How to Cite:
Chukwu, A. V., Ugwoke, R.O., Idu, C.D., Aferokhe, S. E., & Beals, S. (2026). Green accounting practices and the profitability of oil and gas companies in Nigeria. *International Journal of Economic Perspectives*, *20*(6), 605–619. Retrieved from https://ijeponline.org/index.php/journal/article/view/1334

Green accounting practices and the profitability of oil and gas companies in Nigeria

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***Abstract*---**The study examined Green Accounting practices and the Profitability of Oil and Gas companies in Nigeria. The research was carried out using an Ex-post facto research design. Secondary data were employed for this study. A purposive sampling technique was adopted, selecting companies based on the availability and completeness of their financial data for the study period. The research revealed a significant negative effect of Environmental Cost Accounting on ROE, while Carbon accounting disclosure has a positive and significant effect on ROE. The study, therefore, concluded that environmental costs have significant positive effects on profitability. In contrast, carbon accounting disclosure has a significant positive relationship with profitability. Therefore, the study concluded that Environmental expenditures have a direct and negative impact on a firm's profitability in the short run. Transparency about carbon accounting practices has a positive influence on a firm's Return on Equity. Carbon accounting disclosure is a powerful tool for driving shareholder value. The study recommended that Oil and gas companies in Nigeria should adopt a strategic approach to managing environmental costs such as investing in environmental-friendly initiatives that generate long-term financial

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Submitted: 27 April 2026, Revised: 18 May 2026, Accepted: 07 June 2026

benefits. It also went further to recommend that Oil and Gas companies should prioritize transparency in their sustainability reporting as this can improve their ROE by attracting environmentally conscious investors and gaining a competitive edge over companies without carbon disclosure.

***Keywords*---**Green accounting practices, Carbon accounting disclosure, environmental cost accounting, Profitability, Return on Equity, Oil and Gas companies.

Introduction

The environment in which we live as humans need to be highly maintained. The term "green" is used to connote "environment" while accounting is the identifying, recording and classifying financial information. The main objective of green accounting is to assist business to achieve environmental goals as well as financial goals (Ravikumar & Aithal, 2020). Consequently, it takes into consideration the improvement of the environmental performance of a business (Amol, 2023). Therefore, in simple terms, Green accounting can be described as an accounting for the environment. In addition, it is an accounting that takes into cognizance, the environment cost of the impact of oil operations on the environment. The wellness of the environmental atmosphere is vital to human existence. However, the need to keep a clean and sustainable environment becomes pertinent.

The main purpose for the existence of a business is to make profit and create wealth for the shareholders. Nyugen et al (2021) expressed that the traditional focus of businesses on maximizing wealth is facing increasing scrutiny due to its environmental consequences. This can be seen particularly in the oil and gas sector, where activities significantly contribute to greenhouse gas emissions and environmental degradation (Nyugen et al. 2021). While investors undoubtedly seek high returns on investment, the landscape is shifting, and growing awareness of environmental challenges and stricter regulations are prompting investors to consider environmental, social, and governance (ESG) factors alongside financial performance (Jeong-Hwan & Jin Hyung, 2021). Bebbington and Unerman (2022) suggested that green accounting should adopt the cost effectiveness approach such that, the cost of maintaining the environment should not outweigh the benefits enjoyed from its sustenance. Within this context, Andrean (2021) opined that green accounting emerges as a crucial tool for bridging the gap between environmental impact and financial profitability. He further explained that by incorporating environmental costs and benefits into traditional accounting practices, green accounting aims to provide a more holistic picture of a

Statement of the Problem

Profitability remains the primary driver of corporate strategy, particularly within the Nigerian oil industry, which operates as a vital but environmentally contentious player in the global energy market (Pelser & Gaffley, 2020; OPEC,

2023). However, this relentless pursuit of financial gain is increasingly entangled with sustainability imperatives, as fossil fuel extraction contributes significantly to global environmental degradation and climate change (IEA, 2023). In Nigeria, where the oil sector is the economic cornerstone, companies face mounting pressure from global stakeholders to mitigate their environmental footprint while navigating the inherent tension between immediate financial returns and long-term ecological responsibility.

The global energy landscape is undergoing a fundamental transition, necessitating the integration of environmental costs into traditional financial reporting through Green Accounting (Bebbington & Unerman, 2022). These frameworks aim to offer a holistic view of a firm's financial health by identifying externalities that traditional accounting often overlooks (IIRC, 2023). Despite the potential for Green Accounting to enhance transparency and risk mitigation, its adoption in the Nigerian oil sector is hampered by a perceived conflict between environmental stewardship and short-term profitability, creating a strategic hurdle for firms attempting to balance these competing interests (Jeong-Hwan & Jin Hyung, 2021).

A critical disconnect persists within the Nigerian oil sector, where environmental considerations often remain secondary to profit generation, leading to the mispricing of assets and the erosion of investor trust. This misalignment prevents the industry from fully realizing the benefits of sustainable practices and obscures the true relationship between environmental performance and firm profitability. Consequently, a thorough investigation into how Green Accounting practices influence financial outcomes is essential; such research will empower stakeholders to harmonize profitability with sustainability, ultimately fostering a more responsible and resilient oil and gas industry in Nigeria.

Objectives of the study

Generally, the study aims to evaluate the effect of Green accounting practices on profitability of oil and gas companies in Nigeria. Specifically, the study aims to achieve the following:

i. ascertain the effect of Environmental cost accounting on Return on Equity of Listed Oil and Gas companies in Nigeria.
ii. assess the effect of Carbon accounting disclosure on Return on Equity of Listed Oil and Gas companies in Nigeria.

Literature Review
Green Accounting Practices

Green accounting practices in Nigeria are gaining attention from scholars, practitioners, and professional accounting bodies. Green accounting is a practice that involves providing information on the social and environmental costs that may arise from production externalities. International Federation of Accountants (IFAC) defined green accounting as a process of identification, collection, analysis, and use of physical information on the use, flow, and destinies of energy, water, and materials and monetary information on environment-related costs, earnings, and savings. Also, the IFAC definition focused on the accountant and auditor

roles in tracking or verifying environment-related information in financial and other reports (IFAC, 2005). While the US EPA (1995) defined Green accounting as Green Accounting or Environmental Accounting is defined as 'Identifying and measuring the costs of environmental materials and activities and using this information for environmental management decisions. They emphasized that the purpose is to recognize and seek to mitigate the negative environmental effects of activities and systems'. Environmental Protection Agency (EPA) was more specific in its definition of environmental accounting concept to include National income accounting, Financial accounting, and Internal business managerial accounting (EPA, 1995). According to the UN, it aims to help companies achieve sustainable development, conserve the environment, and maintain good relationships with the community. Green accounting practices help businesses measure, manage, and mitigate their environmental impacts and avoid future litigations with regards to compliance to laws and regulations guiding Green Accounting practices. They can also help businesses identify the cost of environmental conservation activities and the benefits gained from those activities (UN, 2014).

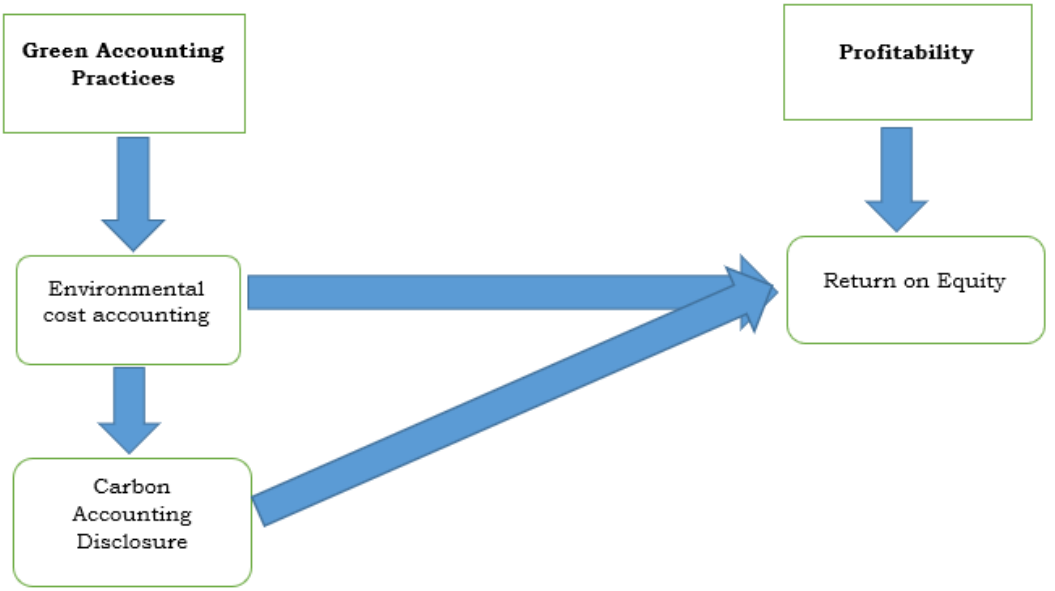
Operationally, Green Accounting practices can be said to be activities carried out by companies to measure the environmental impact on the performance of their businesses. It also involves reporting and disclosing information such as presenting financial, social, and environmental accounting information in a single reporting package. Also, analyzing costs and benefits, that is, calculating the cost and effectiveness of a company's environmental protection activities. The goal of green accounting is to help stakeholders, such as management, shareholders, and customers, evaluate a company's financial position, business performance, and sustainability. Green accounting practices include metrics such as environmental cost accounting, environmental management accounting, carbon accounting disclosure, environmental life cycle assessment among others. Laws related to Green Accounting include Environmental protection water (Prevention and control pollution) Act, 1974; The Air (Prevention and control pollution) Act, 1981; The Environment (Protection) Act, 1986; The Forest Conservation Act, 1980; Hazardous Waste (Management and Handling) Rules, 1986, among others.

Profitability

The main purpose of establishing a business is to make profit. Profitability is the main objective of any business, as profit essential for long-term survival. Profitability is the ability of a company to generate profit within a specific period, usually one business year (Wahyuningsih et al., 2015). Profit can be calculated as Income less expenses. It can also be analyzed using profitability ratios such as current ratios, quick ratios, return on Investments, return on assets among others (Said and Ali, 2016). Profitability is determined by analyzing a business's income and expenses. Income is the amount of money that a business earns from its primary operations, such as the sale of goods or services. However, funds from sources like loans are not considered income; they are simply cash transactions to support business operations or purchase assets, while expenses are the costs of resources consumed during business activities. For example, seeds are an expense for a farm because they are used up in the production process. A

business's profitability is typically measured using an income statement, which outlines income and expenses over a specific period, usually a year. This is a key indicator of a business's success. An unprofitable business cannot last, while a highly profitable one can provide a significant return on investment for its owners. Profitability, in essence, is the ability of a company to generate income from its business activities. It shows how effectively a business uses its resources to generate more income than it spends on expenses. Essentially, it is a key measure of a company's financial health and efficiency, showing its ability to provide a return on the money invested in it.

3 Methodology



An *Ex-post Facto* research design was used for the study and data was gotten from secondary sources. Data was gotten from annual reports of listed oil and gas companies in Nigeria between 2020-2024. Purposive sampling technique was utilized for sample selection. The analysis of data for this study was done based on the data collected from publications of the Nigerian Exchange Group (NGX) and the annual report and accounts of the listed oil and gas companies in Nigeria. The data analysis followed a structured four-stage econometric protocol using E-Views 13. These include descriptive statistics, panel unit root tests, diagnostic tests and Granger causality tests. All tested at 0.1 level of significance.

3.1 Model Specification

The model for this study took the following form:

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \mu$

Where:

Y	=	ROE (dependent variable)
X	=	Green Accounting practices (explanatory/independent Variable)
α	=	constant term (intercept)

β_1- β_2 = Coefficients of Green Accounting practices
μ = Error term (stochastic term)
Explicitly, the equation can be defined as:
ROE = f (Green Accounting Practices) + μ
Representing the equations with the variables of the construct, hence the equations below are formulated:
$ROEit = \alpha + \beta 1 \cdot ECA_{it} + \beta 2 \cdot CAD_{it} + \varepsilon_{it}$
Where:
α = Constant term (intercept)
β_{it} = Coefficients to be estimated i in period t
μ_{it} = Error term/Stochastic term i in period t

ROEit: Return on Equity for firm i at time t
ECAit: Environmental Cost Accounting score for firm i at time t
CADit: Carbon Accounting disclosure dummy (0/1) for firm i at time t
εit: Error term capturing unobserved factors

Why Use 0 and 1? (Dummy Variable Approach)
CAD_it = 0 means the firm did not disclose a sustainability report (no carbon accounting
CAD_it = 1 means the firm did disclose a sustainability report (carbon accounting present)
This dummy-variable technique turns qualitative "yes/no" information into a numerical regressor. It's standard in accounting and finance studies whenever you need to model the presence or absence of an attribute.

4 Data Presentation and Analysis

This study examined the effect of Green Accounting Practices on the Profitability of Oil and Gas companies in Nigeria. Specifically, the study investigated the effect of Environmental costs, carbon accounting disclosure on ROE – a measure of Profitability. Based on data availability, the researcher selected five (5) listed oil and gas firms in Nigeria and extracted the data for analysis. The study employs panel data from five firms over the period 2020–2024 to investigate the effects of Environmental Cost Accounting (ECA), Carbon Accounting disclosure (CAD), on Return on Equity (ROE). Therefore, this chapter presents the results obtained from regression analysis carried out with the secondary data collected for this research work.

Table i: Descriptive Statistics

Sample: 2020 2024			
	ROE	**LOG_EC**	**CA**
Mean	0.039580	13.73902	0.400000
Median	0.075733	14.04360	0.000000
Maximum	2.078425	19.01946	1.000000
Minimum	-3.419433	10.44651	0.000000
Std. Dev.	0.840072	1.967668	0.500000
Skewness	-2.355050	0.340593	0.408248

Kurtosis	13.98670	3.480089	1.166667
Jarque-Bera	148.8466	0.723437	4.195602
Probability	0.000000	0.696478	0.122726
Observations	25	25	25

Source: Author's Computation 2025

The descriptive statistics presented for the variables Return on Equity (ROE), Earnings Per Share (EPS), Log of Environmental Cost (LOG_EC), Carbon Accounting Disclosure (CA), over the 2020-2024 period provide crucial insights into the data distribution and underlying characteristics of the sample.

The mean ROE of 3.96% suggests moderate profitability on average across the sample firms, though the median ROE of 7.57% indicates that half of the firms perform better than this level, pointing to a skewed distribution. This is confirmed by the negative skewness of -2.36 and an exceptionally high kurtosis of 13.99, implying a heavy left tail and presence of extreme negative outliers, which may correspond to firms experiencing significant losses (minimum ROE of -3.42).

The log environmental cost (LOG_EC) has a mean of 13.74 and a median of 14.04, with moderate skewness (0.34) and kurtosis (3.48), suggesting a fairly symmetric and mesokurtic distribution, which is consistent with the log transformation stabilizing variance and reducing skewness.

The carbon accounting disclosure (CA) variable, a dummy variable, has a mean of 0.40, indicating that 40% of the firms disclosed sustainability reports during the sample period. The skewness and kurtosis values near zero reflect the binary nature of this variable.

The Jarque-Bera tests reveal significant departures from normality for ROE (p-values = 0.000), confirming the presence of non-normal distributions likely due to outliers and skewness. LOG_EC and CA do not reject normality at conventional levels.

4.1 Testing for Unit Root Test

In panel data econometrics, the asymptotic properties and reliability of estimators are critically influenced by the dimensions of cross-sectional units (N) and time periods (T), with Pesaran and Smith (1995) emphasizing that consistent inference typically requires both N and T to grow large simultaneously. In this study, we used panel unit root tests to check the stationarity of our key variables: Return on Equity (ROE) and Environmental Cost (EC). These tests combine information across the five firms and five years in our dataset to improve reliability.

Table ii: Unit Root Tests

Variable	Test Method	Statistic	p-value	Stationarity Conclusion
ROE	PP - Fisher Chi-	32.34	0.0004	Reject unit root → Stationary

Variable	Test Method	Statistic	p-value	Stationarity Conclusion
	square			
	PP - Choi Z-stat	-3.46	0.0003	Reject unit root → Stationary
ΔEC (First Difference of Environmental Cost)	PP - Fisher Chi-square	16.86	0.0175	Reject unit root → Stationary after differencing
	PP - Choi Z-stat	1.65	0.2506	Fail to reject unit root → Inconclusive

Source: Author's Computation 2025

The panel unit root tests reported apply the Phillips-Perron (PP) Fisher-type test and the Choi Z-statistic, both of which aggregate individual unit root test statistics across the panel to improve testing power relative to univariate counterparts (Maddala & Wu, 1999; Choi, 2001). These tests accommodate heterogeneity in the autoregressive parameters across cross-sectional units and allow for individual fixed effects, reflecting realistic economic heterogeneity (Pesaran & Smith, 1995).

The null hypothesis for these tests is that each individual series contains a unit root (non-stationary), while the alternative posits stationarity for at least some or all units. The tests incorporate Newey-West automatic bandwidth selection and Bartlett kernel weighting to correct for serial correlation and heteroscedasticity in the error terms, enhancing robustness (Newey & West, 1987).
For Return on Equity (ROE), the PP Fisher Chi-square statistic is 32.34 ($p = 0.0004$), and the Choi Z-statistic is -3.46 ($p = 0.0003$), strongly rejecting the null hypothesis of a unit root.

Similarly, for the first difference of Environmental Cost (D(EC)), the Fisher Chi-square is 16.86 ($p = 0.0175$), rejecting the null, while the Choi Z-statistic is 1.65 ($p = 0.25$), which does not reject the null at conventional levels. This mixed evidence may reflect limited power due to the small sample size or cross-sectional heterogeneity.

These results align with the theoretical framework that profitability measures like ROE tend to be stationary. The rejection of the unit root null for ROE supports the validity of subsequent regression analyses involving ROE in levels (Banerjee et al., 1993).

In summary, the panel unit root tests confirm that the variables under study exhibit differing orders of integration, necessitating tailored econometric treatment. This rigorous testing framework, grounded in the seminar works of Pesaran and colleagues, ensures that the econometric modeling proceeds on a sound statistical foundation, enhancing the reliability of empirical findings.

4.2 Testing for Cross-section test

Model 1
ROE = α + β1*ECA + β2*CAD + ε
Panel EGLS Regression Results for Model 1

Table iii: Dependent Variable: **Return on Equity (ROE)**
Sample: 2020–2024 | Cross-sections: 5 | Observations: 25

Variable	Coefficient	Std. Error	t-Statistic	p-value
LOG_EC	-0.0156	0.0055	-2.83	0.0098**
CA	0.1011	0.0588	1.72	0.0994*
Constant (C)	0.2292	0.0752	3.05	0.0059**

R-squared (Weighted)	0.2765
Adjusted R-squared	0.2107
Standard Error of Regression	1.0528
F-statistic	4.20
Prob(F-statistic)	0.0285**
Durbin-Watson Statistic	1.95

*Authors Computation 2025 *p < 0.10, **p < 0.05*

Table v: Diagnostic Tests for Residual Cross-Section Dependence

Test	Statistic	d.f.	p-value
Breusch-Pagan LM	4.78	10	0.9054
Pesaran Scaled LM	-1.17	—	0.2431
Pesaran CD	0.89	—	0.3758

Authors Computation 2025

Discussion of Result

This study employs a panel Estimated Generalized Least Squares (EGLS) regression with cross-section Seemingly Unrelated Regression (SUR) correction to examine the influence of environmental cost accounting (LOG_EC) and carbon accounting disclosure (CAD) on firm profitability, proxied by Return on Equity (ROE). The balanced panel comprises five firms observed annually over five years (2020–2024), totaling 25 observations.

The estimated coefficient for LOG_EC is -0.0156 (t = -2.83, p = 0.0098), indicating a statistically significant negative relationship between environmental costs and ROE at the 1% significance level. This suggests that higher environmental expenditures are associated with reduced profitability, consistent with the notion that environmental compliance and sustainability investments may impose short-term financial burdens on firms (Schaltegger & Burritt, 2018). The negative coefficient aligns with prior empirical findings that environmental cost accounting can reveal expenses that directly reduce net returns (Gray et al., 1995).

Conversely, the coefficient on CAD, a binary indicator of carbon accounting disclosure, is positive at 0.1011 but only marginally significant (t = 1.72, p = 0.0994). This implies that firms disclosing carbon accounting practices tend to have higher ROE, potentially reflecting enhanced stakeholder trust and improved corporate reputation (Freeman, 1984; Clarkson et al., 2008).

The model's adjusted R-squared of 0.21 indicates that approximately 21% of the variation in ROE is explained by the included explanatory variables, a moderate explanatory power given the complexity of profitability determinants and the limited sample size.

The Durbin-Watson statistic of 1.95 is close to the ideal value of 2, indicating no evidence of first-order autocorrelation in residuals. According to Gujarati (2004), a DW statistic near 2 supports the assumption of independent errors, which is critical for the validity of hypothesis testing in regression analysis.

Further, the Residual Cross-Section Dependence tests (Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD) yield p-values well above conventional significance levels (p > 0.24), failing to reject the null hypothesis of no cross-sectional dependence. This confirms that residuals are not contemporaneously correlated across firms, justifying the use of cross-section SUR correction in the EGLS framework and supporting the robustness of standard errors (Pesaran, 2004). The F-statistic (4.20, p = 0.028) confirms the overall significance of the model, indicating that the regressors jointly explain variation in ROE.

4.4 Pairwise Granger Casuality tests

Table vi: Pairwise Granger Causality Tests
Sample: 2020-2024
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
EC does not Granger Cause ROE	20	0.01346	0.9090
ROE does not Granger Cause EC		0.01193	0.9143
CA does not Granger Cause ROE	20	1.14324	0.2999
ROE does not Granger Cause CA		12.6440	0.0024
CA does not Granger Cause EC	20	0.39691	0.5371
EC does not Granger Cause CA		4.67232	0.0452

Interpretation of Granger Causality Results

Significant Predictive Relationships (p < 0.05):**
1. **Profitability → Carbon Disclosure (CAD):**
   - `ROE does not Granger Cause CA`: **Rejected** (F=12.64, p=0.0024)

Interpretation: Higher profitability (ROE) predicts future carbon disclosure. This aligns with the resource-based view theory which states that—financially healthy firms invest in sustainability reporting to enhance legitimacy (Waddock & Graves, 1997).
2. Environmental Costs (EC) → Carbon Disclosure (CAD):
EC does not Granger Cause CA: Rejected (F=4.67, p=0.0452)
Interpretation: Rising environmental expenditures precede increased carbon transparency, supporting legitimacy theory where firms justify ecological costs through disclosure (Cho & Patten, 2007).

Non-Significant Relationships (p > 0.05):
Profitability ⇄ Environmental Costs: No predictive links (p > 0.90), suggesting environmental spending neither drives nor is driven by short-term profits.
ROE: No mutual predictability (p > 0.53), implying the profit metric captures distinct temporal dynamics.

Theoretical and Policy Implications
- Directionality Matters: Profitability enables sustainability disclosure (not vice-versa), implying that policy incentives (e.g., tax breaks) should target financially stable firms to boost environmental transparency.

Discussion of Findings

The study finding showed that environmental costs has a negative and significant effect of -0.0156 on profitability measured by Return on Equity (ROE). This indicates that a rise in environmental costs will lead to a decrease in Profitability of listed oil and gas companies in Nigeria. Hypothesis one was fulfilled; therefore, we reject the null hypothesis and accept the alternative since the probability value is less than 0.05. There is no significant effect of Environmental costs on ROE of listed oil and gas companies in Nigeria. Therefore, it is advised that companies streamline and pay attention to their environmental costs by engaging in activities that reduce environmental costs in order to encourage investors to employ their resources and boost their confidence in the ability of the company to remain profitable. To enable companies to achieve business goals while also achieving sustainability goals. The results agree with the studies conducted by Ezenwafor and Ifi (2023), Wulandari, Rastafaela, and Hwihanus (2024); and Odum and Arinomor (2023).

Additionally, the study finding confirms that carbon accounting disclosure has a positive and significant effect of 0.1011 on Return on Equity. This implies that if there is a unit increase in carbon disclosure will lead to a corresponding increase in ROE. There is a significant effect of Carbon accounting disclosure on ROE of listed oil and gas companies in Nigeria. Hypothesis three was fulfilled. Hence, the study will reject the null hypothesis while accepting the alternative. The findings of Ofurum and Mmadubuobi (2023); and Appah, Nkak and Eburunobi (2025) conforms with the findings of this study which agrees that environmental disclosure has a statistically significant effect on return on equity (ROE) oil and gas firms in Nigeria.

Conclusions

Based on the findings of the study, the following conclusions were made:

i. In the short term, environmental expenditures have a direct and negative effect on a firm's profitability as measured by Return on Equity. This implies that while essential for sustainability, these costs pose a tangible financial challenge that firms must strategically manage to mitigate their immediate negative impact.
ii. Being transparent about carbon accounting practices have a positive influence on a firm's profitability (ROE). This suggests that transparent reporting enhances a company's reputation and stakeholder trust, which in turn leads to improved financial performance, and even if the effect is not yet highly significant.

Recommendations

Based on the conclusions of the study, this research made the following recommendations:

a. Oil and gas companies should address the negative effect on environmental costs on ROE by adopting a strategic approach to managing environmental costs. Instead of viewing them as purely expenses, companies should invest in environmental-friendly initiatives that generate long-term financial benefits. This can take the form of implementing waste-to-energy projects that will not only reduce waste disposal costs but also create new revenue stream, directly improving profitability.
b. Oil and gas companies in Nigeria should leverage Carbon Accounting Disclosure to boost ROE. This can be achieved by prioritizing transparency in their sustainability reporting. This transparency can improve their ROE by attracting environmentally conscious investors and gaining a competitive edge over companies without carbon disclosure. This will, in turn build stakeholder trust and boost investor confidence, thereby enhancing corporate reputation.
c. Oil and gas companies in Nigeria should prioritize comprehensive carbon accounting disclosure beyond a bare minimum of compliance. This can lead to enhanced investor confidence, improved risk mitigation such as future litigation and regulatory penalties, and an increased Earning per Share.

Authors Contributions

A.V. Chukwu, the corresponding author, was the initiator of the work. R.O. Ugwoke contributed in supervising the first author in making corrections of the work. C.D. Idu contributed by sourcing for the material used in the work. A.E. Sani contributed by running the analysis and interpreting the results. S. Beals compiled the work and prepared the manuscript.

Acknowledgement

The experiment was conducted in Nigeria. The data analysis and preparation of the manuscript was a part requirements for Ph.D defense in the Accountancy Department, Faculty of Business Administration University of Nigeria Nsukka.

Conflict of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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