Innovations

Sustainable Green Economy and Pro-poor Growth in Nigeria

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Abstract: *This study focuses on the link between a sustainable green economy and pro-poor growth in Nigeria. This followed the growing awareness of the role of a green economy in sustainable development. Thus, the effects of renewable energy use, forest area and electricity access on poverty headcount were examined in this study. The datasets were obtained from the World Bank and National Bureau of Statistics (NBS) and analysed using descriptive statistics, pre-estimation tests and the autoregressive distributed lag (ARDL) model. The findings from the unit root test showed that the variables are mixed-integrated with the I(0) and I(1) series. Long-run relationship also exists among the variables from the bounds cointegration test result. The ARDL results showed renewable energy use affected poverty headcount poverty in the long run. This finding could be attributed to the poor level of transition to renewable energy sources to bolster poverty reduction in Nigeria. Similarly, the results showed that forest areas and electricity access contributed positively to poverty headcount in both the short and long run. This finding could be attributed to the inconsistent and unstable power as well as the increase in underserved areas which have worsened the problem of energy poverty with a negative implication on the poverty reduction efforts. This is not surprising following the prevalence of deforestation and energy poverty that has continued to undermine the goal of pro-poor growth in Nigeria. Owing to the findings, this study concludes that the benefit of a sustainable green economy in the form of poverty reduction is yet to be achieved in Nigeria. Therefore, it is recommended that policymakers prioritise investments in clean and sustainable energy to enhance renewable energy use and create opportunities for pro-poor growth.*

Keywords: *Green economy, renewable energy, forest area, electricity access and pro-poor growth*

1. **Introduction**

The gradual transition from conventional economic activities to a green economy has attracted the attention of academics, policymakers and researchers to understand the role played by a green economy in the process of poverty reduction.Ali, Anufriev and Amfo (2021) argue that the concept of a green economy emerged due to global efforts aimed at addressing issues of unsustainable economic development and environmental degradation. This is consistent with the sustainable development goals (SDGs) whichprioritise the needs of the present generation without undermining the ability of the future generation to meet their needs.Prominent among the goals connected with a green economy include SDG 7 (affordable and clean energy), SDG 18 (decent work and economic growth), SDG 11 (sustainable cities), SDG 12 (responsible consumption and production), and SDG 6 (clean water and sanitation), among others.According to Nwokike. (2024), a green economy creates opportunities for improving human well-being and social equity while significantly reducing environmental degradation. This is important for investments in critical sectors that promote pro-poor growth.

Adenikinju (2020) posits that the goal of a green economy is to ensure the efficient use of resources, and social equity while fostering the resilience of the ecosystem. He further explained that a green economy offers numerous benefits such as reduced poverty and inequality, rapid growth and development, energy security, improved health outcomes and improved adaption to climate change, among others. It is also documented in extant literature that the transition to a green economy promotes innovation and the development of sustainable technologies and practices, which in turn creates new employment opportunities. In particular, it is believed that the transition to clean and sustainable energy provides a roadmap for employment generation, economic growth, and long-term prosperity. Mishra (2017) posits that a green economy is good for sustainable growth and improved human welfare. This is consistent with the United Nations Environment Programme (UNEP, 2013) report which highlights that a green economy is closely associated with sustainable development and poverty eradication.

Despite the growing awareness of the benefits of a green economy, the level of achievement in most developing economies including Nigeria has not been very impressive. For instance, the global environmental performance ranking shows that Nigeria's performance is low compared to its counterparts in sub-Saharan Africa. As observed from the 2022 report, Nigeria was ranked 168 out of 180 countries in the Environment Performance Index (EPI). This suggests that the country has not done enough to safeguard its citizens against health hazards associated with the environment, such as heavy metals, poor air quality, unsanitary conditions, contaminated drinking water, and improper waste management.Consequently, there have been growing concerns about the extent of the transition to the green

economy in Nigeria following the 2030 agenda of sustainable development. Given the foregoing, this paper provides insights into the implications of a sustainable green economy on pro-poor growth in Nigeria. Following the introduction, the rest of this paper is structured into four sections. Section 2 provides the literature review with emphasis on the theoretical and empirical literature while Section 3 focuses on the methodology. The results and discussion are provided in Section 4 while Section 5 concludes the paper.

2. Literature Review

2.1. Theoretical literature review

This paper is anchored on the environmental governance theory associated with Young (1992). This theory's basic assumption is that preserving the environment and the entire ecosystemsis imperative for achieving green growth to enhance poverty reduction. Thus, activities that guard against environmental degradation provide the basis for a green economy and pro-poor growth. According to Bennett and Satterfield (2018), the environmental governance theory provides the basis for guiding the behaviour of economic agents in the use of a natural resource through legislation, policies and structures. This suggests that green economic growth is reached through the framework of the institutions in operation which create opportunities for economic development including poverty reduction. Environmental governance theory also highlights the need for adaptive management strategies that can respond to changing environmental conditions and uncertainties. This includes embracing new technologies, incorporating local knowledge, and fostering learning and innovation.

Furthermore, the theory recognises that effective environmental governance must consider multiple scales of decision-making. This means considering national policies and regional, local, and international dynamics. However, the theory is criticised for being too abstract and conceptual, and failing to provide practical guidance for policymakers and practitioners. The environmental governance theory is also criticized for putting too much emphasis on formal institutions and regulations, while overlooking the importance of non-state actors and informal governance mechanisms.

2.2 Empirical Literature

Okonkwoand Uwazie (2015) explore the Nigerian economy's potential for sustainable growth and development within the framework of the green economy. The study used a political economy approach to examine pertinent ideas and determine the fundamental meaning of "sustainable development". To determine the potential economic gains for Nigeria from its transition to a green economy, a limited number of industries were examined for green growth initiatives. The

analysis showed that there are several prospects in the green economy, particularly for the industries under investigation. The requirement for institutional capacity to combine environmental and economic strategies is one of the recommendations made to help Nigeria transition to a green economy.

Using a cross-sectional autoregressive distributed lag (CS-ARDL) approach, Wani, Loganathan and Esmail (2024) examined how green technology, green energy,globalisation, and foreign direct investment, affect the growth of the green economy in the G7 countries. The KOF Swiss Economic Institute, the OECD database, and the WDI are the sources of data. Westerlund's cointegration test was used to determine whether cointegration existed between the variables. The findings showed that longand short-term green economic growth is positively impacted by green energy and foreign direct investment. Green technology also contributes positively to green economic growth in the long run. Given the findings, the study recommends incorporating laws that support green energy and technology and attracting more foreign investment to foster green economic growth in G7.

Using a difference-in-differences (DID) approach, Wirawan and Gultom (2021) investigate the potential role of renewable energy-based rural electrification in reducing poverty in remote non-grid villages of Indonesia. In particular, the study examines the impact of renewable energy-based plants in 217 isolated Indonesian villages by comparing the results of treated and untreated communities in the same subdistrict as the remote villages. The findings showed that the programme considerably decreased the number of vulnerable and impoverished residents in the treated villages by 91 people. Additionally, it was found that the programme could raise the number of small-scale industries in the treated village by three units, indicating that small-scale industries may be the intermediary mechanism by which electricity contributes to the reduction of poverty.

Ogbeide-Osaretin (2021) examined the relationship between energy consumption and poverty in Nigeria. The study used annual data from 1990 to 2017 on the poverty headcount and energy sources. The symmetric ARDL approach was employed for the data analysis and the results showed that that using contemporary energy effectively reduces poverty in Nigeria. In particular, electricity access was shown to significantly reduce poverty, whilst fossil fuels like coal and fuelwood have been shown to significantly increase it. The size of the household, the percentage of women in the labour force, and the rate of inflation all significantly contributed to Nigeria's high rate of poverty. Low-quality energy use (fuelwood) and poverty were found to be causally related in both directions. For Nigeria to effectively reduce poverty, the study recommended for an increase in the availability of contemporary energy supplies, a higher percentage of female employment, and smaller households.

Mhaka, Patrick and Tsvere (2022) investigatedthe challenges preventing afforestation from being widely adopted as a viable alternative land-use strategy for economic growth in Zimbabwe. The study employed content analysis and the findings indicate that farmers' ignorance of the benefits of afforestation, outdated cultural attitudes, institutional and capacity issues, a lack of education and training, aversion to long-term investment, ignorance of the existence of funding partners in afforestation, inadequate extension services, insecure land tenure arrangements for forest land, and the threat of wildlife are the main reasons why the economic value of afforestation is not being fully exploited.The study concluded by highlighting the challenges of afforestation in the country including capital access, extension service access, and tenure security on forest land.

3. Methodology

3.1 Research Design

This study adopted an ex post facto research design motivated by the fact that the data required for this study were obtained from secondary sources.

3.2 Data Description

The sustainable green economy in this study was measured by the transition to renewable energy, afforestation and access to clean energy. Essentially, renewable energy consumption was measured as a percentage of renewable energy in total final energy consumption in Nigeria during the study period. The extent of afforestation was measured by the forest area as a percentage of land area which excludes tree stands in agricultural production as well as trees in urban parks and gardens. The variable, electricity access is measured by the percentage of the population with access to electricity. In addition, pro-poor growth is measured by the poverty headcount. As an income measure, the poverty headcount describes the percentage of the population living below the poverty line of 1.9 dollars per day. The datasets were obtained from the World Bank and the National Bureau of Statistics (NBS) between 1990 and 2022.

3.2 Model Specification

The model set-up for this study is patterned after the work of Mishra (2017) which examined the implications of a green economy on sustainable development and poverty reduction. However, this study followed a broader approach to deepen the understanding of the effect of sustainable green on pro-poor growth in Nigeria. The functional specification of the model is provided as follows:

$POVR_t = f(REU, FORA, ECA)$ (1)

Where: POVR = poverty headcount, REU = renewable energy use, FORA = forest area and ECA = electricity access.

The ARDLmodel for equation (1) is specified accordingly as follows:
provided below:

$$\Delta POVR_{t=} \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta POVR_{t-1} + \sum_{i=1}^{q} \alpha_2 \Delta REU_{t-1} + \sum_{i=1}^{q} \alpha_3 \Delta FORA_{t-1} + \sum_{i=1}^{q} \alpha_4 \Delta ECA_{t-1} + \beta_1 POVR_{t-1} + \beta_2 REU_{t-1} + \beta_3 FORA_{t-1} + \beta_4 ECA_{t-1} + \varepsilon_{1t} \quad (2)$$

Where: α_0 = constant parameter to be estimated, α_1 _ α_4 = short run parameters,β_1 - β_4 = long-run multipliers, p = optimal lag for each of the dependent variables, q = optimal lag of the independent variables, Δ = first difference operator and ε_{1t}= error term

3.3 Method of Data Analysis

The ARDL model developed by Pesaran & Shin (1999) was used for the data analysis. The appeal for this estimation was based on the evidence of fractional integration of the series as observed from the unit root test results. In addition to the ARDL estimation method, the augmented Dickey and Fuller (ADF, 1981) unit root test method was employed to determine if the variables were stationary or not. The bounds co-integration test bound was applied to determine if a long-run relationship exists among the variables for investigation. The test specifically employed the F-statistic for establishing a long-run relationship. Thus, the augmented Dickey-Fuller (ADF) test proposed by Dickey and Fuller (1981) was used for the unit root test. The general specification of the ADF model involving an intercept and linear trend is of the form:

$$\Delta Y_t = \propto_0 + \propto_{1t} + \sum_{i=1}^{K} \beta_i \Delta Y_{t-i} + u_t \quad (3)$$

Where: Y_t = variable under investigation, Y_{t-1} = One period lag of the variable under investigation, β_i = Regression estimate, $\propto_0$= Constant term, $\propto_{1t}$ = linear trend

K = lag length operator and U_t = Error term.

In addition, the bounds method was applied for the cointegration test. The choice of this test method was based on the evidence of I(0) and I(1) series. This study also applied descriptive statistics to analyse the basic descriptive characteristics of the series over the study period.

4. Results and Discussion

4.1 Descriptive Statistics

The descriptive statistics for this study focused on the mean, minimum and maximum values as well as the standard deviation for the sustainable green economy indicators and poverty headcount in Nigeria. The results are presented in Table 1.

Table 1: Summary of descriptive statistics

Variable	POVR	REU	FORA	ECA
Mean	60.31455	84.77554	26.28182	47.41492
Median	62.20000	84.63000	26.26000	48.00000
Maximum	78.60000	88.68000	29.12000	59.30000
Minimum	40.10000	80.64000	23.75000	27.30000
Std. Dev.	11.03773	2.360180	1.694134	7.867236
Jarque-Bera	2.381121	2.197972	2.207855	1.998255
Probability	0.304051	0.333209	0.331566	0.368201
Observations	33	33	33	33

Source: Output from E-views 12

The descriptive statistics showed that the poverty headcount averaged 60.31%, suggesting that more than half of the population lives below the poverty line. It is also evident from the results that renewable energy use and forest area averaged 84.775% and 26.28% respectively while the mean value of electricity access stood at 47.414% during the study area. The results also showed that the poverty headcount fluctuated between the minimum and maximum levels of 40.10% and 78.6% respectively over the study period. This highlights the prevalence of poverty in Nigeria over the past three decades. The standard deviations for each variable are less than their corresponding mean values, suggesting that the observations for each variable clustered around their mean values. The probability values of the Jarque-Bera statistics for each variable are greater than 0.05, suggesting that the observations for the variables are normally distributed over the study period.

4.2 Unit Root Test

The test for unit root was conducted using the ADF method at the 5% significance level. The results are presented in Table 2.

Table 2: ADF unit root test results

Variable	**ADF stat. at levels**	**ADF stat. at 1st diff.**	**5% critical value**	**Order of integration**
POVR	-2.246	-5.298***	-2.96	I(1)
REU	-1.682	-5.599***	-2.96	I(1)
FORA	-2.131	- 3.2518***	-2.96	I(0)
ECA	-3.431**	-	-2.96	I(0)

Source: Output from E-views 12

Note *, ** and * denote significant at 1%, 5% and 10% respectively**

The summary of the ADF unit root test results showed that poverty headcount and renewable energy use are not stationary, Thus, the null hypothesis of the unit root

cannot be rejected. However, they become stationary at the first difference, suggesting that they are integrated of order one, I(1). At the same time, it is evident from the results that the forest area is not stationary given that its order of integration is I(1). On the other hand, the results showed that electricity access by the population is energy use are stationary at levels, suggesting that they are integrated of order zero, I(0). Thus, the null hypothesis of the unit root cannot be rejected. In sum, it followed from the results that variables are mixed-integrated in the forms of I(0) and I(1).

4.3 Cointegration Test

As outlined in the methodology and with the evidence of mixed integration in the series, the bounds cointegration method was applied in this study. The results are presented in Table 3.

Table 3: Summary of bounds cointegration test results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	4.478	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Output from E-views 12

Note: K denotes the number of regressors

The results of this test showed that the computed F-statistic (4.478) is greater than the upper bound [I(1)] critical value (3.67) at the 5% significance level. This finding provides the basis for rejecting the null hypothesis of no levels relationship. Thus, it followed from the results that poverty headcount has a long-run relationship with sustainable green economy indicators. This finding necessitates the estimation of the ARDL model.

4.4 Model Estimation

The long and short-term effects of sustainable green economy indicators on poverty reduction in Nigeria were captured by the regression results. The ARDL results are shown in Table 4.

Table 4: Summary of ARDL results

Dependent variable: POVR				
		Long run results		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
REU	3.276071**	1.513482	2.164592	0.0394
FORA	11.71126**	5.093130	2.299422	0.0294
ECA	2.938679***	1.133877	2.591709	0.0152
C	-664.5175***	211.1805	-3.146681	0.0040
Short run Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(REU)	1.697942**	0.836844	2.028984	0.0524
D(FORA)	6.069783**	2.811806	2.158678	0.0399
D(ECA)	1.523077**	0.663683	2.294887	0.0297
CointEq(-1)	-0.518286***	0.136608	-3.793976	0.0008
R-squared	0.6536		Prob(F-statistic)	0.0000

Source: Output from E-views 12

Note: *, ** and * denote significant at 1%, 5% and 10% respectively**

The results showed that renewable energy use affected poverty headcount positively in both the short and long run. As observed from the results, a percentage increase in renewable energy use contributed positively to a 3.276% increase in poverty in the long run. This finding highlights the fact that renewable energy use is associated with an increase in poverty in Nigeria. This finding could be attributed to the poor level of transition to renewable energy sources to bolster poverty reduction in Nigeria. This finding differed from the proposition of Okesoto (2012), Chikaire, Nnadi and Anyoha (2011) and Emodi and Boo (2015) who highlighted the imperativeness of renewable energy in tackling the problem of poverty in developing economies including Nigeria. At the same time, the results showed that forest areas contributed positively to poverty headcount in both the short and long run. As observed from the long-run results, poverty headcount increases by 11.711% following a percentage increase in forest area. This finding could be attributed to the poor level of afforestation as the country has continued to experience deforestation over time. In addition, this finding could also be linked to the poor tree-planting practice in Nigeria which has posed a threat to environmental sustainability, thus intensifying the problem of poverty in the country. Again, the results showed that electricity access by the population has a positive and significant effect on poverty in the short and long run. This finding could be attributed to the inconsistent and unstable power as well as the increase in underserved areas which

have worsened the problem of energy poverty with a negative implication on the poverty reduction efforts. This finding is consistent with the results of Ogbeide-Osaretin (2021) who established that electricity consumption does not guarantee poverty reduction. The error correction coefficient (-0.51828) in the short-run results showed that the distortions in the long-run equilibrium position can be corrected at a speed of 51.82%. This finding further attests to the evidence of a long-run relationship between a sustainable green economy and poverty incidence in Nigeria. The R-squared of 0.6536 suggests that about 65.36% of the total variations in poverty headcount are due to changes in sustainable green economy indicators. This finding attests to the statistical reliability of the model.

Table 5: Post-estimation test results

Test type	Test Statistic	Probability value
Breusch-Godfrey Serial Correlation LM Test	2.9564	0.0704
Breusch-Pagan-Godfrey heteroscedasticity test	5.714	0.2216
Ramsey RESET Test	0.4022	0.7527

Source: Output from E-views 12

As observed from the post-estimation test results, the probability values of the test statistics for the Breusch-Godfrey serial correlation and Breusch-Pagan-Godfrey heteroscedasticity tests are greater than 0.05, suggesting that residuals are serially independent and homoscedastic. This further indicates that the model is reliable. The results also showed that the estimated parameters are stable given the probability of the test statistic for the Ramsey RESET test is greater than 0.05. Overall, the results showed that the model is reliable for forecast and policy purposes.

5. Conclusion

There has been growing interest in understanding the role of a sustainable green economy in promoting pro-poor growth. This is on the efforts of the key stakeholders in promoting environmental sustainability in accordance with the 2030 agenda of the SDGs. Thus, this study explores how the key indicators of a sustainable green economy including the transition to renewable energy, afforestation and population access to electricity contributed to poverty reduction in Nigeria. The findings showed that renewable energy use contributed positively to poverty incidence in Nigeria. This finding highlights that the transition to renewable has not provided the required opportunities for poverty reduction. This could be attributed to the predominance of fossil fuel as a major energy source in Nigeria which has adversely affected the poor. In addition, the results further showed that

forest area and electricity access significantly increased the incidence of poverty in Nigeria. This finding suggests that the extent of afforestation and electricity access by the population has not translated to poverty reduction. This is not surprising following the prevalence of deforestation and energy poverty that has continued to undermine the goal of pro-poor growth in Nigeria. Given the findings, this study concludes that the benefit of a sustainable green economy in the form of poverty reduction is yet to be achieved in Nigeria. Thus, it is recommended that policymakers prioritise investments in clean and sustainable energy to enhance renewable energy use and create opportunities for pro-poor growth. This study also recommends that tree planting should be encouraged to increase the forest area as a percentage of the total land area to provide a roadmap for poverty reduction.

References

1. *Ali, E. B., Anufriev, V. P., & Amfo, B. (2021). Green economy implementation in Ghana as a road map for a sustainable development drive: A review. Scientific African, 12, e00756.*
2. *Bennett, N. J., & Satterfield, T. (2018). Environmental governance: A practical framework to guide design, evaluation, and analysis. Conservation Letters, 11(6), e12600.*
3. *Chikaire, J., Nnadi, F. N., & Anyoha, N. O. (2011). Access to sustainable Energy: A panacea to Rural Household poverty in Nigeria. Continental journal of renewable energy, 2(1), 7-18.*
4. *Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49(1), 1057-1072.*
5. *Emodi, N. V., & Boo, K. J. (2015). Sustainable energy development in Nigeria: Overcoming energy poverty. International Journal of Energy Economics and Policy, 5(2), 580-597.*
6. *Mhaka, I., Patrick, W. M., & Tsvere, M. (2022). The challenges of adopting afforestation as an alternative and sustainable land use for economic development. Annals of Social and Behavioural Sciences, 4(1), 1-8.*
7. *Mishra, P. K. (2017). Green economy: A panacea for sustainable development and poverty reduction. Journal of International Economics, 8(1), 19-28.*
8. *Nwokike, L. I. (2024). Nigeria's Transition to a Green Economy: A Roadmap to Sustainable Development. Journal of Commercial and Property Law, 11(3), 157-166.*
9. *Ogbeide-Osaretin, E. N. (2021). Analysing energy consumption and poverty reduction nexus in Nigeria. International Journal of Sustainable Energy, 40(5), 477-493.*

10. *Ogbeide-Osaretin, E. N. (2021). Analysing energy consumption and poverty reduction nexus in Nigeria. International Journal of Sustainable Energy, 40(5), 477-493.*
11. *Okesoto, J. O. (2012). Sustainable energy development as a tool for alleviating poverty in Nigeria. Research on Humanities and Social Sciences, 2(6), 115-123.*
12. *Okonkwo, O. N. & Uwazie, I. U. (2015). Green economy and its implications for economic growth in Nigeria. Journal of Resources Development and Management, 15(1), 15-21.*
13. *Pesaran, M.H. & Shin, Y. (1999) An Autoregressive distributed lag modelling approach to cointegration analysis. In: Strom, S., Ed., Chapter 11 in Econometrics and Economic Theory in the 20th Century the Ragnar Frisch Centennial Symposium, Cambridge University Press, Cambridge, 371-413.*
14. *Wani, M. J. G., Loganathan, N., & Esmail, H. A. H. (2024). Impact of green technology and energy on green economic growth: role of FDI and globalization in G7 economies. Future Business Journal, 10(1), 43.*
15. *Wirawan, H., & Gultom, Y. M. (2021). The effects of renewable energy-based village grid electrification on poverty reduction in remote areas: The case of Indonesia. Energy for Sustainable Development, 62, 186-194.*
16. *Young, O. R. (1992). International Environmental Governance: Building Institutions in an Anarchical Society. IIASA, Science and Sustainability-Selected Papers on IIASA's 20th Anniversary, 245-268.*