

Assessment of Firm Value of Oil and Gas Sector in Nigeria: Ideology of Research and Development (R&D) Cost and Environmental Investment

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Abstract

The study investigated the influence of Research and Development (R&D) and environmental investment on the firm value of oil and gas companies in Nigeria. Utilizing an ex-post facto design and drawing data from annual reports of 6 listed oil and gas firms on the NGX, the research investigates three specific areas: the effect of R&D costs, environmental remediation costs, and waste management costs on firm value. The findings reveal that while R&D costs do not significantly affect firm value in Nigeria's oil and gas sector, environmental remediation and waste management costs exhibit a significant positive effect on firm value. The study revealed the importance of environmental investment for oil and gas companies in Nigeria. Recommendations stemming from the findings emphasize the need for companies to prioritize and augment investments in environmental initiatives, integrate environmental considerations into strategic planning processes, actively engage stakeholders to ensure transparency and accountability in environmental management practices, and continue investing in research and innovation despite the observed non-significant impact on firm value

Keywords: Firm value, Research and development, Environmental investment

1. INTRODUCTION

A large chunk of Nigeria's GDP, export profits, and government coffers come from the oil and gas industry, making it a key engine of economic growth. Over 90% of Nigeria's foreign exchange profits and around 70% of government revenue come from the oil and gas business, according to the Nigerian National Petroleum Corporation (NNPC) (2023). Despite this remarkable achievement, the industry faces several challenges that threaten its long-term sustainability, particularly in the areas of research and development and environmental investments. According to Ogbonnaya and Nwoke (2022), these two aspects are becoming more and more acknowledged as important variables in the worldwide oil and gas sector that determine the value of a company.

In order to improve the efficiency of oil exploration, extraction, and refining processes, it is vital to continuously innovate and adopt new technologies. Only through investments in research and development (R&D) can we achieve this. For operational process improvement, cost reduction, and compliance with developing international requirements such as carbon emission reduction, research and development expenditures are crucial (Ogunode & Adegbe, 2022). To keep up with the ever-shifting global energy market, oil and gas companies must pour significant resources into research and development. Since renewable energy is quickly replacing oil and gas as Nigeria's primary energy source, research and development are more important than ever. Companies may convert to cleaner energy production, find new uses for petroleum products, and increase the value of their current reserves by investing in research and development. This agrees with what Olajide (2021) found, which is that investments in research and development have a substantial effect on the success of oil and gas firms.

Equally important in determining how much oil and gas firms are worth is their environmental investment. The Niger Delta and other oil-producing areas have long struggled with environmental deterioration. Loss of biodiversity, water pollution, and health concerns for local populations are just a few of the socio-environmental impacts that have resulted from oil spills, gas flaring, and other detrimental activities (Okoroafor & Mgbemena, 2021). Businesses may lessen the impact of these damages and improve their long-term viability and image by investing in environmental clean-ups, sustainable resource management, and eco-friendly technology (Ikechukwu, 2022). Oraka (2021) study found that companies that prioritize environmental sustainability are more likely to attract investors and see an increase in their market value. Regulatory bodies, investors, and global stakeholders are pushing ESG practices.

In recent years, there has been a lot of focus on the correlation between research and development, environmental investments, and company value. Several studies have shown that investing in innovation and sustainability positively impacts corporate value. Oil and gas companies that put an emphasis on research and development and environmental initiatives, according to Abdullahi (2020), are more likely to have improved financial performance and a higher market valuation. Given the importance of innovation and sustainable practices for the future growth and stability of Nigeria's oil and gas sector, this is particularly pertinent.

Investment in research and development (R&D) and environmental protection (EPD) is crucial, but little is known about how these elements affect business value in Nigeria's oil and gas industry. Most research has not thoroughly examined how financial success and environmental effects contribute to business value. Therefore, this study aims to address that knowledge vacuum by calculating the oil and gas industry's firm value in Nigeria using research and development expenditures and investments in the environment as metrics.

Finally, businesses in Nigeria's oil and gas industry must decide how to respond to the growing worldwide demand for environmentally responsible and technologically advanced products and services. Businesses may increase their worth, ensure growth over the long term, and satisfy customers domestically and abroad by investing in research and development and environmental

protection. In order to provide industry stakeholders with useful insights, this study seeks to evaluate these dynamics within the Nigerian environment.

2. LITERATURE AND HYPOTHESES FORMULATION

The oil and gas business is crucial to the Nigerian economy, contributing considerably to government income and foreign exchange gains. However, the sustainability and expansion of enterprises in this industry rely on various variables, including strategic expenditures in Research and Development (R&D), environmental remediation, and waste management. These elements are vital for preserving competitiveness, compliance with rules, and boosting the corporate value. This literature analysis focuses on how R&D expenses, environmental remediation costs, and waste management costs impact the firm value of oil and gas businesses in Nigeria, and establishes the groundwork for hypothesis building.

Firm Value

What an investor thinks a company is worth is its firm value. The stock price of the firm reflects it. Investors are willing to pay a premium for a higher chance of a return, as demonstrated by a rising share price (Owota et al., 2022). The sum of all a company's assets is what gives it its worth. The market value of the company's shares and its liabilities comprise its worth. You can measure a company's value using Tobin's Q, Price Earnings Ratio (PER), Price to Book Value (PBV), and many other indicators (Guo et al., 2020).

The assets that a company owns are what give it its firm value. Firm value is considered important because it reflects the owner's financial well-being. Consequently, it is the manager's duty to maximize the firm's value in their capacity as an agent for the company (Ogiriki & Owota, 2022). Attracting the interest of other parties in joining the company is a good indicator of its high firm value. The earning power of a company's assets is the determinant of its value, according to Modigliani and Miller (2018). The positive effect of asset earnings power results in a larger profit and more efficient asset turnover for a company with higher earning power. Consequently, the value of the firm will also go up.

Research and Development (R&D) Costs and Firm Value

In capital-intensive sectors such as oil and gas, research and development (R&D) are essential for the preservation of competitiveness and the promotion of innovation. Research and development (R&D) investments enable businesses to reduce manufacturing costs, enhance operational efficiency, and develop new technologies, all of which contribute to a company's value. Numerous empirical studies have demonstrated that investing in research and development (R&D) enhances the value of a company. Alam et al. (2019) looked at how research and development spending affects a company's impact on the environment. They conduct an empirical investigation of the relationship between research and development spending and environmental performance as evaluated by energy consumption and carbon emissions intensity using firm-level data from 2004 to 2016 from G-6 nations. In line with the theoretical claims of the natural resource-based

view (NRBV), Alam et al. discovered that investing in research and development enhances the environmental performance of the organization.

Abdullahi and Mohammed (2020) assert that Nigerian oil and gas companies experience substantial operational efficiency and profitability enhancements as a result of their investment in research and development. Their research indicates that companies that allocate resources to research and development are more likely to identify and extract additional energy sources. This, in turn, enhances their value by reducing production costs and increasing profitability.

In a similar vein, Kalu and Ezeh (2020) emphasised that oil and gas companies in Nigeria become more competitive when they participate in research and development (R&D) because it enables them to utilise new technology. Their research demonstrated that firms that invest in research and development (R&D) experienced firmer market valuations and greater financial success than those that do not. Similarly, Martins and Odogwu (2019) conducted a comparison of the hydrocarbon industries of Ghana and Nigeria and discovered that R&D investment had a significant impact on company value. However, the effect was more pronounced in Ghana due to more supportive government policies.

However, other research cautions against anticipating immediate profits from R&D expenditures. According to Olajide (2021), investments in research and development (R&D) are essential for maintaining a competitive edge in the long term, but they may not yield immediate results. This is especially true in industries that require a significant amount of capital, such as oil and gas. The research determined that R&D returns may not have an instantaneous impact on company value as a result of their long-term nature. This could be problematic during periods of market volatility or when confronted with exogenous shocks, such as fluctuations in energy prices.

Drawing on the empirical evidence in the literature, the subsequent hypotheses are formulated for the study: **H_0 : Research and Development (R&D) costs do not significantly affect the firm value of oil and gas companies in Nigeria.**

Environmental Remediation Costs and Firm Value

Exploration and production activities in Nigeria have resulted in substantial environmental damage, notably in the Niger Delta region. Consequently, environmental remediation has become a critical focus for oil and gas companies. By investing in environmental remediation, oil companies can reduce regulatory risks, improve their corporate image, and reduce community conflicts, all of which can increase their firm value.

The impact of environmental remediation costs on firm value is the subject of conflicting results in empirical studies. Bello (2019) discovered that corporate social responsibility (CSR) initiatives, such as environmental remediation initiatives, have a beneficial impact on firm value by improving a company's reputation and its relationships with critical stakeholders. The research revealed that

investment in environmental sustainability results in a more favourable market perception, which in turn increases the value of the firm.

In the same vein, Okoroafor and Mgbemena (2021) observed that environmental remediation initiatives, particularly in the Niger Delta, assist companies in avoiding costly legal disputes and penalties while simultaneously enhancing their operational environment. This has a beneficial impact on the firm's financial performance and market valuation. Their research indicates that investors are inclined to incentivise organisations that take proactive measures to mitigate environmental concerns.

Nevertheless, certain studies warn that the correlation between environmental remediation costs and firm value may not always be clear. Eze (2020) contended that environmental remediation is essential for regulatory compliance; however, the expenses may not yield immediate financial advantages. Rather, these expenses are frequently perceived as operational burdens, and their beneficial effects on firm value may only become apparent in the long term as companies enhance their sustainability profiles and establish stronger reputations.

The following hypotheses are formulated for the study in accordance with the empirical findings in the literature: ***H₀: Environmental remediation costs do not significantly affect the firm value of oil and gas companies in Nigeria.***

Waste Management Costs and Firm Value

Another critical issue for oil and gas companies is waste management, as the improper handling of hazardous materials can lead to substantial environmental damage and legal penalties. Companies can enhance their corporate reputation and mitigate operational risks by implementing effective waste management practices, which can have a positive impact on firm value. Additionally, these practices ensure regulatory compliance.

Bassey (2021) discovered that organisations that prioritise responsible waste management practices, including recycling and hazardous material disposal, demonstrate superior financial performance. The research demonstrated that waste management investments assist organisations in mitigating the likelihood of environmental accidents, legal penalties, and reputational harm, all of which contribute to enhanced firm value.

Ibrahim and Abubakar (2021) also emphasised the positive correlation between operational efficiency and waste management costs in Nigerian oil and gas companies. Their research demonstrated that organisations that increase their waste management expenditures are more likely to experience operational efficiency, as they are able to prevent costly disruptions caused by environmental violations. The firm's financial performance and market value are both positively impacted by this operational efficiency.

Nevertheless, certain scholars contend that the extent to which waste management expenses affect the value of a company may differ based on its size. Joseph and Onyeka (2021) contended that waste management is fundamental for avoiding regulatory penalties; however, the expenses associated with these activities do not always result in a substantial increase in firm value, particularly for smaller firms that may find it difficult to absorb the high costs of compliance. Nevertheless, the research underscored the potential long-term detrimental effects on a company's profitability and reputation by neglecting to allocate resources to waste management.

Based on the empirical findings in the literature, the following hypotheses are developed for the study: **H_0 : Waste management costs do not significantly affect the firm value of oil and gas companies in Nigeria.**

3. METHODOLOGY

The study employed an ex-post facto design because it relies on pre-existing data that the researcher cannot change. Six oil and gas companies listed on the Nigerian Exchange Group (NGX) made up the sample population for this research. The research relied on secondary data. We extracted secondary data from the yearly reports of the oil and gas companies mentioned. The study employed both descriptive and inferential statistics. We used inferential statistics to figure out how the study's variables were related by using the Ordinary Least Squares (OLS) method and other statistical features to get estimate coefficients. To examine the impact of the independent factors on the dependent variable, the data will be examined with the use of E-views 9.

The model is specified in line with theories and literatures reviewed. The functional model is therefore stated as follows:

$$\text{TobinQ} = f(\text{RDev}, \text{EnVr}, \text{WaMgt}) \quad (\text{Equation 1})$$

This is explicitly written as;

$$\text{TobinQ} = \beta_0 + \beta_1 \text{RDev} + \beta_2 \text{EnVr} + \beta_3 \text{WaMgt} + \varepsilon \quad (\text{Equation 2})$$

Where:

β_0 : intercept term

$\beta_1, \beta_2, \beta_3$: coefficients of the independent variables

ε : error term

4. RESULT

Descriptive Analysis

	TOBIN_Q	R_D_COST	ENV_COST	WASTE_MGT_COST
Mean	0.616611	65857.67	43339.28	92780.44
Median	0.602500	27208.50	31301.00	23087.50
Maximum	0.880000	228329.0	120134.0	590719.0
Minimum	0.000000	0.000000	0.000000	0.000000
Std. Dev.	0.205138	77234.09	37355.01	165333.0
Skewness	-1.353704	0.972466	0.892452	2.080785
Kurtosis	5.558525	2.561260	2.632275	6.042456

Jarque-Bera	10.40708	2.981442	2.490828	19.93140
Probability	0.005497	0.225210	0.287822	0.000047
Sum	11.09900	1185438.	780107.0	1670048.
Sum Sq. Dev.	0.715386	1.01E+11	2.37E+10	4.65E+11
Observations	18	18	18	18

Source: EViews 9

The descriptive analysis in table 4.1 above shows the influence of Research and Development (R&D) and environmental investment on the firm value of oil and gas companies in Nigeria. The mean TOBIN_Q, a measure of firm value, stands at 0.616611. In terms of expenditure, the mean R_D_COST (research and development cost) is approximately 65857.67, while the mean ENV_COST (environmental remediation cost) and WASTE_MGT_COST (waste management cost) are 43339.28 and 92780.44 respectively.

However, when comparing mean values to their respective medians, disparities emerge. For instance, while the mean R_D_COST is 65857.67, the median R_D_COST is considerably lower at 27208.50. Similarly, the median ENV_COST (31301.00) and WASTE_MGT_COST (23087.50) are notably lower than their respective means. This suggests the presence of high-cost outliers skewing the mean values upwards, potentially indicating variations in expenditure levels among the studied companies. Further examination of measures of dispersion unveils additional insights. The positive skewness values for R_D_COST (0.972466), ENV_COST (0.892452), and WASTE_MGT_COST (2.080785) imply that the distributions of these costs are skewed towards lower values, with a few companies incurring significantly higher costs. Moreover, the leptokurtic distributions, indicated by the kurtosis values, suggest heavy tails and the presence of potential outliers in the expenditure data.

Regression Result

Dependent Variable: TOBIN_Q

Method: Least Squares

Date: 04/20/24 Time: 18:37

Sample: 1 18

Included observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
R_D_COST	5.27E-07	9.43E-07	0.559090	0.5849
ENV_COST	2.23E-06	1.96E-06	1.135477	0.0452
WASTE_MGT_COST	3.12E-07	2.58E-07	-1.208291	0.0469
C	0.514158	0.070577	7.285033	0.0000
R-squared	0.422253	Mean dependent var		0.616611
Adjusted R-squared	0.298450	S.D. dependent var		0.205138
S.E. of regression	0.171821	Akaike info criterion		0.491602
Sum squared resid	0.413312	Schwarz criterion		0.293742
Log likelihood	8.424421	Hannan-Quinn criter.		0.464320

F-statistic	3.410689	Durbin-Watson stat	1.663473
Prob(F-statistic)	0.007382		

Source: EViews 9

Discussion of Findings

This study's results provide valuable insights when compared to previous research on the impact of R&D, environmental remediation, and waste management expenses on the firm value of Nigerian oil and gas businesses. Following this, we will go into each finding in depth, building on the work of others.

R&D Costs and Firm Value

There was no statistically significant relationship between research and development expenditures and the market value of Nigerian oil and gas firms, according to the regression analysis ($p = 0.5849$, higher than the 0.05 significance level). Contrary to the vast body of evidence highlighting the beneficial impacts of R&D spending on business value and competitiveness, our study indicates the opposite.

Abdullahi and Mohammed (2020) predict that research and development spending in the oil and gas industry will boost company performance by promoting innovation, enhancing operational efficiency, and reducing production costs. Similarly, Kalu and Ezech (2020) discovered that oil corporations in Nigeria were more competitive when they invested in research and development (R&D). This suggests that companies that spend in R&D might increase their company value by taking advantage of emerging technology. Olajide (2021) points out that the non-significant outcome of this study may explain the delayed nature of R&D returns in a capital-intensive and unpredictable business-like oil and gas. Research and development efforts may not have an immediate impact on a company's bottom line or market value, according to Olajide's findings.

The policy climate in Nigeria may also play a role in explaining the lack of relevance. Martins and Odogwu (2019) conducted a comparison of the oil industries in Nigeria and Ghana and found that R&D (R&D) had a more noticeable beneficial effect in Ghana due to more supportive policies that encourage R&D investment. This may imply that research and development investment levels are insufficient to influence company value in the Nigerian setting or that businesses are not getting the assistance they need from the government.

Environmental Remediation Costs and Firm Value

The study found that **environmental remediation costs have a significant positive impact on firm value** (p -value = 0.0452). This result is consistent with the expanding corpus of research that shows a positive correlation between environmental sustainability activities and enhanced market valuation and company success.

According to Bello (2019), businesses that make significant investments in environmental remediation are viewed as socially conscious, and they often cultivate favorable connections with their stakeholders, such as investors, regulators, and local communities. Better market values and corporate worth may follow from this enhanced reputation. Similar to this, Okoroafor and Mgbemena (2021) contend that environmental cleanup initiatives in the Niger Delta region assist businesses in avoiding fines and disturbances in the community, which stabilizes operations and improves financial performance.

We can also explain this beneficial outcome by considering the regulatory and reputational constraints that oil and gas corporations operating in ecologically sensitive areas face. According to Eze (2020), businesses that do not make investments in environmental sustainability run a serious danger of facing legal issues, paying penalties, and maybe experiencing operational interruptions. Therefore, this study's substantial influence on environmental remediation costs emphasizes how crucial it is to follow environmental regulations in order to conserve and increase business value.

This research lends credence to the notion that businesses might improve their competitive edge by taking proactive environmental actions. In addition to being more robust to operational hazards, environmentally responsible businesses also have a better public image, which may draw in investors that respect sustainability, as demonstrated by Bassey (2021).

Waste Management Costs and Firm Value

The analysis also revealed that **waste management costs have a significant effect on firm value** (p-value = 0.0469). This finding indicates that effective waste management practices are crucial for increasing the value of oil and gas companies in Nigeria. The findings align with existing literature that highlights the significance of waste management in mitigating operational risks, ensuring regulatory compliance, and preventing legal penalties.

Ibrahim and Abubakar (2021) demonstrated that firms possessing well-structured waste management systems are more inclined to enhance operational efficiency by circumventing expensive disruptions associated with environmental violations. Improper waste disposal in the oil and gas sector poses substantial environmental risks and legal repercussions, which can adversely affect a firm's profitability and reputation. Bassey (2021) observed that firms investing in waste management typically see enhancements in corporate governance, which in turn positively influences their market valuation.

The literature indicates that the effect of waste management costs on firm value may differ based on firm size. Joseph and Onyeka (2021) indicate that smaller firms may face challenges in managing the high costs associated with waste management, potentially impacting their short-term profitability adversely. Larger firms can distribute these costs over a broader range of operations, thereby sustaining a favorable effect on firm value.

The findings of this study indicate that waste management costs significantly impact firm value, highlighting that environmental sustainability is both a regulatory requirement and a strategic element that enhances long-term profitability and firm value. Oil and gas companies that emphasize effective waste management are likely to experience reduced operational risks, enhanced regulatory compliance, and improved market perceptions.

Comparison with Overall Model

The F-statistic (3.410689, p-value = 0.007382) shows that at least one independent variable (costs of R&D, costs of cleaning up the environment, or costs of managing waste) has a big effect on the value of the company. Various financial, environmental, and operational factors affect firm value, as this model aligns with existing literature.

This study found R&D costs to be insignificant; however, the notable impact of environmental remediation and waste management costs indicates that oil and gas companies in Nigeria could enhance their value through investments in sustainable practices. The findings highlight the significance of environmental stewardship and adherence to regulations in a sector that faces ongoing scrutiny regarding its environmental impact.

The findings of the study indicate that investments in environmental remediation and waste management enhance firm value within Nigeria's oil and gas sector. This indicates that oil companies ought to emphasize environmental sustainability and adhere to waste management regulations to improve their market valuation. Organisations can gain advantages by minimising operational risks, mitigating legal penalties, and improving their public image, thereby attracting additional investors.

This study contributes to the existing literature on the impact of sustainability on corporate valuation. Investments in environmental and waste management have a notable positive effect on firm value, reinforcing stakeholder theory. This theory posits that companies enhance their financial performance by considering the interests of a wider range of stakeholders, such as communities and regulators. The minimal impact of R&D costs raises questions about the innovation-performance relationship within the Nigerian oil and gas sector, indicating that R&D efforts may require time to yield financial returns.

The findings indicate that regulators ought to formulate policies that promote environmental investments and research and development activities within the oil and gas sector. Although current environmental sustainability initiatives are yielding positive outcomes, there is a necessity for enhanced policies to promote research and development that can foster innovation and ensure long-term competitiveness. Enhancing the regulatory framework may result in improved alignment of corporate practices with national development objectives.

5. CONCLUSION

This study analyzed the impact of research-and-development (R&D) expenditures, environmental remediation expenses, and waste management costs on the valuation of oil and gas firms in Nigeria. The findings indicate that R&D costs do not significantly influence firm value, whereas investments in environmental remediation and waste management exert a positive and significant effect. The results highlight the increasing significance of sustainability practices in influencing corporate valuation in the oil and gas sector. Organizations that emphasize environmental compliance and efficient waste management are more likely to improve their market value, mitigate operational risks, and maintain a favorable public image.

The insignificance of R&D costs suggests that the benefits of innovation in this sector might take longer to manifest or may face constraints due to insufficient investment levels. Firms must balance short-term operational efficiency with long-term innovation strategies. This study enhances the discourse on the impact of sustainability practices on firm value, especially within environmentally sensitive industries. The findings indicate that policymakers should implement stronger incentives for environmental investments and research and development to enhance the sustainability and competitiveness of Nigeria's oil and gas sector.

Study's Limitations

There are a number of limitations to this study, but overall, it sheds light on how research and development expenses, environmental remediation expenditures, and waste management costs affect the firm value of Nigerian oil and gas enterprises.

Availability of Data: The analysis uses publicly accessible financial data, which does not necessarily show how much money was spent on research and development, cleaning up the environment, and managing waste. Underreporting or incomplete data might result if certain businesses fail to completely disclose these expenses.

Time Frame: The research only goes back a certain amount of time, so it might not be able to capture patterns over the long run or the delayed impact of research and development spending on company value. In instance, a short-term analysis could miss the mark when it comes to research and development (R&D) because of its typically lengthier pay-out time.

Particular Considerations: This research looks at the Nigerian oil and gas industry in great detail. The findings may not be applicable to other industries or areas due to industry-specific rules, environmental concerns, and market conditions.

Increasing the sample size, including longitudinal data, and investigating comparisons across sectors or countries might help future study overcome these constraints.

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