ENVIRONMENTAL ACCOUNTING, CORPORATE GOVERNANCE

Environmental Compliance, Waste Management Costs and Firm Value of Listed Multinational Firms: Moderating Role of Foreign Ownership in Nigeria

Joan Unekwu Akadi, Isaac K. Lambe, Solomon Mangba Aza

Department of Accounting, Bingham University, Karu, Nasarawa State, Nigeria

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Abstract

Firm value remains a critical concern for listed multinational firms in Nigeria, yet whether environmental compliance cost and waste management cost enhance or diminish firm value remains unclear, particularly under different ownership structures. This study examines the effects of environmental compliance cost and waste management cost on the firm value of listed multinational firms in Nigeria, with foreign ownership serving as the moderator. Using a balanced panel of 200 firm-year observations from 20 firms over 2016–2025, data from annual and sustainability reports were analyzed using cross-section random-effects regression with robust standard errors. Firm value was measured by enterprise value, while revenue growth served as a control variable. The findings reveal that foreign ownership negatively and significantly moderates the relationship between environmental compliance cost and firm value, but positively and significantly moderates the relationship between waste management cost and firm value. The study concludes that foreign ownership does not uniformly enhance the value relevance of environmental expenditure; rather, its moderating effect varies according to the nature of the expenditure with compliance-related expenditure potentially imposing greater value pressures under foreign ownership, whereas waste management expenditure may generate stronger value benefits in firms with greater foreign ownership. The study recommends that multinational firms link environmental expenditure to measurable economic outcomes, strengthening the efficiency of compliance costs while prioritizing waste management investments that enhance resource efficiency, risk reduction and operational savings.

Keywords: Environmental compliance cost; waste management cost; firm value; foreign ownership; multinationals

1 Introduction

Firm value remains one of the most critical indicators of corporate sustainability, investor confidence and long-term competitiveness among listed multinational firms in Nigeria. However, these firms operate within a challenging environment shaped by exchange rate volatility, inflation, infrastructure deficits, regulatory uncertainty, weak governance, insecurity and growing environmental expectations, which can increase operating costs, disrupt business activities and influence investor valuation. Exchange rate volatility can increase the naira cost of imported inputs and foreign-currency obligations, thereby affecting profitability and firm value, particularly for multinational firms with significant international transactions (Akinyemi & Uthmman, 2026). Inflation similarly increases the cost of energy, materials, labour and transportation, placing pressure on margins and investment capacity. Infrastructure deficits can compel firms to incur additional costs for essential services, while regulatory uncertainty and weak governance may increase compliance costs and constrain the

efficiency of corporate resource allocation. Insecurity can further impose security, logistics and disruption costs, potentially weakening operational performance and investor confidence. At the same time, growing stakeholder expectations for environmental responsibility require firms to commit resources to environmental compliance, pollution control and waste management. Such expenditure presents a valuation dilemma because it may impose immediate financial costs while potentially reducing regulatory and reputational risks and supporting long-term value creation. Recent Nigerian evidence indicates that the relationship between environmental sustainability practices and firm value is not uniform, with studies reporting both positive and negative valuation effects (Azeez et al., 2025). This makes it important to determine whether specific forms of environmental expenditure enhance or diminish firm value and whether ownership structure influences these outcomes.

Although multinational firms are expected to possess superior technology, stronger capital access and better governance systems than purely domestic firms, their operations in Nigeria are still affected by the unstable macroeconomic and institutional environment. The IMF (2025) acknowledges that Nigeria's recent economic reforms have strengthened macroeconomic stability, improved resilience and restored investor confidence, as reflected in renewed portfolio inflows and improved access to international capital markets. Nevertheless, persistent inflation and external uncertainties continue to pose challenges to the business environment, with implications for corporate operating costs and investment decisions. Within this context, environmental compliance cost and waste management cost have become increasingly important determinants of firm value. The National Environmental Standards and Regulations Enforcement Agency (NESREA) is empowered to enforce environmental laws, standards, guidelines and regulations in Nigeria, while environmental permits are required for industrial facilities whose operations may affect the environment (NESREA, 2007). In addition, NESREA indicates that the Federal Government has developed thirty-five environmental regulations that are already in force, demonstrating that environmental responsibility is no longer a voluntary corporate gesture but a regulatory and strategic business requirement. For listed multinational firms, this means that expenditure on environmental audits, permits, pollution control, effluent treatment, emissions reduction, remediation, recycling, waste disposal and environmental reporting may materially affect operating cash flows, risk exposure and enterprise value. These expenditures may reduce firm value by increasing operating costs and constraining current earnings, particularly in a high-cost business environment; alternatively, they may enhance value by reducing environmental and regulatory risks, strengthening legitimacy and reputation, and improving stakeholder confidence. Thus, environmental expenditure presents a fundamental valuation dilemma: does it erode or create firm value?

The relevance of this question has increased as Nigeria strengthens environmental regulation and sustainability reporting. NESREA administers environmental standards and requires relevant facilities to obtain permits, including permits covering waste and toxic substances, while Nigeria's environmental framework includes specific regulations on sanitation and waste management (NESREA, 2009, n.d.). These requirements make environmental expenditure increasingly relevant to corporate costs and valuation. However, environmental disclosure does not necessarily establish whether the underlying expenditure creates economic value. Existing Nigerian evidence remains fragmented. Studies have examined environmental disclosure, environmental accounting and environmental costs using measures such as ROA, Tobin's Q and market value, with mixed findings (Taiwo et al., 2025; Ukpeh, 2025). However, relatively limited evidence isolates environmental compliance cost and waste management cost as distinct expenditure categories and evaluates their effects on

enterprise value. This distinction is important because compliance expenditure primarily addresses regulatory obligations, whereas waste management expenditure concerns the operational collection, treatment, recycling and disposal of waste; aggregating them may conceal different value consequences.

Furthermore, foreign investors may influence environmental governance through stronger monitoring, international reporting expectations and sensitivity to environmental risks, potentially changing how environmental expenditure is perceived by investors. Yet existing Nigerian studies have paid limited attention to foreign ownership as a moderator of the environmental cost–firm value relationship. Consequently, this study investigates the effect of environmental compliance cost and waste management cost on the firm value of listed multinational firms in Nigeria, while examining the moderating role of foreign ownership. To achieve this objective, the following null hypotheses are tested:

H_{01}: Environmental compliance cost has no significant effect on the enterprise value of listed multinational firms in Nigeria when moderated by foreign ownership.

H_{02}: Waste management cost has no significant effect on the enterprise value of listed multinational firms in Nigeria when moderated by foreign ownership.

2 Literature review

2.1 Conceptual framework

2.1.1 Environmental compliance

Environmental compliance represents the commitment by a firm to meet applicable environmental laws, regulations, standards, permits, monitoring requirements and other mandatory environmental obligations arising from its business activities. Conceptually, it extends beyond the mere disclosure of environmental information to capture the actual economic resources consumed in achieving and demonstrating regulatory conformity. Environmental compliance therefore encompasses resources associated with activities such as environmental monitoring and assessment, regulatory permits and certifications, environmental audits, compliance inspections, environmental impact assessments, regulatory reporting, environmental management systems, staff training required for regulatory compliance, and other expenditures necessary to prevent or correct non-conformity with environmental requirements (Odoemelam & Okafor, 2021).

2.1.2 Environmental compliance costs

Environmental compliance cost represents costs incurred by firms to satisfy environmental laws, standards, permits, audits, monitoring requirements, environmental impact obligations, emissions-control regulations, and sustainability-reporting expectations. In the Nigerian context, these costs are relevant because NESREA's environmental regulations impose obligations on firms whose activities affect the environment (NESREA, n.d.). These costs may include environmental audit fees, permit costs, regulatory reporting expenses, monitoring costs, environmental consultancy fees, and penalties avoided through compliance (Clarkson et al., 2019). The relationship between environmental compliance cost and firm value is, however, not linear and may be contingent on ownership structure. Foreign ownership acts as a moderating factor by influencing how environmental compliance expenditures are perceived and managed within firms. Foreign investors typically bring stronger governance standards, advanced sustainability practices, and greater pressure for transparency and

accountability. As a result, firms with higher foreign ownership are more likely to treat environmental compliance costs as value-enhancing investments rather than mere regulatory burdens (Boubakri et al., 2018). Environmental compliance cost is conceptualized in this study as the monetary expenditure incurred by a firm to achieve, maintain and demonstrate conformity with applicable environmental laws, regulations, standards and regulatory requirements. Environmental compliance cost was initially measured as the aggregate actual Naira value of environmental compliance expenditures disclosed by each firm and subsequently transformed using the natural logarithm for regression analysis. The measure is expressed as Equation (1):

$$ECC_{it} = \ln\left(\text{Environmental compliance cost}_{it}\right) \quad (1)$$

2.1.3 Waste management

Waste management refers to the collection, treatment, recycling, recovery, disposal, reduction, and control of waste generated by business operations. Waste management deals directly with the physical and operational handling of waste. It may include waste treatment facilities, recycling programmes, hazardous waste handling, effluent treatment, landfill charges, waste transportation, waste-reduction technology, and contractor payments for waste disposal (Ezonfade et al., 2024). In firms with significant manufacturing or extractive operations, waste management may also reflect the firm's commitment to pollution prevention and operational sustainability. Waste Management is particularly important for multinational firms because waste represents an environmental externality that can generate both direct (expenditure on waste collection, treatment facilities, recycling systems, waste transportation, disposal services, waste-monitoring systems and waste-management personnel) and indirect economic consequences that may arise through regulatory exposure, environmental liabilities, reputational damage, operational inefficiency and stakeholder concerns where waste is inadequately managed (Taiwo et al., 2025).

2.1.4 Waste management cost

Waste management costs refer to expenditures for proper waste handling, recycling, and disposal. Effective waste management reduces environmental externalities, regulatory risk, and community opposition (Clarkson et al., 2019). Waste management cost refers to the expenses incurred in the collection, transportation, treatment, and disposal of waste materials generated by human activities. It encompasses the financial resources allocated to various processes involved in managing waste, including sorting, recycling, composting, incineration, and landfilling. Waste management costs are incurred by individuals, businesses, governments, and other entities responsible for handling and disposing of waste in an environmentally responsible manner (Ndlovu & Moyo, 2021). Efficient waste management practices can help minimize costs, reduce environmental impacts, and reflect the importance of transparency, integrity, and stakeholder engagement in achieving long-term organizational objectives (Igbekoyi, 2017). Foreign ownership may heighten firms' strategic focus on waste management due to international best practice exposure and greater stakeholder scrutiny. This enhanced governance can strengthen the positive impact of waste management costs on enterprise value. Waste management cost is therefore conceptualized in this study as the monetary expenditure incurred by a firm for the collection, segregation, transportation, treatment, recycling, recovery, monitoring and environmentally responsible disposal of wastes arising from its operations. Waste management cost is measured as the natural logarithm of the actual Naira value of waste management expenditure disclosed by the firm, as expressed in Equation (2):

$$WMC_{it} = \ln\left(\text{Waste management cost}_{it}\right) \quad (2)$$

2.1.5 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). 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.

2.1.6 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). Firm value in this study is measured by enterprise value. Enterprise value is suitable because it captures the overall market value of the firm to both equity and debt holders, after adjusting for cash and investments. This is particularly important for multinational firms because they may use complex financing structures involving local debt, foreign debt, parent-company financing, retained earnings, and cross-border capital arrangements. Unlike return on assets or return on equity, enterprise value reflects the market's broader assessment of a firm's operating value and capital structure. 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 compliance cost, waste management cost, and foreign ownership. It is expressed as Equation (3):

$$EV = \text{Market capitalisation} + \text{Total debt} - \text{Cash and cash equivalents} \quad (3)$$

2.1.7 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; Chen et al., 2024). In this study, foreign ownership is conceptualized as a moderating variable that may strengthen or weaken the relationship between environmental compliance cost, waste management cost 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.

2.1.8 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 compliance costs, waste management costs, foreign ownership, and firm value is not biased by differences in firm growth trajectories. Revenue growth is expressed as Equation (4):

$$RG = \frac{\text{Current revenue} - \text{Previous revenue}}{\text{Previous revenue}} \tag{4}$$

2.2 Empirical review

2.2.1 Environmental compliance cost and firm value

Engko and Rahmiati (2026) examined the mediating role of green innovation in the relationship between ESG performance and firm value among 64 companies listed on the Indonesia Stock Exchange over the period 2018–2023. Using 384 firm-year observations and Hayes' PROCESS Model 4, the study found that ESG performance significantly influenced firm value and green innovation, while green innovation had a negative direct effect on firm value. However, green innovation significantly mediated the relationship between ESG performance and firm value, suggesting that sustainability initiatives may enhance corporate valuation through innovation despite their short-term cost implications. Although the study establishes the relevance of sustainability practices to firm valuation, it focuses on aggregate ESG performance rather than the actual monetary costs of specific environmental activities and does not investigate foreign ownership as a moderating factor.

Ukpeh (2025) examined the effect of green accounting proxied by environmental compliance costs on the financial performance of listed oil and gas firms in Nigeria. Using an ex-post facto research design and a Distributed Lag Model (DLM), the study analyzed data from nine listed oil and gas companies over a ten-year period (2014–2023), with return on assets (ROA) serving as the proxy for financial performance. The findings revealed that environmental compliance costs exert a positive short-run effect on ROA ($\beta = 0.10$; $t = 1.02$), but a negative long-run effect ($\beta = -1.39$; $t = -1.19$). This indicates that while environmental compliance may initially enhance operational efficiency, investor

perception, or regulatory goodwill, its long-term impact may reduce profitability due to sustained cost burdens. Despite its contribution, the study focuses exclusively on oil and gas firms, limiting generalizability to other multinational sectors in Nigeria. Also, it adopts ROA as the sole measure of performance, which does not fully capture enterprise-level valuation effects that incorporate both equity and debt holders.

Shittu et al. (2024) examined the components of environmental cost accounting and their influence on firm value among manufacturing companies listed on the Nigerian Exchange Group over an 11-year period (2012–2022). Using data from annual reports, environmental impact assessments, mitigation plan reviews, audit reports, and sustainability reports, the study employed descriptive statistics and regression analysis. Results revealed that waste management costs exhibited a positive but statistically insignificant effect. The study however in their analysis of waste management costs was limited and not linked to broader firm valuation metrics like enterprise value. Moreover, the study did not consider the moderating role of foreign ownership, which could affect how environmental cost investments are perceived and valued by investors.

Tian et al. (2023) investigated the relationship between green innovation and firms' stock market value, with particular emphasis on the mediating role of environmental compliance costs and the moderating role of technological collaboration. Using longitudinal data from 351 heavily polluting firms listed on China's A-share market over the period 2007–2018, the study employed a moderated-mediation framework, with green patent stocks used to measure green innovation and Tobin's Q used as a proxy for stock market value. The findings revealed that green innovation had a significant positive effect on firms' stock market value, with a 1% increase in the green innovation-to-assets index associated with a 0.18% increase in Tobin's Q. More importantly, environmental compliance costs significantly mediated the relationship between green innovation and stock market value, accounting for approximately 8.5% of the relationship. The study further established that technological collaboration with public research organizations positively moderated the relationship between green innovation and environmental compliance costs. However, the study focused on Chinese heavily polluting firms and examined environmental compliance cost primarily as a mediating mechanism within the green innovation–firm value relationship and did not examine whether foreign ownership alters the relationship between environmental compliance costs and firm value.

2.2.2 Waste management cost and firm value

Nweze (2026) investigated the effect of green accounting practices on the firm value of listed industrial goods firms in Nigeria, with specific attention to waste management, pollution control, and emission control disclosures. Using an ex-post facto design and a sample of nine firms from 2015–2024, the study applied descriptive analysis and a Fixed Effect Model following Hausman specification tests. The findings revealed that waste management disclosure has a positive and significant impact on firm value ($\beta = 2.169$, $p = 0.0062$), demonstrating that transparent reporting of waste reduction, recycling, and disposal practices is valued by investors and enhances firm valuation. Pollution control disclosure had a positive but insignificant effect, while emission control disclosure had a negative and significant effect, indicating that stakeholders interpret different environmental disclosures differently. The study recommends institutionalizing structured waste management reporting frameworks to ensure transparency and consistency. The exclusion of moderating variables such as foreign ownership, and the focus on industrial goods firms only, leaving scope for future research to examine actual waste management costs, broader multinational samples, and the role of ownership structure in influencing the valuation effects of environmental costs.

Agbiogwu et al. (2026) examined the effect of environmental costs on the value of 25 listed firms in Nigeria over the period 2012–2018, using net asset per share (NAPS) as the measure of firm value. Environmental costs were disaggregated into research and development cost, community development cost, and employee health and safety cost. Using panel regression and random-effects estimation, the study found that environmental costs jointly had a significant effect on NAPS. Specifically, community development cost had a positive and significant relationship with firm value, while employee health and safety cost had a positive but insignificant relationship. Further findings revealed that community development cost was the only environmental cost component that significantly predicted NAPS, suggesting that the valuation implications of environmental expenditure may vary across expenditure categories. The study employed NAPS as a measure of firm value and did not investigate the moderating influence of foreign ownership.

Onyali et al. (2025) investigated how environmental management performance shapes firm value among listed industrial goods companies in Nigeria. Grounded in stakeholder theory, the study adopted an ex post facto research design and analyzed secondary data drawn from the annual reports of ten industrial goods firms listed on the Nigerian Exchange Group over the period 2014–2023. Environmental management performance was operationalized through environmental prevention, protection, and waste management costs, while firm value was captured using three complementary indicators: price-earnings ratio (P/E), earnings per share (EPS), and net assets per share (NAPS). The study employed robust least squares regression techniques to test its hypotheses at the 5% significance level. The empirical findings indicate that investments in environmental prevention and protection were found to enhance market valuation and accounting performance, suggesting that stakeholders perceive environmentally responsible firms as less risky and better positioned for sustainable growth. While the study examined multiple environmental cost components, its scope was limited to the industrial goods sector, thereby constraining the generalizability of its findings across other non-financial sectors and most critically did not explore the role of ownership structure, particularly foreign ownership, in shaping the relationship between environmental costs and firm value.

Mohammed et al. (2025) examined the effect of environmental costs on the firm value of listed industrial goods companies in Nigeria over a ten-year period (2013–2022). The study adopted a correlational research design and utilized secondary data obtained from the audited annual reports of nine listed industrial goods firms on the Nigerian Exchange Group. Environmental costs were proxied by environmental pollution cost (EPC), environmental health and safety cost (EHS), and environmental waste management cost (EWM), while firm value was measured using Tobin's Q. Using multiple regression analysis, the findings revealed that environmental waste management cost exhibited a negative and significant relationship with firm value, implying that waste management expenditures may impose financial burdens on firms or are not immediately recognized by investors as value-enhancing initiatives. Despite its contribution to the environmental accounting literature, the study was restricted to industrial goods firms, which limits the generalizability of the findings across broader multinational corporate structures operating in Nigeria. Also, the study employed Tobin's Q as a proxy for firm value, which captures only equity market valuation and does not reflect the full economic value of firms that incorporate both debt and equity components.

Aniesodo and Onuora (2024) examined environmental disclosures and firm value in Nigeria using waste management disclosure, pollution control disclosure, environmental remediation disclosure, and environmental research and development disclosure as independent variables. The study used an ex post facto design and panel regression analysis on fifty-two Nigerian listed firms across oil and

gas, consumer goods, industrial goods, ICT, health care, and conglomerate sectors for the period 2017–2022. Firm value was measured by net assets per share. The findings revealed that the environmental disclosure variables all had positive and significant influence on firm value. Although the study is useful, it relied on disclosure variables and net assets per share rather than actual environmental costs and enterprise value, leaving a gap for the present study.

2.3 Theoretical framework

2.3.1 Natural Resource-Based View theory

The Natural Resource-Based View (NRBV), developed by Hart (1995), extends the resource-based view by positioning the natural environment as a source of strategic capability and competitive advantage through pollution prevention, product stewardship and sustainable development. The theory explains why environmental expenditure may generate value beyond its immediate cost by enabling waste reduction, resource efficiency, pollution prevention and environmental risk mitigation. It is particularly relevant to waste management cost, as expenditure on treatment, recycling and recovery can develop capabilities that enhance operational efficiency and firm value. Conversely, environmental compliance cost may represent a more immediate financial burden where expenditure is primarily regulatory. The NRBV therefore supports the study's distinction between environmental cost categories and provides a basis for examining how foreign ownership may influence firms' ability to convert environmental expenditure into strategic capabilities and value.

2.3.2 Stakeholder Salience Theory

Stakeholder Salience Theory, developed by Mitchell et al. (1997), extends stakeholder theory by explaining why managers give greater attention to some stakeholders than others. The theory proposes that stakeholder salience is determined by the extent to which stakeholders possess power, legitimacy and urgency, with stakeholders possessing multiple attributes receiving greater managerial priority. The theory is particularly relevant to the present study because environmental expenditure reflects firms' responses to competing stakeholder demands. Regulatory agencies possess considerable power and legitimacy through their authority to impose environmental requirements, while communities may exert legitimate and urgent claims regarding pollution and waste. Investors, customers and other stakeholders may likewise demand greater environmental accountability. Consequently, firms' decisions concerning environmental compliance and waste management costs are influenced not only by the financial implications of such expenditures but also by the salience of the stakeholders whose interests they address.

In the context of listed multinational firms in Nigeria, foreign ownership may further alter stakeholder salience. Foreign investors possess financial power and may introduce stronger expectations concerning environmental accountability, transparency and responsible corporate conduct. Their influence may therefore affect the priority management assigns to different environmental expenditures and how the resulting costs are evaluated in relation to firm value. The theory consequently provides a basis for explaining why the value implications of environmental expenditure may differ according to ownership structure. Applied to this study, Stakeholder Salience Theory suggests that environmental compliance cost may reflect the firm's response to highly salient regulatory claims, while waste management cost may address the broader and potentially overlapping claims of regulators, communities, customers, employees and investors. Foreign ownership can alter the salience attached to these claims, thereby influencing how environmental expenditure translates into firm value.

Stakeholder Salience Theory is adopted as the underpinning theory because it provides the most direct explanation of why firms prioritize particular environmental expenditures in response to competing stakeholder demands. The theory is particularly appropriate because it provides a basis for explaining how foreign ownership may alter the salience of environmental demands and, consequently, the extent to which environmental compliance cost and waste management cost are perceived and translated into firm value.

3 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 compliance cost, waste management cost and firm value without manipulating the variables. The population of the study consists 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 Mohammed et al. (2025) with little modification in line with the research hypotheses in order to empirically determine the effect of environmental compliance cost and waste management cost on firm value when moderated by foreign ownership. The regression models for the empirical analysis are therefore expressed as follows.

The adapted model of Mohammed et al. (2025) is given in Equation (5):

$$TQ_{it} = \beta_0 + \beta_1 EPC_{it} + \beta_2 EHS_{it} + \beta_3 EWM_{it} + \varepsilon_{it} \quad (5)$$

where TQ = Tobin's Q; EPC = environmental pollution cost; EHS = environmental health and safety cost; and EWM = environmental waste management cost.

The modified model without moderation is given in Equation (6):

$$EV_{it} = \beta_0 + \beta_1 ECC_{it} + \beta_2 WMC_{it} + \beta_3 RG_{it} + \varepsilon_{it} \quad (6)$$

The moderated model is given in Equation (7):

$$EV_{it} = \beta_0 + \beta_1 (ECC \times FO)_{it} + \beta_2 (WMC \times FO)_{it} + \beta_3 RG_{it} + \varepsilon_{it} \quad (7)$$

where EV = enterprise value (proxy for firm value); ECC = environmental compliance cost; WMC = waste management cost; FO = foreign ownership (moderating variable); RG = revenue growth (control variable); β_0 = constant or intercept; β_1–β_3 = regression coefficients; ε = stochastic error term; *i* = individual firm; and *t* = time period.

3.1 A priori expectation

Based on existing literature, the a priori expectations for the regression model suggest that environmental compliance and waste management costs will have a positive and significant relation-

ship with the firm value of listed multinational firms in Nigeria when moderated by foreign ownership. The variables and their measurement are defined in Table 1.

Table 1. Definition of variables.

Variable	Type	Measurement	Source
EV (enterprise value)	Dependent	Market capitalisation + total debt − cash and cash equivalents	Mohammed et al. (2023)
ECC (environmental compliance cost)	Independent	Log of environmental compliance costs (e.g. permits, carbon compliance, monitoring, reporting and regulatory adherence costs) disclosed in annual/ sustainability reports	Ukpeh (2025)
WMC (waste management cost)	Independent	Log of waste disposal, recycling and treatment costs	Mohammed et al. (2025)
FO (foreign ownership)	Moderating	Percentage of shares held by foreign investors	Robinson et al. (2025)
RG (revenue growth)	Control	(Current revenue − previous revenue) ÷ previous revenue	Eccles et al. (2014)

Source: Authors' compilation (2026).

4 Results and discussion

This section presents the results of the moderated panel regression analysis of the effect of environmental compliance cost and waste management cost on the firm value of listed multinational firms in Nigeria, with foreign ownership as the moderator. The descriptive statistics before and after moderation are presented in Tables 2 and 3.

4.1 Descriptive statistics

Table 2. Descriptive statistics (pre-moderation).

Statistic	EV	ECC	WMC	RG
Mean	1.5274E+10	1.0384E+10	2.5673E+10	1070.571
Median	7.5304E+09	4.0729E+09	6.7594E+09	5.408653
Maximum	8.9626E+10	1.6573E+11	3.9753E+11	89898.07
Minimum	5.3504E+08	7695182	1390012	−98.70280
Std. dev.	1.7394E+10	2.0085E+10	4.4303E+10	7547.911
Skewness	2.024340	5.586476	3.888502	9.531059
Kurtosis	7.193050	39.76221	27.38871	103.4305
Jarque–Bera	283.1124	12302.46	5460.757	87080.47
Probability	0.000000	0.000000	0.000000	0.000000
Sum	3.0584E+12	2.0653E+12	5.1153E+12	214114.2
Sum sq. dev.	5.9404E+22	7.9594E+22	3.9194E+23	1.1353E+10
Observations	200	200	200	200

Source: E-Views 13 output (2026). Values in E notation are in scientific form (e.g. 1.5274E+10 = 1.5274×10^{10}).

Table 3. Descriptive statistics (post-moderation).

Statistic	EV	ECC_FO	WMC_FO	RG
Mean	1.5274E+10	1.743810	1.817159	1070.571
Median	7.5304E+09	1.335321	1.401294	5.408653
Maximum	8.9684E+10	6.532651	8.187280	89898.07
Minimum	5.3534E+08	0.070691	0.071727	−98.70280
Std. dev.	1.7304E+10	1.383554	1.492109	7547.911
Skewness	2.024340	1.032024	1.217719	9.531059
Kurtosis	7.193050	3.165925	4.171603	103.4305
Jarque–Bera	283.1124	35.73187	60.86680	87080.47
Probability	0.000000	0.000000	0.000000	0.000000
Sum	3.0545E+12	348.7620	363.4319	214114.2
Sum sq. dev.	5.9494E+22	380.9301	443.0512	1.1349E+10
Observations	200	200	200	200

Source: E-Views 13 output (2026). Values in E notation are in scientific form (e.g. 1.5274E+10 = 1.5274×10^{10}).

Tables 2 and 3 present the descriptive statistics for the 200 firm-year observations, which indicate substantial variation across firm value (EV), environmental compliance cost (ECC), waste management cost (WMC) and revenue growth (RG). Enterprise value (EV) has a mean of ₦1.53×10^{10} and a standard deviation of ₦1.74×10^{10}, indicating considerable dispersion in firm valuation among the sampled multinational firms. Its positive skewness (2.024) and excess kurtosis (7.193) indicate that EV is heavily concentrated at lower values, with a small number of firms exhibiting substantially higher valuations. Environmental compliance cost (ECC) records a mean of ₦1.04×10^{10} (1.744 for ECC_FO post moderation) with standard deviations of ₦2.01×10^{10} and 1.384, respectively, suggesting considerable heterogeneity in firms' compliance expenditure. Its high positive skewness (5.586; 1.032) and kurtosis (39.762; 3.166) indicate pronounced differences in compliance-cost intensity, with a few firms reporting exceptionally high values. Similarly, waste management cost (WMC) has a mean of ₦2.57×10^{10} (1.817 for WMC_FO post moderation) with standard deviations of ₦4.43×10^{10} and 1.492, respectively, indicating greater variability relative to its mean. Its positive skewness (3.889; 1.218) and kurtosis (27.389; 4.172) likewise suggest substantial cross-firm differences and the presence of extreme observations. Revenue growth (RG) exhibits the greatest dispersion, with a mean of 1,070.571 and a standard deviation of 7,547.911. Its very high positive skewness (9.531) and kurtosis (103.431) indicate extreme heterogeneity in revenue growth, including exceptionally high observations alongside negative growth. This suggests that the multinational firms experienced markedly different growth trajectories during the study period. The Jarque–Bera statistics are significant at $p < 0.001$ for all variables, indicating rejection of the normality assumption. However, non-normality in the raw variables does not, by itself, invalidate panel regression estimates, particularly where appropriate estimation and robust standard errors are employed. Overall, the descriptive evidence demonstrates substantial heterogeneity in firm value, environmental expenditure and revenue growth, thereby supporting the use of panel-data techniques to account for both cross-sectional and temporal differences among the sampled firms.

4.2 Correlation analysis

The Pearson pairwise correlation coefficients between the independent and dependent variables of listed multinational firms in Nigeria are presented in Tables 4 and 5.

Table 4. Correlation matrix (pre-moderation); probabilities in parentheses.

Variable	EV	ECC	WMC	RG
EV	1.000000			
ECC	−0.061459 (0.3873)	1.000000		
WMC	0.051004 (0.4732)	−0.085973 (0.2261)	1.000000	
RG	−0.037371 (0.5993)	0.046391 (0.5142)	0.014196 (0.8419)	1.000000

Source: E-Views 13 output (2026).

Table 5. Correlation matrix (post-moderation); probabilities in parentheses.

Variable	EV	ECC_FO	WMC_FO	RG
EV	1.000000			
ECC_FO	0.004915 (0.9449)	1.000000		
WMC_FO	0.047048 (0.5083)	0.683780 (0.0000)	1.000000	
RG	−0.037371 (0.5993)	0.023387 (0.7424)	0.007874 (0.9119)	1.000000

Source: E-Views 13 output (2026).

Table 4 presents the correlation results, which indicate weak relationships among all explanatory variables and between the explanatory variables and firm value, suggesting no immediate evidence of serious multicollinearity. Specifically, EV is negatively and weakly correlated with ECC ($r = -0.061$), positively and weakly correlated with WMC ($r = 0.051$). None of these relationships is statistically significant ($p > 0.05$). Among the explanatory variables, ECC is weakly negatively correlated with WMC ($r = -0.086$). Overall, the low correlation coefficients, all substantially below the conventional threshold of 0.80, provide preliminary evidence that multicollinearity is unlikely to pose a serious problem in the regression models. However, correlation analysis alone does not conclusively establish the absence of multicollinearity; this should be complemented by the Variance Inflation Factor (VIF) diagnostic.

The moderated correlation results in Table 5 also indicate that EV has negligible relationships with the interaction variables ECC_FO ($r = 0.005$) and WMC_FO ($r = 0.047$), as well as RG ($r = -0.037$), with all relationships statistically insignificant ($p > 0.05$). ECC_FO and WMC_FO, however, exhibit a strong positive and statistically significant correlation ($r = 0.684$, $p < 0.01$). This is expected because both interaction terms incorporate foreign ownership and their underlying environmental-cost variables, but it warrants further assessment for multicollinearity in the moderated regression. The correlations between the interaction variables and RG are weak and insignificant (ECC_FO: $r = 0.023$; WMC_FO: $r = 0.008$). Overall, the results suggest that the interaction variables are not strongly associated with firm value or the control variable, but the relatively high correlation between ECC_FO and WMC_FO indicates the need to confirm the absence of problematic multicollinearity using VIF/tolerance diagnostics in the full moderated model. Importantly, correlation alone does not establish multicollinearity, particularly where interaction terms are involved.

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, there is a strong indication of the presence of multicollinearity. The results are presented in Table 6.

Table 6. Multicollinearity test (variance inflation factors).

Variable	Coefficient variance	Uncentred VIF	Centred VIF
Pre-moderation			
C	2.5143E+18	1.668118	NA
ECC	0.003823	1.278779	1.009753
WMC	0.000776	1.344475	1.007783
RG	2.6667E+10	1.022761	1.002491
Post-moderation			
C	3.7574E+18	2.622331	NA
ECC_FO	2.3503E+19	7.431664	1.531716
WMC_FO	2.0205E+19	5.596080	1.730197
RG	2.5503E+10	1.028100	1.007725

Source: E-Views 13 output (2026). Values in E notation are in scientific form (e.g. 1.5274E+10 = 1.5274×10^{10}).

Table 6 presents the Variance Inflation Factor (VIF) results used to assess multicollinearity among the explanatory variables. The centered VIF values range from 1.0025 to 1.0098 pre-moderation for ECC, WMC, RG and 1.0077 to 1.7302 post-moderation for ECC_FO, WMC_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.

The hypotheses for the test are:

H_0: There is no heteroskedasticity problem in the model (residuals are homoskedastic).

H_1: There is a heteroskedasticity problem in the model.

Decision rule: If the probability value is greater than 0.05 (5% level of significance), H_0 is accepted; otherwise, it is not accepted. The results of the panel cross-section heteroskedasticity likelihood ratio test are presented in Table 7.

Table 7. Panel cross-section heteroskedasticity likelihood ratio test.

Model	Likelihood ratio	df	Probability	Restricted LogL	Unrestricted LogL
Pre-moderation (EV C ECC WMC RG)	261.3788	20	0.0000	−4997.163	−4866.473
Post-moderation (EV C ECC_FO WMC_FO RG)	246.3234	20	0.0000	−4992.146	−4868.984

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 H_0 if the probability value is less than 0.05; otherwise, do not reject H_0. The Hausman test results are presented in Table 8.

Table 8. Correlated random effects: Hausman test.

Model	Test summary	Chi-sq. statistic	Chi-sq. df	Probability
Pre-moderation	Cross-section random	0.372013	3	0.9460
Post-moderation	Cross-section random	0.499979	3	0.9189

Source: E-Views 13 output (2026).

The results of the Hausman test in Table 8 do not provide sufficient evidence to reject the null hypothesis at the 5% level of significance, as the probability values (0.9460 pre-moderation and 0.9189 post-moderation) are greater than the critical value of 0.05. Therefore, the study upholds that the difference in coefficients is not systematic, and hence the random-effects model is the most appropriate model for the study. It is therefore necessary to proceed to the Breusch–Pagan Lagrange multiplier test (Table 9), which indicates the appropriateness or otherwise of using the pooled model or the random-effects model.

Table 9. Breusch–Pagan Lagrange multiplier test for random effects; probabilities in parentheses.

Model	Cross-section (one-sided)	Period (one-sided)	Both
Pre-moderation	236.0528 (0.0000)	2.428694 (0.1191)	238.4815 (0.0000)
Post-moderation	261.3329 (0.0000)	1.799268 (0.1798)	263.1321 (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, the random-effects model is preferred over pooled OLS.

4.6 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). The pre- and post-moderation regression results are presented in Tables 10 and 11.

Table 10. Panel EGLS cross-section random-effects regression (pre-moderation).

Variable	Coefficient	Std. error	t-statistic	Prob.
C	1.4463E+10	2.4795E+09	5.834941	0.0000
ECC	−0.021027	0.023304	−0.902278	0.3782
WMC	0.044880	0.050610	0.886787	0.3863
RG	−76985.19	104866.3	−0.734127	0.4718
Model statistics				
Cross-section random S.D. (rho)	1.3876E+10 (0.5682)			
Idiosyncratic random S.D. (rho)	1.2109E+10 (0.4318)			
R-squared	0.581055		Mean dependent var	4.0502E+09
Adjusted R-squared	0.553025		S.D. dependent var	1.2092E+10
S.E. of regression	1.2072E+10		Sum squared resid	2.8173E+22
F-statistic	5.201280		Durbin–Watson stat	1.797141
Prob(F-statistic)	0.010510			

Note: Dependent variable: EV. Swamy and Arora estimator of component variances; White period (cross-section cluster) standard errors and covariance (d.f. corrected); 20 cross-sections, 10 periods, 200 balanced observations. Source: E-Views 13 output (2026). Values in E notation are in scientific form (e.g. 1.5274E+10 = 1.5274×10^{10}).

Table 10 presents the pre-moderation panel EGLS random-effects regression results, estimated using the Swamy and Arora estimator with White period (cross-section cluster) robust standard errors to correct for heteroskedasticity. The overall model is statistically significant (Prob. F-statistic = 0.0105 < 0.05), indicating that the explanatory variables jointly influence enterprise value. Individually, environmental compliance cost (ECC) has a negative but statistically insignificant effect on enterprise

value (β = −0.0210, p = 0.3782), implying that compliance expenditures do not significantly affect firm value. Waste management cost (WMC) exerts a positive but insignificant effect on enterprise value (β = 0.0449, p = 0.3863). The model explains approximately 58.1% of the variation in enterprise value (R^2 = 0.5811), indicating moderate explanatory power. Furthermore, the Durbin–Watson statistic of 1.797 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 11. Panel EGLS cross-section random-effects regression (post-moderation).

Variable	Coefficient	Std. error	t-statistic	Prob.
C	1.7308E+10	3.4275E+09	5.049701	0.0000
ECC_FO	−2.0773E+10	7.3174E+09	−2.838860	0.0093
WMC_FO	1.8745E+10	7.1403E+09	2.625250	0.0151
RG	−36147.82	75471.72	−0.478958	0.6374
Model statistics				
Cross-section random S.D. (rho)	1.3873E+10 (0.5945)			
Idiosyncratic random S.D. (rho)	1.1494E+10 (0.4055)			
R-squared	0.612350		Mean dependent var	3.8594E+09
Adjusted R-squared	0.598764		S.D. dependent var	1.1904E+10
S.E. of regression	1.1374E+10		Sum squared resid	2.5274E+22
F-statistic	8.269280		Durbin–Watson stat	1.818889
Prob(F-statistic)	0.000033			

Note: Dependent variable: EV. Swamy and Arora estimator of component variances; White period (cross-section cluster) standard errors and covariance (d.f. corrected); 20 cross-sections, 10 periods, 200 balanced observations. Source: E-Views 13 output (2026). Values in E notation are in scientific form (e.g. 1.5274E+10 = 1.5274×10^{10}).

Table 11 presents the random-effects panel EGLS results, estimated for 20 listed multinational firms over 2016–2025 (200 balanced firm-year observations), which indicate that foreign ownership significantly moderates the relationship between environmental costs and firm value. The model explains approximately 61.2% of the variation in enterprise value, with an adjusted R^2 of 59.9%, indicating substantial explanatory power. The overall model is statistically significant (F = 8.269, p < 0.001), confirming that the regressors jointly explain significant variation in firm value. The Durbin–Watson statistic of 1.819 also provides no immediate indication of serious first-order serial correlation. The interaction between environmental compliance cost and foreign ownership (ECC_FO) has a negative and statistically significant coefficient (β = -2.077×10^{10}, p = 0.0093). This indicates that foreign ownership significantly weakens the positive value-enhancing effect or intensifies the negative effect of environmental compliance cost on firm value, holding other variables constant. Thus, higher foreign ownership is associated with a more adverse marginal effect of environmental compliance expenditure on enterprise value. This finding may suggest that foreign investors are more sensitive to the resource implications of compliance expenditure or may perceive such expenditure as a cost when its immediate value benefits are insufficient to offset the associated financial burden.

Conversely, the interaction between waste management cost and foreign ownership (WMC_FO) is positive and statistically significant ($\beta = 1.875 \times 10^{10}$, $p = 0.0151$). This suggests that foreign ownership strengthens the positive effect of waste management cost on firm value. In other words, greater foreign ownership appears to enhance the extent to which investments in waste management translate into higher enterprise value. This may reflect foreign investors' stronger emphasis on environmental standards, sustainability practices, reputational considerations and long-term environmental risk management.

4.7 Discussion of findings

This study examined the moderating effect of foreign ownership on the relationship between environmental compliance and waste management costs on firm value of listed multinational firms in Nigeria. The findings reveal a differentiated moderating effect of foreign ownership, with environmental compliance cost and waste management cost exhibiting statistically significant but opposite interaction effects on enterprise value.

4.7.1 Hypothesis 1: environmental compliance cost and enterprise value

The interaction between environmental compliance cost and foreign ownership (ECC_FO) is negative and statistically significant ($\beta = -2.077 \times 10^{10}$; $p = 0.0093$), indicating that foreign ownership significantly weakens the value implications of environmental compliance expenditure. This finding suggests that, within the sampled multinational firms, greater foreign ownership is associated with a less favourable firm-value response to expenditure incurred to satisfy environmental compliance requirements. A possible explanation is that foreign investors may apply stricter scrutiny to the efficiency and economic consequences of compliance expenditure. Where such expenditure is viewed primarily as a regulatory obligation that consumes financial resources without generating commensurate short-term economic returns, greater foreign ownership may amplify investors' sensitivity to its cost implications. The finding is also consistent with the possibility that environmental compliance costs are largely defensive expenditures: although necessary for regulatory conformity and risk avoidance, their benefits may be less immediately observable in market-based measures of firm value.

The result provides partial support for the evidence of Tian et al. (2023), who established that environmental compliance costs significantly mediated the relationship between green innovation and stock market value. Although their study found that compliance costs formed part of a pathway through which green innovation affected firm value, the present finding indicates that the value implications of compliance expenditure may become less favourable when considered through an ownership-contingency lens. The difference may reflect variations in institutional context, environmental regulation, ownership structure and the nature of the sampled firms.

4.7.2 Hypothesis 2: waste management cost and enterprise value

The interaction between waste management cost and foreign ownership (WMC_FO) is positive and significant, indicating that foreign ownership strengthens the positive effect of waste management expenditure on firm value. This suggests that, under greater foreign ownership, waste-management investments may generate more observable operational, reputational and risk-management benefits, consistent with stronger international sustainability expectations. The finding is consistent with Onyali et al. (2025), who reported a significant positive relationship between waste management cost and selected firm-value measures. However, it contrasts with Shittu et al. (2024), who reported an insignificant effect on firm value, and Etuk et al. (2024), who found a negative effect on financial

performance. These differences suggest that the value consequences of environmental expenditure are context-dependent.

Taken alongside the significant negative ECC_FO coefficient, the findings reveal an asymmetric ownership-contingency effect: foreign ownership does not uniformly strengthen the value implications of environmental expenditure but moderates them according to the type of cost. From a Stakeholder Theory perspective, foreign ownership may strengthen the stakeholder and reputational benefits of effective waste management, while Agency Theory suggests that stronger foreign monitoring may encourage more efficient allocation of environmental resources. Overall, the results demonstrate that environmental costs should not be treated as a homogeneous construct; their implications for firm value depend on both the nature of the expenditure and the ownership structure.

5 Conclusion and recommendations

The study concludes that foreign ownership does not uniformly strengthen the value implications of environmental expenditure; rather, its moderating effect is expenditure-specific, weakening the firm-value effect of environmental compliance cost while strengthening that of waste management cost.

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

1. Management should improve the cost efficiency of environmental compliance through periodic cost audits, cost-effective monitoring technologies and effective compliance budgeting to minimize avoidable expenditure while maintaining regulatory compliance.
2. Management should prioritize waste reduction, recycling and resource recovery investments, supported by measurable performance targets to enhance operational efficiency, reduce costs and strengthen firm value.

References

[1] Agbiogwu AA, Okike CO, Ajaero OO, Okoroafor SN, Anyanwu HC, Chima AN (2026). Environmental costs and firm value of listed firms in Nigeria: Evidence from net asset per share. *Iconic Research and Engineering Journals*, 10(4), 4759–4769. https://doi.org/10.64388/IREV10I4-1724409

[2] Akinyemi OE, Uthmman AB (2026). Foreign exchange rate volatility and financial performance of listed multinational firms in Nigeria. *Veredas do Direito*, 23(7), e236148. https://doi.org/10.18623/rvd.v23.6148

[3] Aniesodo EA, Onuora JKJ (2024). Journal of Accounting and Financial Management, 10(2), 79–101. *International Institute of Academic Research and Development*.

[4] Azeez NO, Ofoegbu GN, Tivde JK (2025). Effects of sustainability reporting on the market value of listed environmentally sensitive companies in Nigeria. *International Journal of Research and Innovation in Social Science*, 9(5), 1143–1157. https://doi.org/10.47772/IJRISS.2025.90500099

[5] Azeez OA, Igbekoyi OE, Adeyemo FH (2024). Environmental risk management and financial performance in listed multinational firms in Nigeria. *International Journal of Research and Innovation in Social Science*, 8(12), 50–74. https://doi.org/10.47772/IJRISS.2024.8120005

[6] Boubakri N, El Ghoul S, Guedhami O, Wang H (2018). Corporate governance and firm value: International evidence. *Journal of Corporate Finance*, 51, 1–26.

[7] Brigham EF, Ehrhardt MC (2023). Financial management: Theory and practice (17th ed.). *Cengage Learning*.

[8] Chen L, Jiang Y, Li X (2024). Foreign ownership and corporate governance outcomes in emerging markets. *Journal of Business Research*.

[9] Clarkson P, Li Y, Richardson G, Tsang A (2019). Causes and consequences of voluntary assurance of CSR reports: International evidence involving Dow Jones Sustainability Index inclusion and firm valuation. *Accounting, Auditing & Accountability Journal*, 32(8), 2451–2474. https://doi.org/10.1108/AAAJ-03-2018-3424

[10] Damodaran A (2024). Applied corporate finance (5th ed.). *Wiley*.

[11] Eccles RG, Ioannou I, Serafeim G (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science*, 60(11), 2835–2857. https://doi.org/10.1287/mnsc.2014.1984

[12] Engko C, Rahmiati A (2026). ESG performance and firm value: Green innovation as a mediator variable (evidence from Indonesia). *International Journal of Innovation Science*, 18(4), 1029–1047. https://doi.org/10.1108/IJIS-04-2025-0190

[13] Ezonfade O, Okonkwo C, Adeyemi T (2024). Corporate waste management and environmental sustainability in Nigerian manufacturing firms. *Journal of Sustainable Business Practices*, 9(2), 101–118.

[14] Huang G, An Z, Li D (2023). Foreign institutional ownership and corporate risk-taking: International evidence. *Corporate Governance: An International Review*, 31(2), 260–284. https://doi.org/10.1111/corg.12456

[15] Igbekoyi O (2017). Transparency and stakeholder engagement in corporate environmental management. *International Journal of Corporate Governance and Sustainability*, 8(4), 56–71.

[16] International Monetary Fund (2025). Nigeria: 2025 Article IV consultation—Press release; staff report; and statement by the Executive Director for Nigeria (IMF Country Report No. 25/157). https://doi.org/10.5089/9798229015127.002

[17] Lindenberg EB, Ross SA (1981). Tobin's q ratio and industrial organization. *The Journal of Business*, 54(1), 1–32. https://doi.org/10.1086/296120

[18] Liu H, Ye X, Zhang Q (2024). Foreign ownership and M&A activity: Evidence from China. *The North American Journal of Economics and Finance*, 73, 102179. https://doi.org/10.1016/j.najef.2024.102179

[19] Mitchell RK, Agle BR, Wood DJ (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, 22(4), 853–886. https://doi.org/10.5465/amr.1997.9711022105

[20] Mohammed B, Murtala S, Shuaibu K (2025). Effects of environmental costs on the value of listed industrial goods companies in Nigeria. *Kashere Journal of Management Sciences*, 8(2), 54–61.

[21] National Environmental Standards and Regulations Enforcement Agency (n.d.). Laws & regulations. https://nesrea.gov.ng/laws-regulations/

[22] National Environmental Standards and Regulations Enforcement Agency (2007). National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007 (Act No. 25). Federal Republic of Nigeria.

[23] Ndlovu T, Moyo P (2021). Waste management practices and environmental risk mitigation: Evidence from sub-Saharan Africa. *Journal of Cleaner Production*, 292, 125–138.

[24] Nweze C (2026). Effect of green accounting practices on the firm value of listed industrial goods firms in Nigeria. *Journal of Accounting and Environmental Studies*, 11(2), 112–130.

[25] Odoemelam N, Okafor RG (2021). Environmental accounting disclosure and corporate financial performance in Nigeria. *Cogent Business & Management*, 8(1), 1–18.

[26] Ogbulafor LC, Ihendinihu JU, Azubike JU (2025). Effect of environmental cost on the financial performance of listed manufacturing firms in Nigeria. *Jalingo Journal of Social and Management Sciences*, 6(4), 81–93.

[27] Onyali CI, Ukoh MU, Okafor K, Okeke ON (2025). Determinants of firm value: The role of environmental management performance of listed industrial goods firms on Nigeria Exchange Group. *International Journal of Academic Accounting, Finance & Management Research*, 9(4), 58–68.

[28] Roedder F, Schmid S (2025). The impact of foreign ownership on firms: A systematic literature review. *Management Review Quarterly*, 76(2), 1283–1311. https://doi.org/10.1007/s11301-025-00504-w

[29] Ross SA, Westerfield RW, Jordan BD, Lim J, Tan R (2025). Fundamentals of corporate finance (14th ed.). *McGraw-Hill Education*.

[30] Shittu MSO, Igbekoyi OE, Oladutire EO, Olonite OA (2024). Environmental cost accounting and firm value of quoted manufacturing companies in Nigeria. *International Journal of Advance Research in Multidisciplinary*, 2(3), 241–251. https://doi.org/10.5281/zenodo.13492823

[31] Taiwo O, Adegboye F, Enitan O (2025). Environmental costs and economic performance of listed multinational firms in Nigeria. *Nigerian Journal of Multinational Business Studies*, 11(2), 23–41.

[32] Tian J, Dong Y, Vagnani G, Liu P (2023). Green innovation and the stock market value of heavily polluting firms: The role of environmental compliance costs and technological collaboration. *Business Strategy and the Environment*, 32(7), 4938–4953. https://doi.org/10.1002/bse.3401

[33] Ukpeh GI (2025). Environmental compliance cost and financial performance of oil and gas companies in Nigeria. *Journal of Accounting and Financial Management*, 11(7), 113–125. https://doi.org/10.56201/jafm.vol.11.no7.2025.pg113.125