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Effect of Environmental Cost on Profitability of Listed Oil and Gas Firms in Nigeria

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Abstract

This study investigates the effect of environmental costs on the profitability of listed Nigerian oil and gas firms over the period 2014 to 2024, with Return on Equity (ROE) employed as the measure of firm performance. The specific objectives of the study are to examine how Environmental Compliance Cost (ECC), Pollution Control Cost (PCC) and Waste Management Cost (WMC) influence Return on Equity (ROE), addressing the growing concern of balancing environmental responsibilities with financial outcomes in the oil and gas sector. The study employed panel data from five listed firms. They are analyzed using panel least squares regression to evaluate the relationship between environmental expenditures and profitability. Findings reveal that Waste Management Cost has a statistically significant negative effect on Return on Equity (β = -0.000611, p = 0.0079), indicating that higher spending on waste management is associated with lower profitability. In contrast, Environmental Compliance Cost (β = 0.000337, p = 0.1324) and Pollution Control Cost (β = 0.000242, p = 0.5389) do not exhibit statistically significant effect on Return on Equity (ROE), suggesting that expenditures in these areas do not immediately constrain firm profitability. Descriptive statistics highlight moderate variability in environmental expenditures and financial performance across the sampled firms, reflecting differences in operational efficiency, management strategies, and sectoral practices. The study contributes to the literature by providing empirical evidence from Nigeria's oil and gas industry on the differential effects of environmental costs on profitability, emphasizing that not all environmental investments affect financial outcomes equally. The results underscore the importance of adopting strategic and cost-effective environmental management approaches to mitigate the negative financial implications of waste management. The study concludes that integrating environmental management into broader operational and strategic initiatives is essential for enhancing firm profitability and achieving long-term sustainability. The findings offer practical guidance for managers, investors, and policymakers in designing policies and strategies that balance environmental compliance with financial performance in resource-intensive industries.

Keywords: *Environmental Cost; Return on Equity; Environmental Compliance; Pollution Control; Waste Management; Financial Performance; Oil and Gas Firms; Nigeria.*

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Introduction

Environmental costs are expenditures that firms incur to manage their environmental impacts, including compliance, pollution control, remediation and waste management. These costs are particularly significant in the oil and gas sector due to the industry's high environmental footprint and increasing regulatory requirements for sustainable operations. Empirical evidence indicates that environmental costs can affect both short-term profitability and long-term corporate value (Mikail & Ene, 2025; Enekwe et al., 2023).

In Nigeria, listed oil and gas companies are subject to stringent environmental regulations that mandate adherence to pollution control, waste management and environmental protection standards. Previous research on Nigerian firms presents mixed findings regarding the relationship between environmental costs and financial performance. Some studies report positive associations; for example, panel data analyses show that pollution control, environmental prevention, and detection costs significantly enhance return on capital employed, suggesting that environmental expenditures may support profitability (Mikail & Ene, 2025). Similarly, other investigations indicate that disclosure of environmental costs can positively influence profitability measures such as net profit margin, although the effects vary by cost type (Okudo & Amahalu, 2023).

Conversely, some studies document limited or nonsignificant effects of environmental costs on financial outcomes. Enekwe et al. (2023) find that certain environmental cost components have no significant impact on profitability proxies, while Salihu et al. (2025) report weak relationships between environmental expenditures and earnings per share. These divergent results highlight the need for a more nuanced understanding of how specific environmental cost types such as compliance, pollution control and waste management affect profitability, particularly return on equity, in the Nigerian oil and gas sector.

This study addresses this gap by examining the impact of environmental cost components on the profitability of listed oil and gas firms in Nigeria using secondary data from annual reports and financial statements. The findings aim to provide evidence-based insights for regulators, managers and investors on the financial implications of environmental management strategies.

Statement of the Problem

Oil and gas firms are expected to manage environmental costs in a manner that ensures regulatory compliance while maintaining or enhancing profitability. Practices such as environmental compliance, pollution control and waste management are intended to protect ecosystems, uphold regulatory standards, and support long-term financial stability. Ideally, these practices should result in balanced corporate performance, where environmental expenditures are justified by improved reputation, stakeholder trust, and operational efficiency.

In practice, the effect of environmental costs on profitability in Nigerian listed oil and gas firms remains unclear and inconsistently documented. Empirical evidence presents mixed results, with some studies reporting positive impacts of environmental spending on financial performance, while others observe weak, insignificant, or variable relationships between specific environmental cost components and profitability measures. Furthermore, incomplete reporting or under-disclosure of environmental expenditures in annual reports limits accurate financial assessment, making it difficult for managers, investors, and regulators to understand how environmental cost structures influence return on equity and other performance indicators.

If this issue remains unresolved, firms may continue to underreport or poorly manage environmental cost data, undermining performance measurement and impairing evidence-based decision-making. Persistent ambiguity regarding the link between environmental costs and profitability can reduce investor confidence, hinder effective environmental investment strategies, and create gaps in policy enforcement and governance. Weak integration of environmental cost management with financial planning may also prevent firms from meeting regulatory expectations and sustainability standards, potentially eroding competitive advantage and long-term shareholder value.

This study addresses these gaps by examining how specific environmental cost components such as compliance costs, pollution control costs and waste management costs affect the profitability of Nigerian listed oil and gas firms, measured through return on equity. The findings are intended to inform managers, policymakers, and investors on effective environmental investment strategies that align sustainability objectives with financial performance.

Objectives of the Study

The primary purpose of this study is to examine the effect of environmental cost on profitability of listed oil and gas firms in Nigeria. The specific objectives are to:

i. assess the effect of environmental compliance cost on return on equity of listed oil and gas firms in Nigeria.
ii. examine the effect of pollution control cost on return on equity of listed oil and gas firms in Nigeria.
iii. investigate the effect of waste management cost on return on equity of listed oil and gas firms in Nigeria.

Research Questions

The study provided answers to the following research questions.

i. What is the effect of environmental compliance cost on the return on equity of listed oil and gas firms in Nigeria?
ii. How does pollution control cost influence the return on equity of listed oil and gas firms in Nigeria?
iii. To what extent does waste management cost impact the return on equity of listed oil and gas firms in Nigeria?

Statement of Hypotheses

The following hypotheses in null form (H_0) guided this study

i. Environmental compliance cost has no significant effect on the return on equity of listed oil and gas firms in Nigeria.
ii. Pollution control cost has no significant effect on the return on equity of listed oil and gas firms in Nigeria.
iii. Waste management cost has no significant effect on the return on equity of listed oil and gas firms in Nigeria.

Scope of the Study

This study focuses on listed oil and gas firms in Nigeria, with the companies themselves serving as the units of analysis. Data are obtained from published annual reports and financial statements, ensuring that the study is based on objective and verifiable secondary data rather than subjective surveys or opinions.

The research is geographically confined to Nigeria, where the oil and gas sector is a critical component of the national economy. This focus enables the study to capture the specific regulatory, environmental, and operational challenges faced by firms in this region, ensuring that the findings are contextually relevant for local policy, governance, and industry practices.

The study examines three independent variables: Environmental Compliance Cost (ECC), Pollution Control Cost (PCC), and Waste Management Cost (WMC). The dependent variable is firm profitability, measured specifically by Return on Equity (ROE). These variables are selected because they are measurable from companies' annual reports and represent key dimensions of environmental cost management and their potential impact on financial performance in the oil and gas sector.

Definition of Terms

i. **Environmental Cost (EC):** Environmental cost refers to expenses incurred by a firm to prevent, reduce, or remediate environmental harm resulting from its operations. In this study, it is operationalized through three components: Environmental Compliance Cost, Pollution Control Cost, and Waste Management Cost.
ii. **Environmental Compliance Cost (ECC):** Expenditures that firms incur to comply with national and international environmental laws, regulations, and standards. This includes costs for permits, environmental monitoring, policy implementation, and regulatory reporting.
iii. **Pollution Control Cost (PCC):** Funds spent to prevent, reduce, or treat pollutants released into air, water, or land during operations. This includes investments in emission reduction technologies, effluent treatment facilities, and air quality control systems.
iv. **Waste Management Cost (WMC):** Expenditures associated with the proper handling, treatment, and disposal of industrial and operational waste. This includes costs for recycling, hazardous waste disposal, landfill management, and other waste mitigation initiatives.
v. **Profitability:** A firm's ability to generate financial gains relative to its resources and investments. In this study, profitability is measured using Return on Equity (ROE).
vi. **Return on Equity (ROE):** A financial performance indicator that measures the percentage of profit a firm generates from shareholders' equity. ROE is calculated as net income divided by total shareholders' equity and reflects management effectiveness in generating returns for investors.

Review of Related Literature

Conceptual Review

Environmental Cost

Environmental cost fundamentally represents the monetary quantification of negative externalities imposed on ecological systems and human welfare by production and consumption activities (Enwien & Orits 2023). This conceptualization moves beyond private corporate expenditure to encompass the societal burden of resource depletion, pollution, and ecosystem degradation, which are frequently excluded from traditional market prices and financial statements, leading to a distortion in economic decision-making.

A critical conceptual distinction lies between internalized and externalized environmental costs. Internal costs are direct financial outlays, such as waste treatment fees or pollution control technology investments, borne by the responsible entity. In contrast, external costs, or negative externalities, are unaccounted impacts transferred to society, including public health consequences from poor air quality or the loss of ecosystem services from deforestation, which represent a core market failure (Madueke & Aliyu 2021).

The valuation of these externalities presents a major methodological challenge. Techniques like shadow pricing and damage cost assessment aim to assign plausible monetary values to non-market environmental goods, thereby making ecological impacts commensurable with conventional economic metrics for integrated analysis. This process is essential for applying the polluter-pays principle and conducting accurate environmental cost-benefit analyses for policy and project appraisal (Chukwu & Bello 2022).

Strategically, the management and disclosure of environmental costs are increasingly seen as a component of corporate risk management and sustainability reporting. Proactive internalization, rather than mere compliance, can drive eco-innovation and operational efficiency, transforming a potential liability into a source of competitive advantage while aligning corporate practice with the broader objectives of sustainable development and circular economy models (Gibson & Adeyemi 2020).

Therefore, the systematic integration of environmental cost accounting into national and corporate frameworks is pivotal for transitioning towards an economy that accurately reflects its true ecological footprint. This paradigm shift is necessary for fostering long-term resilience, ensuring that economic growth does not permanently undermine the natural capital upon which all human activity and well-being ultimately depend.

Environmental Compliance Cost

Environmental compliance cost refers to the direct and indirect financial expenditures incurred by organizations to adhere to environmental laws, regulations, and standards. These costs are fundamental to the polluter-pays principle, representing mandatory investments to prevent, monitor, and control pollution, thereby internalizing a portion of the economic activity's environmental externalities into corporate financial planning (Sharma & Singh, 2022).

Conceptually, these costs are categorized into capital and operational expenditures. Capital costs include investments in pollution control technology and abatement equipment, while operational costs encompass ongoing expenses for monitoring, reporting, certification, and administrative management required to maintain a state of regulatory adherence (Fontana & Benedetti, 2020). This distinction is crucial for analyzing the financial burden and strategic planning of environmental management within firms.

A key aspect is their role as a regulatory driver for technological innovation. While initially perceived as a financial burden, stringent compliance requirements can stimulate the adoption of cleaner production technologies and processes. This can lead to long-term operational efficiencies and reduce resource consumption, potentially offsetting initial expenditures and enhancing competitiveness (Lee & Wang, 2021).

The magnitude of compliance costs is highly dynamic, influenced by regulatory stringency, enforcement consistency, and sector-specific risks. Firms operating in heavily regulated industries like chemicals or mining face significantly higher costs, which can affect market entry, profitability, and global investment decisions, creating a complex interface between environmental policy and economic performance (U.S. Environmental Protection Agency, 2023).

Moreso, effective management of these costs is integral to corporate sustainability strategy, influencing stakeholder trust and market valuation. Proactive compliance, rather than mere reactive expenditure, mitigates risks of fines and reputational damage while signaling commitment to operational integrity and long-term environmental stewardship in an increasingly regulated global economy.

Pollution Control Cost

Pollution control cost constitutes the direct financial outlays specifically dedicated to reducing, managing, or eliminating pollutants released into the environment from industrial or municipal activities. These are operational and capital investments in technologies and processes designed to meet regulatory limits or voluntary standards, forming a core subset of broader environmental compliance expenditures (Nguyen & Pham, 2020).

These costs are primarily divided into end-of-pipe controls and integrated process changes. End-of-pipe solutions, such as scrubbers or wastewater treatment plants, capture pollutants after generation. Integrated pollution prevention modifies production processes to minimize waste creation at source, often proving more cost-effective and efficient in the long term by reducing raw material and energy use (Bhattacharya & Roy, 2019).

A critical economic consideration is the trade-off between abatement cost and environmental damage cost. Optimal pollution control theoretically occurs where the marginal cost of abatement equals the marginal cost of the damage caused by the pollutant, guiding efficient regulatory targets and corporate investment decisions for maximum societal benefit (World Bank, 2022).

The structure of these costs significantly influences industrial competitiveness and innovation. High pollution control costs can impact profit margins and global trade dynamics, yet they also create markets for environmental goods and services, driving technological advancement in monitoring and cleaner production across sectors (Dechezleprêtre & Sato, 2017).

Furthermore, analyzing pollution control costs is essential for effective environmental policy design, ensuring regulations are economically efficient. These investments directly reflect the tangible price of mitigating industrial ecological footprints and transitioning towards sustainable operational models within a circular economy framework.

Waste Management Cost

Waste management cost encompasses all financial expenditures associated with the handling, treatment, recovery, and final disposal of waste materials from point of generation to end-of-life. This includes collection, transportation, processing, landfilling, and the administration of waste streams, representing a critical operational and environmental liability for municipalities and corporations (Wilson & Velis, 2020).

These costs are heavily influenced by the chosen hierarchy of waste management. The traditional linear model of collection and disposal is often cost-intensive, whereas integrated systems prioritizing waste prevention, reuse, and recycling can create revenue streams and reduce long-term liabilities by recovering material value (Kaza et al., 2018).

A significant portion of costs is externalized, not reflected in product prices. The concept of extended producer responsibility (EPR) seeks to internalize these end-of-life management costs by shifting the financial and operational burden from municipalities back to the producers, incentivizing greener product design and reducing municipal expenditure (OECD, 2021).

Technological investment is a major cost driver, particularly for advanced treatment like energy-from-waste facilities or advanced material recovery. The capital intensity and scale required often necessitate public-private partnerships, with cost recovery achieved through gate fees, levies, or municipal taxation, impacting local economics (Marshall & Farahbakhsh, 2020).

Moreover, optimizing waste management cost is fundamental to circular economy transitions, where the goal is to transform waste into a resource. Effective cost analysis must therefore evaluate total system expenditures against environmental and social benefits, moving beyond mere disposal accounting to value retention and sustainable material flow management.

Profitability

Profitability is a financial metric assessing an entity's capacity to generate earnings relative to its expenses, investments, and operational costs over a specific period. It is the ultimate indicator of financial viability and efficiency, demonstrating the success of converting revenue into net income after all obligations are met (Brealey et al., 2020).

Core profitability is measured through interrelated ratios. Return on Assets (ROA) evaluates efficiency in using assets to generate profit, while Return on Equity (ROE) measures the return generated on shareholders' investments. Net profit margin, a key percentage, reveals the portion of revenue remaining as profit after all costs are deducted (Damodaran, 2022).

Profitability is fundamentally driven by revenue growth and cost management. Strategic pricing, market share expansion, and product differentiation enhance revenue, while operational efficiency, supply chain optimization, and disciplined financial control are critical for managing costs of goods sold and administrative expenses to protect margins (Grant, 2021).

It is distinct from liquidity and cash flow, as profitable firms can face short-term insolvency if earnings are not converted into accessible cash. Profitability, therefore, must be analyzed alongside cash flow statements to provide a complete picture of financial health and sustainability (Kieso et al., 2019).

Moreover, sustainable long-term profitability is increasingly linked to strategic non-financial factors, including innovation, brand equity, environmental and social governance performance, and adaptive management, which collectively secure competitive advantage and resilience in dynamic market environments.

Return on Equity

Return on Equity (ROE) is a critical financial ratio measuring a corporation's profitability relative to shareholders' equity. It calculates the net income generated as a percentage of the total equity invested by shareholders, serving as a primary indicator of management's effectiveness in utilizing equity capital to create profits (Pinto et al., 2020).

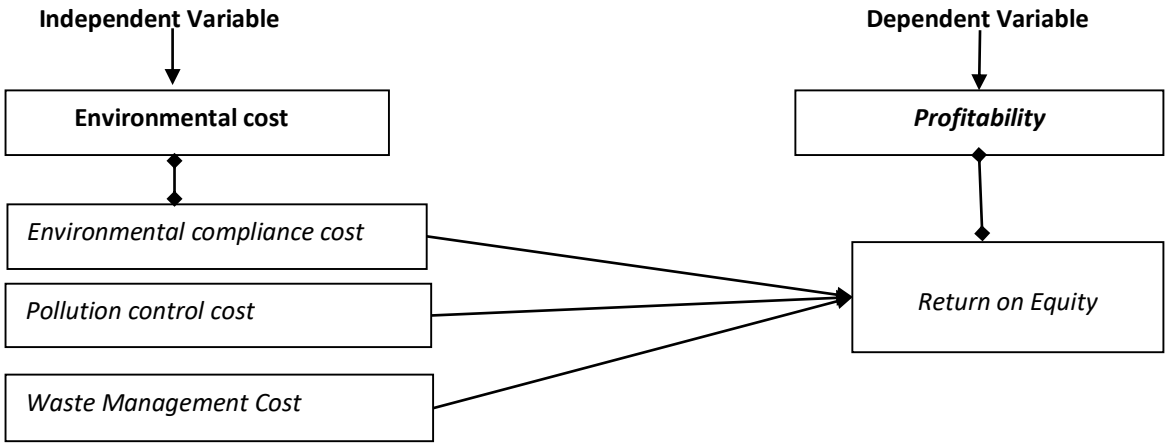
Conceptually, ROE is derived from the DuPont analysis, which decomposes it into three core drivers: operating efficiency (net profit margin), asset use efficiency (total asset turnover), and financial leverage (equity multiplier). This breakdown allows for precise diagnosis of whether performance stems from operations, asset management, or debt financing (Bodie et al., 2021).

A high ROE typically signals effective capital allocation and strong competitive advantages. However, it must be interpreted cautiously, as elevated ratios can also result from excessive financial leverage rather than operational excellence, thereby increasing financial risk and potentially misleading investors about true economic performance (Damodaran, 2020).

The ratio is essential for comparative analysis across firms within the same industry, providing a standardized measure of relative profitability on equity capital. It is a fundamental metric in equity valuation and a key input in models like the sustainable growth rate, which estimates how fast a company can grow using its retained earnings without requiring additional external financing (Ross et al., 2019).

Furthermore, while a vital performance gauge, ROE must be evaluated alongside liquidity and solvency metrics to provide a holistic view of corporate health, ensuring that high returns are achieved through sustainable operations and prudent capital structure rather than excessive risk-taking.

Figure 1
Conceptual Framework of Environmental Cost and Profitability



Note. Author's Compilation (2025).

Theoretical Review

This study is theoretically underpinned by the Natural Resource–Based View (NRBV) developed by Hart (1995), which extends the traditional Resource-Based View by emphasizing the strategic role of environmental capabilities in achieving competitive advantage. The NRBV posits that firms that proactively manage environmental challenges through pollution prevention, waste management, and regulatory compliance can transform environmental costs into valuable strategic resources that enhance firm performance and profitability. Within the context of the Nigerian oil and gas sector, investments in environmental compliance, pollution control, and waste management are expected to reduce operational inefficiencies by optimizing resource use and minimizing waste, thereby lowering production costs. Effective environmental cost management also helps firms comply with stringent environmental regulations, reducing the risk of legal penalties, sanctions, and operational disruptions that could adversely affect profitability. Furthermore, firms that demonstrate strong environmental responsibility tend to enhance their corporate reputation and stakeholder trust, which can attract investors and improve market positioning. Consistent with the NRBV, this study views environmental costs not merely as financial burdens but as strategic investments that support long-term sustainability, strengthen competitive advantage, and ultimately improve firm profitability as measured by Return on Equity (ROE).

Empirical Review

Mikail & Ene (2025) evaluated the impact of environmental costs, including pollution prevention, pollution detection, and community development expenditures, on the profitability of six Nigerian Exchange Group (NGX) listed oil and gas companies from 2013 to 2024. Using panel data analysis and PLS regression, they found that these environmental expenditures significantly and positively influenced return on capital employed (ROCE), suggesting that strategic environmental investments can enhance both profitability and corporate reputation.

Enekwe et al. (2023) examined staff development, community development, and employee health and safety costs on the financial performance of four NGX-listed oil and gas companies from 2010 to 2019. Using panel Ordinary Least Squares (OLS) regression, they found that staff development costs had a negative but statistically insignificant effect on return on assets (ROA), whereas community development and health and safety costs had positive but insignificant effects, indicating limited financial impact from small-scale expenditures.

Salihu et al. (2025) studied the downstream segment of listed Nigerian oil and gas firms, analyzing the influence of community development, waste management, and employee health and safety costs between 2014 and 2023. Their multiple regression analysis revealed that community development costs significantly affected financial performance, while waste management and employee health and safety costs were not significant, highlighting segment-specific variations in environmental cost effects.

Igba et al. (2022) analyzed the relationship between environmental costs and financial performance in ten listed oil and gas firms from 2011 to 2020. Using fixed-effects panel regression, they reported that environmental costs positively and significantly influenced gross profit margin (GPM) and return on capital employed (ROCE), indicating that environmental expenditures can align with improved financial outcomes.

Oyinpreye & Korolo (2025) investigated the effects of environmental costs on multiple financial performance measures including EPS, dividends per share (DPS), net profit margin (NPM) and ROCE across ten NGX-listed oil and gas companies from 2010 to 2023. They found that environmental costs significantly influenced several profitability metrics, demonstrating the complex and multifaceted relationship between ecological expenditures and firm performance.

Methodology

Research Design

This study adopts an *ex-post-facto* research design, utilizing historical financial data from selected oil and gas firms listed in Nigeria.

Area of Study

The research focuses on oil and gas firms operating in Nigeria.

Sources of Data

Secondary data are sourced from the audited financial statements and annual reports of the sampled firms for the years 2014 to 2024. These documents provide detailed financial information necessary to compute environmental compliance cost (ECC), pollution control cost (PCC), waste management cost (WMC) and return on equity (ROE).

Population of the Study

The population consists of all oil and gas firms listed on the Nigerian Stock Exchange as of 2024.

Sample Size and Sampling Technique

Using purposive sampling, five oil and gas firms with consistent, reliable and accessible financial data over the study period were selected. The sample includes: Total Energies Nigeria Plc, Seplat Energy Plc, Oando Plc, NNPC & Conoil Plc.

Model Specification

General Functional Form:

$ROE_{i,t} = f(Environmental\ Compliance\ Cost_{i,t}, Pollution\ Control\ Cost_{i,t}, Waste\ Management\ Cost\ of\ firm_{i,t})$……(i)

Econometric Form:

$ROE_{i,t} = \beta_0 + \beta_1 ECC_{i,t} + \beta_2 PCC_{i,t} + \beta_3 WMC_{i,t} + c_i + \epsilon_{i,t}$……(ii)

Where:

$ROE_{i,t}$	=	Return on Equity of firm *i* in year *t*
$ECC_{i,t}$	=	Environmental Compliance Cost of firm *i* in year *t*
$PCC_{i,t}$	=	Pollution Control Cost of firm *i* in year *t*
$WMC_{i,t}$	=	Waste Management Cost of firm *i* in year *t*
β_0	=	Intercept term
$\beta_1, \beta_2, \beta_3$	=	Coefficients to be estimated
c_i	=	Unobserved firm-specific effects
$\epsilon_{i,t}$	=	Error term

Method of Data Analysis

The study employed both descriptive and inferential statistical techniques for data analysis. Descriptive statistics were used to summarize and describe the characteristics of the data, including measures of central tendency and dispersion, in order to provide an overview of the environmental cost components and firm profitability of listed oil and gas firms in Nigeria.

For inferential analysis, panel data regression techniques were adopted to examine the relationship between environmental compliance cost, pollution control cost, waste management cost, and firm profitability measured by Return on Equity (ROE). Based on the structure of the data, which comprises multiple firms observed over several years, the Panel Least Squares (PLS) estimation technique was employed. The regression analysis was conducted using a balanced panel of five firms over an eleven-year period (2014–2024), yielding a total of 55 firm-year observations. Relevant diagnostic and specification tests were conducted to validate the suitability of the panel regression model and to guide the estimation procedure applied in the analysis. All analyses were performed using EViews statistical software.

Data Presentation and Analysis

Data Presentation

Descriptive Statistics

Table 1: Descriptive Statistics of the variables

	ECC	PCC	WMC	ROE
Mean	587.1818	346.3636	235.0909	0.161273
Median	560.0000	330.0000	215.0000	0.160000
Maximum	900.0000	520.0000	400.0000	0.220000
Minimum	380.0000	220.0000	140.0000	0.100000
Std. Dev.	137.6717	76.75390	71.26172	0.029755
Skewness	0.595935	0.595002	0.728085	0.092460
Kurtosis	2.405195	2.510227	2.469170	2.262229
Jarque-Bera	4.066208	3.794968	5.505068	1.325733
Probability	0.130928	0.149945	0.063766	0.515372
Sum	32295.00	19050.00	12930.00	8.870000
Sum Sq. Dev.	1023488.	318122.7	274224.5	0.047811
Observations	55	55	55	55

Source: E-view 11.0 Statistical Output, 2025

Table 1 presents the descriptive statistics for environmental compliance cost (ECC), pollution control cost (PCC), waste management cost (WMC), and return on equity (ROE) of the sampled Nigerian oil and gas firms from 2014 to 2024. The mean ECC of ₦587.18 million indicates that, on average, firms incur substantial expenditures on environmental compliance activities. Similarly, the average pollution control and waste management costs amount to ₦346.36 million and ₦235.09 million respectively, while the mean ROE of 0.1613 suggests an average return of 16.13 percent over the study period.

The median values are close to their respective means, indicating that the distributions are not unduly influenced by extreme observations. The minimum and maximum values reveal considerable variation across firms, reflecting differences in environmental cost allocation and profitability levels. Standard deviation results show that ECC exhibits the highest variability, followed by PCC and WMC, while ROE displays relatively low dispersion, suggesting stable profitability among the firms.

All variables exhibit positive skewness, indicating mildly right-skewed distributions, while ROE is nearly symmetrically distributed. Kurtosis values are close to three, implying approximately mesokurtic distributions. The Jarque–Bera test results show probability values exceeding the 5 percent significance level for all variables, indicating that the data do not significantly deviate from normality and are suitable for subsequent parametric analyses.

Table 2: Panel Regression Analysis Result of the Time Series Data

Dependent Variable: ROE
Method: Panel Least Squares
Date: 12/26/25 Time: 06:15
Sample: 2014 2024
Periods included: 11
Cross-sections included: 5
Total panel (balanced) observations: 55

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECC	0.000337	0.000220	1.529277	0.1324
PCC	0.000242	0.000391	0.618724	0.5389
WMC	-0.000611	0.000221	-2.763373	0.0079
C	0.023498	0.021283	1.104057	0.2748

R-squared	0.602479	Mean dependent var	0.161273
Adjusted R-squared	0.579095	S.D. dependent var	0.029755
S.E. of regression	0.019304	Akaike info criterion	-4.987010
Sum squared resid	0.019006	Schwarz criterion	-4.841022
Log likelihood	141.1428	Hannan-Quinn criter.	-4.930556
F-statistic	25.76502	Durbin-Watson stat	0.207246
Prob(F-statistic)	0.000000		

Source: E-view 11.0 Statistical Output, 2025

Table 2 presents the results of the Panel Least Squares regression examining the effect of environmental compliance cost (ECC), pollution control cost (PCC), and waste management cost (WMC) on the return on equity (ROE) of five listed Nigerian oil and gas firms over the period 2014–2024.

The results show that environmental compliance cost has a positive coefficient (0.000337) but is statistically insignificant ($p = 0.1324$), indicating that compliance-related expenditures do not have a statistically significant effect on ROE within the study period. Similarly, pollution control cost exhibits a positive but statistically insignificant relationship with profitability (coefficient = 0.000242; $p = 0.5389$).

In contrast, waste management cost is negatively related to ROE and statistically significant at the 1 percent level (coefficient = −0.000611; $p = 0.0079$), suggesting a significant inverse association between waste management expenditure and firm profitability.

The constant term is positive but statistically insignificant, indicating that it does not independently influence ROE in the model. The R-squared value of 0.602 indicates that approximately 60.2 percent of the variation in ROE is explained by the environmental cost variables, while the adjusted R-squared of 0.579 confirms the robustness of the model after accounting for the number of predictors. The F-statistic (25.765) and its associated probability value ($p < 0.01$) indicate that the model is jointly significant.

Test of Hypotheses

Test of Hypothesis One

Restatement of the Hypotheses in Null and Alternative Form

H_{o1}: Environmental compliance cost has no significant effect on the return on equity of listed oil and gas firms in Nigeria

H_{a1}: Environmental compliance cost has significant effect on the return on equity of listed oil and gas firms in Nigeria

Decision Rule

The null hypothesis is rejected if the p-value of the t-statistic is less than 0.05; otherwise, the null hypothesis is not rejected.

Decision

The regression result shows that environmental compliance cost has a coefficient of 0.000337 with a t-statistic of 1.5293 and a p-value of 0.1324, which exceeds the 0.05 significance level. Therefore, the null hypothesis (H_{o1}) is not rejected.

Conclusion

Environmental compliance cost does not have a statistically significant effect on the return on equity of listed oil and gas firms in Nigeria during the study period.

Test of Hypothesis Two

Restatement of the Hypotheses in Null and Alternative Form

H_{o2}: Pollution control cost has no significant effect on the return on equity of listed oil and gas firms in Nigeria

H_{a2}: Pollution control cost has significant effect on the return on equity of listed oil and gas firms in Nigeria

Decision Rule

The null hypothesis is rejected if the p-value of the t-statistic is less than 0.05; otherwise, the null hypothesis is not rejected.

Decision

Pollution control cost has a coefficient of 0.000242 with a t-statistic of 0.6187 and a p-value of 0.5389, which is greater than 0.05. Therefore, the null hypothesis (H_{o2}) is not rejected.

Conclusion

Pollution control cost does not have a statistically significant effect on the return on equity of listed oil and gas firms in Nigeria over the study period.

Test of Hypothesis Three

Restatement of the Hypotheses in Null and Alternative Form

H_{o3}: Waste management cost has no significant effect on the return on equity of listed oil and gas firms in Nigeria

H_{a3}: Waste management cost has significant effect on the return on equity of listed oil and gas firms in Nigeria

Decision Rule

The null hypothesis is rejected if the p-value of the t-statistic is less than 0.05; otherwise, the null hypothesis is not rejected.

Decision

Waste management cost has a coefficient of −0.000611 with a t-statistic of −2.7634 and a p-value of 0.0079, which is less than the 0.05 significance level. Therefore, the null hypothesis (H_{o3}) is rejected.

Conclusion

Waste management cost has a statistically significant negative effect on the return on equity of listed oil and gas firms in Nigeria during the study period.

Summary of Findings, Conclusion and Recommendations

Summary of Findings

The key findings of the study are elucidated below:

i. Environmental Compliance Cost (ECC) was found to have a positive but statistically insignificant effect on return on equity, with a coefficient of 0.000337 (t = 1.5293, p = 0.1324). This indicates that environmental compliance expenditures are positively associated with firm profitability; however, the relationship is not statistically significant among the sampled oil and gas firms.
ii. Pollution Control Cost (PCC) also exhibited a positive but statistically insignificant effect on return on equity, with a coefficient of 0.000242 (t = 0.6187, p = 0.5389). This suggests that pollution control expenditures do not have a statistically significant relationship with profitability during the study period.
iii. Waste Management Cost (WMC) showed a negative and statistically significant effect on return on equity, with a coefficient of −0.000611 (t = −2.7634, p = 0.0079). This finding indicates a statistically significant inverse relationship between waste management costs and firm profitability among the sampled oil and gas firms.

Conclusion

This study highlights the role of environmental costs in influencing the profitability of listed Nigerian oil and gas firms. Analysis indicates that among the environmental cost components examined, Environmental Compliance Cost (ECC), Pollution Control Cost (PCC) and Waste Management Cost (WMC), only waste management cost is significantly associated with return on equity (ROE), exhibiting a negative relationship. In contrast, ECC and PCC, while theoretically relevant, do not show a statistically significant effect on profitability.

These results underscore the complexity of managing environmental costs in a capital-intensive and highly regulated industry. They suggest that profitability is not solely determined by environmental expenditures but also shaped by operational efficiency, regulatory compliance, and broader economic and market conditions.

Consequently, oil and gas firms should adopt an integrated approach that balances environmental responsibility with cost efficiency and strategic operational planning. Such an approach can help firms achieve sustainable profitability while ensuring compliance with environmental regulations and supporting long-term business resilience.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

i. Although Environmental Compliance Cost (ECC) showed a positive but statistically insignificant effect on return on equity, oil and gas firms should continue to invest strategically in environmental compliance. Firms can optimize expenditures by adopting cost-effective technologies and practices that meet regulatory requirements while minimizing unnecessary financial strain.
ii. Given the positive but statistically insignificant effect of Pollution Control Cost (PCC), firms are advised to maintain efficient pollution control programs that minimize environmental risks. Implementing proactive monitoring and preventive measures can help reduce potential liabilities and support sustainability, even if the immediate impact on profitability is limited.
iii. Since Waste Management Cost (WMC) exhibited a significant negative effect on return on equity, firms should focus on improving waste management efficiency. This can be achieved through investment in modern waste reduction technologies, recycling programs, and process optimization to lower costs while maintaining regulatory compliance. Such measures can mitigate the adverse impact of waste management expenditures on profitability.

References

Bhattacharya, A., & Roy, S. (2019). End-of-pipe versus process-integrated techniques: A cost-effectiveness analysis for industrial water pollution control. *Journal of Environmental Management, 231*, 968–975. https://doi.org/10.1016/j.jenvman.2018.10.105

Bodie, Z., Kane, A., & Marcus, A. J. (2021). *Investments* (12th ed.). McGraw-Hill Education.

Brealey, R. A., Myers, S. C., & Allen, F. (2020). *Principles of corporate finance* (13th ed.). McGraw-Hill Education.

Chukwu, L. I., & Bello, A. (2022). Monetary valuation of ecosystem services: A review of methodological approaches. *Journal of Environmental Planning and Management, 65*(8), 1501–1524.

Damodaran, A. (2020). *Investment valuation: Tools and techniques for determining the value of any asset* (4th ed.). Wiley. https://pages.stern.nyu.edu/~adamodar/

Damodaran, A. (2022). *Corporate finance: Theory and practice* (4th ed.). Wiley. https://pages.stern.nyu.edu/~adamodar/

Dechezleprêtre, A., & Sato, M. (2017). The impacts of environmental regulations on competitiveness. *Review of Environmental Economics and Policy, 11*(2), 183–206. https://doi.org/10.1093/reep/rex013

Enekwe, C. I., Ugwudioha, O. M., & Uyagu, B. D. (2023). Effect of environmental costs on the financial performance of listed oil and gas companies in Nigeria. *International Journal of Accounting Research, 8*(1), 31–36. https://doi.org/10.65453/ijar.v8i1.688

Enwien, B. C., & Orits, J. (2023). Externalities and the true cost of economic production: Reconceptualizing environmental liabilities. *Ecological Economics, 204*, 107667.

Fontana, E., & Benedetti, I. (2020). Assessing the cost of compliance: Evidence from Italian manufacturing firms. *Journal of Cleaner Production, 277*, 123295. https://doi.org/10.1016/j.jclepro.2020.123295

Gibson, P., & Adeyemi, O. (2020). Environmental management accounting and corporate strategy: A systematic review. *Sustainability Accounting, Management and Policy Journal, 11*(2), 457–483.

Grant, R. M. (2021). *Contemporary strategy analysis* (11th ed.). Wiley.

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986–1014.

Igba, J. A., Imeokparia, L., & Owolabi, F. (2022). Environmental cost and financial performance of listed oil and gas companies in Nigeria. *Proceedings of the 40th IBIMA Business Conference.* https://ibima.org/accepted-paper/environmental-cost-and-financial-performance-of-listed-oil-and-gas-companies-in-nigeria/

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0: A global snapshot of solid waste management to 2050. World Bank. https://openknowledge.worldbank.org/handle/10986/30317

Kieso, D. E., Weygandt, J. J., & Warfield, T. D. (2019). *Intermediate accounting* (17th ed.). John Wiley & Sons.

Lee, C.-C., & Wang, F. (2021). How does environmental regulation drive technology innovation? Evidence from Chinese manufacturing industries. *Journal of Environmental Management, 297*, 113382. https://doi.org/10.1016/j.jenvman.2021.113382

Madueke, C., & Aliyu, S. (2021). Internalizing externalities: The role of policy and corporate accountability in environmental cost management. *Business Strategy and the Environment, 30*(4), 1892–1905.

Marshall, R. E., & Farahbakhsh, K. (2020). Systems approaches to integrated solid waste management in developing countries. *Waste Management, 33*, 988–1003. https://doi.org/10.1016/j.wasman.2012.12.023

Mikail, N. E. A., & Ene, J. (2025). Environmental costs and the profitability of listed oil and gas companies in Nigeria. *International Journal of Intellectual Discourse, 8*(1). https://ijidjournal.org/index.php/ijid/article/view/876

Nguyen, T. T., & Pham, T. A. (2020). Assessing the cost structure of pollution control in manufacturing firms: Evidence from Vietnam. *Business Strategy and the Environment, 29*(3), 1038–1051. https://doi.org/10.1002/bse.2416

OECD. (2021). Extended Producer Responsibility. Organisation for Economic Co-operation and Development.https://www.oecd.org/env/toolsevaluation/extendedproducerresponsibility.htm

Okudo, C. L., & Amahalu, N. N. (2023). Effect of environmental accounting on profitability of listed oil and gas firms in Nigeria. https://www.ijaar.org/effect-of-environmental-accounting-on-profitability-of-listed-oil-and-gas-firms-in-nigeria/

Oyinpreye, A. O. G., & Korolo, E. O. (2025). Environmental costs and financial performance of quoted oil and gas companies in Nigeria. *Journal of Accounting and Financial Management, 11*(7), 98–112. https://doi.org/10.56201/jafm.vol.11.no7.2025.pg98.112

Pinto, J. E., Henry, E., Robinson, T. R., & Stowe, J. D. (2020). *Equity asset valuation* (4th ed.). John Wiley & Sons.

Ross, S. A., Westerfield, R. W., & Jaffe, J. F. (2019). *Corporate finance* (12th ed.). McGraw-Hill Education.

Salihu, M. A., Olanisebe, M. B., & Rabiu, N. (2025). Does environmental cost influence financial performance in Nigeria? Evidence from listed downstream oil and gas firms? *Journal of Global Accounting.* https://journals.unizik.edu.ng/joga/article/view/5627

Salihu, M. A., Olanisebe, M. B., & Rabiu, N. B. (2025). Does environmental cost influence financial performance? Evidence from listed downstream oil and gas firms in Nigeria. *Journal of Global Accounting.* https://journals.unizik.edu.ng/joga/article/view/5627

Sharma, P., & Singh, R. (2022). Environmental compliance costs and firm productivity: A systematic review. *Business Strategy and the Environment, 31*(3), 909–927. https://doi.org/10.1002/bse.2926

U.S. Environmental Protection Agency. (2023). *The benefits and costs of the Clean Air Act 1990-2020*. https://www.epa.gov/benefit-cost-analysis/benefits-and-costs-clean-air-act-1990-2020

Wilson, D. C., & Velis, C. A. (2020). Waste management—Still a global challenge in the 21st century: An evidence-based call for action. *Waste Management & Research, 38*(9), 1009–1011. https://doi.org/10.1177/0734242X20959369

World Bank. (2022). Pollution management and environmental health program: Key concepts. World Bank Group. https://www.worldbank.org/en/topic/environmentalhealth/brief/pollution-management-and-environmental-health-program-key-concepts