigeria has not fully harnessed the economic potential of digital and green technologies. CO_2 emissions showed no consistent impact suggesting limited environmental regulation or green policy enforcement. The error correction term confirmed a stable long-run relationship among the variables. These findings point to gaps in policy implementation and infrastructure development. Overall, the results emphasize the importance of strengthening digital capabilities and optimizing green innovation to support sustainable economic growth in Nigeria.

5.2 Conclusion

This research examined the role of digitalization and green technological innovation in driving economic growth in Nigeria from 1990 to 2023. The study employed the ARDL model to analyze the relationship between real GDP and key variables such as high-tech exports, foreign direct investment, renewable energy consumption and CO_2 emissions. The findings revealed that while foreign direct investment significantly supports economic growth the contributions of high-tech exports and renewable energy remain weak or negative highlighting the underutilization of technological and environmental innovations in Nigeria's growth process. The results suggest that although efforts have been made to integrate technology and sustainability into development these areas are not yet fully optimized to yield the desired economic outcomes. The study concludes that for Nigeria to achieve inclusive and sustainable growth it must improve its digital infrastructure foster green innovation and align these with broader development goals. Without deliberate investment and coordinated policy efforts the benefits of digitalization and green technology may remain largely untapped.

5.3 Recommendations For Policymakers

Policymakers should prioritize investments in digital infrastructure to enhance the contribution of high-tech exports to economic growth. Efforts should be made to support local innovation through funding, capacity building and the creation of technology hubs across the country. Additionally, renewable energy development should be scaled up by addressing technical, financial and regulatory barriers that hinder its efficiency and integration into the economy. Policies that encourage clean energy adoption in both urban and rural areas will support long-term sustainability. Foreign direct investment should be directed toward sectors that promote digital and green innovation with clear incentives and monitoring frameworks. Finally, government agencies must coordinate effectively to ensure that digitalization and environmental sustainability are mainstreamed into national development strategies creating a balanced path toward inclusive and resilient economic growth.

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