

Green Accounting and Financial Performance of Selected Listed Oil and Gas Companies in Nigeria

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DOI: <https://doi.org/10.51244/IJRSI.2026.1305000215>

Received: 18 May 2026; Accepted: 24 May 2026; Published: 10 June 2026

ABSTRACT

This study investigates the impact of green accounting on the financial performance of listed oil and gas companies in Nigeria. Green accounting used as the independent variable was assessed through four key components: remediation and pollution control, emission cost control, renewable energy expenditure, and waste management costs. Financial performance, the dependent variable, was measured using Return on Assets (ROA). Ex-post facto research design was employed to achieve the study's objectives. The study population comprised all eight oil and gas firms listed on the Nigerian Exchange Group (NGX). Secondary data were extracted from the annual reports and financial statements of these companies over a 15-year period, spanning from 2010 to 2024. The data were analyzed using the Auto-Regressive Distributed Lag (ARDL) model to determine both short-term and long-term relationships between variables. The findings revealed that both remediation and pollution control and waste management costs have a statistically significant impact on the ROA of the oil and gas firms. Conversely, emission cost control and renewable energy expenditures did not exhibit a significant effect on ROA. Based on these findings, the study recommends that oil and gas firms in Nigeria strategically integrate environmental costs particularly those related to remediation and pollution control into their financial planning. Adopting comprehensive green accounting practices, such as tracking and reporting environmental remediation and prevention costs can help reduce long-term liabilities, minimize regulatory penalties, and enhance operational efficiency.

Keywords: Emission control, Renewable Energy, Remediation, Pollution Control, Financial Performance,

INTRODUCTION

In recent years, there has been a global surge in environmental consciousness, driven by growing concerns over climate change, biodiversity loss, and ecological imbalances caused by industrial activities. As a result, stakeholders including investors, regulators, consumers, and civil society are increasingly demanding that companies demonstrate responsible environmental behavior and mitigate the negative externalities of their operations (Agbiogwu, 2014). Climate change and global warming are some of the major issues facing the world and operations of most Companies in Nigeria due to increasing expansions and operational activities in industrial production especially manufacturing, oil and gas exploration, solid mineral mining, energy generation and other carbon related activities. This rise in industrial activities however gave rise to environmental concerns and have prompted request for their environmental impact assessment. These concerns have led government at different levels to enact legislations that seek to protect the environment from the dangerous impact of mineral exploration and related activities on the environment. The legislations have come in form of safety and security (industrial safety) laws with attendant consequences on the operations of the firms. Giving rise to green accounting.

Green accounting also known as environmental accounting refers to the process of incorporating environmental information and social costs into traditional accounting systems. It involves tracking, analyzing, and reporting

all data related to environmental costs, sustainability initiatives, and ecological impacts of organizational activities. Green accounting plays a vital role in highlighting how environmental factors affect economic performance. It offers a dual perspective: on one hand, it captures the contribution of natural resources such as water, minerals, and forests to economic development; on the other hand, it quantifies the costs associated with environmental degradation, such as pollution, resource depletion, and ecosystem damage (Agnieszka & Okon, 2018). It aims to bridge the gap between environmental sustainability and financial decision-making by embedding environmental considerations into the core accounting frameworks used by companies (Umaigba et al., 2025). Green accounting enables companies to track environmental indicators, including greenhouse gas (GHG) emissions, and assess their progress in achieving environmental reduction targets (Uwaigbe & Jimoh, 2014).

In today's world, where climate change, environmental damage, and dwindling resources threaten our very survival, green accounting helps companies measure their impact on the planet and give a fuller picture of how they are really doing (UNEP, 2023; Kaur & Kaur, 2022). In the last few years, there has been a surge in the need for corporate entities to incorporate environmental performance in the financial health of the firm. Organizations that ignored this are face with potential reputational damage, fines and fees, and loss of investor confidence (Kaur & Kaur, 2022).. Conversely, firms that engage in environmental disclosure and adopt sustainable practices often enjoy enhanced stakeholder trust, improved access to capital, and competitive advantage (Wasiu & Temitope, 2021; Yadav & Pathak, 2022).

In the Nigerian context, green accounting is increasingly being recognized as an essential component of corporate sustainability, although its implementation remains uneven across sectors. As the detrimental effects of environmental activities continue to escalate, there is a growing global focus not only on the profitability of companies but also on their environmental and social impacts. This broader outlook emphasizes the responsibility these companies bear towards the broader stakeholders, the wider society, and future generations (Agnieszka & Okoye, 2018).

The financial implications of green accounting in Nigeria remain underexplored especially among oil and gas firms due to the voluntary nature of the required level of environmental disclosures currently practiced in Nigeria. Though various laws have been enacted, they are however still largely voluntary in practice with little or no regulatory oversight. Empirical evidences in literature offer mixed outcomes with some reporting a positive influence of environmental accounting on financial performance while others reporting an inverse relationship arguing that sustainability practices do not always yield immediate financial gains but may instead impose additional operational costs, particularly in the absence of regulatory incentives or supportive institutional frameworks.

Extant literature however argues that good environmental disclosure practices are likely to reduce information asymmetry and agency cost which will in turn lead to better financial outcomes. This relay consistency with stakeholder and legitimacy theory that argues that companies perform better as they align with expectations and receive approvals. Based on the above this paper seek to provide empirical evidence on the effect of green accounting on financial performance in Oil and gas companies in Nigeria.

Research Objectives

The main objective of this study is to evaluate the effect of green accounting on the financial performance of selected listed oil and gas firms in Nigeria. Specifically, the study seek to:

1. Determine the effect of remediation and pollution control on return on assets of oil and gas firms in Nigeria
2. Ascertain the effect of emission control cost on return on assets of oil and gas firms in Nigeria
3. Examine the effect of waste management cost on return on assets of oil and gas firms in Nigeria
4. Explore the effect of renewable energy cost of return on assets of oil and gas firms in Nigeria

Research Hypothesis

The following hypothesis are formulated in the null form:

1. Remediation and pollution control has no significant effect on return on assets of oil and gas firms in Nigeria
2. Emission control cost has no significantly affect return on assets of selected oil and gas firms in Nigeria
3. Waste management cost has no significant effect on return on assets of selected oil and gas firms in Nigeria
4. Renewable energy cost has no significant effect on return on asset of selected oil and gas firms in Nigeria

THEORETICAL REVIEW

Stakeholder Theory

Stakeholder theory, as developed by Freeman (1984), avers that companies should prioritize the needs of various stakeholders rather than just shareholders. The stakeholders are those persons or group of persons whose activities affect the business or whose activities the business may affect. Ezekwere & Ikilidi, 2024 observe that the adoption of green accounting by businesses is in line with the urge to meet the stakeholders' expectations about environmental responsibility. Chude et al. (2023) conclude that the involvement of stakeholders has progressively become a major strategic element that encourages sustainability disclosure in Nigerian listed companies, especially when there are high stakes involved in reputation management and compliance with regulatory requirements.

Legitimacy Theory

Legitimacy theory posits that organizations must align their operations with societal norms and values to gain public acceptance and maintain a "social contract," ensuring their survival by demonstrating responsible behavior. According to the legitimacy theory, companies engage in green accounting in order to substantiate their activities and to pretend to be like others according to the public's norms and expectations. Green accounting practices are normally used by the companies in the environmentally sensitive industries like oil and gas to keep up their legitimacy (Okporo et al., 2023). Akinleye and Owoniyi (2024) claim that public and investors' growing pressure on the firms to prove their environmental responsibility has made legitimacy theory extremely suitable for the interpretation of the green reporting behavior framework.

Empirical Review

Empirical investigations into the relationship between green accounting and financial performance have yielded mixed results across various contexts. In Nigeria, as in many developing economies, environmental costs are often excluded from financial reports, which hinders a comprehensive evaluation of organizational performance. However, recent empirical studies suggest a growing correlation between environmental accountability and firm-level profitability.

Umaigba et al. (2025) examined the impact of green accounting disclosures on the financial performance of listed non-financial firms in Nigeria. It employed an ex post facto research design and analyzed a panel dataset covering 60 non-financial firms listed on the Nigerian Exchange Group between 2015 and 2024. The empirical results reveal a positive and statistically significant relationship between green accounting disclosures and all three financial performance indicators. Firms with stronger environmental reporting practices exhibited superior profitability and efficiency, providing evidence that sustainability initiatives yield both ecological and financial benefits. The effect of control variables such as firm size and age was marginal, indicating that even medium-sized firms can benefit from sustainability-oriented practices. These findings affirm the business case

for green accounting, challenging the perception that environmental disclosures are mere compliance costs. In the same vein, Erhejuwa and Ehiedu (2025) examined the impact of green accounting on firm performance in Nigeria, with a focus on listed firms in environmentally sensitive sectors such as oil and gas, manufacturing, and industrial goods. Using secondary data from financial statements and environmental disclosures of 30 purposively selected Nigerian firms over a 10-year period (2015–2024). Multiple regression analysis was conducted to assess the relationship between environmental disclosure, sustainability reporting, environmental costs, and firm performance indicators. Findings reveal a significant positive relationship between green accounting practices and firm performance. Environmental disclosure and sustainability reporting enhance financial outcomes, while investment in environmental costs, contrary to traditional belief, contributes positively to profitability.

Adelabu and Salaudeen (2025) investigated the effects of green accounting on the financial performance of listed consumer goods companies in Nigeria using a sample size of 30 firms with data extracted from the published financial statements. They found a positive correlation between green accounting variables and financial performance. The study concludes that green accounting practices positively impact firm performance in Nigeria. Samuel et al. (2024) explored the impact of environmental accounting reporting and performance of selected manufacturing firms in Nigeria. The findings obtained shows that waste management cost has significant effect on performance of selected manufacturing firms in Nigeria has significant relationship with the organizational growth and development.

Wati, *et al.*, (2024), examined the impact of the application of green accounting on increasing environmental awareness and public knowledge in the East Cirebon region. This research uses a qualitative approach with descriptive qualitative methods through in-depth interviews, observations, surveys, and distributing questionnaires to small and medium enterprises. The results showed that the application of green accounting looking at renewable energy cost in the East Cirebon region had a positive impact on increasing environmental awareness. By presenting accounting information that considers the environment, people can understand the economic impact of their activities on Green Accounting Practice and listed Oil and Gas Companies Performance Metric in Nigeria. [Akuboere and Korolo](#) (2024), explored Environmental Remediation Cost and Financial Performance of Oil and Gas Companies in Nigeria This study investigates the relationship between environmental remediation costs and the financial performance of oil and gas companies in Nigeria. Ex-post facto research design was used and the study used secondary data from annual reports of sampled companies for the relevant years under consideration (2018-2022) the ordinary Least Squares regression technique was employed to investigate the relationship existing between the variables. The study found that environmental prevention cost has a negative and insignificant effect on the return on assets of oil and gas companies in Nigeria while environmental detection cost has a positive and significant effect on the Return on assets of oil and gas companies in Nigeria.

Ezekwere & Ikilidi (2024) found that consumer goods firms with higher environmental disclosure scores showed significantly improved Return on Assets (ROA) and Return on Equity (ROE). Akinleye & Owoniya (2024) demonstrated that sustainability reporting is positively correlated with earnings per share (EPS) and brand valuation among quoted manufacturing firms in Nigeria. Obarolo-Iguobaro & Akpoveta (2024) showed that environmental costs, when adequately managed and disclosed, contribute positively to profit margins in the oil and gas sector. Conversely, Chude et al. (2023) reported that while environmental expenditures enhance brand equity and stakeholder trust, their short term impact on profitability is not statistically significant. Okporo et al. (2023) argued that regulatory inconsistencies and weak enforcement dilute the impact of environmental disclosure on financial outcomes in Nigeria.

METHODOLOGY

The study adopts an ex-post facto research design, suitable for examining the historical relationship between green accounting practices and financial performance using secondary data from past financial statements. Secondary data are sourced from audited annual financial statements, sustainability reports, and NGX factbooks for the period 2010-2024, providing a 15-year panel dataset to capture longitudinal trends. Eight (8) oil and gas firms listed on the Nigerian Exchange group were selected and multiple panel least squares regression analysis was employed. Model of the study is similar to the model adopted by Okporo, *et al.* (2023).

$$ROA = \beta_0 + \beta_1RPC + \beta_2ECC + \beta_3REC + \beta_4WMC + \varepsilon$$

The ARDL model is stated as:

$$ROA_{it} = \alpha_0 + \sum_{j=1}^p \beta_j ROA_{i,t-j} + \sum_{j=0}^{q1} \beta_j RPC_{i,t-j} + \sum_{j=0}^{q2} \beta_j ECC_{i,t-j} + \sum_{j=0}^{q3} \beta_j REC_{i,t-j} + \sum_{j=0}^{q4} \beta_j WMC_{i,t-j}$$

ε_{it} = error term Where $ROA = Return\ on\ Assets$

RPC= Remediation and pollution control

ECC= Emission Control Cost

REC= Renewable Energy Cost

WMC= Waste Management Cost

ε_{it} = error term

i = cross-sectional unit

t = time period

p, q1,q2,q3,q4 = optimal lag lengths

By a prior, $b_0 > 0, b_1 > 0$

DATA ANALYSIS AND DISCUSSION

Descriptive Statistics

Table 1: Descriptive Statistic

	LNRPC	LNECC	LNWMC	LNREC	ROA
Mean	4.293082	4.480782	6.162529	7.011015	0.056049
Median	4.218406	4.464504	6.219823	7.206730	0.050466
Maximum	5.866287	5.911690	8.660420	8.964084	1.513072
Minimum	2.060698	2.086360	3.207634	5.055428	-0.994077
Std. Dev.	0.732269	0.636195	0.970893	0.732708	0.192652
Skewness	-0.319981	-0.605580	-0.199821	-0.501867	1.974239
Kurtosis	2.522359	4.708009	3.400748	3.953524	36.42133
Jarque-Bera	3.188458	21.92101	1.601562	9.184138	5662.879
Probability	0.203065	0.000017	0.448978	0.010132	0.000000
Observations	120	120	120	115	120

Source: Authors analysis from E-views

Table 1 presents the descriptive statistics for the variables used in the study, namely LNRPC, LNECC, LNWMC, LNREC, and ROA, based on 120 observations (except LNREC with 115 observations). The mean

values show the average level of each variable during the study period. The average values of LNRPC, LNECC, LNWMC, and LNREC are 4.293, 4.481, 6.163, and 7.011 respectively, while ROA has a mean of 0.056, indicating that firms recorded an average return on assets of about 5.6%. The median values are close to the mean for most variables, suggesting that the distributions are relatively balanced with limited extreme deviations. The maximum and minimum values indicate the range of the data. For instance, ROA ranges from -0.994 to 1.513, implying that some firms experienced losses while others recorded very high profitability. Similarly, the other variables exhibit reasonable dispersion between their minimum and maximum values. The standard deviation measures the variability of the data around the mean. The values indicate moderate variation across the variables, with LNWMC (0.971) showing the highest variability among the independent variables, while ROA (0.193) shows relatively lower dispersion compared with the log-transformed variables. The skewness statistics reveal the degree of asymmetry in the data distribution. LNRPC, LNECC, LNWMC, and LNREC have negative skewness, indicating that their distributions are slightly left-skewed, while ROA (1.974) is positively skewed, suggesting the presence of extreme high values in profitability. The kurtosis values indicate the peakedness of the distributions. Most variables have kurtosis values around 3, suggesting a distribution close to normal. However, ROA has an extremely high kurtosis (36.42), indicating a leptokurtic distribution with significant outliers. Finally, the Jarque-Bera test and associated probabilities assess the normality of the variables. The probability values for LNECC, LNREC, and ROA are less than 0.05, indicating that these variables significantly deviate from normal distribution. In contrast, LNRPC and LNWMC have probability values greater than 0.05, suggesting that their distributions do not significantly differ from normality. Overall, the descriptive statistics indicate moderate variability in the variables, with some evidence of skewness and non-normality, particularly in the ROA variable.

Multicollinearity test (VIF)

Table 2: Multicollinearity test

Variables	Coefficient variance	Uncentered VIF	Centered VIF
LNRPC	0.000773	44.74707	1.287984
LNECC	0.001072	66.96478	1.311493
LNWMC	0.001221	142.5433	3.437391
LNREC	0.002287	344.9175	3.694414
C	0.039898	121.0959	NA

Source: Authors Output from E-views

The multicollinearity test presented in Table 2 uses the Variance Inflation Factor (VIF) to assess the degree of correlation among the explanatory variables in the model. The centered VIF values are the most relevant for interpretation. A common rule of thumb is that a VIF value above 10 indicates serious multicollinearity, while values below 5 (or even 3 in stricter cases) suggest that multicollinearity is not a major concern. From the table, LNRPC (1.287984) and LNECC (1.311493) have very low VIF values, indicating minimal correlation with other independent variables. LNWMC (3.437391) and LNREC (3.694414) show moderate VIF values but still fall within acceptable limits, suggesting only mild correlation that is unlikely to distort the regression estimates. The constant term (C) has no centered VIF, which is standard and not a concern. Although the uncentered VIF values appear quite high, they are generally not relied upon for decision-making in multicollinearity analysis, especially when a constant term is included in the model. Overall, the results indicate that there is no serious multicollinearity problem among the explanatory variables, and the regression estimates can be considered reliable.

Unit Root Test

To avoid running a spurious regression, unit root test is carried out to ensure that the variables employed in this study are mean reverting i.e. stationary. For this purpose, the Levin, Lin & Chu test is employed to test for stationary of data. The result of the test is presented in the table below.

Table 3: Unit Root Test Table

Variable	LLC T-Statistics	LLC (Common P-value)	Difference	Order
RPC	4.89900	0.0000	1 st difference	1(1)
ECC	3.00233	0.0013	1 st difference	1(1)
WMC	4.70325	0.0000	1 st difference	1(1)
REC	2.15975	0.0154	Level	1(0)
ROA	2.54245	0.0055	Level	1(0)

Source: E-view Output

The result in table 3 is the outcome of the unit root test to determine the common and individual stationarity of the variables. For the common stationarity test, the Levin Lin & Chu (LLC) test was used which considers lags in data series. A variable is stationary if the p-value is less than or equal to 0.05 level of significance. The result from the table shows that RPC, ECC and WMC are stationary at first difference. However, REC and ROA are stationary at level. Since there is mixed order of integration (1(0) and 1(1)), ARDL is the most suitable analytical tool for the study.

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Long Run Co-integration (Bound Test)

Table 4: Bound test

Test Statistic	Value	K
F-statistic	6.884118	4
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.20	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: E-view Output

The ARDL bounds test result shows that the computed F-statistic (6.884118) exceeds the upper critical bound values at the 1%, 2.5%, 5%, and 10% significance levels. This implies rejection of the null hypothesis of no long-run relationship. Therefore, there exists a stable long-run (Cointegration) relationship among the variables in the model. This implies that we can proceed to determine the short run relationship and carry out ECM to understand the speed of adjustment from disequilibrium in the short run.

Short Run Relationship

Table 5: Short Run ARDL Model Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
ROA(-1)	0.265721	0.074453	3.568995	0.0006
ROA(-2)	0.065069	0.063838	1.019283	0.3106
ROA(-3)	-0.350596	0.066517	-5.270732	0.0000
ROA(-4)	0.251369	0.074610	3.369100	0.0011
LNRPC	0.042701	0.017661	2.417800	0.0175

LNECC	-0.005070	0.024757	-0.204777	0.8382
LNWMC	0.021795	0.025854	0.843022	0.4013
LNWMC(-1)	-0.061439	0.024692	-2.488253	0.0145
LNREC	-0.045481	0.048731	-0.933298	0.3530
LNREC(-1)	0.079637	0.050035	1.591630	0.1147
C	-0.133667	0.137501	-0.972118	0.3334
R-Square	0.372583			
Adjusted R-Square	0.308561			
F-statistics	5.819604			
Prob(F-statistics)	0.000001			
Durbin_Watson	1.448454			

Source: E-view Output

In table 5 we observe the short-run Autoregressive Distributed Lag (ARDL) model results examining the effect of the explanatory variables on Return on Assets (ROA). The estimated model incorporates both the current and lagged values of the variables, thereby capturing the short-run dynamic relationships among the variables. The coefficient of determination (R-Square) is 0.372583, implying that approximately 37.26% of the variations in ROA are explained by the independent variables included in the model. The Adjusted R-Square of 0.308561 indicates that after adjusting for the number of explanatory variables, about 30.86% of the variations in ROA are jointly explained by the model. This suggests a moderate explanatory power of the model. The F-statistic value of 5.819604 with a probability value of 0.000001 indicates that the model is statistically significant at the 5% level. This means that the explanatory variables jointly have a significant effect on ROA in the short run. The Durbin-Watson statistic of 1.448454 suggests the absence of severe autocorrelation in the model, although the value indicates mild positive serial correlation may exist. The lagged values of ROA show mixed effects on current ROA. ROA (-1) has a positive and statistically significant coefficient of 0.265721 ($p = 0.0006$), implying that the previous year’s profitability positively influences current profitability. ROA (-2) has a positive but insignificant coefficient of 0.065069 ($p = 0.3106$), indicating no significant effect in the second lag period. ROA (-3) has a negative and significant coefficient of -0.350596 ($p = 0.0000$), suggesting that profitability three periods ago negatively affects current ROA. ROA (-4) has a positive and significant coefficient of 0.251369 ($p = 0.0011$), indicating that profitability from four periods earlier positively influences current profitability.

These findings reveal the dynamic nature of profitability adjustment over time. The independent variable LNRPC has a positive and statistically significant coefficient of 0.042701 ($p = 0.0175$). This indicates that a 1% increase in RPC leads to approximately a 0.043 increase in ROA in the short run. The result suggests that RPC positively contributes to firm profitability. LNECC has a negative coefficient of -0.005070 with a probability value of 0.8382, indicating that ECC has a negative but statistically insignificant effect on ROA in the short run. LNWMC has a positive but insignificant current coefficient of 0.021795 ($p = 0.4013$), suggesting that the immediate effect of WMC on ROA is not statistically significant. However, the lagged value, LNWMC (1), has a negative and statistically significant coefficient of -0.061439 ($p = 0.0145$), implying that WMC from the previous period adversely affects current profitability. LNREC has a negative and insignificant current coefficient of -0.045481 ($p = 0.3530$), indicating that REC does not significantly affect ROA contemporaneously. However, the lagged coefficient LNREC (-1) is positive (0.079637) though statistically insignificant ($p = 0.1147$), suggesting no meaningful lagged influence on profitability. The constant term (C) is negative and statistically insignificant, indicating that when all explanatory variables are held constant, the baseline effect on ROA is not statistically different from zero. Overall, the short-run ARDL results indicate that RPC significantly improves financial performance measured by ROA, while the lagged effect of WMC significantly reduces ROA. Other variables such as ECC and REC do not exhibit statistically significant effects in the short run. The significance of several lagged ROA terms also confirms the dynamic adjustment process of profitability over time.

Table 6: Short Run-ECM Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(LNRPC)	-0.003575	0.030414	-0.117543	0.9067
D(LNRPC(-1))	0.032767	0.028385	1.154378	0.2514
D(LNECC)	0.086606	0.049430	1.752110	0.0831
D(LNECC(-1))	0.008066	0.052572	0.153432	0.8784
D(LNREC)	-0.044145	0.024660	-1.790157	0.0768
D(LNREC(-1))	-0.037579	0.025605	-1.467628	0.1457
D(LNWMC)	-0.007402	0.021956	-0.337107	0.7368
D(LNWMC(-1))	-0.025367	0.020948	-1.210976	0.2290
CointEq(-1)*	-0.575458	0.094492	-6.090048	0.0000
R-squared	0.350609			
Adjusted R-squared	0.289729			
S.E. of regression	0.127907			
Sum squared resid	1.570591			
Log likelihood	72.82783			
Durbin-Watson stat	2.069346			

Source: E-view Output

The table presents the Short-Run Error Correction Model (ECM) result obtained from the ARDL framework in E-views. The result explains the short-run dynamics among the variables and the speed at which deviations from long-run equilibrium are corrected. The coefficient of D (LNRPC) is -0.003575 with a probability value of 0.9067, which is greater than 0.05. This indicates that, in the short run, changes in LNRPC have a negative but statistically insignificant effect on the dependent variable. A 1% increase in LNRPC leads to approximately 0.0036% decrease in the dependent variable, but the effect is not significant. The lagged value of LNRPC has a coefficient of 0.032767 and a p-value of 0.2514. This suggests a positive but insignificant short-run effect of the previous period's LNRPC on the dependent variable. The coefficient of D (LNECC) is 0.086606 with a p-value of 0.0831. This indicates that LNECC exerts a positive short-run effect on the dependent variable and is statistically significant at the 10% level, though not at the 5% level. Specifically, a 1% increase in LNECC increases the dependent variable by about 0.087% in the short run.

The lagged value of LNECC has a coefficient of 0.008066 and a probability value of 0.8784, indicating a positive but statistically insignificant effect. The coefficient of D (LNREC) is -0.044145 with a p-value of 0.0768. This implies that LNREC has a negative short-run effect on the dependent variable and is significant at the 10% level. A 1% increase in LNREC reduces the dependent variable by about 0.044% in the short run. The lagged value of LNREC has a coefficient of -0.037579 with a p-value of 0.1457, showing a negative but statistically insignificant short-run relationship. The coefficient of D (LNWMC) is -0.007402 with a p-value of 0.7368. This indicates that LNWMC has a negative and insignificant short-run effect on the dependent variable. The lagged value of LNWMC has a coefficient of -0.025367 and a p-value of 0.2290, indicating a negative but insignificant short-run influence. The ECM coefficient is negative, statistically significant, and correctly signed, which confirms the existence of a long-run equilibrium relationship among the variables. The value of -0.575458 implies that approximately 57.5% of the short-run disequilibrium is corrected each period toward the long-run equilibrium. This means that when deviations occur, the system adjusts relatively quickly back to equilibrium. The probability value of 0.0000 further confirms that the adjustment process is highly significant statistically.

The R-squared value indicates that approximately 35.1% of the variations in the dependent variable are explained by the independent variables included in the model. After adjusting for the number of explanatory variables, about 28.9% of the variation in the dependent variable is explained by the model. The Durbin-Watson statistic is approximately 2, indicating the absence of serious autocorrelation in the residuals of the model.

DISCUSSIONS OF FINDINGS

From the regression output, it is observed that remediation and pollution cost exert a statistically significant effect on the Return on Assets (ROA) of listed oil and gas firms in Nigeria. This empirical outcome suggests that resource allocations directed toward environmental rehabilitation and mitigation protocols are not merely sunk operational costs; rather, they serve as critical determinants of corporate financial performance within the extractive sector. From a theoretical perspective, this finding strongly converges with the tenets of Stakeholder Theory and Legitimacy Theory. The Nigerian oil and gas industry is characterized by heightened environmental degradation, regulatory scrutiny, and host-community agitations hence, expenditures on remediation control function as a strategic mechanism to secure organizational legitimacy. By dedicating capital to pollution control, these firms effectively mitigate ecological friction, minimize the risk of disruptive host-community hostilities, and avert punitive regulatory sanctions. Consequently, this maintains operational continuity and protects the asset base from impairment, ultimately manifesting as an improved return on corporate assets. This finding aligns with the empirical evidence of Amalya et al. (2023), who evaluated the transmission mechanism of green accounting on financial performance using environmental performance as a mediating construct. Utilizing ROA as the financial baseline, their findings similarly indicated that remediation investments exert a significant influence on corporate profitability. Conversely, the results depart from the established paradigm presented in Akuboere and Korolo (2024), whose decomposition of environmental expenditures revealed that pollution prevention costs yielded a non-significant, negative effect on ROA, whereas only detection costs demonstrated a significant positive relationship. Similarly, this outcome diverges from the empirical conclusions of Cletus et al. (2022), who investigated quoted Nigerian oil and gas firms from 2000 to 2020. Their regression diagnostics demonstrated that front-end pollution prevention costs exerted a statistically non-significant effect on Return on Equity (ROE). The empirical variance observed between this study and the documentation of Cletus et al. (2022) and Akuboere and Korolo (2024) can be methodologically attributed to differences in temporal scopes, structural shifts in Nigeria's environmental regulatory enforcement, and specific variations in the proxies used to capture the independent environmental constructs.

Secondly, the regression analysis indicates that emission cost control does not yield a statistically significant effect on the Return on Assets (ROA) of the selected oil and gas firms in Nigeria in spite of the positive relationship. This statistical reality implies that the current capital outlays dedicated to carbon and gas flaring emission mitigations do not directly translate into short-term improvements in accounting-based profitability metrics. This empirical outcome can be interpreted through the lens of Legitimacy Theory. It indicates that while emission expenditures are necessary to fulfill regulatory compliance mandates and sustain the institutional "license to operate," they primarily function as defensive compliance costs rather than value-generating strategic investments. This is because carbon emission control measures in the Nigerian extractive sector often demand substantial capital expenditures on specialized engineering technologies without offering immediate internal cost-efficiencies, they act as a short-term drag on asset productivity. This finding structurally conforms to the empirical evidence of Ibrahim and Kefe (2024). Utilizing a random effects panel data model to analyze sustainability indices, they documented that carbon emissions and their associated compliance burdens exert a distinct negative pressure on both ROA and ROE, substantiating the claim that emission-related costs present an immediate financial trade-off. On the contrary, the results depart from the empirical paradigm of Omaliko et al. (2021), whose generalized least squares (OLS) regression metrics established that carbon emission disclosure quantified via the GRI G4 index exerted a positive and statistically significant effect on corporate sustainability at 1% significance level. This divergence suggests that while the disclosure of emission metrics generates positive market signals and boosts institutional reputation, the actual *cash outflows* required for emission control infrastructure place a heavy burden on current asset returns. Furthermore, this finding partially deviates from Cletus et al. (2022), whose empirical evaluation of environmental accounting costs (EAC) demonstrated that while internal and external failure costs (EIFC/EEFC) significantly altered financial performance dynamics, front end prevention and detection costs (EPPC/EDC) remained statistically neutral in relation to asset yields.

Furthermore, the empirical diagnostics demonstrate that renewable energy costs do not exert a statistically significant effect on the Return on Assets (ROA) of selected oil and gas firms in Nigeria. This statistics indicate that the integration of renewable energy alternatives within the traditional fossil-fuel energy mix has

reached neither the critical mass nor the economies of scale necessary to fundamentally alter the corporate asset-yield profile. The finding reflects a critical limitation within Stakeholder Theory. When firms invest in green energy alternatives primarily to appease external green stakeholders, those investments can conflict with internal profit-maximization objectives if the underlying green technologies remain expensive. In the Nigerian context, the high upfront capital cost of transitioning to renewable energy, coupled with the absence of robust fiscal incentives or carbon-credit subsidization frameworks, prevents these expenditures from producing visible improvements in short-term accounting profits. This outcome is consistent with the empirical evidence of Hulshof et al. (2020). In their large-scale panel data analysis of 920 firms, they failed to establish any statistically significant link between renewable energy deployment and firm profitability. They concluded that a corporate "win-win" scenario where higher profits and environmental preservation converge seamlessly does not automatically materialize. Instead, firms appear to absorb a premium for renewable energy that is decoupled from immediate economic rewards. Conversely, the results depart from the macro-conclusions of Hendrik et al. (2024), whose systematic literature review (SLR) and PRISMA-compliant bibliometric synthesis asserted that renewable energy integration significantly and positively alters firm performance. This divergence underscores a structural variation in economic environments. While renewable energy investments yield positive performance returns in developed jurisdictions due to mature innovation ecosystems and supportive regulatory frameworks, they remain financially neutral in developing economies like Nigeria due to structural supply-chain challenges and high initial installation costs.

Lastly, the inferential results evaluating the effect of waste management cost confirm that waste management expenditures exert a statistically significant effect on the Return on Assets (ROA) of oil and gas firms in Nigeria. This finding highlights that the operational cost of treating, discharging, and disposing of hazardous and non-hazardous production by-products are deeply integrated into the financial performance architecture of the extractive sector. From the theoretical stance of Legitimacy Theory, corporate waste management practices serve as a highly visible indicator of institutional compliance. For oil and gas companies, improper waste disposal can lead to severe reputational damage, lengthy litigations, and devastating environmental liabilities. Consequently, systematic financial investments in waste management mitigate these liabilities, optimizing the operational environment and directly influencing asset efficiency metrics. This finding aligns with the foundational logic presented by Aleluia and Ferrão (2016). Their empirical analysis of manufacturing entities confirmed that environmental compliance policies and waste management strategies significantly influence corporate valuation metrics, demonstrating that market and operational frameworks respond sharply to how organizations manage their waste. Furthermore, this finding is consistent with the empirical evidence of Nwanwu (2022), who specifically investigated the relationship between waste management costs and financial performance within the Nigerian oil and gas sector. Utilizing descriptive and explanatory regression models, Nwanwu documented a significant, though weak and negative, relationship between waste management outlays and return on investment. This confirms that while these costs reduce immediate liquidity, their impact on overall financial performance remains statistically significant. Additionally, the results complement the conclusions of Balogun and Gospel (2022), who examined the relationship between hazardous waste management disclosures and investors' perceptions of firm value using multiple regression analysis. Their findings indicated that while hazardous waste management can create a short-term financial burden, it generates positive financial rewards over the long term. This is because equity markets assign a valuation premium to firms that maintain transparent environmental disclosure practices, supporting the long-term business case for green accounting.

CONCLUSION

This study evaluated the empirical nexus between green accounting architectures and the financial performance of selected listed oil and gas firms in Nigeria, grounded within the theoretical paradigms of Stakeholder and Legitimacy theories. Corporate financial performance was proxied via Return on Assets (ROA), while green accounting was decomposed into four critical dimensions: remediation and pollution control costs, emission cost control, renewable energy costs, and waste management costs. Based on the empirical insights derived from the inferential diagnostics, the following conclusions are established: First, capital allocations toward remediation and pollution control yield a statistically significant effect on ROA. This proves that environmental rehabilitation expenditures are not merely deadweight operational losses; rather, they serve as

vital strategic investments that secure an organization's "license to operate," minimize host-community disruptions, and optimize asset productivity. Secondly, expenditures targeting emission cost control do not exert a statistically significant positive effect on asset returns. This underscores the reality that current carbon mitigation outlays function primarily as defensive compliance costs. They demand immediate cash outflows for complex engineering technologies without yielding immediate, short-term accounting returns. Thirdly, renewable energy costs remain statistically neutral regarding asset yields. This indicates that green energy transitions within the Nigerian oil and gas sector have not yet achieved the economies of scale or structural maturity required to positively influence short-term corporate profitability. Lastly, waste management costs significantly influence corporate financial performance. This confirms that systemic investments in treating and disposing of hazardous production by-products are deeply integrated into the sector's operational efficiency, shielding firms from long-term environmental liabilities and reputational impairment.

Summarily, the study concludes that while specific green accounting components (remediation and waste management) act as significant drivers of financial performance by mitigating operational risks and securing institutional legitimacy, others (emission control and renewable energy) present short-term financial trade-offs due to high structural costs and compliance burdens in Nigeria.

POLICY RECOMMENDATIONS

In alignment with the research objectives and empirical findings, the following policy recommendations are put forward for corporate strategists, industry regulators, and government policymakers:

- For Corporate Management, Oil and gas firms should transition from reactive environmental remediation to proactive, integrated pollution control strategies. Because remediation significantly influences asset returns, institutionalizing these practices into core budgeting frameworks will systematically reduce host-community friction and protect corporate assets from operational disruptions. While for regulators, The Nigerian Upstream Petroleum Regulatory Commission (NUPRC) should standardize remediation benchmarks, ensuring that environmental rehabilitation funds are transparently managed and tied to verifiable ecological restoration milestones.
- Given that emission cost control places a heavy burden on current asset returns without improving short-term profitability, the Federal Government should introduce fiscal incentives. These should include tax credits, capital allowances on gas-flare reduction technologies, or carbon credit offsets to alleviate the immediate financial drag on compliant firms. Firms should look beyond basic regulatory compliance and explore innovative technologies that convert captured carbon/gas emissions into secondary commercial products (e.g., gas-to-power projects), turning a defensive compliance cost into a revenue-generating stream.
- To bridge the gap where renewable energy investments remain financially neutral, the Ministry of Petroleum Resources, in tandem with the Energy Commission of Nigeria, should craft a robust policy framework. This framework should offer pioneer status, tariff exemptions, and subsidies for renewable energy infrastructure imported by oil and gas firms looking to green their operational fields. Firms should adopt a collaborative, joint-venture approach to renewable energy infrastructure procurement. Sharing the high initial capital costs of green energy transitions across industry clusters will help firms achieve the economies of scale necessary to protect their asset yield profiles.
- The Financial Reporting Council of Nigeria (FRCN), in collaboration with the Federal Ministry of Environment, should establish unified, mandatory disclosure templates for hazardous and non-hazardous waste management costs. Standardizing these green accounting disclosures will enhance financial transparency, allowing investors to properly value compliant firms. Oil and gas organizations must invest in modern circular-economy waste technologies. By reducing, recycling, and reusing industrial waste streams, firms can minimize overall waste management costs, enhance eco-efficiency, and bolster their overall Return on Assets.

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