Environmental Remediation, Capital Expenditure and Firm Value of Listed Multinational Firms in Nigeria: Moderating Role of Foreign Ownership

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ABSTRACT

The persistent quest to enhance firm value amid increasing environmental obligations has become a strategic concern for listed multinational firms, as investors and other stakeholders increasingly evaluate corporate performance based on both financial and non-financial outcomes. Motivated by the need to understand how environmental investments influence firm valuation, this study examined the effect of environmental remediation cost and environmental capital expenditure on firm value measured by enterprise value of listed multinational firms in Nigeria, with foreign ownership as a moderator. An ex post facto design was adopted, using panel data from 20 listed multinational firms covering 2016–2025. Data were analyzed using Panel EGLS random-effects regression. Findings showed that environmental remediation cost moderated by foreign ownership had a positive and significant effect on enterprise value. Environmental capital expenditure moderated by foreign ownership had a negative but insignificant effect. The study concluded that foreign ownership strengthens the value relevance of environmental remediation cost but does not significantly enhance the effect of environmental capital expenditure. It recommended improved environmental remediation practices, clearer disclosure of environmental capital investments, and stronger foreign ownership-driven environmental governance.

Keywords: Environmental Remediation, Capital Expenditure, Enterprise Value, Foreign Ownership, Firm value

INTRODUCTION

Sustaining and enhancing the firm value of listed multinational firms has become one of the most significant strategic challenges confronting corporations in an increasingly competitive and sustainability-driven global economy (Eccles et al., 2014). As investors, regulators and other stakeholders increasingly assess corporate success based on both financial performance and environmental stewardship, multinational firms are expected to generate sustainable shareholder value while fulfilling their environmental responsibilities. The increasing emphasis on environmental sustainability has transformed environmental accountability from a voluntary corporate practice into a strategic imperative for firms worldwide. Consequently, multinational firms face growing pressure from investors, regulators, and other stakeholders to integrate environmental considerations into their operational and investment decisions. Environmental remediation costs, which represent expenditures incurred to prevent, mitigate, or restore environmental damage, and capital expenditure, which reflects long-term investments in productive assets, have emerged as important determinants of corporate value and sustainable growth (Eze et al., 2025). In Nigeria, listed multinational firms contribute significantly to economic development through foreign direct investment, employment generation, and technology transfer. However, many operate in environmentally sensitive industries characterized by pollution, waste generation, and ecosystem degradation, necessitating substantial environmental remediation expenditures. While such expenditures may enhance corporate legitimacy and stakeholder confidence, they may also increase operational costs and reduce short-term profitability, creating uncertainty regarding their effect on firm value (Solanke et al., 2025). Similarly, capital expenditure is expected to improve operational efficiency, innovation capacity, and future cash flows, thereby enhancing firm value. Nevertheless, evidence suggests that inefficient investment decisions and resource misallocation may undermine the expected benefits of capital investments (Eze et al., 2025). As investors

increasingly consider environmental performance and sustainability commitments in their valuation decisions, firms with inadequate environmental management practices may face reputational risks, regulatory sanctions, and declining market valuation (Orshi & Aliyu, 2024).

Despite the growing body of literature on environmental accounting and sustainability reporting, empirical evidence on the combined effect of environmental remediation costs and capital expenditure on firm value remains limited, particularly within the context of listed multinational firms in Nigeria. Existing studies have largely focused on environmental disclosure, sustainability reporting, and financial performance using Tobin's Q, ROA, or other conventional indicators of firm performance and value, with comparatively little attention devoted to environmental remediation costs as a distinct determinant of firm value (Solanke et al., 2025). Furthermore, the moderating role of foreign ownership remains insufficiently explored. Foreign investors are often associated with stronger monitoring mechanisms, improved corporate governance, and greater commitment to sustainability practices, which may influence how environmental remediation costs and capital expenditure affect firm value (Musa, 2024). However, empirical evidence regarding this moderating effect remains inconclusive. Consequently, despite substantial investments in environmental remediation activities and capital assets, the firm value of many listed multinational firms in Nigeria continues to fall below investors' expectations. This unresolved issue presents a significant gap in the literature and necessitates an investigation into the effect of environmental remediation costs and capital expenditure on firm value, as well as the moderating role of foreign ownership among listed multinational firms in Nigeria (Musa, 2024; Orshi & Aliyu, 2024; Solanke et al., 2025). It is against this backdrop that this study investigates the effect of environmental remediation costs and capital expenditure on the firm value of listed multinational firms in Nigeria, while examining the moderating role of foreign ownership. To achieve this objective, the following hypotheses underlying this study are stated thus:

$H0_1$: Environmental Remediation Costs has no significant effect on Enterprise Value of listed Multinational Firms in Nigeria when moderated by foreign ownership.

$H0_2$: Environmental Capital Expenditure has no significant effect on Enterprise Value of listed Multinational Firms in Nigeria when moderated by foreign ownership.

LITERATURE REVIEW

2.1 Conceptual Framework

2.1.1 Environmental Remediation

Environmental remediation refers to the process of restoring, rehabilitating, or removing environmental contamination from land, water, and ecosystems affected by industrial and commercial activities. It involves actions such as site clean-up, oil spill recovery, soil and groundwater treatment, waste removal, and ecosystem restoration to mitigate environmental damage and restore ecological quality in accordance with regulatory standards (United States Environmental Protection Agency, 2024). Environmental remediation is a fundamental component of corporate environmental management, reflecting a firm's commitment to environmental stewardship, regulatory compliance, and sustainable business practices. Beyond addressing environmental liabilities, effective remediation enhances corporate reputation, strengthens stakeholder confidence, reduces regulatory and litigation risks, and contributes to long-term value creation (Grewal et al., 2019). From a theoretical perspective, Stakeholder theory suggest that firms undertake environmental remediation to meet stakeholder expectations, maintain societal legitimacy, and preserve their license to operate. In multinational firms, these outcomes are often reinforced by foreign ownership, as foreign investors promote stronger governance, environmental accountability, and transparency, thereby increasing the effectiveness and value relevance of environmental remediation initiatives (Ferreira & Matos, 2008; Boubakri et al., 2018). Accordingly, this study conceptualizes environmental remediation as a strategic environmental management practice aimed at restoring environmental quality, fulfilling regulatory obligations, and supporting sustainable value creation, with its effectiveness strengthened by sound governance and foreign ownership.

2.1.2 Environmental Remediation Costs

Environmental remediation cost refers to the expenditures incurred by a firm to restore or rehabilitate environmental damage arising from its operations. These costs include activities such as contaminated site clean-up, oil spill remediation, land restoration, hazardous waste treatment, ecosystem rehabilitation, and other corrective measures undertaken to comply with environmental regulations and restore affected environments (International Accounting Standards Board, 2021). Such expenditures may be recognized as operating expenses, capitalized costs, or environmental provisions depending on their nature and the applicable accounting standards. From a theoretical perspective, Stakeholder Theory explain that firms undertake environmental remediation to fulfil their responsibilities to stakeholders, maintain societal legitimacy, and preserve their license to operate. Although remediation costs may reduce short-term profitability, they can enhance long-term firm value by reducing environmental liabilities, strengthening corporate reputation, improving regulatory compliance, and increasing investor confidence (Grewal et al., 2019). The value implications of environmental remediation are further influenced by foreign ownership. Foreign investors generally promote stronger corporate governance, greater environmental accountability, and enhanced disclosure practices. Through effective monitoring and oversight, they encourage firms to view remediation expenditures as strategic sustainability investments rather than mere compliance costs, thereby increasing their potential to enhance enterprise value (Ferreira & Matos, 2008; Boubakri et al., 2018). Accordingly, this study conceptualizes environmental remediation cost as the monetary value of expenditures incurred by listed multinational firms to restore environmental quality and fulfil environmental restoration obligations. It is regarded as a strategic environmental investment whose contribution to firm value is expected to be strengthened by the moderating influence of foreign ownership.

2.1.3 Environmental Capital Expenditure

Environmental capital expenditure refers to long-term investments made by firms in environmental assets, technologies, infrastructure, and projects intended to improve environmental performance, reduce environmental impacts, and generate future economic benefits. Unlike environmental remediation costs, which are primarily corrective and restorative in nature, environmental capital expenditure is preventive and strategic, focusing on investments that enhance environmental sustainability and operational efficiency over the long term. Environmental capital expenditure typically includes investments in pollution-control equipment, waste treatment facilities, renewable energy systems, clean production technologies, emission reduction technologies, environmentally friendly machinery, water treatment plants, recycling facilities, and other environmental protection assets. These expenditures are capitalized because they are expected to generate future economic benefits beyond the current accounting period through improved resource efficiency, reduced environmental risk, enhanced regulatory compliance, and strengthened corporate competitiveness (Mukwarami & Van der Poll, 2024). The concept is rooted in investment theory, which posits that firms undertake capital investments to improve productive capacity and maximize future returns. In the environmental context, environmental capital expenditure represents proactive investments aimed at preventing environmental degradation while simultaneously enhancing firm value. Such investments are increasingly viewed as strategic sustainability investments capable of improving operational efficiency, reducing future remediation obligations, strengthening stakeholder trust, and supporting long-term corporate value creation (Lu et al., 2026). In this study, environmental capital expenditure is conceptualized as long-term investments made by listed multinational firms in Nigeria toward environmental protection assets, pollution prevention technologies, waste management infrastructure, environmental conservation projects, and other environmentally sustainable capital projects designed to improve environmental performance and enhance firm value.

2.1.4 Firm Value

Firm value refers to the overall economic worth of a company as perceived by investors and other market participants. It represents the market's assessment of a firm's ability to generate future cash flows, sustain profitability, manage risks, and create wealth for shareholders over time. In corporate finance literature, firm value is regarded as the ultimate measure of organizational success because it captures both current performance and future growth prospects (Brigham & Ehrhardt, 2023). The concept of firm value is rooted in shareholder wealth maximization theory, which posits that managerial decisions should be directed toward increasing the

market value of the firm. A higher firm value reflects investors' confidence in the firm's strategic direction, operational efficiency, governance quality, and long-term sustainability. Consequently, firm value serves as a critical indicator used by investors, creditors, regulators, and other stakeholders in evaluating corporate performance and investment attractiveness (Ross et al., 2025). From a market perspective, firm value is influenced by both financial and non-financial factors. Financial determinants include profitability, liquidity, leverage, growth opportunities, and investment efficiency, while non-financial determinants encompass corporate governance quality, environmental performance, sustainability initiatives, innovation capability, and stakeholder relations. In recent years, environmental, social, and governance (ESG) factors have become increasingly important drivers of firm value as investors incorporate sustainability considerations into investment decisions (Eccles & Klimenko, 2019; Friede et al., 2015). Empirically, firm value is commonly measured using market-based indicators such as Tobin's Q, market capitalization, market-to-book ratio, and enterprise value. Among these measures, Tobin's Q remains one of the most widely used proxies because it captures investors' expectations regarding the future earning potential of a firm by comparing market value with the replacement cost of assets (Lindenberg & Ross, 1981). Within the context of this study, firm value is conceptualized as the market-based economic worth of listed multinational firms in Nigeria, reflecting investors' evaluation of the firm's current performance, future growth prospects, environmental responsibility, and capacity to generate sustainable shareholder wealth.

2.1.5 Enterprise Value

Enterprise Value (EV) is a comprehensive measure of a firm's total market value that incorporates both equity and debt financing. Unlike traditional measures such as market capitalization, which focus solely on shareholders' ownership interest, enterprise value captures the total value of a business available to all capital providers, including shareholders, creditors, and other claimholders. Consequently, enterprise value is often regarded as a more holistic measure of corporate worth and acquisition value (Damodaran, 2024). Enterprise value is generally computed as the market value of equity plus total debt and preferred stock, less cash and cash equivalents. This measure reflects the theoretical cost of acquiring an entire company and therefore provides a broader assessment of firm value than market capitalization alone. Financial analysts and investors frequently utilize enterprise value when comparing firms across industries because it neutralizes differences in capital structure and financing decisions (Koller et al., 2025). Theoretical support for enterprise value originates from modern valuation theory, which views the value of a firm as the present value of expected future cash flows available to all providers of capital. Consequently, enterprise value reflects investors' collective assessment of a firm's operational performance, investment opportunities, risk profile, and future cash-generating capacity. Factors such as profitability, capital expenditure, innovation, sustainability investments, corporate governance quality, and environmental performance may significantly influence enterprise value by affecting future cash flow expectations and risk perceptions (Brealey et al., 2024). Recent sustainability literature suggests that environmental investments and environmental risk management practices increasingly affect enterprise value because investors view environmentally responsible firms as less exposed to regulatory, reputational, and operational risks. Consequently, firms that effectively manage environmental obligations and undertake strategic sustainability investments may enhance enterprise value by reducing risk, improving operational efficiency, and creating opportunities for financial value creation (PwC, 2025). In this study, enterprise value is conceptualized as the total market value of listed multinational firms in Nigeria, representing the combined value attributable to both equity holders and debt holders, and serving as a comprehensive measure of corporate value creation influenced by environmental remediation costs, environmental capital expenditure, and foreign ownership.

2.1.6 Foreign Ownership

Foreign ownership refers to the proportion of a firm’s equity held by non-domestic investors, including foreign institutional and individual shareholders. In contemporary corporate finance and governance literature, it is conceptualized as a strategic ownership structure that introduces external monitoring, global governance standards, and cross-border capital discipline into firm decision-making processes (Roedder & Schmid, 2025). Empirical evidence consistently shows that foreign ownership influences firm behavior through enhanced monitoring, improved transparency, and stronger governance mechanisms. For instance, foreign institutional investors are found to reduce agency conflicts by strengthening internal control systems and improving

managerial accountability (Huang et al., 2023). Similarly, studies demonstrate that foreign shareholders are associated with improved corporate governance quality, reduced opportunistic behavior, and more disciplined investment decisions (Liu et al., 2024; Phan, 2024).

In emerging markets, foreign ownership plays an even more pronounced governance role due to weaker institutional environments. Evidence suggests that foreign investors enhance information environments and reduce information asymmetry, thereby improving market discipline and valuation efficiency (Dang et al., 2023). Furthermore, firms with higher foreign ownership tend to adopt stronger sustainability and risk management practices, as foreign investors often demand adherence to international environmental and financial reporting standards (Onjewu et al., 2024). In this study, foreign ownership is conceptualized as a moderating variable that may strengthen or weaken the relationship between environmental remediation costs, environmental capital expenditure, and firm value. The moderating logic is grounded in agency theory and institutional theory, which suggest that foreign investors influence managerial decisions by enforcing stricter monitoring mechanisms, improving transparency, and aligning corporate practices with global best standards. Consequently, the value relevance of environmental investments may be amplified in firms with higher foreign ownership due to improved credibility, accountability, and investor confidence.

2.1.7 Revenue Growth

Revenue growth refers to the percentage increase in a firm's sales or operating income over a specified period. It is widely recognized in corporate finance and empirical accounting literature as a key indicator of a firm's expansion capacity, market demand strength, and operational performance (Damodaran, 2024). Accordingly, in this study, revenue growth is conceptualized as a control variable capturing firm-level expansion and performance dynamics. It is included to ensure that the observed relationship between environmental remediation costs, environmental capital expenditure, foreign ownership, and firm value is not biased by differences in firm growth trajectories.

2.2 Empirical Review

2.2.1 Environmental Remediation and Firm Value

Empirical evidence on the valuation implications of environmental remediation costs presents mixed findings, partly because prior studies have differed in their conceptualization of environmental costs, measures of firm performance, and geographical contexts. In Nigeria, Akinlade et al. (2026) examined the impact of environmental cost disclosure on corporate sustainability among quoted oil and gas companies in Nigeria from 2019–2025, with particular emphasis on environmental remediation expenditures. Using secondary data from annual reports, sustainability reports, and financial statements, the study employed descriptive statistics, correlation, and regression analyses and found that environmental remediation cost disclosure significantly enhances corporate sustainability among quoted oil and gas companies, suggesting that transparent reporting of remediation activities can strengthen stakeholder trust, corporate legitimacy, and long-term organizational resilience.

Similarly, Udoh et al. (2025) investigated the relationship between environmental restoration cost disclosure and investor behaviour among listed oil and gas firms in Nigeria using data from 2014–2023 and reported a positive and significant relationship between environmental clean-up and waste management cost disclosures and market capitalization among listed oil and gas firms. Taken together, these Nigerian studies suggest that environmental remediation information can generate favourable stakeholder and investor responses. However, both studies examined disclosure rather than actual environmental remediation expenditure, making it difficult to determine whether the expenditure itself, rather than its disclosure, is associated with improvements in corporate value or performance.

Evidence based on actual environmental costs is less conclusive. Taiwo et al. (2025) examined 44 multinational corporations in Nigeria over 2012–2023 and found that environmental remediation cost had a positive but statistically insignificant effect on economic performance. This finding contrasts with the significant positive effects reported by Akinlade et al. (2026) and Udoh et al. (2025), but the difference may partly reflect the

outcome variable employed. Whereas the latter studies considered corporate sustainability and market capitalization respectively, Taiwo et al. (2025) focused on economic performance, thereby leaving open the question of whether remediation expenditure has implications for broader market-based measures of firm valuation. Moreover, none of these Nigerian studies directly examines environmental remediation expenditure in relation to enterprise value, which incorporates both the market value of equity and the firm's debt position and therefore provides a broader perspective on corporate valuation.

Evidence from developed markets further demonstrates that the relationship between environmental costs and firm value may not necessarily be positive. Arthur (2024), investigated the value relevance of environmental damage costs using a large sample of U.S. firms from 2004–2022, found a significant negative association between environmental damage costs and firm value, indicating that investors may discount firms exposed to greater environmental liabilities. The study also showed that ownership structure can influence the market consequences of environmental costs. This evidence is important because it demonstrates that environmental costs may have different valuation consequences depending on institutional and ownership contexts. However, the U.S. setting differs substantially from the Nigerian emerging-market environment in terms of environmental regulation, investor sophistication, disclosure practices, and corporate governance structures, limiting the direct generalizability of its findings to Nigerian firms.

Overall, the literature reveals three important patterns. First, Nigerian evidence generally associates environmental cost disclosure with favourable stakeholder, sustainability, or market responses, while evidence based on actual remediation expenditure remains less conclusive. Second, the direction and significance of the relationship appear to depend partly on the measure of corporate outcomes employed, with existing Nigerian studies concentrating on corporate sustainability, economic performance, or market capitalization rather than enterprise value. Third, the evidence from Arthur (2024) indicates that ownership structure may condition the valuation effects of environmental costs, but this moderating dimension remains insufficiently explored in the Nigerian context. Consequently, an important empirical gap persists concerning whether actual environmental remediation expenditure affects the enterprise value of listed multinational firms in Nigeria and whether foreign ownership alters this relationship. Addressing this gap provides the basis for the present study.

2.2.2 Environmental Capital Expenditure and Firm Value

The empirical evidence on environmental capital expenditure and firm value remains mixed, with findings varying according to the nature of environmental expenditure, the outcome measure employed, and the institutional context. Evidence from Nigeria generally points to a favourable valuation effect of environmental investment. Owota and Mansi (2025) who examined the effect of environmental investment on the firm value of listed oil and gas companies in Nigeria using data from six NGX-listed firms employing an ex-post facto design and OLS regression, found that environmental capital expenditure significantly and positively affects the firm value of listed oil and gas companies, suggesting that investments in environmental infrastructure and sustainable assets may enhance investor confidence and corporate valuation. This finding is consistent with the broader evidence of Asiri and Alyafai (2025) who investigated the relationship between capital expenditure (CAPEX) and ESG performance among Saudi-listed firms from 2014–2023, while examining the moderating role of CEO board membership. Using OLS regression, they study found that capital expenditure positively influences ESG performance among Saudi-listed firms. However, their finding that the effect weakens when CEOs simultaneously serve as board members demonstrates that the consequences of investment may depend on governance arrangements. Thus, environmental investment may not produce uniform outcomes independently of the organizational and governance conditions under which it is undertaken.

The positive evidence is, however, not universal. Fatma and Mondal (2026) examined the effect of environmental and social costs on the firm value of Nifty 50 companies in India using panel data from 2021–2023 and pooled OLS regression. Firm value was measured using Tobin's Q and EPS, while environmental and social costs were derived from integrated annual reports. T. Findings revealed a significant negative relationship between environmental and social costs and firm value among Nifty 50 companies in India, suggesting that investors may perceive sustainability expenditures as short-term cost burdens rather than immediate sources of value creation. This contrasts with the positive valuation effect reported by Owota and Mansi (2025) and indicates that the

relationship between environmental expenditure and firm value may depend on how investors interpret the nature, magnitude, and expected returns of such expenditures. The divergence may also reflect differences in the measurement of environmental costs and firm value: Fatma and Mondal (2026) employed Tobin's Q and earnings per share, whereas Owota and Mansi (2025) examined firm value in the Nigerian oil and gas context. These differences make direct comparison difficult and reinforce the need for evidence using alternative and broader measures of corporate valuation.

Related evidence further suggests that environmental capital investment is associated with stronger sustainability-oriented corporate outcomes, although this does not necessarily establish a direct valuation effect. Moussa and Elmarzouky (2023) examined whether capital expenditure influences ESG disclosure among non-financial firms in the United Kingdom. Using panel data from FTSE All-Share firms, found that higher capital expenditure among UK non-financial firms was associated with stronger ESG commitments and environmental disclosure. While this supports the view that capital investment can facilitate environmental and sustainability initiatives, the study examined ESG disclosure rather than firm value. Consequently, the evidence establishes an association between investment and sustainability-related outcomes but does not directly demonstrate whether such investments are reflected in the market valuation of firms. Similarly, Asiri and Alyafai (2025) focused on ESG performance rather than firm value, further limiting the extent to which their findings can be directly applied to the environmental investment–valuation relationship. Collectively, the literature therefore reveals a notable inconsistency. Studies examining environmental capital expenditure tend to report positive effects on firm value or ESG-related outcomes, whereas broader measures of environmental and social costs may be negatively associated with firm value. This suggests that investors may distinguish between environmental expenditure viewed as productive investment in sustainable assets and infrastructure and expenditure perceived primarily as a cost burden. The literature also indicates that governance and ownership characteristics may condition the consequences of environmental investment, yet this moderating dimension remains insufficiently examined in the Nigerian context.

More importantly, existing Nigerian evidence is concentrated in the oil and gas sector and relatively small samples, while international studies largely reflect developed or other emerging-market contexts. Prior studies also employ diverse firm-value measures, with limited attention to enterprise value. Moreover, little is known about how ownership structure conditions the relationship between specific environmental cost components and enterprise value among listed multinational firms in Nigeria. This study addresses these gaps by examining environmental capital expenditure and enterprise value, with foreign ownership as a moderator, thereby extending the literature beyond direct effects to the conditions under which environmental investment may translate into corporate value.

THEORETICAL FRAMEWORK

2.3.1 Agency Theory

Agency Theory, developed by Jensen and Meckling (1976), explains the relationship between shareholders (principals) and managers (agents), emphasizing that conflicts of interest may arise when managers pursue personal objectives at the expense of shareholder wealth maximization. The theory is relevant to this study because environmental remediation costs and environmental capital expenditure involve significant resource allocation decisions that may be subject to managerial discretion. Foreign ownership serves as an important governance mechanism capable of reducing agency conflicts through enhanced monitoring, transparency, and accountability. Foreign investors are often associated with stronger governance practices that improve investment efficiency and ensure that environmental investments contribute to value creation (Roedder & Schmid, 2025). Thus, Agency Theory provides the theoretical basis for explaining the moderating role of foreign ownership in the relationship between environmental investments and firm value.

2.3.2 Stakeholder Theory

Stakeholder Theory, propounded by Freeman (1984), posits that firms are accountable not only to shareholders but also to a broad range of stakeholders, including employees, customers, regulators, communities, and the

environment. The theory argues that organizations create sustainable value when they effectively address stakeholders' economic, social, and environmental expectations (Harrison et al., 2020). The theory is relevant to this study because environmental remediation costs and environmental capital expenditure represent strategic environmental investments undertaken to mitigate environmental damage, improve sustainability performance, and enhance stakeholder confidence. By responding to stakeholders' environmental concerns, firms can strengthen their legitimacy, reduce environmental risks, improve corporate reputation, and ultimately enhance firm value (Harrison et al., 2020). Consequently, Stakeholder Theory provides the primary explanation for how environmental investments influence the value of listed multinational firms in Nigeria and is therefore adopted as the underpinning theory of the study.

Stakeholder Theory underpins this study because it directly explains how environmental remediation costs and environmental capital expenditure can enhance firm value through improved stakeholder relations, legitimacy, and sustainability performance. Agency Theory complements this perspective by explaining how foreign ownership strengthens managerial monitoring and enhances the value relevance of environmental investments.

METHODOLOGY

The study adopts an ex-post facto research design. This design is appropriate because the study relies on historical and publicly available secondary data from the annual financial reports of Multinational firms listed on the Nigerian Exchange Group (NGX). It enables the researcher to investigate causal relationships between environmental remediation cost, environmental capital expenditure and firm value without manipulating the variables. The population of the study consist of all twenty-six (26) multinational firms listed on the Nigeria Exchange Group (NGX) as at 31st December 2025 for a period of 10 years from 2016 to 2025. The sample size is twenty (20) and purposive sampling technique was employed. The six excluded firms did not meet one or more of the predetermined criteria, particularly continuous listing throughout 2016–2025, availability of complete annual/sustainability reports, and adequate disclosure of environmental cost and foreign ownership data. Data for this study were obtained from audited financial statements and sustainability reports of the listed multinational firms in Nigeria. The panel regression analysis was employed as appropriate statistical procedure. Consequently, incorporating the variables of the study into equation, the study adapted the model of Taiwo et al. (2025) with little modification in line with the research hypotheses in order to empirically determine the effect of environmental remediation cost and environmental capital expenditure on firm value when moderated by foreign ownership. Accordingly, the original dependent variable, economic performance, and the environmental cost variables of waste management cost and pollution control cost used by Taiwo et al. (2025) were not retained because they do not form part of the present study. The regression model for the empirical analysis is therefore expressed as:

Pre moderation Model:

$$\mathbf{EV_{it} = \beta_{0\,it} + \beta_1 ERC_{it} + \beta_2 ECAPX_{it} + \beta_3 RG_{it} + \epsilon_{it}} \quad \textbf{(i)}$$

Where:

EV = Enterprise Value (proxy for Firm Value)

ERC = Environmental Remediation Cost

ECAPX = Environmental Capital Expenditure

RG = Revenue Growth (control variable)

β_0= Constant or intercept

$\beta_1 - \beta_3$ = Regression coefficients for each variable

ϵ = Stochastic error term

i = Individual firm

t = time Period

Moderated Model:

$$EV_{it} = \beta_{0\,it} + \beta_1 ERC*FO_{it} + \beta_2 ECAPX*FO_{it} + \beta_3 RG*FO_{it} + \epsilon \ldots\ldots\ldots\

4.1 Descriptive Statistics

The study's data are described using the mean, standard deviation, variance, maximums, minimums, skewness, and kurtosis. Table 2 presents the descriptive statistics for the variables of the study below.

Table 4.1: Descriptive Statistics

	EV	ERC	ECAPX	RG
Mean	1.52E+10	1.02E+10	3.23E+11	1070.571
Median	7.53E+09	1.19E+09	7.69E+09	5.408653
Maximum	8.96E+10	8.32E+10	7.87E+12	89898.07
Minimum	5.35E+08	100000.0	40000.00	-98.70280
Std. Dev.	1.73E+10	1.65E+10	1.10E+12	7547.911
Skewness	2.024340	2.089029	4.613481	9.531059
Kurtosis	7.193050	6.981961	25.56528	103.4305
Jarque-Bera	283.1124	277.6015	4952.738	87080.47
Probability	0.000000	0.000000	0.000000	0.000000
Sum	3.05E+12	2.04E+12	6.45E+13	214114.2
Sum Sq. Dev.	5.94E+22	5.42E+22	2.42E+26	1.13E+10
Observations	200	200	200	200

Source: E-views 13 Output (2026)

Table 4.1 presents the descriptive statistics for enterprise value (EV), environmental remediation cost (ERC), environmental capital expenditure (ECAPX), and revenue growth (RG) based on 200 firm-year observations. The results indicate substantial variation across the sampled multinational firms. Enterprise value has a mean of approximately ₦15.2 billion and a median of ₦7.53 billion, with a maximum of ₦89.6 billion and a minimum of ₦535 million. The standard deviation of ₦17.3 billion and positive skewness of 2.024 indicate considerable dispersion and a concentration of observations toward the lower end, with a few firms recording substantially higher valuations. Similarly, ERC has a mean of ₦10.2 billion compared with a median of ₦1.19 billion, ranging from ₦100,000 to ₦83.2 billion. Its standard deviation of ₦16.5 billion and skewness of 2.089 indicate substantial variation and the influence of relatively high remediation expenditures in some observations.

ECAPX exhibits the greatest dispersion among the monetary variables, with a mean of approximately ₦323 billion, median of ₦7.69 billion, and a range of ₦40,000 to ₦7.87 trillion. Its standard deviation of ₦1.10 trillion and skewness of 4.613 indicate pronounced positive asymmetry, suggesting that a relatively small number of observations account for exceptionally high environmental capital expenditures. The Jarque–Bera probabilities of 0.0000 for all variables indicate rejection of the null hypothesis of normality. Overall, the statistics demonstrate considerable heterogeneity in firm value and environmental expenditure among the sampled firms and provide an important basis for interpreting the subsequent results.

4.2 Correlation Analysis

Table 4.2 below shows the results of the association between the independent and dependent variables of listed Multinational firms in Nigeria. It contains the Pearson pairwise correlation coefficients of the variables under study. The correlation matrix is presented in Table 4.2 below. **Table 4.2: Correlation Matrix (Pre-Moderation)**

Covariance Analysis: Ordinary					
Date: 06/29/26 Time: 15:25					
Sample: 2016 2025					
Included observations: 200					
Correlation					
Probability	EV	ERC	ECAPX	RG	
EV	1.000000				

ERC	-0.160860	1.000000			
	0.0229	-----			
ECAPX	-0.118888	0.346828	1.000000		
	0.0936	0.0000	-----		
RG	-0.037371	-0.072561	-0.038438	1.000000	
	0.5993	0.3072	0.5889	-----	

Source: E-views 13 Output (2026)

Table 4.2.1: Correlation Matrix (Post-Moderation)

Covariance Analysis: Ordinary					
Date: 07/22/26 Time: 14:53					
Sample: 2016 2025					
Included observations: 200					
Correlation					
Probability	EV	ERC_FO	ECAPX_FO	RG	
EV	1.000000				

ERC_FO	-0.040420	1.000000			
	0.5698	-----			
ECAPX_FO	-0.035404	0.464032	1.000000		
	0.6187	0.0000	-----		
RG	-0.037371	-0.028094	0.004103	1.000000	
	0.5993	0.6929	0.9540	-----	

Source: E-views 13 Output (2026)

Table 4.2 presents the Pearson correlation matrix for the study variables. The results indicate that Environmental Remediation Cost (ERC) has a weak negative and statistically significant relationship with Enterprise Value (EV) ($r = –0.1609$, $p = 0.0229$), suggesting that higher remediation costs are associated with lower firm value. Environmental Capital Expenditure (ECAPX) also shows a weak negative but insignificant relationship with enterprise value ($r = –0.1189$, $p = 0.0936$), while Revenue Growth (RG) exhibits a very weak and insignificant negative correlation with enterprise value ($r = –0.0374$, $p = 0.5993$). Among the explanatory variables, the highest correlation is between ERC and ECAPX ($r = 0.3468$, $p < 0.01$), which is well below the 0.80 threshold, indicating the absence of multicollinearity. Overall, the low-to-moderate correlations among the independent variables suggest that they are suitable for inclusion in the panel regression model.

Table 4.2.1 also presents the Pearson correlation matrix post-moderation for the variables. The results show that the interaction variables, ERC_FO ($r = –0.0404$, $p = 0.5698$) and ECAPX_FO ($r = –0.0354$, $p = 0.6187$), exhibit weak negative and statistically insignificant relationships with Enterprise Value (EV), indicating that the moderated environmental cost variables do not have a significant linear association with firm value at the correlation level. Similarly, Revenue Growth (RG) has a very weak and insignificant negative correlation with enterprise value ($r = –0.0374$, $p = 0.5993$). Among the explanatory variables, the highest correlation is between ERC_FO and ECAPX_FO ($r = 0.4640$, $p < 0.01$), which is well below the commonly accepted threshold of 0.80, indicating the absence of multicollinearity. Overall, the low-to-moderate correlations among the independent variables suggest that the moderated variables are suitable for inclusion in the panel regression model.

4.3 Multicollinearity Test

Multicollinearity test is conducted to check the presence of harmful correlation between the explanatory variables that could distort the regression result. In this study, multicollinearity test was conducted using Variance Inflation Factor (VIF). According to Gujarati (2004), when the Centered VIF value is more than 10, then there is a strong indication of the presence of multicollinearity.

Table 4.3: Multicollinearity Test (VIF)

Pre-Moderation

Variance Inflation Factors			
Date: 06/29/26 Time: 14:27			
Sample: 2016 2025			
Included observations: 200			
	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	5.295318	3.590272	NA
ERC	0.006649	1.691836	1.222178
ECAPX	1.391006	1.244165	1.145829
RG	2.619410	1.025836	1.005506

Source: E-views 13 Output (2026)

Table 4.3.1: Multicollinearity Test (VIF)

Post-Moderation

Variance Inflation Factors			
Date: 07/27/26 Time: 09:25			
Sample: 2016 2025			
Included observations: 200			
	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	4.345718	2.875181	NA
ERC_FO	1.816719	1.065761	1.436467
ECAPX_FO	1.812419	1.009403	1.435358
RG	2.716310	1.035290	1.014773

Source: E-views 13 Output (2026)

Table 4.3 and 4.3.1 presents the Variance Inflation Factor (VIF) results used to assess multicollinearity among the explanatory variables. The centered VIF values range from 1.0055 to 1.222178 pre-moderation for ERC, CAPX, RG and 1.014773 to 1.436467 post-moderation for ERC_FO, ECAPX_FO and RG which are substantially below the commonly accepted threshold of 10.0 (and the more conservative threshold of 5.0). These results indicate the absence of multicollinearity among the independent variables, implying that each variable provides distinct explanatory information. Consequently, the regression coefficients can be considered reliable and unbiased for subsequent panel regression analysis.

4.4 Heteroskedasticity Test

In order to validate the panel regression results, the Heteroskedasticity test was conducted as a robustness check. Heteroskedasticity happens when the standard errors of a variable, monitored over a specific amount of time, are non-constant. Heteroskedasticity is a violation of the assumptions for linear regression modeling, and so it can impact the validity of the result from any analysis while heteroskedasticity does not cause bias in the coefficient estimates, it does make them less precise; lower precision increases the likelihood that the coefficient estimates are further from the correct population value.

Hypothesis

H0: There is no heteroskedasticity problem in the model (Residuals are homoskedastic)

H1: There is heteroskedasticity problem in the model

Decision Rule:

Accept H0 if the Prob. value is greater than 0.05 (5% level of significant). Otherwise, do not accept H0.

Table 4.4: Heteroskedasticity Test (Pre-Moderation)

Panel Cross-section Heteroskedasticity LR Test				
Equation: UNTITLED				
Specification: EV C ERC ECAPX RG				
Null hypothesis: Residuals are homoskedastic				
	Value	df	Probability	
Likelihood ratio	256.0233	20	0.0000	
LR test summary:				
	Value	df		
Restricted LogL	-4994.532	196		
Unrestricted LogL	-4866.520	196		

Source: E-views 13 Output (2026)

Table 4.4.1: Heteroskedasticity Test (Post-Moderation)

Panel Cross-section Heteroskedasticity LR Test				
Equation: UNTITLED				
Specification: EV C ERC_FO ECAPX_FO RG				
Null hypothesis: Residuals are homoscedastic				
	Value	Df	Probability	
Likelihood ratio	260.0341	20	0.0000	
LR test summary:				
	Value	Df		
Restricted LogL	-4997.534	196		
Unrestricted LogL	-4867.517	196		

Source: E-views 13 Output (2026)

Based on the decision rule, the Heteroskedasticity Test produced a probability value of 0.0000 for both the pre- and post-moderation models, which is less than the 5% significance level ($p < 0.05$). Accordingly, the null hypothesis of homoscedasticity is rejected, indicating the presence of heteroskedasticity in both regression models. To address this violation and ensure efficient parameter estimates and valid statistical inference, the regression models were estimated using White period (cross-section) heteroskedasticity-robust standard errors, which correct for heteroskedasticity and produce robust standard errors for hypothesis testing.

4.5 Panel Properties

Decision Rule:

Reject H0 if the Prob > F is less than 0.05. Otherwise, do not reject H0.

Table 4.5: Hausman Test (Pre-Moderation)

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.929041	3	0.8184

Source: E-views 13 Output (2026)

Table 4.5.1: Hausman Test (Post-Moderation)

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.341398	4	0.9870

Source: E-views 13 Output (2026)

The result of the Hausman test appended in table 4.5 and 4.5.1 does not provide sufficient evidence to reject this null hypothesis at 5% level of significance as can be seen that the probability value (0.9818 and 0.9870) pre and post moderation of the test is greater than the critical value of 0.05. Therefore, the study upholds that difference in coefficients is not systematic and hence, the random effect model is the most appropriate models for the study. It is imperative therefore, to proceed to another test which is the Langranger Multiplier test, which will indicate the appropriateness or otherwise of using the pooled effect model or the random effect model.

Table 4.6: Breusch-Pagan and Lagranger Multiplier Test (Pre-Moderation)

Lagrange multiplier (LM) test for panel data			
Date: 07/22/26 Time: 15:07			
Sample: 2016 2025			
Total panel observations: 200			
Probability in ()			
Null (no rand. effect)	Cross-section	Period	Both
Alternative	One-sided	One-sided	
Breusch-Pagan	214.0914	2.518689	216.6101
	(0.0000)	(0.1125)	(0.0000)

Source: E-views 13 Output (2026)

Table 4.6.1: Breusch-Pagan and Lagranger Multiplier Test (Post-Moderation)

Lagrange multiplier (LM) test for panel data			
Date: 07/22/26 Time: 15:11			
Sample: 2016 2025			
Total panel observations: 200			
Probability in ()			
Null (no rand. effect)	Cross-section	Period	Both
Alternative	One-sided	One-sided	
Breusch-Pagan	234.0516	2.565048	236.6166
	(0.0000)	(0.1092)	(0.0000)

Source: E-views 13 Output (2026)

Since the Breusch-Pagan cross-section probability value is 0.0000 pre and post moderation, which is less than 0.05, the null hypothesis of no random effect is rejected. Therefore, random effects model is preferred over pooled OLS.

4.7 Test of Research Hypotheses

In panel regression analysis, the ultimate goal is the estimation of the relationship between dependent and independent variables. This goal can be achieved through the estimation of the coefficients of each independent variable in the model. The sign of coefficients of independent variables indicates their relationship with dependent variable, while the magnitude of the coefficients implies the responses of dependent variables to independent variables.

Decision Rule: The decision rule for accepting or rejecting the null hypothesis for any of these tests was based on the Probability Value (PV) and the Probability (F-statistic). If the PV is less than 5% or 0.05 (that is, if PV < 0.05), it implies that the regressor in question is statistically significant at 5% level; and if the PV is more than 5% or 0.05 (that is, if PV > 0.05), it is categorized as not significant at that level. This implies that the level of significance for the study is at 5% (for the two-tailed test). Thus, the decision rule for accepting or rejecting the null hypothesis is based on both the Probability Value (PV) and the Probability (F-statistic).

Table 4.7: Panel Regression Result (Random Effect)

Pre-Moderation

Dependent Variable: EV				
Method: Panel EGLS (Cross-section random effects)				
Date: 07/22/26 Time: 15:13				
Sample: 2016 2025				
Periods included: 10				
Cross-sections included: 20				
Total panel (balanced) observations: 200				
Swamy and Arora estimator of component variances				
White period (cross-section cluster) standard errors & covariance (d.f. corrected)				
Standard error and t-statistic probabilities adjusted for clustering				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.606410	3.449409	4.655360	0.0002
ERC	-0.054100	0.063886	-0.846820	0.4076
ECAPX	-0.000376	0.000297	-1.264927	0.2212
RG	-74811.59	102273.7	-0.731484	0.4734
	Effects Specification			
			S.D.	Rho
Cross-section random			1.339410	0.5446
Idiosyncratic random			1.228210	0.4554
	Weighted Statistics			
R-squared	0.533640	Mean dependent var		4.237409
Adjusted R-squared	0.511610	S.D. dependent var		1.200410
S.E. of regression	1.216410	Sum squared resid		2.875322
F-statistic	3.238703	Durbin-Watson stat		1.986959
Prob(F-statistic)	0.023416			

Source: E-views 13 Output (2026)

Table 4.7 presents the pre-moderation Panel EGLS random-effects regression results estimated using the Swamy and Arora estimator White period (cross-section cluster) robust standard errors to correct for heteroskedasticity. The overall model is statistically significant (Prob. F-statistic = 0.0234 < 0.05), indicating that the explanatory variables jointly influence enterprise value.

Individually, Environmental Remediation Cost (ERC) has a negative but statistically insignificant effect on

Enterprise Value (β = –0.0541, p = 0.4076), implying that remediation expenditures do not significantly affect firm value. Likewise, Environmental Capital Expenditure (ECAPX) exerts a negative and insignificant effect (β = –0.000376, p = 0.2212), while Revenue Growth (RG) also has a negative and insignificant influence on enterprise value (β = –74811.59, p = 0.4734).

The model explains approximately 53.36% of the variation in enterprise value (R^2 = 0.5336), indicating moderate explanatory power. Furthermore, the Durbin–Watson statistic of 1.987 suggests the absence of serious autocorrelation in the residuals, confirming the reliability of the estimated model. Overall, the findings indicate that, prior to moderation, the environmental cost variables do not exert a statistically significant direct effect on the enterprise value of listed multinational firms in Nigeria.

Table 4.7.1: Panel Regression Result (Random Effect)

Post-Moderation

Dependent Variable: EV				
Method: Panel EGLS (Cross-section random effects)				
Date: 07/22/26 Time: 15:24				
Sample: 2016 2025				
Periods included: 10				
Cross-sections included: 20				
Total panel (balanced) observations: 200				
Swamy and Arora estimator of component variances				
White period (cross-section cluster) standard errors & covariance (d.f. corrected)				
Standard error and t-statistic probabilities adjusted for clustering				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.588310	3.006509	5.248019	0.0000
ERC_FO	0.005912	0.002014	2.935452	0.0067
ECAPX_FO	-0.000122	0.000684	-0.178363	0.8598
RG	-97576.57	112547.6	-0.866980	0.3968
	Effects Specification			
			S.D.	Rho
Cross-section random			1.387210	0.5649
Idiosyncratic random			1.217810	0.4351
	Weighted Statistics			
R-squared	0.618722	Mean dependent var		4.089409
Adjusted R-squared	0.586450	S.D. dependent var		1.208310
S.E. of regression	1.203610	Sum squared resid		2.847422
F-statistic	5.574884	Durbin-Watson stat		1.923951
Prob(F-statistic)	0.001000			

Source: E-views 13 Output (2026)

Table 4.7.1 presents the post-moderation Panel EGLS random-effects regression results estimated using the Swamy and Arora estimator with White period (cross-section cluster) robust standard errors. The overall model is statistically significant (Prob. F-statistic = 0.0010 < 0.05), indicating that the moderated model provides a significant explanation of variations in enterprise value. Environmental Remediation Cost when moderated by Foreign Ownership (ERC_FO) has a positive and statistically significant effect on Enterprise Value (β = 0.005912, p = 0.0067), indicating that foreign ownership positively moderates the relationship between environmental remediation cost and firm value. However, Environmental Capital Expenditure when moderated by Foreign Ownership (ECAPX_FO) has a negative but statistically insignificant effect on enterprise value (β =

–0.000122, p = 0.8598). The model explains approximately 61.87% of the variation in enterprise value (R^2 = 0.6187), indicating improved explanatory power compared to the pre-moderation model. Furthermore, the Durbin–Watson statistic of 1.924 suggests the absence of serious autocorrelation in the residuals. Overall, the findings indicate that foreign ownership strengthens the relationship between environmental remediation cost and enterprise value but does not significantly moderate the effect of environmental capital expenditure on firm value.

DISCUSSION OF FINDINGS

This study examined the moderating effect of foreign ownership on the relationship between environmental remediation and environmental capital expenditure on firm value of listed multinational firms in Nigeria. The findings demonstrate that foreign ownership plays a significant moderating role in the relationship between environmental costs and the enterprise value of listed multinational firms in Nigeria.

$H0_1$: Environmental Remediation Costs and Enterprise Value

Environmental Remediation Cost when moderated by Foreign Ownership (ERC_FO) has a positive and statistically significant effect on Enterprise Value, indicating that foreign ownership positively moderates the relationship between environmental remediation cost and firm value. This suggests that higher foreign ownership strengthens the value-enhancing effect of environmental remediation expenditures. Prior to moderation, environmental remediation cost exerted a negative but statistically insignificant effect on enterprise value. However, after introducing foreign ownership as an interaction variable, the coefficient became positive and statistically significant. This indicates that foreign ownership strengthens the positive value relevance of environmental remediation expenditures, suggesting that the impact of environmental costs on firm value depends on the extent of foreign equity participation. The significant moderating effect can be attributed to the governance and monitoring role typically associated with foreign investors. Foreign shareholders generally demand higher standards of environmental accountability, transparency, and sustainability reporting while exerting greater oversight over managerial decisions. Consequently, environmental remediation expenditures are more likely to be viewed as strategic investments that enhance corporate reputation, reduce environmental risk, improve regulatory compliance, and strengthen long-term competitiveness. These factors increase investor confidence and, ultimately, enterprise value. The finding therefore suggests that foreign ownership transforms environmental remediation costs from being perceived merely as compliance expenditures into value-enhancing strategic investments.

The result provides empirical support for Agency Theory, which posits that effective monitoring by shareholders reduces agency conflicts and improves managerial decision-making. It also supports Stakeholder Theory, which argues that firms creating value for diverse stakeholders through responsible environmental practices are more likely to achieve superior long-term performance. Furthermore, foreign ownership enhances the credibility of environmental investments by signaling stronger corporate governance and commitment to sustainability, thereby improving market valuation. The findings are also consistent with the empirical evidence of Ferreira and Matos (2008) and Boubakri et al. (2018), who reported that foreign institutional ownership strengthens corporate governance, enhances monitoring efficiency, and contributes positively to firm valuation. Similarly, Abdulkarim et al. (2025) found that governance mechanisms significantly enhance the value relevance of environmental sustainability expenditures. The present study extends this evidence by demonstrating that, within the Nigerian multinational context, foreign ownership is not merely an ownership characteristic but an important governance mechanism that conditions the effect of environmental costs on enterprise value.

$H0_2$: Environmental Capital Expenditure and Enterprise Value

Environmental Capital Expenditure when moderated by Foreign Ownership (ECAPX_FO) has a negative but statistically insignificant effect on enterprise value. This suggests that foreign ownership does not strengthen the value relevance of long-term environmental capital investments. A plausible explanation is that the economic benefits of environmental capital expenditure are realized over a longer investment horizon and may not be immediately reflected in market valuation, even in firms with substantial foreign ownership. Overall, the findings

underscore that foreign ownership enhances the effectiveness of environmental remediation expenditure in creating firm value but does not significantly influence the relationship between environmental capital expenditure and enterprise value. This implies that ownership structure constitutes a critical institutional mechanism through which environmental strategies translate into market value, reinforcing the importance of attracting and retaining foreign investors who promote stronger governance, environmental stewardship, and sustainable value creation.

CONCLUSION AND RECOMMENDATION

The study concludes that foreign ownership significantly strengthens the positive effect of environmental remediation cost on enterprise value of listed multinational firms in Nigeria. However, foreign ownership does not significantly moderate the effect of environmental capital expenditure on enterprise value. This suggests that visible remediation activities enhance investor confidence and firm valuation, while long-term environmental capital investments may take time to generate measurable value.

Based on the study's findings, the following recommendations are proposed to enhance the efficient market value of listed multinational firms on the Nigeria Exchange Group;

1. Listed multinational firms should prioritize environmental remediation because it improves enterprise value when supported by foreign ownership.
2. Firms should improve disclosure of environmental capital expenditure to show its long-term benefits to investors.

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