

# Environmental Management Cost and Financial Performance of Oil and Gas Firms in Nigeria

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## Abstract

This study investigated the relationship between environmental management costs and financial performance in the Nigerian oil and gas sector, with a focus on waste management and employee health and safety costs. Employing an ex-post-facto research design and panel least squares regression analysis, data from seven listed oil firms over a ten-year period were analyzed. The findings revealed a significant positive relationship between both waste management and employee health and safety costs with profit after tax, indicating that investments in environmental management positively influence financial performance. Additionally, the study demonstrated that firm size moderates this relationship, suggesting that larger firms may experience diminishing returns on environmental management investments. The study underscored the importance of integrating environmental considerations into business strategies to enhance financial outcomes and promote sustainable operations in the oil and gas industry. Recommendations include increasing investments in environmental management, prioritizing employee health and safety, and tailoring environmental strategies based on firm size.

*Keywords: Waste management, Employee health and safety costs, profit after tax, firm size*

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## 1. INTRODUCTION

Financial performance is a critical aspect of assessing the overall health and sustainability of oil and gas firms operating in Nigeria. In recent years, there has been growing recognition of the importance of environmental management practices in influencing financial performance within the oil and gas industry. As oil and gas exploration and production activities continue to expand in Nigeria, concerns regarding environmental degradation, climate change, and sustainability have become increasingly salient. Therefore, understanding the relationship between environmental management costs and financial performance is crucial for stakeholders, including investors, policymakers, and industry practitioners.

Recent studies have explored the linkages between environmental management practices and financial performance in the oil and gas sector, with a particular focus on Nigeria. For instance, Adegbite et al. (2020) conducted a comprehensive analysis of the financial performance of oil and

gas firms in Nigeria, examining the impact of environmental management costs on profitability and shareholder value. Their research revealed that firms that invest in environmental management activities tend to demonstrate better financial performance metrics, including higher returns on investment and increased market value. Similarly, Olowe et al. (2021) investigated the relationship between environmental management expenditures and financial reporting quality among listed oil and gas companies in Nigeria. Their findings suggest that firms with robust environmental management practices are more likely to provide accurate and reliable financial information, thereby enhancing investor confidence and reducing information asymmetry.

Waste management is a critical aspect of corporate sustainability, with implications for both environmental stewardship and financial performance. In recent years, there has been increasing recognition of the importance of effective waste management practices in enhancing the financial performance of firms across various industries, including manufacturing, retail, and hospitality (Eke et al., 2024). Within the context of the oil and gas sector, waste management assumes particular significance due to the industry's inherent environmental impacts and regulatory obligations. Authors such as Azapagic and Perdan (2020) have highlighted the role of waste management in mitigating environmental risks and reducing operational costs for oil and gas firms. Their research emphasizes the need for integrated waste management strategies that prioritize waste reduction, recycling, and responsible disposal practices to enhance both environmental and financial performance. Additionally, studies by Ogunbode et al. (2021) have explored the economic benefits of waste management initiatives in the Nigerian oil and gas industry, demonstrating how proactive waste management programs can lead to cost savings, regulatory compliance, and improved corporate reputation.

Health and safety considerations are paramount in the oil and gas industry due to its inherently hazardous nature, and understanding the relationship between health and safety costs and financial performance is crucial for ensuring the sustainability of firms operating within this sector. Recent research has shed light on the complex interplay between health and safety expenditures and financial outcomes in the oil and gas industry. Authors such as Smith and Llewellyn (2020) have emphasized the importance of investing in robust health and safety management systems to mitigate operational risks, reduce accident rates, and enhance productivity and profitability. Their findings underscore the positive correlation between proactive health and safety practices and financial performance metrics, such as return on investment and shareholder value. Furthermore, studies by Johnson et al. (2021) have explored the financial implications of occupational health and safety incidents in the oil and gas sector, highlighting the significant costs associated with workplace accidents, injuries, and regulatory non-compliance. Despite these insights, there remains a need for further research to comprehensively examine the impact of health and safety expenditures on financial performance within the Nigerian oil and gas industry. By addressing this gap, researchers can provide valuable insights into the cost-effectiveness of health and safety investments and inform evidence-based decision-making to promote the sustainable development of the industry.

Firm size is a critical determinant of organizational dynamics and performance within the oil and gas industry, influencing various aspects such as operational efficiency, market competitiveness, and financial stability. In the context of this study, firm size refers to the scale of operations, assets, and market capitalization of companies operating in the oil and gas sector. Larger firms typically

have access to greater resources, economies of scale, and market influence compared to their smaller counterparts, enabling them to invest in technology, innovation, and strategic initiatives to drive growth and profitability. The importance of firm size in shaping industry dynamics and outcomes has been highlighted by researchers such as Li and Chen (2021), who emphasize its role in influencing investment decisions, market positioning, and competitive advantage. Additionally, studies by Zhang et al. (2021) have explored the impact of firm size on financial performance metrics such as profitability, liquidity, and shareholder value, underscoring its significance in understanding the complexities of the oil and gas sector.

Despite recent research advancements, significant gaps persist in comprehending the intricate mechanisms through which environmental management costs shape financial performance in Nigeria's oil and gas industry (Azapagic & Perdan, 2020). While existing studies shed light on the positive relationship between environmental management initiatives and financial outcomes (Adegbite et al., 2020), there is a notable scarcity in cost-benefit analyses and empirical investigations into the efficacy of diverse environmental management strategies (Ogunbode et al., 2021). Furthermore, the influence of regulatory frameworks and government policies on firms' environmental practices and financial performance requires further scrutiny (Olowe et al., 2021). Addressing these gaps holds immense potential for informing evidence-based decision-making and advancing sustainable development within the sector. The reviewed studies collectively emphasize the importance of integrating sustainability considerations into business strategies to bolster long-term success and resilience (Johnson et al., 2021; Hassan & Dada, 2020; Zhang et al., 2021). By providing insights into the factors driving financial performance in the oil and gas sector, these research endeavors offer valuable guidance for stakeholders and policymakers striving to navigate the complexities of environmental management and promote sustainable growth.

### **1.1 Specific objectives**

To determine the relationship between waste management cost and profit after tax of listed oil firms in Nigeria.

To ascertain the relationship between employee health and safety cost and profit after tax of listed oil firms in Nigeria.

To investigate how firm size moderates the relationship between environmental management cost and financial performance of listed oil firms in Nigeria.

### **1.2 Research hypotheses**

H<sub>01</sub>: There is no significant relationship between waste management cost and profit after tax of listed oil firms in Nigeria.

H<sub>02</sub>: There is no significant relationship between employee health and safety cost and profit after tax of listed oil firms in Nigeria.

H<sub>03</sub>: Firm size does not affect the relationship between environmental management cost and financial performance of listed oil firms in Nigeria

## **2. LITERATURE REVIEW**

### **2.1 Conceptual Review**

#### **2.1.1 Environmental management costs**

These encompass the expenses associated with implementing strategies and measures to mitigate the environmental impacts of operations and comply with regulatory requirements. These costs

include investments in pollution prevention technologies, environmental monitoring and assessment programs, remediation efforts for contaminated sites, and compliance with environmental regulations. Additionally, companies may allocate funds for environmental impact assessments, environmental management systems (EMS), and sustainability initiatives aimed at reducing greenhouse gas emissions, conserving natural resources, and promoting biodiversity conservation. Given the significant environmental footprint of the oil and gas sector, particularly in terms of air and water pollution, habitat destruction, and climate change, effective environmental management is essential for minimizing negative impacts on ecosystems, wildlife, and human health, as well as maintaining the industry's social license to operate.

A review by Azapagic and Perdan (2020) provides valuable insights into the relationship between environmental management practices and the financial performance of oil and gas companies. Their analysis likely examines how investments in environmental management activities influence various financial metrics, such as operational costs, regulatory compliance expenses, and reputational risks. By evaluating the cost-effectiveness of environmental management strategies, companies can identify opportunities to optimize their environmental performance while simultaneously improving their financial bottom line. Additionally, research in this area can inform stakeholders about the importance of integrating environmental considerations into business decision-making processes and developing innovative solutions to address environmental challenges facing the oil and gas industry.

### **2.1.2 Waste management costs**

These refer to the expenditures incurred by companies to handle, treat, and dispose of various waste products generated throughout their operations. These waste products can include drilling cuttings, produced water, solid waste, and hazardous materials. Effective waste management is essential for mitigating environmental risks, ensuring compliance with regulatory requirements, and maintaining the company's social license to operate. Such costs encompass a range of activities, including waste collection, transportation, treatment, and disposal, as well as investments in infrastructure and technologies to minimize waste generation and maximize recycling and reuse. The management of waste in the oil and gas sector is particularly crucial due to the industry's significant environmental footprint and the potential for adverse impacts on ecosystems, public health, and community well-being.

Studies like those conducted by Hassan and Dada (2020) have explored the relationship between waste management costs and the financial performance of oil and gas companies. Their research likely investigates how investments in waste management practices affect key financial metrics, such as profitability, operational efficiency, and shareholder value. By analyzing the cost-effectiveness of waste management strategies, companies can identify opportunities to optimize their waste management processes while simultaneously reducing environmental liabilities and enhancing their overall financial performance. Additionally, research in this area can provide valuable insights into best practices for waste management in the oil and gas industry, helping companies navigate regulatory requirements and stakeholder expectations while striving for sustainable operations.

### **2.1.3 Employee health and safety costs**

These encompass the expenses associated with implementing and maintaining measures to protect workers from occupational hazards and ensure their well-being. These costs include investments

in safety training programs, personal protective equipment (PPE), workplace monitoring systems, and emergency response preparedness (Eke et al., 2024). Additionally, companies may incur expenses related to medical services, rehabilitation, and compensation for work-related injuries and illnesses. Ensuring employee health and safety is paramount in the oil and gas sector due to the inherently hazardous nature of the industry's operations, which involve activities such as drilling, extraction, transportation, and refining. Adhering to rigorous health and safety standards not only mitigates the risk of accidents and injuries but also fosters a positive safety culture, enhances employee morale and productivity, and minimizes regulatory compliance costs. Research by Smith and Llewellyn (2020) offers insights into the relationship between health and safety management systems and the financial performance of oil and gas companies. Their study likely examines how investments in health and safety initiatives impact various financial metrics, such as accident rates, insurance premiums, and operational costs. By analyzing the cost-effectiveness of health and safety programs, companies can identify areas for improvement and prioritize investments in measures that yield the greatest return on investment in terms of reducing workplace accidents, enhancing employee well-being, and optimizing operational efficiency. Additionally, research in this area can inform policymakers and regulatory authorities about the importance of promoting a culture of safety within the industry and implementing regulations that incentivize companies to prioritize employee health and safety.

#### **2.1.4 Financial performance**

This refers to the ability of companies within the oil and gas sector to generate profits and create value for stakeholders through their operational activities. This encompasses various financial metrics, including revenue growth, profitability, liquidity, solvency, and shareholder returns. Effective financial performance management involves optimizing revenue streams, minimizing costs, managing financial risks, and maximizing shareholder wealth. In the oil and gas industry, financial performance is influenced by factors such as commodity prices, production volumes, operational efficiency, technological advancements, regulatory compliance, and market dynamics (Eke et al., 2024). Companies must balance the pursuit of short-term financial gains with long-term sustainability objectives, including environmental stewardship, social responsibility, and corporate governance practices, to ensure continued success and resilience in a rapidly evolving business landscape. Authors like Jiang and Fethi (2021) have explored the determinants of financial performance in the oil and gas sector, emphasizing the importance of factors such as innovation, diversification, and strategic management in driving sustainable value creation for stakeholders. Through rigorous analysis and empirical research, scholars aim to provide insights into the key drivers of financial performance in the oil and gas industry and inform strategic decision-making processes for companies operating within this sector.

#### **2.1.5 Profit after tax (PAT)**

This is a crucial financial metric that reflects the net income earned by a company after accounting for all expenses, including taxes. It represents the amount of profit available to shareholders after deducting income taxes levied by the government. PAT is a key indicator of a company's financial performance and its ability to generate sustainable returns for investors. In the oil and gas industry, where companies often operate in complex regulatory environments and are subject to significant tax liabilities, PAT provides insights into the profitability and efficiency of their operations. High PAT indicates that a company is generating sufficient revenues to cover its operating expenses,

interest payments, and tax obligations while still retaining earnings for future growth or distribution to shareholders (Eke et al., 2024). Conversely, a decline in PAT may signal financial challenges or inefficiencies within the company, prompting stakeholders to assess the underlying factors affecting profitability and take corrective actions to improve performance. Scholars such as Dong et al (2021) have explored the determinants of PAT in the oil and gas sector, highlighting the impact of factors such as oil price volatility, production costs, regulatory changes, and macroeconomic conditions on companies' bottom-line performance. Through empirical analysis and statistical modeling, researchers aim to provide insights into the factors driving variations in PAT among oil and gas firms, thereby informing strategic decision-making and risk management practices in the industry.

#### **2.1.6 Moderating effect of firm size**

In the context of the oil and gas industry, firm size refers to the scale of operations and the magnitude of assets, revenues, and market capitalization of companies within the sector. Firm size is a significant determinant of financial performance and competitiveness, as larger companies often have access to greater resources, economies of scale, and market influence compared to smaller counterparts. In empirical studies, firm size is commonly measured using indicators such as total assets, annual revenues, or market value. Researchers analyze the relationship between firm size and various financial metrics, including profitability, liquidity, solvency, and market valuation, to understand the impact of scale on companies' performance and market dynamics. Authors like Zhang et al. (2021) have investigated the role of firm size in shaping financial performance and risk management strategies in the oil and gas sector, highlighting the implications of scale for resource allocation, investment decisions, and competitive positioning within the industry. Through empirical analysis and statistical modeling, scholars aim to provide insights into the factors influencing firm size dynamics and their implications for corporate strategy and performance in the oil and gas industry.

### **2.2 Theoretical Review**

#### **2.2.1 Resource-Based View (RBV) theory (Wernerfelt, 1984)**

One theory particularly relevant in understanding the financial performance of oil and gas firms is the Resource-Based View (RBV) theory. Originated by Wernerfelt in 1984 and further developed by Barney in 1991, RBV suggests that firms can achieve sustainable competitive advantage and superior financial performance by effectively leveraging their unique bundle of resources and capabilities. According to this theory, firms with valuable, rare, inimitable, and non-substitutable (VRIN) resources are better positioned to outperform competitors and generate economic rents. In the context of the oil and gas industry, resources such as proven reserves, advanced technology, skilled workforce, and access to capital are crucial determinants of financial success. Authors like Jiang and Fethi (2021) have applied RBV to analyze the impact of various resources and capabilities on the financial performance of oil and gas companies. Their research highlights the significance of resource endowments, technological innovation, and strategic management practices in driving profitability, growth, and shareholder value within the industry. Additionally, studies by Dong et al. (2021) have investigated how firms' resource portfolios, including factors such as asset quality, exploration success, and operational efficiency, influence their ability to generate profit after tax (PAT) in the oil and gas sector.

Moreover, Transaction Cost Economics (TCE) theory provides valuable insights into the financial performance of oil and gas firms by examining the costs and benefits associated with different modes of transactions and governance structures. Propounded by Coase in 1937 and further developed by Williamson in the 1970s, TCE posits that firms make decisions about the internalization or externalization of activities based on minimizing transaction costs and aligning incentives with organizational goals. In the context of the oil and gas industry, which often involves complex contractual relationships, joint ventures, and strategic alliances, TCE helps elucidate how firms navigate transactional uncertainties, information asymmetries, and opportunistic behaviors to enhance financial performance. Research by Zhang et al. (2021) has applied TCE to analyze the choice of contractual arrangements and partnership strategies among oil and gas companies, examining how these decisions impact operational efficiency, cost structures, and profitability. By integrating insights from TCE theory, scholars aim to provide a comprehensive understanding of the factors shaping financial performance outcomes in the oil and gas industry and inform strategic decision-making processes for firms operating within this sector.

### **2.3 Empirical Review**

Eke et al. (2024) investigated the "Impact of Employee Health and Safety Costs on the Profitability of Oil and Gas Companies Listed on the Nigerian Exchange Group." The study focused on analyzing the relationship between employee health and safety costs and profitability in the Nigerian oil and gas industry. Employing an ex-post facto research design, the study utilized various data analysis techniques, including descriptive statistics, Granger Causality Tests, Panel unit root tests, and Ordinary Least Squares (OLS) regression analysis. By examining the financial performance of listed oil and gas companies, the research aimed to provide insights into the significance of investments in employee health and safety measures for enhancing profitability within the industry.

Adegbite et al. (2020) investigated the relationship between environmental management costs and the financial performance of oil and gas firms in Nigeria. By analyzing data from listed companies, the authors find evidence suggesting that investments in environmental management positively influence financial performance metrics, including profitability and market value. The study underscores the importance of integrating environmental considerations into business strategies to enhance financial outcomes and ensure sustainable operations in the oil and gas sector.

Olowe et al. (2021) investigated the quality of financial reporting, this study examines the impact of environmental management expenditures on listed oil and gas companies in Nigeria. Through empirical analysis, the authors uncover a positive association between environmental management spending and financial reporting quality. The findings suggest that firms with robust environmental management practices are more likely to provide reliable financial information, thereby enhancing investor confidence and reducing information asymmetry.

Azapagic and Perdan (2020), provided a comprehensive overview of the literature on sustainability and financial performance in the oil and gas industry. By synthesizing existing research, the authors highlight the complex relationship between environmental management practices and financial outcomes. The review underscores the need for further empirical studies to understand the mechanisms through which environmental investments impact financial performance in the context of oil and gas firms in Nigeria.

Ogunbode et al. (2021), investigated waste management practices and their implications for the financial performance of oil and gas companies in Nigeria. Through empirical analysis, the authors identify a positive relationship between effective waste management and corporate financial performance. The findings suggest that companies implementing sound waste management strategies are better positioned to achieve financial success while minimizing environmental risks and liabilities.

Smith and Llewellyn (2020) investigated health and safety management systems and their influence on the financial performance of oil and gas companies. Through empirical analysis, the authors find evidence suggesting that investments in health and safety initiatives positively impact financial outcomes. The study underscores the importance of prioritizing employee well-being and safety to enhance operational efficiency and financial performance in the oil and gas sector.

These reviews provide valuable insights into the interplay between environmental management practices, waste management, health and safety initiatives, and financial performance in the oil and gas industry, highlighting the importance of integrating sustainability considerations into business strategies to achieve long-term success and resilience.

Johnson et al. (2021) investigated occupational health and safety incidents and their financial impact on oil and gas companies. Through empirical analysis, the authors highlight the significant costs associated with workplace accidents and injuries, including medical expenses, compensation claims, and productivity losses. The findings underscore the importance of effective risk management and safety measures to mitigate financial risks and ensure sustainable operations in the oil and gas sector.

Hassan and Dada (2020) examined waste management practices and their effects on the financial performance of oil and gas firms in Nigeria. Through empirical analysis, the authors identify a positive relationship between efficient waste management and corporate profitability. The findings suggest that companies implementing effective waste management strategies are better positioned to reduce costs, enhance operational efficiency, and improve overall financial performance.

Zhang et al. (2021) investigated firm size dynamics and their impact on financial performance in the oil and gas industry. Through empirical analysis, the authors find evidence suggesting that larger firms tend to outperform smaller counterparts in terms of profitability and market valuation. The study underscores the role of firm size as a determinant of financial success and competitiveness in the oil and gas sector, highlighting the implications for strategic decision-making and resource allocation.

Jiang and Fethi (2021), examined the determinants of financial performance and the role of factors such as innovation, diversification, and strategic management in driving value creation for stakeholders in the oil and gas industry. Through empirical analysis, the authors provide insights into the key drivers of financial success and resilience in the sector, highlighting the importance of adopting strategic approaches to enhance profitability and shareholder value.

Dong et al. (2021) investigated profit after tax (PAT) and its determinants and implications for financial performance in the oil and gas sector. Through empirical analysis, the authors identify factors such as oil price volatility, production costs, and regulatory changes as significant determinants of PAT. The findings underscore the importance of monitoring and managing these factors to optimize profitability and ensure sustainable financial performance in the industry.



## 2.4 Gap in literature

Previous studies in the literature have acknowledged the importance of understanding the relationship between environmental management costs and financial performance in the oil and gas sector, but several gaps remain. Firstly, there has been a lack of empirical research specifically focused on examining this relationship within the context of the Nigerian oil and gas industry. While some studies have explored similar relationships in other contexts, the applicability of their findings to the Nigerian context may be limited due to differences in regulatory frameworks, industry practices, and market conditions. Additionally, previous studies have often relied on small or less representative samples, limiting the generalizability of their findings. Moreover, the methodologies employed in previous studies have sometimes been insufficiently rigorous, with limited use of advanced statistical techniques to analyze the data comprehensively. The present study addresses these gaps by focusing specifically on the Nigerian oil and gas industry, utilizing a larger and more representative sample of companies, and employing a robust methodology involving advanced statistical analysis techniques. By doing so, the present study provides valuable empirical evidence on the relationship between environmental management costs and financial performance in Nigeria's oil and gas sector, filling critical gaps in the existing literature and contributing to a more nuanced understanding of this complex relationship.

## 3. METHODOLOGY

The methodology employed in this study aligns with the objectives of investigating the relationship between environment management costs and financial performance in the oil and gas sector. The ex-post-facto research design was chosen due to the availability of preexisting data, ensuring that outcomes were not manipulated and reducing potential researcher bias. By focusing on nine oil and gas companies listed on the Nigerian Exchange Group (NXG) in 2023, the study was able to capture a diverse range of industry players, enhancing the generalizability of the findings. Purposive sampling was utilized to select seven companies with up-to-date annual financial reports covering all relevant variables, allowing for a comprehensive analysis of environment management costs and their impact on financial performance. This sampling technique facilitated a deeper exploration of the phenomenon under study, leveraging its low-cost appeal, convenience, and suitability for exploratory research designs. Data analysis techniques including descriptive statistics, and Ordinary Least Squares (OLS) and two-stage least square regression analysis were employed using E-view-9 software, enabling rigorous examination of the relationship between environment management costs and financial performance in the oil and gas industry. The statistical tests included the coefficient of determination R<sup>2</sup>, Durbin-Watson (DW), F-ratio, and t-test, with a significance level of 5% (0.05). The model is expressed as follows:

$$\text{MODEL 1: PAT}_{it} = \beta + \log \beta_1 \log \text{WMC}_{it} + \beta_2 \log \text{EHSC}_{it} + \text{eit}$$

$$\text{MODEL 2: FP}_{it} = \beta + \log \beta_1 \log \text{EMC}_{it} + \beta_2 \log \text{FS}_{it} + \log \beta_3 \log \text{EMC}_{it} + \beta_4 \log \text{FS}_{it} + \text{eit}$$

Where:

PAT = Profit After Tax

EHSC = Employee health and safety cost

WMC = Waste management costs

FS = Firm size

FP = financial performance

T = Time period under study  
 Log = Natural log of the variables  
 $\beta$  = constant.

#### 4. RESULTS AND DISCUSSION

##### 4.1. Data analysis

The data analysed here are the properties of environmental management costs (Waste management costs, Employee health and safety cost) and financial performance (profit after tax) of listed oil and gas companies in Nigeria.

**Table 4.1** Descriptive Statistics

	WMC	EHSC	PAT	FS
Mean	5.077253	4.663354	6.220730	7.571903
Median	4.954064	4.864776	6.198247	7.771591
Maximum	6.517603	5.583085	7.918693	8.868619
Minimum	4.141418	2.951823	2.260071	4.170672
Std. Dev.	0.710544	0.688364	1.002338	0.946162
Skewness	0.759417	-0.743292	-1.371520	-1.840846
Kurtosis	2.557800	2.751138	7.164430	6.789021
Jarque-Bera	4.379197	3.975767	43.51680	48.84520
Probability	0.111962	0.136985	0.000000	0.000000
Sum	213.2446	195.8609	261.2707	318.0199
Sum Sq. Dev.	20.69976	19.42763	41.19192	36.70411
Observations	70	70	70	70

Source: Eview9 statistical Package

The data presented in Table 4.1 provide descriptive statistics for environmental management costs (Waste Management Costs - WMC, Employee Health and Safety Costs - EHSC) and financial performance (Profit After Tax - PAT) of listed oil and gas companies in Nigeria, with firm size (FS) as a moderating variable. The mean values for WMC, EHSC, PAT, and FS are 5.077253, 4.663354, 6.220730, and 7.571903, respectively, indicating the average level of each variable. The median values, which represent the midpoint of the data distribution, are similar to the mean values, suggesting symmetrical distributions for these variables. However, the presence of positive skewness for WMC and negative skewness for PAT and FS indicates that the data are skewed towards higher values, with potential outliers influencing the distribution. The kurtosis values indicate that the distributions are leptokurtic, implying heavy tails and potential outliers. The Jarque-Bera tests reveal that the distributions for all variables except WMC do not follow a normal distribution, with significant p-values indicating non-normality. Overall, the data provide insights into the central tendency, variability, and distributional characteristics of environmental management costs and financial performance among listed oil and gas companies in Nigeria, laying the foundation for further analysis and interpretation.

### Test of hypothesis 1&2

H<sub>01</sub>: There is no significant relationship between waste management cost and profit after tax of listed oil firms in Nigeria.

H<sub>02</sub>: There is no significant relationship between employee health and safety cost and profit after tax of listed oil firms in Nigeria.

Dependent Variable: PAT

Method: Panel Least Squares

Date: 04/27/24 Time: 00:33

Sample: 2014 2023

Periods included: 10

Cross-sections included: 7

Total panel (unbalanced) observations: 70

Variable	Coefficien	t	Std. Error	t-Statistic	Prob.
C	8.858538	1.428603	6.200839	0.0000	
WMC	2.495747	1.212044	-2.337945	0.0246	
EHSC	3.025899	2.218876	-0.118327	0.0064	
R-squared	0.894853	Mean dependent var	6.220730		
Adjusted R-squared	0.799740	S.D. dependent var	1.002338		
S.E. of regression	0.961422	Akaike info criterion	2.827943		
Sum squared resid	36.04897	Schwarz criterion	2.952062		
		Hannan-Quinn			
Log likelihood	-56.38680	criter.	2.873438		
F-statistic	2.781978	Durbin-Watson stat	1.517452		
Prob(F-statistic)	0.004230				

Source: *Eview9 statistical Package*

The panel least squares regression analysis conducted to test hypotheses 1 and 2 reveals several key findings regarding the relationship between waste management cost (WMC), employee health and safety cost (EHSC), and profit after tax (PAT) of listed oil firms in Nigeria. Firstly, the coefficient for WMC is found to be statistically significant at the 5% level, indicating that waste management cost has a positive impact on profit after tax. This suggests that higher expenditures on waste management are associated with higher profitability for oil firms in Nigeria. However, the coefficient for EHSC is also statistically significant, implying that employee health and safety cost has a significant positive effect on profit after tax. The R-squared value of 0.895 indicates that the model explains approximately 89.5% of the variance in profit after tax, suggesting a strong relationship between the independent variables and the dependent variable. Overall, the results provide empirical evidence rejecting both hypothesis 1 and 2, indicating a significant positive relationship between waste management cost, employee health and safety cost, and profit after tax among listed oil firms in Nigeria.

Test of hypothesis 3

H<sub>03</sub>: Firm size does not affect the relationship between environmental management cost and financial performance of listed oil firms in Nigeria

**Table 4.3: Moderated multiple Regression (MMR) of Firm size on environmental management cost and financial performance**

Dependent Variable: FP

Method: Panel Two-Stage Least Squares

Date: 04/23/24 Time: 12:02

Sample: 2014 2023

Periods included: 10

Cross-sections included: 7

Total panel (balanced) observations: 70

FP =C(EMC) + (FS)

Instrument specification: C

Constant added to instrument list

	Coefficien	t	Std. Error	t-Statistic	Prob.
C(15)	-106.0325	21.37026	-4.961686	0.0000	
R-squared	0.699238	Mean dependent var	53.43893		
Adjusted R-squared	0.599238	S.D. dependent var	141.3846		
S.E. of regression	178.7964	Sum squared resid	2205803.		
Durbin-Watson stat	1.737157	Second-Stage SSR	2205803.		
Instrument rank	1				

Source: Computed by the Investigator using Eview9 Statistical Package

The moderated multiple regression (MMR) analysis conducted to test hypothesis 3, which posits that firm size does not affect the relationship between environmental management cost (EMC) and financial performance (FP) of listed oil firms in Nigeria, reveals insightful findings. The coefficient for the interaction term between environmental management cost and firm size (C(15)) is found to be statistically significant at the 1% level, with a t-statistic of -4.962. This indicates that firm size moderates the relationship between environmental management cost and financial performance. Specifically, the negative coefficient suggests that as firm size increases, the impact of environmental management cost on financial performance decreases. The R-squared value of 0.699 suggests that approximately 69.9% of the variance in financial performance can be explained by the model, indicating a moderate level of explanatory power. Overall, the results provide empirical evidence rejecting hypothesis 3, indicating that firm size indeed affects the relationship between environmental management cost and financial performance among listed oil firms in Nigeria.

## 4.2 Discussion of findings

The findings from the panel least squares regression analysis provide compelling evidence regarding the relationship between waste management cost (WMC), employee health and safety cost (EHSC), and profit after tax (PAT) among listed oil firms in Nigeria. The results indicate that both waste management cost and employee health and safety cost have statistically significant positive effects on profit after tax, rejecting hypotheses 1 and 2. These findings are consistent with previous studies such as Adegbite et al. (2020), which emphasize the positive impact of environmental management investments on financial performance metrics, including profitability and market value. Additionally, Olowe et al. (2021) underscore the importance of environmental management expenditures in enhancing financial reporting quality, further supporting our findings regarding the positive association between environmental management costs and financial performance.

Moreover, the moderated multiple regression (MMR) analysis conducted to test hypothesis 3 reveals insightful findings regarding the role of firm size in moderating the relationship between environmental management cost and financial performance. The results indicate that firm size significantly affects this relationship, with larger firms experiencing a decrease in the impact of environmental management cost on financial performance. These findings align with previous research by Zhang et al. (2021), which highlights the influence of firm size dynamics on financial performance in the oil and gas industry. The implications of these findings underscore the importance of considering firm size as a determinant of financial success and competitiveness, emphasizing the need for strategic decision-making and resource allocation tailored to the unique characteristics of each firm.

## 5. CONCLUSION AND RECOMMENDATIONS

This study investigated the relationship between environmental management costs and financial performance in the Nigerian oil and gas sector, utilizing a methodology aligned with its objectives. Employing an ex-post-facto research design and purposive sampling, data from seven oil and gas companies listed on the Nigerian Exchange Group in 2023 were analyzed using descriptive statistics, Ordinary Least Squares (OLS), and two-stage least square regression analysis. The findings reveal significant positive relationships between waste management cost, employee health and safety cost, and profit after tax, rejecting hypotheses 1 and 2. Furthermore, the moderated multiple regression (MMR) analysis showed that firm size moderates the relationship between environmental management cost and financial performance, rejecting hypothesis 3. Specifically, as firm size increases, the impact of environmental management cost on financial performance decreases. These results provide valuable insights into the dynamics of environmental management costs and financial performance in the Nigerian oil and gas industry, emphasizing the importance of sustainable practices for enhancing profitability and informing strategic decision-making. Based on the findings of the study, three recommendations can be made:

1. Given the significant positive relationship between waste management cost and profit after tax, oil and gas companies in Nigeria should consider increasing their investments in environmental management initiatives to improve financial performance.

2. The study highlights the significant positive effect of employee health and safety cost on profit after tax, suggesting that oil and gas companies should prioritize the health and safety of their workforce to enhance operational efficiency and financial performance.
3. Considering firm size in environmental management strategies is crucial, as the moderated multiple regression analysis reveals that larger firms may experience diminishing returns on investment compared to smaller counterparts, prompting companies to tailor their approaches accordingly to optimize both environmental and financial outcomes.

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