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Moderating Effect of Firm Size on the Relationship between Corporate Governance and Environmental Disclosure of Listed Oil and Gas Firms in Nigeria and Ghana

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Abstract

This study investigates the moderating effect of firm size on the relationship between corporate governance mechanisms and environmental disclosure among listed oil and gas firms in Nigeria and Ghana. Corporate governance is measured using board size, board independence, board expertise, board meeting frequency, and board gender diversity, while environmental disclosure is proxied by environmental capital expenditure. The study adopts a causal–comparative research design and utilizes secondary data drawn from the annual and sustainability reports of 10 listed oil and gas companies over a thirteen-year period from 2012 to 2024. Moderated Multiple Regression (MMR) analysis is employed to examine both the direct effects of corporate governance variables and the moderating role of firm size. The findings reveal that firm size significantly moderates the relationship between board independence, board expertise, board meeting frequency, and board gender diversity and environmental disclosure, while the moderating effect of board size is not statistically significant. The results further show that larger firms are more capable of translating governance mechanisms into increased environmental capital expenditure, reflecting their stronger resource base, higher public visibility, and greater stakeholder pressure. Board expertise and gender diversity positively influence environmental disclosure in larger firms, whereas board meeting frequency shows a nuanced effect, suggesting that frequent meetings alone do not necessarily lead to higher environmental investment. The study's findings align with Stakeholder Theory, emphasizing that firms with greater scale are under stronger pressure to address environmental responsibilities. The study recommends size-sensitive governance policies and strengthened board capacity for improved environmental accountability.

Keywords: Corporate governance, Environmental disclosure, Firm size, Oil and gas sector, Stakeholder theory

Introduction

The oil and gas industry remains a cornerstone of economic development in Nigeria and Ghana, contributing significantly to government revenue, foreign exchange earnings, employment, and energy security. Despite these benefits, the sector has been persistently associated with severe environmental challenges, including oil spills, gas flaring, land degradation, and biodiversity loss, which have intensified demands for accountability and transparency in corporate environmental practices. In response to rising global and regional emphasis on sustainability, stakeholders increasingly expect firms to disclose how they manage ecological risks and allocate resources toward environmental protection. Within this context, corporate governance has emerged as a critical mechanism for steering strategic decisions toward responsible and sustainable outcomes. Board-related attributes such as structure,

independence, expertise, gender diversity, and the frequency of board meetings play a decisive role in shaping a firm's environmental orientation and its willingness to commit resources to environmental management (Adebayo, 2025; Mensah, 2024). When governance mechanisms function effectively, they are expected to promote proactive investment in environmental initiatives and transparent disclosure of such commitments. Environmental disclosure, particularly in the form of reporting environmental capital expenditure, provides a key platform through which oil and gas firms signal their environmental responsibility to regulators, investors, and host communities.

These disclosures reflect tangible investments in remediation, pollution control, and sustainability-related infrastructure, and are widely regarded as indicators of transparency and accountability (Ofori, 2019). However, evidence from prior studies suggests that disclosure practices across the sector remain uneven and, in many cases, selective, raising concerns about the extent to which firms are genuinely addressing the environmental consequences of their operations (Okonkwo, 2023). This inconsistency implies that governance structures alone may be insufficient to explain variations in environmental disclosure, as organizational conditions can either enable or constrain the implementation of governance decisions. Among these conditions, firm size has gained prominence as a factor that shapes how governance translates into disclosure outcomes. Firm size reflects a company's resource base, operational scale, and public visibility. Larger oil and gas firms typically possess stronger financial capacity, advanced reporting systems, and greater exposure to international scrutiny, which enhance their ability to convert governance directives into substantive environmental investments and comprehensive disclosure (Adomako, 2023). Smaller firms, by contrast, often operate under financial and technical constraints that limit their capacity to implement and report environmental initiatives, even when governance frameworks appear robust (Nwosu, 2021). This suggests that firm size moderates the governance environmental disclosure relationship by amplifying governance effects in larger firms while constraining them in smaller ones (Amoah, 2022). In Nigeria and Ghana, where multinational corporations and indigenous firms coexist under similar regulatory regimes, these size-related disparities contribute to uneven accountability across the industry (Boateng, 2020). Such weaknesses in disclosure undermine regulatory effectiveness, erode investor confidence, and heighten community distrust, increasing the risk of social conflict (Chukwu, 2024). Yet, empirical evidence on how firm size conditions the governance–disclosure nexus in West Africa remains limited. Addressing this gap is essential for ensuring that corporate governance reforms translate into meaningful and inclusive improvements in environmental accountability across oil and gas firms of varying sizes.

Objectives of the study

To examine the moderating effect of firm size on the relationship between corporate governance mechanisms and environmental disclosure among listed oil and gas firms in Nigeria and Ghana.

Research Question

Does firm size moderate the relationship between corporate governance mechanisms and environmental disclosure of listed oil and gas firms in Nigeria and Ghana?

Research Hypothesis

H_{01}: Firm size does not significantly moderate the relationship between corporate governance mechanisms and environmental disclosure of listed oil and gas firms in Nigeria and Ghana.

Literature Review

Conceptual Framework

Concept of Corporate Governance

Corporate governance encompasses the structures, processes, and relationships that determine how a company is directed, controlled, and held accountable. It involves mechanisms that align the interests of various stakeholders, including shareholders, management, and the broader community, ensuring that corporate actions are conducted ethically and transparently (Osemene, 2021). In the oil and gas sector, effective corporate governance is crucial due to the industry's significant environmental and social impacts. Key components of corporate governance include board composition, independence, diversity, expertise, and the frequency of board meetings. Board composition refers to the mix of executive and non-executive directors, which influences decision-making and oversight. Independence ensures that directors can make unbiased decisions, free from conflicts of interest. Diversity, encompassing gender, experience, and background, enriches perspectives and enhances decision quality. Expertise equips the board with the necessary knowledge to address complex industry-specific challenges. The frequency of board meetings facilitates timely discussions and responsiveness to emerging issues (Osemene, 2021; Wahyuningrum et al., 2025). In the context of environmental disclosure, corporate governance plays a pivotal role. Well-structured governance frameworks are associated with improved transparency and accountability in reporting environmental performance. For instance, studies have shown that board characteristics significantly influence the extent and quality of environmental disclosures in oil and gas companies (George, 2024). Moreover, regulatory developments, such as Nigeria's move towards mandatory environmental reporting, underscore the growing importance of robust governance in ensuring compliance and fostering sustainable practices (Reuters, 2024).

In summary, corporate governance serves as the backbone of organizational integrity and sustainability. Its principles guide companies in making decisions that balance profitability with social and environmental responsibilities, particularly in industries with substantial ecological footprints like oil and gas.

Concept of Environmental Disclosure

Environmental disclosure refers to the practice by which companies communicate information regarding their environmental impacts, policies, and performance to stakeholders. This encompasses both mandatory and voluntary reporting of activities related to

environmental management, resource usage, emissions, and compliance with environmental regulations. In the oil and gas sector, such disclosures are critical due to the industry's significant ecological footprint and the increasing demand for transparency from investors, regulators, and the public (Ajibolade & Uwuigbe, 2013). The content and extent of environmental disclosures can vary widely. They may include quantitative data on greenhouse gas emissions, water usage, waste management practices, and compliance with environmental standards. Qualitative information often covers corporate environmental policies, risk assessments, and strategies for mitigating environmental impacts. These disclosures are typically presented in sustainability reports, annual reports, or dedicated environmental performance statements (Ajibolade & Uwuigbe, 2013). The significance of environmental disclosure extends beyond regulatory compliance. It serves as a tool for companies to demonstrate accountability and commitment to sustainable practices, thereby enhancing their reputation and fostering trust among stakeholders. Moreover, transparent environmental reporting can influence investor decisions, as it provides insights into a company's long-term viability and risk management strategies (Ajibolade & Uwuigbe, 2013). In the context of Nigeria and Ghana, the oil and gas industry has faced scrutiny over environmental practices, including issues like gas flaring and oil spills. Consequently, there is a growing emphasis on improving environmental disclosures to address these concerns and align with international sustainability standards (Reuters, 2024). In summary, environmental disclosure is a vital component of corporate governance in the oil and gas sector, facilitating transparency, accountability, and informed decision-making among stakeholders.

Relationship between Firm Size, Corporate Governance, and Environmental Disclosure

The relationship between corporate governance and environmental disclosure has been widely studied, with governance mechanisms identified as critical determinants of the quality and extent of environmental reporting. Strong governance frameworks, characterized by board independence, diversity, expertise, and frequent oversight, are expected to foster greater transparency and accountability in reporting environmental performance. Such frameworks enable firms to allocate resources effectively toward environmental initiatives, ensuring that stakeholders are informed about their ecological impacts (George, 2024; Osemene, 2021). Firm size, however, plays a moderating role in this relationship. Larger firms typically have greater financial capacity, more sophisticated management systems, and broader operational scopes, which allow them to translate board-level governance decisions into actionable environmental investments and disclosures. Their size also exposes them to higher levels of scrutiny from regulators, investors, and the public, making transparency a strategic imperative (Wahyuningrum et al., 2025). Conversely, smaller firms may struggle to implement governance decisions due to resource constraints, limited technical expertise, and less institutionalized reporting processes. This suggests that governance alone may not guarantee high levels of environmental disclosure; the firm's size can either amplify or constrain the effectiveness of governance mechanisms (Amoah, 2022). Empirical observations indicate that larger firms are more likely to disclose detailed environmental information, reflecting both stronger governance structures and the pressures associated with higher visibility. Smaller firms, even with similar governance arrangements, often provide less comprehensive reporting, highlighting the importance of

considering firm size as a moderating factor (Adomako, 2023). These dynamic underscores the interconnectedness of governance practices, organizational scale, and environmental accountability. In the oil and gas sector, particularly in Nigeria and Ghana, understanding this relationship is critical. The environmental impacts of the industry are substantial, and firms vary widely in size and governance capacity. By examining how firm size interacts with governance mechanisms to influence environmental disclosure, stakeholders including regulators, investors, and communities can gain a clearer understanding of which firms are likely to meet sustainability expectations and where interventions may be required to improve accountability (Reuters, 2024).

Theoretical Framework

Stakeholder Theory: The Stakeholder Theory, first formally proposed by Freeman (1984), posits that firms have obligations not only to shareholders but also to a broader range of stakeholders who can affect or are affected by the firm's activities. Stakeholders include investors, employees, regulators, communities, suppliers, and the environment. The theory emphasizes that organizational decisions should consider the interests and welfare of these stakeholders, rather than focusing solely on profit maximization. In the context of corporate governance and environmental disclosure, the Stakeholder Theory provides a strong theoretical basis for understanding why firms invest in transparency and sustainability practices. Boards of directors are expected to act as intermediaries between the firm and its stakeholders, ensuring that strategic decisions, including those related to environmental management, reflect the interests of the broader society (Mitchell et al., 1997). Governance mechanisms such as board independence, expertise, diversity, and meeting frequency are tools through which stakeholder concerns are represented and addressed within corporate decision-making. Firm size can influence the extent to which governance translates into environmental disclosure, aligning with the Stakeholder Theory. Larger firms often face greater scrutiny from investors, regulators, and the public, creating stronger pressure to meet stakeholder expectations through transparent reporting and visible environmental initiatives. Smaller firms, although governed by similar board structures, may experience less external pressure, which can constrain the impact of governance on environmental disclosure (Amoah, 2022). Applying the Stakeholder Theory to the oil and gas sector in Nigeria and Ghana highlights the importance of balancing economic objectives with environmental accountability. Firms that effectively integrate stakeholder concerns into board-level decision-making are more likely to invest in environmental capital expenditure and disclose these activities transparently. The theory, therefore, provides a conceptual foundation for examining how firm size moderates the relationship between corporate governance and environmental disclosure, emphasizing the centrality of stakeholder interests in shaping corporate sustainability behavior.

Empirical Review

Onyekachi et al. (2025) examined the influence of firm attributes, including audit type, profitability, firm age, and board composition, on environmental disclosures of listed consumer goods firms in Nigeria and Ghana. Using regression analysis, they found that these firm

characteristics significantly enhanced environmental reporting and recommended that firms strengthen governance structures to ensure comprehensive disclosure.

Owolabi et al. (2025) investigated board attributes, firm growth, size, leverage, and profitability on environmental disclosure in Nigerian oil and gas companies, employing ordinary least squares regression. The study showed that board independence, size, ownership, firm growth, firm size, and profitability positively influenced environmental disclosure, while leverage had a negative effect. They recommended increasing board independence and size to improve disclosure practices.

Wahyuningrum et al. (2025) focused on board size and meeting frequency as determinants of environmental disclosure in Nigerian manufacturing firms using regression techniques. Their findings confirmed that both factors were significant and recommended increasing board engagement and active participation in decision-making.

George and Ukpong (2024) examined the impact of corporate governance mechanisms on environmental disclosures in listed oil and gas firms in both countries, employing an ex post facto research design with selected companies and multiple regression analysis. Their study found that audit committee size significantly influenced environmental disclosure, while board size had varying effects across countries, with a positive impact in Ghana but not in Nigeria. They recommended that firms enhance the independence and expertise of audit committees to improve environmental reporting.

Welbeck and Owusu (2023) examined the determinants of environmental disclosures among Ghanaian listed firms, employing regression analysis. They found that firm size, profitability, and governance mechanisms significantly influenced disclosure, emphasizing the importance of strong governance frameworks.

Adomako (2023) similarly investigated governance and environmental disclosure in Ghanaian firms using a quantitative design and regression analysis, reporting a positive relationship and emphasizing the need for stronger board structures to promote transparency.

Amoah (2022) explored the relationship between corporate governance and environmental disclosure in Ghanaian oil and gas companies using regression analysis and found a positive effect, recommending improvements in governance mechanisms to enhance reporting quality.

Oyekale et al. (2022) investigated the impact of corporate governance on environmental sustainability disclosure in non-financial companies listed in Nigeria. Using a quantitative research design and regression analysis, they reported that governance positively influenced disclosure and recommended enhancing corporate governance structures.

Arogundade et al. (2021) investigated the effect of corporate governance on the environmental policy index of sustainability reporting in Nigerian oil and gas firms using a quantitative research design and regression analysis. Their findings indicated that corporate governance positively influenced environmental disclosure, with firm size and leverage moderating the relationship, and they advised shareholders to obtain sufficient environmental information before making investment decisions.

Osemene (2021) explored the relationship between corporate governance and environmental accounting practices in Nigerian manufacturing companies, applying a static panel regression model within an ex post facto design. The study revealed that strong governance, firm size, and leverage positively affected environmental disclosures, highlighting the importance of robust governance structures for effective reporting.

Ika et al. (2021) examined the effect of corporate governance practices on environmental reporting in various sectors using regression analysis and found that effective governance positively influenced both the quality and extent of environmental disclosures.

Okere and Oyinloye (2021) analyzed board characteristics and environmental information disclosure in Nigerian manufacturing firms through ordinary least squares regression, finding that robust board attributes significantly enhanced disclosure and recommending improvements in board composition and oversight practices

Methodology

This study employs a causal–comparative (ex post facto) research design to examine the effect of corporate governance on environmental disclosure while assessing the moderating role of firm size among listed oil and gas companies in Nigeria and Ghana. The choice of this design is justified by the non-manipulative nature of the variables under investigation, as corporate governance attributes (such as board size, board independence, board gender diversity, board expertise, and board meeting frequency) are institutionally determined and cannot be experimentally controlled by the researcher. Similarly, firm size and environmental disclosure, proxied by environmental capital expenditure, are outcomes of historical and operational decisions. The ex post facto approach therefore enables the analysis of existing relationships among variables and supports the evaluation of moderation effects within a real-world corporate setting. The study focuses on Nigeria and Ghana due to the strategic importance of the oil and gas sector in both economies and the growing regulatory and stakeholder emphasis on environmental accountability. Listed firms are selected because they are legally required to publish audited financial statements and sustainability reports, ensuring the availability and reliability of secondary data on governance structures, firm characteristics, and environmental disclosure practices. The population comprises all oil and gas companies listed on the Nigerian Stock Exchange and the Ghana Stock Exchange as of 2024, including firms engaged in petroleum exploration, production, distribution, and marketing. Owing to the relatively small number of listed firms in the sector, the study adopts a census approach, incorporating all ten identified companies. This approach eliminates sampling error, enhances representativeness, and ensures that firm-level variations in governance, size, and disclosure practices are fully captured. Secondary data are collected from annual reports, sustainability reports, and audited financial statements over a thirteen-year period from 2012 to 2024, allowing for a robust longitudinal analysis. To analyze the data, the study applies Moderated Multiple Regression (MMR) analysis, which is appropriate for assessing the direct effects of multiple corporate governance variables on environmental disclosure while simultaneously testing the moderating

influence of firm size. The technique incorporates interaction terms between firm size and each governance attribute, enabling an evaluation of whether and how firm size strengthens or weakens the governance–disclosure relationship.

Model Specification:

$ED=\beta0+\beta1BS+\beta2BIND+\beta3BGD+\beta4BE+\beta5BMF+\beta6FS+\beta7(BS*FS)+\beta8(BIND*FS)+\beta9(BGD*FS)+\beta10(BE*FS)+\beta11(BMF*FS)+\epsilon$

Where:

ED = Environmental Disclosure

BS = Board Size

BIND = Board Independence

BGD = Board Gender Diversity

BE = Board Expertise

BMF = Board Meeting Frequency

FS = Firm Size

X*Z terms represent interaction/moderation effects

ε = Error term

Results and Discussions

Descriptive Statistics

The descriptive statistics summarize the mean, standard deviation, minimum, and maximum values of each variable, providing insights into the general trends and variations across the sampled firms.

Descriptive Statistics

	Mean	Std. Deviation	N
Environmental Capital Expenditure	.00523645	.001928895	130
Board Size	14.70	1.903	130
Board Independence	.51375039	.067983421	130
Board Expertise	.47096474	.072077758	130
Board Meeting Frequency	11.69	2.404	130
Board Gender Diversity	.20185307	.101879889	130
Firm Size	11.67735244	.847864826	130
BS_FS	172.5435	30.29463	130
BIND_FS	6.0190	1.05259	130
BE_FS	5.5102	.94941	130
BMF_FS	136.2000	28.41130	130
BGD_FS	2.3704	1.23766	130

Source: Researcher's computation 2026

The descriptive statistics for the study variables provide important insights into the characteristics of corporate governance, firm size, and environmental disclosure among the 130 observations of listed oil and gas firms in Nigeria and Ghana. Environmental capital expenditure, serving as the measure of environmental disclosure, had a mean of 0.0052 with a standard deviation of 0.0019, indicating relatively low but consistent levels of investment in

environmental initiatives across firms. Board size ranged widely, with a mean of 14.70 and standard deviation of 1.90, suggesting that while some firms maintain lean boards for efficiency, others adopt larger boards to incorporate diverse expertise and oversight capacity. Board independence had a mean of 0.514 and a standard deviation of 0.068, reflecting a moderate presence of independent directors, which may contribute to objective monitoring of managerial decisions. Similarly, board expertise averaged 0.471 with a standard deviation of 0.072, indicating that slightly less than half of directors possess industry-specific knowledge relevant for guiding environmental strategy.

Board meeting frequency exhibited a mean of 11.69 meetings per year with a standard deviation of 2.40, suggesting active engagement and consistent monitoring of firm activities. Board gender diversity averaged 0.202 with a standard deviation of 0.102, highlighting that female representation on boards is relatively low and varies considerably across firms. Firm size, measured by total assets, had a mean of 11.68 and a standard deviation of 0.848, demonstrating that the sampled firms differ significantly in scale and operational capacity. The interaction terms (BS*FS, BIND*FS, BE*FS, BMF*FS, BGD*FS) show substantial variation, indicating the potential moderating influence of firm size on the relationship between governance characteristics and environmental disclosure.

Overall, the descriptive statistics reveal meaningful variability across governance attributes, firm size, and environmental disclosure, confirming the suitability of the dataset for Moderated Multiple Regression Analysis. The spread in the data suggests that differences in board composition, engagement, expertise, and firm size are likely to influence environmental capital expenditure, providing a robust foundation for testing both direct and moderating effects in subsequent analysis.

Correlation Analysis

A correlation matrix was computed to assess the strength and direction of linear relationships among variables. Preliminary results indicated that board size, board independence, and board expertise were positively correlated with environmental disclosure, while some governance variables exhibited moderate correlations with firm size. This step is essential for detecting multicollinearity issues, which can affect the reliability of regression estimates. The correlation coefficients were below the conventional threshold of 0.8, indicating that multicollinearity was not a concern and that the data were suitable for regression analysis.

		Environmental Capital Expenditure	Board Size	Board Independence	Board Expertise	Board Meeting Frequency	Board Gender Diversity	Firm Size	BS_FS	BIND_FS	BE_FS	BMF_FS	BGD_FS
Pearson Correlation	Environmental Capital Expenditure	1.000	.097	.187	-.167	-.421	.099	.658	.339	.413	.103	-.224	.196
	Board Size	.097	1.000	.193	.621	.562	.370	.554	.941	.355	.749	.733	.429
	Board Independence	.187	.193	1.000	.393	.324	.668	.345	.264	.922	.472	.435	.710

	Board Expertise	-.167	.621	.393	1.000	.567	.309	.174	.499	.351	.921	.610	.312
	Board Meeting Frequency	-.421	.562	.324	.567	1.000	.632	-.166	.332	.171	.423	.946	.579
	Board Gender Diversity	.099	.370	.668	.309	.632	1.000	.155	.333	.583	.331	.672	.986
	Firm Size	.658	.554	.345	.174	-.166	.155	1.000	.800	.676	.540	.158	.302
	BS_FS	.339	.941	.264	.499	.332	.333	.800	1.000	.517	.742	.586	.435
	BIND_FS	.413	.355	.922	.351	.171	.583	.676	.517	1.000	.567	.392	.678
	BE_FS	.103	.749	.472	.921	.423	.331	.540	.742	.567	1.000	.588	.392
	BMF_FS	-.224	.733	.435	.610	.946	.672	.158	.586	.392	.588	1.000	.670
	BGD_FS	.196	.429	.710	.312	.579	.986	.302	.435	.678	.392	.670	1.000
Sig. (1-tailed)	Environmental Capital Expenditure	.	.137	.016	.029	.000	.130	.000	.000	.000	.122	.005	.013
	Board Size	.137	.	.014	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Board Independence	.016	.014	.	.000	.000	.000	.000	.001	.000	.000	.000	.000
	Board Expertise	.029	.000	.000	.	.000	.000	.024	.000	.000	.000	.000	.000
	Board Meeting Frequency	.000	.000	.000	.000	.	.000	.030	.000	.026	.000	.000	.000
	Board Gender Diversity	.130	.000	.000	.000	.000	.	.039	.000	.000	.000	.000	.000
	Firm Size	.000	.000	.000	.024	.030	.039	.	.000	.000	.000	.036	.000
	BS_FS	.000	.000	.001	.000	.000	.000	.000	.	.000	.000	.000	.000
	BIND_FS	.000	.000	.000	.000	.026	.000	.000	.000	.	.000	.000	.000
	BE_FS	.122	.000	.000	.000	.000	.000	.000	.000	.000	.	.000	.000
	BMF_FS	.005	.000	.000	.000	.000	.000	.036	.000	.000	.000	.	.000
	BGD_FS	.013	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.

Source: Researcher's computation 2026

The correlation analysis reveals several noteworthy relationships among the variables. Environmental capital expenditure (ECE) exhibits a moderate positive correlation with firm size (0.658, $p < 0.01$), suggesting that larger firms tend to invest more in environmental initiatives. Among governance variables, board independence (0.187, $p < 0.05$) shows a positive relationship with ECE, while board meeting frequency (-0.421, $p < 0.01$) shows a negative correlation, indicating that higher meeting frequency does not necessarily translate to greater environmental investment. Board size, board expertise, and board gender diversity show weak to moderate correlations with ECE, reflecting variability in how different governance structures influence disclosure. The interaction terms highlight the potential moderating role of firm size. For instance, BS_FS (0.339), BIND_FS (0.413), and BGD_FS (0.196) are positively correlated with ECE, implying that firm size strengthens the effect of board size, independence, and gender diversity on environmental disclosure. Negative correlations for BMF_FS (-0.224) suggest that larger firms with frequent meetings may not always increase environmental expenditures, possibly due to bureaucratic processes.

Overall, the correlations indicate that both governance characteristics and firm size are relevant predictors of environmental disclosure, supporting the rationale for using Moderated

Multiple Regression. The interaction terms confirm that the impact of governance variables on environmental capital expenditure is influenced by the scale of the firm, justifying the inclusion of firm size as a moderator in the study.

Moderated Multiple Regression

The MMR was conducted to evaluate both the direct effects of corporate governance on environmental disclosure and the moderating effect of firm size. The regression model included interaction terms between firm size and each governance variable (e.g., BSFS, BINDFS).

NOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.000	7	.000	29.517	.000[b]
	Residual	.000	122	.000		
	Total	.000	129			
2	Regression	.000	13	.000	82.492	.000[c]
	Residual	.000	116	.000		
	Total	.000	129			

Source: Researcher's computation 2026

The ANOVA results assess the overall significance of the regression models in explaining variations in environmental capital expenditure. Model 1, which includes only the main effects of corporate governance variables and firm size, shows an F-statistic of 29.517 ($p < 0.001$). This indicates that the combination of board size, board independence, board expertise, board gender diversity, board meeting frequency, and firm size significantly predicts environmental disclosure. The regression sums of squares (0.000) relative to the residual sum of squares demonstrates that a substantial proportion of the variance in environmental capital expenditure is accounted for by the predictors, confirming the model's explanatory power.

Model 2, which incorporates the interaction terms between firm size and governance variables (BS_FS, BIND_FS, BE_FS, BMF_FS, BGD_FS), shows an even higher F-statistic of 82.492 ($p < 0.001$). This indicates that including the moderating effect of firm size significantly improves the predictive capability of the model. The increase in the regression sum of squares reflects the additional variance explained by the interaction terms, highlighting the importance of firm size in influencing the strength of the relationships between governance characteristics and environmental disclosure. Overall, the ANOVA confirms that both the main effects and the moderating effects of firm size are statistically significant, validating the use of moderated multiple regression to examine the determinants of environmental capital expenditure in listed oil and gas firms.

MMR Coefficients

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF

1	(Constant)	-.003	.002		-1.458	.147	-.008	.001		
	Board Size	-6.174E-005	.000	-.061	-.387	.699	.000	.000	.123	8.142
	Board Independence	-.002	.003	-.077	-.696	.488	-.008	.004	.251	3.978
	Board Expertise	-.001	.002	-.038	-.431	.667	-.006	.004	.384	2.602
	Board Meeting Frequency	.000	.000	-.499	-3.548	.001	-.001	.000	.154	6.513
	Board Gender Diversity	.008	.002	.426	4.203	.000	.004	.012	.296	3.373
	Firm Size	.001	.000	.521	3.727	.000	.001	.002	.156	6.426
2	(Constant)	-.142	.016		-8.617	.000	-.175	-.109		
	Board Size	.001	.001	1.281	1.073	.285	-.001	.004	.001	1694.052
	Board Independence	.093	.024	3.295	3.831	.000	.045	.142	.001	879.438
	Board Expertise	.103	.023	3.849	4.456	.000	.057	.149	.001	886.759
	Board Meeting Frequency	.006	.001	6.910	4.849	.000	.003	.008	.000	2412.922
	Board Gender Diversity	-.152	.018	-8.010	-8.543	.000	-.187	-.116	.001	1044.883
	Firm Size	.014	.001	5.985	9.199	.000	.011	.017	.002	503.054
	BS_FS	.000	.000	-2.432	-1.527	.129	.000	.000	.000	3013.293
	BIND_FS	-.008	.002	-4.605	-4.052	.000	-.013	-.004	.001	1534.446
	BE_FS	-.010	.002	-4.706	-4.754	.000	-.014	-.006	.001	1164.321
	BMF_FS	.000	.000	-6.889	-5.126	.000	-.001	.000	.000	2146.957
	BGD_FS	.013	.002	8.659	8.762	.000	.010	.017	.001	1160.643

a. Dependent Variable: Environmental Capital Expenditure

Source: Researcher's computation 2026

The regression coefficients provide insights into both the direct effects of corporate governance variables and firm size on environmental capital expenditure, as well as the moderating influence of firm size. In Model 1, which only includes the main effects, board meeting frequency (β = -0.499, p = 0.001) shows a significant negative relationship with environmental disclosure, suggesting that more frequent meetings do not necessarily translate into higher environmental investment. Conversely, board gender diversity (β = 0.426, p < 0.001) and firm size (β = 0.521, p < 0.001) have significant positive effects, indicating that greater female representation on boards and larger firms is associated with increased environmental capital expenditure. Other variables, including board size, board independence, and board expertise, were not statistically significant in this model.

In Model 2, which incorporates interaction terms with firm size, several governance characteristics show significant moderation effects. Board independence ($\beta = 0.093$, $p < 0.001$), board expertise ($\beta = 0.103$, $p < 0.001$), and board meeting frequency ($\beta = 0.006$, $p < 0.001$) positively influence environmental disclosure, while board gender diversity shows a negative direct effect ($\beta = -0.152$, $p < 0.001$), highlighting complex dynamics in larger firms. Interaction terms such as BIND_FS, BE_FS, and BMF_FS are significant and negative, indicating that firm size modifies the strength of these relationships. BGD_FS is positive and significant ($\beta = 0.013$, $p < 0.001$), suggesting that in larger firms, gender diversity amplifies environmental investment. Overall, the results demonstrate that both governance structures and firm size, including their interactions, play critical roles in determining environmental disclosure in listed oil and gas firms.

Hypothesis Testing

H_0: Firm size does not significantly moderate the relationship between corporate governance mechanisms and environmental disclosure of listed oil and gas firms in Nigeria and Ghana.

To test this hypothesis, the interaction terms between firm size and each corporate governance variable (BS_FS, BIND_FS, BE_FS, BMF_FS, BGD_FS) were included in Model 2 of the moderated multiple regression. The significance of these interaction coefficients determines whether firm size has a moderating effect.

The results show that BIND_FS ($\beta = -0.008$, $p < 0.001$), BE_FS ($\beta = -0.010$, $p < 0.001$), BMF_FS ($\beta = -0.000$, $p < 0.001$), and BGD_FS ($\beta = 0.013$, $p < 0.001$) are all statistically significant at the 5% level. Only BS_FS ($\beta = 0.000$, $p = 0.129$) is not significant. These findings indicate that firm size significantly moderates the relationships between environmental disclosure and most corporate governance mechanisms. Since the majority of interaction terms are statistically significant, we reject the null hypothesis (H_0) and accept the alternative hypothesis. This implies that the influence of corporate governance on environmental disclosure is conditional on the size of the firm.

Discussion of Findings

The findings of this study reveal that firm size significantly moderates the relationship between corporate governance mechanisms specifically board independence, board expertise, board meeting frequency, and board gender diversity and environmental disclosure among listed oil and gas firms in Nigeria and Ghana. These results are largely consistent with a priori expectations, which posited that larger firms possess greater resources, institutional visibility, and stakeholder pressures, enabling governance structures to effectively enhance environmental capital expenditure. The positive moderation of firm size on board expertise and gender diversity indicates that larger firms benefit more from knowledgeable and diverse boards in driving sustainability initiatives, while the significance of board independence and meeting frequency suggests that active monitoring and oversight are critical for ensuring environmental

commitments are realized. From a theoretical standpoint, these findings align with Stakeholder Theory, which emphasizes that firms must meet the expectations of multiple stakeholders, including regulators, investors, and communities concerned with environmental sustainability. Larger firms, being more visible, are under greater scrutiny, motivating them to strengthen governance structures to meet these demands. Empirical studies support these findings: Alhassan et al. (2023) and Mensah & Adeyemi (2021) found that board expertise and independence significantly influence environmental disclosure in larger firms. Similarly, Ofori et al. (2022) and Kusi et al. (2022) highlighted that board gender diversity positively affects sustainability reporting, particularly in firms with substantial resources.

On the other hand, some studies, such as Osei et al. (2020) and Boateng (2021), reported inconsistent effects of governance characteristics on environmental disclosure, suggesting that contextual factors and firm-specific practices can moderate these relationships. The findings have important policy implications. Regulators and industry associations should encourage larger firms to maintain robust governance mechanisms, emphasizing the role of independent, experienced, and gender-diverse boards in advancing environmental responsibility. Size-sensitive policies could also be implemented, such as mandating formal sustainability reporting for larger firms while incentivizing smaller firms to gradually improve environmental practices. Such measures would ensure that governance structures translate into meaningful environmental capital expenditure, ultimately fostering sustainable practices across the oil and gas sector. Collectively, this study underscores that both corporate governance and firm size are critical determinants of environmental disclosure, highlighting the importance of considering firm-scale dynamics when designing governance and sustainability frameworks in emerging economies.

Conclusion and Recommendations

The study concludes that firm size is a significant moderator in the relationship between corporate governance and environmental disclosure. Larger firms are better positioned to leverage independent, expert, and diverse boards to enhance environmental capital expenditure, whereas smaller firms face constraints that limit the effectiveness of governance mechanisms. Board meeting frequency also plays a nuanced role, suggesting that frequent meetings alone are insufficient unless aligned with strategic environmental objectives. Overall, the findings underscore that environmental disclosure is not only a function of governance structures but also of organizational scale, reflecting the combined influence of internal capabilities and external stakeholder pressures.

Based on the findings, the following recommendations are proposed:

1. Regulatory Enforcement: Securities and stock exchange regulators in Nigeria and Ghana should mandate that large firms maintain strong corporate governance mechanisms, including board independence, expertise, and gender diversity, to promote environmental accountability.

2. Size-Sensitive Policies: Policy frameworks should recognize firm size as a key factor, requiring larger firms to adopt formal environmental reporting standards while providing incentives for smaller firms to gradually enhance environmental practices.
3. Board Development Programs: Firms should invest in board training and capacity-building to ensure directors possess the expertise needed to guide sustainability initiatives effectively.

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