

Effect of Environmental Cost on Financial Performance of Listed Oil and Gas Firms in Nigeria**Festus Ndubuisi Nkwo¹ & Eneh, Sylvia Nnenna, Ph.D., TRCN, ACA^{2*}****Abstract**

This study examined the effect of environmental cost on the financial performance of listed oil and gas firms in Nigeria. The broad objective was to ascertain how environmental cost disclosures relate to firm profitability, while the specific objectives assessed the effect of environmental costs, environmental losses, and environmental liabilities on Return on Assets (ROA). The study adopted an ex-post facto research design anchored on secondary data extracted from the audited annual reports and accounts of five purposively selected oil and gas firms quoted on the Nigerian Exchange Group (NGX) — Conoil Nigeria Plc, Mobil Oil Nigeria Plc (now 11Plc), Forte Oil Nigeria Plc (now Ardova Plc), MRS Oil Nigeria Plc, and Total Petroleum Nigeria Plc (now TotalEnergies Marketing Nigeria Plc) — covering the period 2009 to 2023. Panel data regression, comprising pooled OLS, fixed effects, and random effects estimators, was employed, with the Hausman specification test used to select the appropriate model, while diagnostic tests (unit root, multicollinearity, heteroscedasticity, and serial correlation) were conducted to validate the robustness of the results. Findings revealed that environmental cost and environmental liabilities had a statistically significant negative effect on ROA, while environmental losses exerted a significant positive effect on ROA among the sampled firms. The study concludes that environmental cost disclosure practices materially affect the financial performance of Nigerian oil and gas firms and recommends that regulatory bodies such as the Financial Reporting Council of Nigeria (FRCN) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) strengthen mandatory environmental cost disclosure frameworks to enhance transparency and long-term firm value.

Keywords: Environmental cost, Environmental liabilities, Environmental losses, Financial performance, Return on Assets, Oil and gas firms

Cite: Festus, N. N. & Eneh, S. N. (2026). Effect of Environmental Cost on Financial Performance of Listed Oil and Gas Firms in Nigeria. *International Journal of Accounting Research and Financial Insights*, 4(4), 299-310. <https://doi.org/10.5281/zenodo.20788933>

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Introduction

The oil and gas sector remains the mainstay of the Nigerian economy, contributing significantly to government revenue, foreign exchange earnings, and gross domestic product. However, the exploration, production, refining, and distribution activities of firms in this sector are associated with substantial environmental degradation, including oil spillage, gas flaring, soot emission, and contamination of land and water bodies, particularly within the Niger Delta region. These environmental consequences have heightened the demand for firms to recognise, measure, and disclose environmental costs in their financial statements as part of broader corporate social responsibility and sustainability reporting obligations (Akintoye et al., 2020).

Environmental cost, in this context, refers to the costs incurred by firms in preventing, controlling, remediating, and complying with regulations relating to environmental degradation arising from their operations. These costs manifest in various forms, including environmental remediation expenditure, environmental losses arising from spillage and clean-up operations, and environmental liabilities recognised as provisions for future obligations such as decommissioning and site restoration (Uwuigbe et al. 2018). As stakeholders increasingly demand environmental accountability, firms face the dual challenge of complying with environmental regulations while sustaining profitability, making the relationship between environmental cost and financial performance an issue of considerable academic and policy interest.

Statement of the Problem

Despite the growing regulatory emphasis on environmental disclosure in Nigeria, oil and gas firms continue to record significant incidents of oil spillage and gas flaring, often resulting in litigation, regulatory fines, and reputational damage. While proponents of corporate environmental responsibility argue that proactive environmental cost management enhances long-term financial performance through improved stakeholder relations and reduced litigation risk, critics contend that the immediate cost of environmental compliance, remediation, and liability provisioning erodes profitability and reduces returns to shareholders. This conflicting theoretical position, combined with inconsistent empirical findings in extant Nigerian studies, creates an unresolved debate on the true direction and magnitude of the effect of environmental cost on financial performance. Furthermore, several prior Nigerian studies on environmental accounting have focused largely on manufacturing and conglomerate firms, with comparatively limited firm-level panel evidence covering an extended fifteen-year period (2009–2023) specifically for the oil and gas sector, which is the sector most directly implicated in environmental degradation. It is this contextual and temporal gap that the present study seeks to address.

Research Gap

Existing studies such as Uwuigbe, Teddy, Uwuigbe, Emmanuel, and Babajide (2018), Akintoye, Adegbe, and Bello (2020), and Iyoha, Ojeka, and Ebomah (2017) have examined environmental cost disclosure or environmental accounting practices in Nigerian listed firms, but most cover shorter periods, mix sectors, or do not disaggregate environmental cost into its constituent components of environmental costs proper, environmental losses, and environmental liabilities. This study fills this gap by isolating these three dimensions and examining their individual effects on ROA using a fifteen-year panel of sector-specific data drawn exclusively from oil and gas firms, thereby providing more granular and sector-focused evidence than prior studies.

Objectives of the Study

The broad objective of the study is to ascertain the effect of environmental cost on financial performance of listed oil and gas firms in Nigeria. The specific objectives are to:

1. determine the effect of environmental costs on Return on Assets of selected oil and gas firms in Nigeria;

2. ascertain the effect of environmental losses on Return on Assets of selected oil and gas firms in Nigeria; and
3. assess the effect of environmental liabilities on Return on Assets of selected oil and gas firms in Nigeria.

Research Hypotheses

In line with the specific objectives, the following null hypotheses were formulated:

H01: Environmental cost has no significant effect on Return on Assets of listed oil and gas firms in Nigeria.

H02: Environmental losses have no significant effect on Return on Assets of listed oil and gas firms in Nigeria.

H03: Environmental liabilities have no significant effect on Return on Assets of listed oil and gas firms in Nigeria.

Theoretical Framework

This study is anchored on the Stakeholder Theory propounded by Freeman (1984). The theory posits that a firm's long-term success depends on its ability to manage and balance the interests of all stakeholders, including shareholders, employees, government, host communities, and the environment, rather than focusing exclusively on shareholder wealth maximisation. Applied to this study, Stakeholder Theory suggests that oil and gas firms that proactively incur environmental costs to manage their environmental footprint are responding to the legitimate expectations of host communities, regulators, and environmentally conscious investors, and that such responsiveness can influence financial performance either positively, through enhanced legitimacy and reduced regulatory friction, or negatively, in the short run, through increased operating costs. The theory therefore provides a suitable lens for explaining the dual and sometimes conflicting effects of environmental cost components on firm profitability observed in the empirical literature. The study is complemented by Legitimacy Theory (Suchman, 1995), which similarly explains firms' incentives to incur environmental costs as a means of maintaining their social licence to operate within host communities.

Empirical Review

Uwuigbe et al. (2018) examined environmental disclosure practices and financial performance of listed manufacturing firms in Nigeria and found a significant positive relationship between environmental disclosure and firm performance, suggesting that proactive environmental reporting enhances investor confidence.

Akintoye, Adegbe, and Bello (2020) investigated environmental accounting and the financial performance of listed industrial goods firms in Nigeria, reporting that environmental cost had a significant negative effect on return on assets, attributing this to the short-term cost burden of environmental compliance.

Iyoha, Ojeka, and Ebomah (2017) studied environmental accounting practices and profitability of listed oil and gas firms and found that environmental cost disclosure significantly influenced profitability, although the direction varied across firms depending on the scale of environmental liabilities incurred.

Okafor and Ogiedu (2019) assessed the effect of environmental and social cost disclosure on the financial performance of Nigerian oil and gas companies and found a significant but negative relationship between environmental cost and return on assets.

Adediran and Alade (2013) examined the impact of environmental accounting and reporting on the performance of Nigerian manufacturing companies, observing that environmental costs reduced reported profit in the short run but were associated with improved long-run firm value.

Ezeagba, John-Akamelu, and Umeoduagu (2017) analysed environmental accounting disclosure and financial performance of selected quoted oil and gas companies in Nigeria, finding a significant relationship between environmental liability provisions and firm profitability.

Nzewi and Akpan (2020) studied environmental disclosure and corporate financial performance of oil and gas firms in Nigeria and reported that environmental cost disclosure had a negative but significant effect on return on assets.

Owolabi and Lyoha (2021) examined environmental cost management and corporate performance among quoted energy firms, noting that environmental losses arising from spillage incidents significantly affected profitability in the period immediately following the incident, while well-managed environmental liability provisioning had limited adverse effect over the longer term.

These reviewed studies, while informative, present mixed findings, are largely sector-mixed or short-period in scope, and rarely disaggregate environmental cost into its discrete components, thus reinforcing the gap this study addresses.

Methodology

Research Design

The study adopted an ex-post facto research design, which is appropriate because the variables of interest — environmental cost, environmental losses, environmental liabilities, and Return on Assets — had already occurred and were extracted from historical, audited financial statements without manipulation by the researcher. The design is complemented by a longitudinal panel structure, given that data were pooled across five firms over a fifteen-year period (2009–2023), thereby combining cross-sectional and time-series dimensions.

Population and Sample

The population of the study comprises all oil and gas firms listed on the Nigerian Exchange Group (NGX) as at 31 December 2023. From this population, a sample of five (5) firms was selected: Conoil Nigeria Plc, Mobil Oil Nigeria Plc, Forte Oil Nigeria Plc, MRS Oil Nigeria Plc, and Total Petroleum Nigeria Plc, covering the period 2009 to 2023, giving a total of 75 firm-year observations (5 firms × 15 years).

Sample Selection Criteria

A non-probabilistic, purposive (judgmental) sampling technique was employed. The inclusion criteria were: (i) the firm must be quoted on the NGX under the oil and gas sector classification throughout the study period; (ii) the firm must have published complete and accessible audited annual reports for the entire 2009–2023 period; and (iii) the firm's annual reports must contain identifiable environmental cost, environmental loss, and environmental liability disclosures or sufficient information from which these could be extracted. Firms with incomplete annual reports, those delisted before 2023, or those that became listed after 2009 were excluded from the sample.

Sources of Secondary Data

Data were sourced entirely from secondary sources, namely: the audited annual reports and financial statements of the five sampled firms obtained from the Nigerian Exchange Group (NGX) corporate disclosure portal and the respective firms' investor relations websites; the NGX Fact Book; and the Central Bank of Nigeria (CBN) Statistical Bulletin, which was used to source macroeconomic control data where applicable. No primary data (questionnaires or interviews) were used, consistent with the secondary-data nature of the study.

Study Period

The study covers the fifteen-year period from 2009 to 2023. This period was chosen because it captures the post-global financial crisis era of increased regulatory attention to environmental disclosure in Nigeria, including the establishment of the National Oil Spill Detection and Response Agency (NOSDRA) reporting requirements, the enactment of the Petroleum Industry Act (2021), and the period of the Nigerian Code of Corporate Governance (2018), all of which heightened environmental disclosure obligations for oil and gas firms, making it an appropriate window for assessing the cost–performance relationship.

Variable Measurement

Variable	Type	Proxy / Measurement	Source
Return on Assets (ROA)	Dependent	Profit after tax ÷ Total assets	Firms' annual reports
Environmental Cost (ENVC)	Independent	Natural log of total environmental remediation/compliance expenditure	Firms' annual reports / notes to accounts
Environmental Losses (ENVL)	Independent	Natural log of losses recognised from oil spillage, clean-up, and related incidents	Firms' annual reports
Environmental Liabilities (ENVB)	Independent	Natural log of provisions for decommissioning, site restoration, and environmental obligations	Statement of financial position / notes
Firm Size (FSIZE)	Control	Natural log of total assets	Firms' annual reports
Leverage (LEV)	Control	Total debt ÷ Total assets	Firms' annual reports

Source: Author's Compilation, 2026.

Method of Data Analysis

Data were analysed using panel data regression techniques comprising the Pooled Ordinary Least Squares (OLS), Fixed Effects, and Random Effects estimators, estimated with the aid of STATA 17 / E-Views 12 statistical software. Descriptive statistics were first computed, followed by correlation analysis. The Hausman specification test was conducted to determine the more appropriate model between the fixed effects and random effects estimators, and the selected model's coefficients were reported and interpreted at the 5% level of significance.

Pre-Estimation Tests

Prior to estimation, the following pre-estimation diagnostic tests were conducted: (i) panel unit root tests (Levin-Lin-Chu and ADF-Fisher) to confirm stationarity of the variables; (ii) descriptive statistics to examine the central tendency and dispersion of the data; (iii) Pearson correlation analysis to examine the association between variables; and (iv) Variance Inflation Factor (VIF) test to detect the presence of multicollinearity among the independent variables.

Post-Estimation Diagnostic Tests

Following estimation, the following post-estimation diagnostic tests were conducted to validate the robustness of the regression results: The Durbin-Watson test for first-order serial correlation; the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity; the Pesaran Cross-Sectional Dependence (CD) test; and the Wooldridge test for autocorrelation in panel data. Where these tests indicated violations of classical assumptions, the model was corrected using Feasible Generalised Least Squares (FGLS) or robust (Driscoll-Kraay/clustered) standard errors, and the corrected model is reported as the final result.

Model Specification

The panel regression model is specified as follows:

$$ROA_{it} = \beta_0 + \beta_1 ENVC_{it} + \beta_2 ENVL_{it} + \beta_3 ENVB_{it} + \beta_4 FSIZE_{it} + \beta_5 LEV_{it} + \epsilon_{it}$$

Where: ROA_{it} = Return on Assets of firm i in year t; ENVC_{it} = Environmental cost of firm i in year t; ENVL_{it} = Environmental losses of firm i in year t; ENVB_{it} = Environmental liabilities of firm i in year t; FSIZE_{it} = Firm size (control); LEV_{it} = Leverage (control); β₀ = constant/intercept; β₁–β₅ = coefficients of the explanatory variables; ε_{it} = stochastic error term; i = 1...5 firms; t = 2009...2023.

Results and Discussion

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Jarque-Bera
ROA	75	0.082	0.061	-0.045	0.241	0.512	3.218	4.27 (0.118)
ENVC	75	14.226	1.184	11.602	16.815	-0.203	2.876	0.61 (0.737)
ENVL	75	12.981	1.532	9.210	15.940	0.347	3.104	1.59 (0.452)
ENVB	75	13.704	1.267	10.815	16.220	0.118	2.654	0.55 (0.760)
FSIZE	75	16.842	0.957	14.910	18.602	-0.085	2.991	0.11 (0.946)
LEV	75	0.487	0.193	0.102	0.912	0.276	2.745	1.04 (0.594)

Source: Researcher's computation (STATA 17), based on extracted firm-year data, 2026. Note: Jarque-Bera p-values in parentheses indicate the variables are approximately normally distributed at the 5% level.

Correlation Matrix and Multicollinearity Check

Variable	ROA	ENVC	ENVL	ENVB	FSIZE	LEV	VIF
ROA	1.000						
ENVC	-0.342	1.000					1.61
ENVL	0.218	0.276	1.000				1.38
ENVB	-0.389	0.412	0.193	1.000			1.74
FSIZE	0.247	0.358	0.142	0.301	1.000		1.55
LEV	-0.296	0.221	-0.087	0.264	0.198	1.000	1.29

Source: Researcher's computation (STATA 17), 2026. The mean VIF of 1.51 and individual VIF values below the threshold of 10 confirm the absence of harmful multicollinearity among the explanatory variables.

Panel Unit Root Test

Variable	LLC Statistic (p-value)	ADF-Fisher Statistic (p-value)	Order of Integration
ROA	-4.812 (0.000)	38.94 (0.001)	I(0)
ENVC	-3.967 (0.000)	34.27 (0.004)	I(0)
ENVL	-5.103 (0.000)	41.18 (0.000)	I(0)
ENVB	-3.642 (0.001)	31.85 (0.008)	I(0)
FSIZE	-4.225 (0.000)	36.02 (0.002)	I(0)
LEV	-3.811 (0.000)	33.49 (0.005)	I(0)

Source: Researcher's computation (STATA 17), 2026. All variables were stationary at levels, I(0), at the 5% significance level, justifying the use of panel-level regression without differencing.

Hausman Specification Test

The Hausman test was conducted to choose between the fixed effects and random effects models. The test produced a chi-square statistic of 18.47 with a p-value of 0.0024, which is statistically significant at the 5% level. The null hypothesis of no systematic difference between the fixed and random effects estimators was therefore rejected, and the Fixed Effects model was selected as the more appropriate and consistent estimator for this study.

Diagnostic Tests on the Selected Model

The Breusch-Pagan/Cook-Weisberg test indicated the presence of heteroscedasticity (chi-square = 14.62, p = 0.0021), while the Wooldridge test indicated first-order autocorrelation (F = 6.83, p = 0.0118). The Pesaran CD test result (CD = 1.342, p = 0.1795) showed no significant cross-sectional dependence. Given the evidence of heteroscedasticity and autocorrelation, the Fixed Effects model was re-estimated using Feasible Generalised Least

Squares (FGLS) with robust, clustered standard errors to correct for these violations, and the corrected FGLS results are reported as the final model in Table 7.

Main Regression Result (Final Corrected FGLS Model)

Variable	Coefficient	Std. Error	z-statistic	p-value
Constant	0.184	0.052	3.538	0.000
ENVC	-0.027	0.009	-3.000	0.003
ENVL	0.019	0.007	2.714	0.007
ENVB	-0.034	0.011	-3.091	0.002
FSIZE	0.012	0.006	2.000	0.046
LEV	-0.041	0.014	-2.929	0.003

Wald chi-square = 42.61 (p = 0.000); R-squared (within) = 0.487. Source: Researcher's computation (STATA 17), 2026.

The result shows that environmental cost (ENVC) has a negative and statistically significant effect on ROA ($\beta = -0.027$, $p = 0.003$), implying that a unit increase in environmental cost reduces ROA, holding other variables constant. Environmental losses (ENVL) exhibit a positive and statistically significant effect on ROA ($\beta = 0.019$, $p = 0.007$), suggesting that firms which proactively recognise and manage environmental losses tend to record improved profitability, possibly through enhanced stakeholder confidence and reduced regulatory sanctions. Environmental liabilities (ENVB) have a negative and statistically significant effect on ROA ($\beta = -0.034$, $p = 0.002$), indicating that the recognition of larger environmental provisions is associated with lower current profitability. Firm size has a positive and significant effect on ROA, while leverage exerts a negative and significant effect, consistent with theoretical expectation.

Hypothesis Testing Decisions

Hypothesis	Decision Rule	p-value	Decision
H01: Environmental cost has no significant effect on ROA	Reject if $p < 0.05$	0.003	Rejected — Environmental cost has a significant effect on ROA
H02: Environmental losses have no significant effect on ROA	Reject if $p < 0.05$	0.007	Rejected — Environmental losses have a significant effect on ROA
H03: Environmental liabilities have no significant effect on ROA	Reject if $p < 0.05$	0.002	Rejected — Environmental liabilities have a significant effect on ROA

Discussion of Findings

The finding that environmental cost has a significant negative effect on ROA aligns with the findings of Akintoye, Adegbe, and Bello (2020) and Okafor and Ogiedu (2019), who similarly reported that environmental compliance and remediation costs reduce short-term profitability of Nigerian listed firms. This negative relationship can be explained through the lens of Stakeholder Theory: while environmental expenditure satisfies the legitimate

demands of host communities and regulators, it represents an immediate cash outflow that depresses reported earnings in the period incurred.

The positive and significant effect of environmental losses on ROA, however, diverges from the largely negative findings reported in most prior studies and lends support to the position of Owolabi and Iyoha (2021), who found that firms that transparently disclose and actively manage environmental loss incidents often experience improved stakeholder trust and reduced future litigation costs, which can translate into improved operating efficiency and profitability over time. This finding suggests that the manner and timeliness of loss recognition, rather than the loss itself, may be the more relevant driver of the performance effect.

The negative and significant effect of environmental liabilities on ROA corroborates the findings of Ezeagba, John-Akamelu, and Umeoduagu (2017) and Nzewi and Akpan (2020), both of which found that the recognition of decommissioning and restoration provisions constrains reported profitability by increasing recognised obligations on the statement of financial position. This is consistent with Legitimacy Theory, which suggests that firms accept short-term financial costs in the form of liability provisioning in order to maintain their social licence to operate within host communities and avoid more severe regulatory or reputational sanctions.

Therefore, the findings validate the theoretical framework of the study, demonstrating that environmental cost management in the Nigerian oil and gas sector is not a uniformly negative undertaking for shareholders; rather, its effect on financial performance depends on the specific component of environmental cost involved and the manner in which it is managed and disclosed.

Conclusion and Recommendations

Summary of Findings

This study examined the effect of environmental cost on the financial performance of five listed oil and gas firms in Nigeria over the period 2009–2023. Based on the Fixed Effects FGLS regression results, the study found that: environmental cost had a significant negative effect on ROA, leading to the rejection of H01; environmental losses had a significant positive effect on ROA, leading to the rejection of H02; and environmental liabilities had a significant negative effect on ROA, leading to the rejection of H03.

Conclusion

The study concludes that environmental cost, in its various components, is a material determinant of the financial performance of listed oil and gas firms in Nigeria. While environmental cost and environmental liabilities depress short-term profitability, the positive effect of environmental losses suggests that transparent recognition and proactive management of environmental incidents can yield reputational and financial benefits that partly offset the cost burden. The study's findings affirm the relevance of Stakeholder Theory and Legitimacy Theory in explaining corporate environmental cost behaviour in a developing economy context such as Nigeria.

Theoretical Contribution

The study contributes to theory by disaggregating environmental cost into three distinct components — environmental cost proper, environmental losses, and environmental liabilities — and demonstrating that each exerts a distinct and sometimes opposing effect on financial performance, thereby extending the explanatory scope of Stakeholder and Legitimacy Theories beyond the aggregate environmental cost–performance relationship commonly examined in prior Nigerian literature.

Policy Recommendations

Based on the findings, the study recommends that: (i) the management of oil and gas firms should view environmental cost not merely as a regulatory burden but as a strategic investment that, if properly disclosed and managed, can enhance long-term stakeholder confidence; (ii) the Financial Reporting Council of Nigeria (FRCN) should strengthen and standardise the framework for environmental cost disclosure to ensure comparability of environmental cost, loss, and liability figures across reporting firms; (iii) the National Environmental Standards and Regulations Enforcement Agency (NESREA) and the National Oil Spill Detection and Response Agency (NOSDRA) should enforce stricter and more consistent compliance monitoring to reduce the incidence of environmental losses; and (iv) investors and financial analysts should incorporate disaggregated environmental cost information into firm valuation models rather than relying solely on aggregate profitability figures.

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