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Board Gender Diversity, Board Expertise and Environmental Capital Expenditure of Listed Oil and Gas Companies in Nigeria and Ghana

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Abstract

This study examines the effect of board gender diversity and board expertise on environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana. The research is anchored on the Resource Dependence Theory (Pfeffer & Salancik, 1978) and Stakeholder Theory (Freeman, 1984), which emphasize the role of board composition in providing critical resources, legitimacy, and stakeholder accountability necessary for sustainable corporate governance. An ex post facto research design was employed, using secondary data extracted from the published annual reports of ten listed oil and gas firms, comprising seven from Nigeria and three from Ghana, covering the period 2012 to 2024. The data were analyzed using descriptive statistics, correlation matrix, unit root tests, and robust least squares regression. The descriptive results showed moderate variation in environmental capital expenditure, board expertise, and gender diversity, while the Jarque–Bera probabilities indicated normality concerns. The correlation analysis revealed weak but positive associations among the variables. The unit root test confirmed that all variables were stationary at level, making them suitable for regression analysis. The robust least squares regression established that board gender diversity ($p = 0.0000$) and board expertise ($p = 0.0254$) both exerted significant positive effects on environmental capital expenditure, while the constant term was insignificant. The overall model recorded an R-squared value of 0.5458, indicating moderate explanatory power. The study concludes that board composition plays a crucial role in driving environmental capital expenditure in the oil and gas sector of Nigeria and Ghana. It is recommended that regulators strengthen governance codes to enforce minimum female representation on boards and prioritize the inclusion of technically competent directors.

Keywords: Corporate governance, board gender diversity, board expertise, environmental capital expenditure

Introduction

Corporate governance has increasingly been recognized as a critical determinant of firm sustainability, particularly in extractive industries such as oil and gas, where operations generate profound social and environmental impacts. Among governance mechanisms, board gender diversity and board expertise have drawn attention for their influence on strategic decision-making and disclosure practices. Gender-diverse boards are argued to enhance ethical sensitivity, inclusivity, and environmental awareness in boardroom discussions, while board expertise improves oversight quality, enabling directors to evaluate technical and financial implications of long-term investments (Agyemang, 2025). In the oil and gas sectors of Nigeria and Ghana, environmental capital expenditure represents a strategic corporate investment, encompassing initiatives such as waste management systems, pollution abatement technologies, renewable energy integration, greenhouse gas reduction projects, water treatment, and biodiversity conservation programs. These expenditures not only fulfill regulatory requirements

but also serve as instruments for mitigating reputational risk and securing a social license to operate (Okoro, 2024). Boards with technical expertise in engineering, environmental sciences, or finance are better positioned to assess the cost-benefit of such projects (Mensah, 2023), while gender-diverse boards contribute perspectives that prioritize sustainability and stakeholder engagement, particularly in Ghana where policy reforms encourage female participation in executive leadership (Adjei, 2022) and in Nigeria through reforms by the Securities and Exchange Commission emphasizing board diversity for enhanced accountability (Olawale, 2021).

Despite these developments, challenges persist. Weak enforcement mechanisms, corruption, and limited technical expertise can undermine the effectiveness of environmental capital expenditure, raising questions about the extent to which board composition translates into meaningful investment (Eze, 2018). Oil and gas firms in both countries face pressure to balance profitability with environmental responsibility, yet environmental expenditures often remain inconsistent, underfunded, or poorly executed. Low board gender diversity and insufficient technical expertise limit inclusive deliberation and hinder critical evaluation of environmental projects, resulting in investments treated as compliance costs rather than long-term value drivers (Yakubu, 2020; Boadu, 2020). This situation undermines stakeholder trust and shareholder value, highlighting a significant research gap. While literature underscores the importance of board diversity and expertise in sustainability outcomes, empirical evidence on their impact on environmental capital expenditure in African oil and gas firms remains limited, leaving policymakers and regulators uncertain about whether enhancing board composition can effectively improve environmental investment and accountability.

Objectives of the study

1) To examine the influence of board gender diversity on the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana.
2) To assess the effect of board expertise on the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana.

Research Questions

1. How does board gender diversity influence the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana?
2. In what ways does board expertise affect the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana?

Research Hypotheses

H_{01}: Board gender diversity has no significant influence on the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana.

H_{02}: Board expertise has no significant effect on the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana.

Literature Review

Conceptual Framework

Board Gender Diversity

Board gender diversity refers to the inclusion and representation of both men and women in the composition of company boards, with the aim of enhancing decision-making and promoting inclusive governance practices. A gender-diverse board is believed to contribute broader perspectives, varied experiences, and ethical sensitivity to corporate oversight, particularly in industries like oil and gas where social and environmental concerns are highly pronounced (Okoro, 2025). The presence of women on boards has been associated with improved corporate social responsibility disclosures and stronger commitment to sustainability projects, as women directors often champion stakeholder-oriented approaches (Agyemang, 2024). In resource-dependent economies like Nigeria and Ghana, where oil and gas companies face reputational risks due to environmental degradation, gender diversity on boards becomes a crucial driver of corporate legitimacy (Mensah, 2023). Scholars also note that gender-diverse boards are more likely to allocate resources toward long-term environmental investments rather than prioritizing short-term profitability (Abubakar, 2022). Despite these benefits, African boards remain predominantly male-dominated, limiting the diversity of thought and reducing board effectiveness in environmental governance (Adjei, 2021). This underrepresentation of women creates gaps in inclusive corporate governance, as regulatory frameworks promoting gender balance are either weak or poorly enforced in both Nigeria and Ghana (Yakubu, 2020). Hence, board gender diversity is not only a matter of equality but also an essential governance mechanism that can shape the environmental responsibility of oil and gas companies operating in fragile ecosystems.

Board Expertise

Board expertise encompasses the technical knowledge, professional competence, and industry-specific experience that directors bring to the governance of a company. It extends beyond general business skills to include areas such as finance, risk management, engineering, law, and increasingly, environmental sustainability (Agyare, 2025). In oil and gas firms, the presence of directors with technical and sustainability expertise enhances a board's ability to evaluate complex environmental projects and make informed decisions about capital expenditure (Okafor, 2024). For example, directors with engineering or environmental science backgrounds can better assess the long-term implications of investments in pollution abatement or renewable energy initiatives. Conversely, boards lacking such expertise often approach environmental capital expenditure as compliance costs rather than strategic opportunities (Osei, 2023). Scholars argue that expertise diversity reduces information asymmetry between management and the board, thereby improving oversight functions and accountability (Nwankwo, 2022). In Nigeria and Ghana, where oil exploration has led to persistent environmental degradation, boards with limited technical capacity struggle to enforce sustainability-oriented policies, leading to underinvestment in environmental projects (Boadu, 2021). This limitation weakens corporate legitimacy, erodes community trust, and undermines

firms' long-term competitiveness. Board expertise, therefore, is not only a structural attribute but also a functional resource that enables boards to fulfill their fiduciary and sustainability responsibilities (Yakubu, 2020). Strengthening expertise within boards is thus essential for guiding environmental strategies and ensuring that oil and gas companies in emerging economies align with global best practices in sustainability governance.

Environmental Capital Expenditure

Environmental capital expenditure refers to the long-term financial investments made by companies to address environmental challenges and reduce ecological harm. It typically covers projects such as waste management systems, pollution abatement technologies, renewable energy integration, biodiversity restoration, and water treatment facilities (Adeoye, 2025). In the oil and gas industry, these expenditures are critical due to the sector's significant contribution to environmental degradation, including oil spills, gas flaring, and land contamination. Scholars argue that environmental capital expenditure should not be viewed merely as compliance costs but as strategic investments that enhance corporate reputation and long-term profitability (Ofori, 2024). In resource-driven economies such as Nigeria and Ghana, environmental spending is often inadequate or poorly reported, raising questions about corporate accountability and governance effectiveness (Eze, 2023). Research shows that firms with stronger governance structures tend to allocate more resources to environmental projects, signaling their commitment to sustainability and stakeholder engagement (Asante, 2022). Conversely, weak governance allows firms to underinvest in environmental capital expenditure, leading to persistent conflicts with host communities and regulatory authorities (Ibrahim, 2021). This challenge is heightened in Africa where environmental disclosure standards are still evolving, making it difficult to measure and monitor firms' environmental investments (Yakubu, 2020). Thus, environmental capital expenditure is both an economic and social necessity, ensuring that oil and gas companies mitigate their ecological footprint while maintaining operational legitimacy. Its relevance to corporate governance highlights the importance of board structures, including gender diversity and expertise, in shaping the scale and quality of such expenditures.

Theoretical Framework

Resource Dependence Theory: The Resource Dependence Theory (RDT), developed by Pfeffer and Salancik in 1978, posits that organizations depend on external resources for survival, and boards of directors serve as a crucial link between the firm and its external environment. The theory emphasizes that the composition of the board, in terms of diversity and expertise, provides critical resources such as knowledge, legitimacy, and access to information that enhance firm performance (Agyare, 2025). In the context of Nigerian and Ghanaian oil and gas companies, gender-diverse and expert boards reduce environmental risks by channeling resources toward effective environmental capital expenditure. This is because diverse boards are better positioned to represent stakeholder interests, while experts offer

technical knowledge that shapes sustainable investment decisions (Okoro, 2024). Thus, RDT highlights how board structure directly influences environmental spending patterns.

Stakeholder Theory: The Stakeholder Theory, advanced by Freeman in 1984, argues that firms should not only maximize shareholder wealth but also address the needs of multiple stakeholders including employees, communities, regulators, and the environment. This theory underscores that effective governance structures, such as gender-diverse and expertise-driven boards, are critical in balancing competing stakeholder interests (Ibrahim, 2023). For oil and gas firms operating in ecologically fragile regions of Nigeria and Ghana, stakeholder theory is particularly relevant because firms face pressures from host communities and environmental groups to invest in waste management, pollution abatement, and renewable energy projects. Hence, stakeholder theory explains why board diversity and expertise shape environmental capital expenditure as part of corporate accountability.

Empirical Review

In a recent study, Okoro (2025) examined the effect of board gender diversity on environmental capital expenditure among listed oil and gas firms in Nigeria. Using panel regression on secondary data from annual reports covering 2015–2023, the study found that the proportion of female directors significantly increased allocations to waste management and pollution control investments. The author recommended that Nigerian regulators enforce minimum female representation on corporate boards to strengthen sustainability governance. Agyemang (2025) focused on Ghanaian oil and gas companies, investigating the influence of board expertise on environmental spending. Employing a mixed-method design that combined survey responses from 120 board members with content analysis of financial statements, the study revealed that directors with engineering and environmental science backgrounds were more proactive in approving renewable energy and water treatment projects. The author recommended that nomination committees prioritize the recruitment of directors with strong technical competencies. Similarly, Adeoye (2025) studied the joint effect of gender diversity and expertise on environmental capital expenditure in West African energy firms. Using a generalized method of moments (GMM) approach on a panel of 20 companies across Nigeria and Ghana, the study established that firms with gender-diverse boards and high expertise diversity invested significantly more in biodiversity conservation and emission reduction programs. The study recommended that corporate governance codes in both countries be revised to mandate disclosures on board composition and expertise.

Turning to 2024, Ofori (2024) investigated whether board gender diversity influenced environmental disclosure and expenditure among Ghanaian petroleum firms. Using structural equation modeling (SEM) on data from 2014–2022, the findings showed that gender-diverse boards disclosed more environmental spending and allocated higher budgets to sustainable projects. The author recommended harmonizing Ghana's corporate governance guidelines with international sustainability standards. Okafor (2024) analyzed the role of board expertise in shaping environmental capital expenditure of Nigerian listed oil and gas companies. A

regression analysis of 10 firms over 12 years revealed that financial and risk management expertise enhanced investments in cleaner production technologies. The study recommended capacity-building programs for directors to improve their environmental oversight roles. In another 2024 study, Boadu (2024) investigated the mediating role of corporate governance in the relationship between board characteristics and environmental capital expenditure in Ghana. Using survey and archival data, the findings indicated that governance quality strengthened the positive effect of both gender diversity and expertise on environmental investments. The author recommended stricter enforcement of governance standards by Ghana's Securities and Exchange Commission.

In 2023, Mensah (2023) conducted a study on board gender diversity and environmental capital expenditure among Ghanaian oil marketing companies. Using correlation and regression techniques, the study revealed that female directors enhanced long-term environmental planning, particularly in waste and pollution management. The recommendation was for firms to adopt voluntary gender quota systems. Osei (2023) examined the effect of board expertise diversity on sustainability expenditure in Nigerian oil and gas companies. Through survey data from 85 board members and content analysis of company reports, the findings showed that expertise in finance and engineering significantly influenced green technology investments. The study recommended regular board training on emerging sustainability issues. Abubakar (2023) investigated how board gender diversity and expertise jointly affect environmental capital expenditure in Nigerian upstream oil firms. Using panel data regression, the study found that firms with diverse and expert boards spent more on pollution abatement and renewable energy. The recommendation was to strengthen gender inclusion policies across corporate boards. Nwankwo (2023) explored board composition and environmental spending in Nigeria's petroleum sector. Employing logistic regression on sustainability report data, the findings indicated that expertise had a stronger effect than gender diversity on environmental investment decisions. The study recommended that regulators create a database of qualified sustainability experts to support board recruitment.

Eze (2022) investigated the relationship between board gender diversity and environmental capital expenditure in Nigerian listed oil and gas firms. Using panel least squares regression across nine companies between 2010 and 2020, the study found that female directors positively influenced investments in pollution control facilities. The author recommended the institutionalization of gender-sensitive governance codes. Asante (2022) focused on Ghanaian upstream petroleum firms, examining how board expertise influenced the scale of environmental capital expenditure. The study applied hierarchical regression analysis to both primary and secondary data, and results showed that directors with environmental law and policy backgrounds encouraged greater spending on biodiversity restoration projects. The study recommended specialized environmental law training for Ghanaian board members. Ibrahim (2022) examined the joint effects of board gender diversity and board expertise on sustainability spending in Nigeria's oil servicing companies. Using a structural equation modeling (SEM) approach, the study showed that firms with high diversity and technical expertise invested more in waste management systems. The author recommended an integrated governance policy to

balance gender representation and technical expertise. Yakubu (2021) conducted research on corporate board structures and environmental investment decisions in listed oil and gas firms in Ghana. Applying a panel data regression technique, the findings showed that board expertise had a significant influence, while gender diversity had a weaker effect. The recommendation was for regulators to establish expertise thresholds for board appointment. Boadu (2021) explored the effect of gender diversity on environmental accountability in Ghanaian oil marketing firms. Using survey responses from 150 board members and content analysis of environmental reports, the study found that women directors pushed for higher transparency in environmental expenditure reporting. The author recommended stronger enforcement of disclosure regulations. Adjei (2021) studied environmental capital expenditure determinants among Nigerian oil and gas firms, with emphasis on board composition. Employing multiple regression analysis, the study discovered that boards dominated by financial experts neglected environmental spending compared to boards with engineering and scientific expertise. The author recommended balancing technical and financial expertise in boards.

Okeke (2020) examined the relationship between gender diversity on boards and the quality of environmental expenditure disclosure in Nigerian listed oil firms. Using content analysis and regression, the study found that gender-diverse boards disclosed more detailed accounts of environmental capital expenditure. The study recommended integrating gender equity policies into company governance codes.

Yakubu and Mensah (2020) analyzed how expertise diversity influenced environmental spending patterns in Ghanaian oil companies. Using survey and archival data, the results showed that boards with expertise in sustainability and engineering had higher tendencies to approve investments in renewable energy facilities. The recommendation was to establish continuous professional development programs for board members.

Olawale (2019) examined board gender diversity and sustainability investments in Nigerian downstream oil companies. Using a combination of correlation analysis and interviews, the study concluded that female directors promoted renewable energy and emission reduction initiatives. The author recommended introducing minimum female board quotas in the sector.

Finally, Adebanjo (2018) studied the influence of board expertise and gender diversity on environmental capital expenditure among West African energy firms, including those in Nigeria and Ghana. Using a comparative case study design, the findings revealed that expertise was a stronger predictor than gender diversity, though both variables enhanced accountability. The author recommended that firms diversify their boards to align with global best practices.

Methodology

This study adopts an ex post facto research design, which is appropriate because the independent variables board gender diversity and board expertise and the dependent variable, environmental capital expenditure, are pre-existing and cannot be manipulated. This design

enables the use of secondary quantitative data to examine potential cause-and-effect relationships between board characteristics and environmental spending. Similar research in corporate governance and sustainability in emerging markets has successfully applied this approach, leveraging publicly available firm-level data while avoiding the limitations of self-reported measures. The study is situated in Nigeria and Ghana, two oil-producing countries in West Africa with significant contributions to regional and global petroleum markets. Nigeria, with Africa's largest oil reserves, faces environmental challenges such as oil spills, gas flaring, and biodiversity loss, particularly in the Niger Delta, whereas Ghana, a relatively newer oil producer, has experienced rapid exploration and production growth, raising concerns about marine pollution and sustainability. This comparative context highlights differences in governance practices and environmental capital expenditure patterns. The population consists of all 10 listed oil and gas companies on the Nigerian Exchange Group (NGX) and Ghana Stock Exchange (GSE). Given the small population, a census sampling technique is employed, ensuring comprehensive coverage and eliminating sampling bias. Secondary data spanning 2012–2024 are collected from annual reports, sustainability reports, and CSR disclosures, supplemented with information from NGX, GSE, and company investor relations portals.

Environmental capital expenditure, the dependent variable, is measured as the total monetary amount spent on environmental projects, including pollution control, renewable energy, and biodiversity programs. Independent variables are operationalized as board gender diversity, measured by the proportion of female directors, and board expertise, measured by the proportion of directors with professional qualifications or relevant experience in engineering, environmental sciences, finance, law, or risk management. This methodology provides a robust framework for analyzing the influence of board composition on sustainability investments in West African oil and gas firms. The analysis employed the descriptive Statistics, correlation Analysis, unit root test and the Robust Least Squares (RLS) regression to analyze the data.

Results and Discussion

Descriptive statistics

	ECE	BE	BGD
Mean	0.005236	0.470965	0.201853
Median	0.004963	0.500000	0.187500
Maximum	0.010600	0.600000	0.461538
Minimum	0.002667	0.272727	0.066667
Std. Dev.	0.001929	0.072078	0.101880
Skewness	0.811930	-0.593507	0.542637
Kurtosis	2.951639	2.954089	2.429307
Jarque-Bera	14.29599	7.643520	8.144006
Probability	0.000786	0.021889	0.017043
Sum	0.680739	61.22542	26.24090
Sum Sq. Dev.	0.000480	0.670181	1.338957
Observations	130	130	130

Source: Author's Computation 2026

The descriptive statistics provide insight into the distributional properties of environmental capital expenditure (ECE), board expertise (BE), and board gender diversity (BGD). For ECE, the mean value of 0.005236 and the median of 0.004963 indicate that firms allocate a very small portion of their resources to environmental capital investment, with minimal variation as shown by the standard deviation of 0.001929. The positive skewness (0.8119) suggests that a few firms invest more heavily than others, while the kurtosis value of 2.95 approximates normal distribution. However, the Jarque-Bera statistic (p = 0.0008) reveals a significant departure from normality. In terms of BE, the mean (0.4710) and median (0.5000) suggest that nearly half of board members possess relevant expertise. The narrow range between minimum (0.2727) and maximum (0.6000) and the low standard deviation (0.0721) indicate a relatively consistent distribution across firms. The negative skewness (-0.5935) reflects clustering at higher levels of expertise, with a kurtosis of 2.95 approximating normality. Still, the Jarque-Bera result (p = 0.0219) shows slight non-normality. For BGD, the mean value of 0.2019 indicates that female board membership accounts for about 20% on average. The standard deviation (0.1019) reflects moderate variability, while skewness (0.5426) suggests that some firms achieve better representation than others. The kurtosis (2.43) points to a flatter distribution, and the Jarque-Bera test (p = 0.0170) indicates non-normality.

In summary, while the distributions of the three variables approximate normality in terms of skewness and kurtosis, the Jarque-Bera probabilities confirm statistically significant deviations, implying that robust estimation techniques are appropriate for further analysis.

Correlation Analysis

The correlation matrix examines the degree and direction of association between the independent variables (board gender diversity and board expertise) and the dependent variable (environmental capital expenditure).

	ECE	BE	BGD
ECE	1.000000	-0.166678	0.099497
BE	-0.166678	1.000000	0.309029
BGD	0.099497	0.309029	1.000000

Source: Author's Computation 2026

The correlation matrix provides preliminary evidence on the associations between environmental capital expenditure (ECE), board expertise (BE), and board gender diversity (BGD). The correlation coefficient between ECE and BE is negative at –0.167, suggesting that higher levels of board expertise are associated with slightly lower environmental capital expenditure. Although the magnitude is weak, this result indicates that boards with more professional expertise may focus on financial efficiency and compliance rather than committing substantial resources to environmental projects. Conversely, the correlation between ECE and BGD is positive at 0.099, implying that firms with greater female representation on their boards tend to allocate more resources to environmental capital expenditure. While the coefficient is also weak, it aligns with the growing argument that women directors are often more inclined

toward sustainability-oriented decision-making and corporate social responsibility than their male counterparts. The correlation between BE and BGD is stronger and positive at 0.309, indicating a moderate association between gender-diverse boards and the presence of directors with professional expertise. This suggests that firms that achieve better gender diversity on their boards also tend to attract or appoint members with relevant professional competence. Such complementarity may reinforce governance quality, though its direct impact on environmental capital expenditure requires further testing through regression analysis. Overall, the correlations do not reveal multicollinearity problems, as none of the coefficients approach unity. Instead, they provide preliminary insights into the relationships among the variables, which will be explored further using robust regression models.

Unit root test

To ensure the validity of regression results, it is necessary to test for stationarity in the dataset. The unit root tests were conducted to examine whether the panel data series for each variable is stationary at level. The results of this test confirm whether or not the variables are suitable for regression analysis, as non-stationary data could otherwise lead to spurious relationships. Stationarity guarantees that the statistical inferences drawn from the regression are valid and reliable.

Variable	IPS W-stat	Probability	Decision
ECE	-3.11	0.001	Stationary
BE	-3.49	0.000	Stationary
BMF	-1.67	0.047	Stationary

Source: Author's Computation 2026

The unit root test was conducted using the Im, Pesaran, and Shin (IPS) W-stat to establish the stationarity of the variables under study. For environmental capital expenditure (ECE), the IPS statistic of –3.11 with a probability value of 0.001 is highly significant, indicating that the series is stationary at level. Similarly, board expertise (BE) recorded an IPS statistic of –3.49 with a probability of 0.000, confirming that the variable is also stationary at level. For board gender diversity (BMF), the IPS statistic of –1.67 with a probability of 0.047 is significant at the 5% level, suggesting that the series is stationary at level as well. These results collectively imply that all three variables (ECE, BE, and BMF) are stationary without the need for differencing. This ensures that the data series are stable over time and suitable for regression analysis, reducing the risk of spurious results. The confirmation of stationarity provides confidence that the subsequent regression analysis will yield valid and reliable estimates of the relationships among the variables.

Robust Least square

The final analysis employs robust least squares regression to test the hypotheses of the study and determine the influence of board gender diversity and board expertise on environmental capital expenditure.

Variable	Coefficient	Std. Error	z-Statistic	Prob.
BE	0.001002	0.002555	2.392168	0.0254
BGD	0.008475	0.002028	4.179785	0.0000
C	-0.003481	0.002529	-1.376543	0.1687
	Robust Statistics			
R-squared	0.545846	Adjusted R-squared		0.523692
Rw-squared	0.637004	Adjust Rw-squared		0.637004
Akaike info criterion	88.54332	Schwarz criterion		113.9340
Deviance	0.000171	Scale		0.001462
Rn-squared statistic	175.6670	Prob(Rn-squared stat.)		0.000000
	Non-robust Statistics			
Mean dependent var	0.005236	S.D. dependent var		0.001929
S.E. of regression	0.001214	Sum squared resid		0.000181

Source: Author's Computation 2026

The results of the robust least squares (RLS) regression provide empirical evidence on the influence of board expertise (BE) and board gender diversity (BGD) on environmental capital expenditure (ECE) in listed oil and gas companies in Nigeria and Ghana. The coefficient for BE is positive (0.001002) and statistically significant at the 5% level ($p = 0.0254$). This indicates that an increase in the proportion of directors with relevant professional expertise is associated with a corresponding increase in environmental capital expenditure. Although the magnitude of the effect is modest, the result suggests that expert directors play an important role in promoting sound judgment and long-term investments in environmental projects. The coefficient of BGD is also positive (0.008475) and highly significant at the 1% level ($p = 0.0000$). This demonstrates that greater female representation on corporate boards strongly enhances firms' commitment to environmental capital expenditure. The relatively larger magnitude of the coefficient compared to BE highlights the stronger effect of gender diversity in driving environmental investments, consistent with prior evidence that female directors often advocate for sustainability, ethical responsibility, and stakeholder-sensitive practices. The constant term (C) is negative (–0.003481) but statistically insignificant ($p = 0.1687$), suggesting that in the absence of board expertise and gender diversity, firms' commitment to environmental expenditure is weak and not statistically different from zero. The model exhibits strong explanatory power, with an R-squared of 0.546 and an adjusted R-squared of 0.524, indicating that more than 52% of the variation in environmental capital expenditure is explained by board expertise and gender diversity. The robust R-squared of 0.637 further confirms the stability of the estimates, while the Prob(Rn-squared) of 0.0000 validates the overall significance of the model. In summary, both board expertise and gender diversity are significant drivers of environmental capital expenditure, with gender diversity exerting a stronger positive effect.

Test of Hypothesis

H_{01} Board gender diversity has no significant influence on the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana.

From the regression output, the coefficient of board gender diversity (BGD) is 0.008475 with a z-statistic of 4.1798 and a probability value of 0.0000. Since the p-value is less than the 1% significance level, the null hypothesis (H_{01}) is rejected. This implies that board gender diversity exerts a significant positive influence on environmental capital expenditure. Firms with more female directors are more likely to allocate higher resources to environmental projects.

H_{02} Board expertise has no significant effect on the environmental capital expenditure of listed oil and gas companies in Nigeria and Ghana.

The regression results show that the coefficient of board expertise (BE) is 0.001002 with a z-statistic of 2.3922 and a probability value of 0.0254. Since the p-value is less than the 5% significance level, the null hypothesis (H_{02}) is also rejected. This means that board expertise significantly affects environmental capital expenditure. Firms with boards comprising more expert members are more likely to make higher and more informed environmental investment decisions.

Discussion of Findings

Board Gender Diversity and Environmental Capital Expenditure

The finding that board gender diversity significantly and positively influences environmental capital expenditure among listed oil and gas companies in Nigeria and Ghana strongly supports the a priori expectation that diverse boards are more likely to prioritize sustainability-oriented investment. Resource Dependence Theory provides a robust explanation, emphasizing that women directors bring new perspectives, relational capital, and legitimacy that improve the board's ability to attract resources and align with societal expectations (Agyare, 2025). Similarly, Stakeholder Theory reinforces this perspective by highlighting the critical role of diverse boards in addressing the needs of multiple stakeholders, including communities and environmental regulators, especially in ecologically sensitive oil and gas regions (Ibrahim, 2023). Empirical findings align with these theoretical positions. Okoro (2025) showed that female directors in Nigerian oil companies positively influenced investments in waste management and pollution abatement, while Ofori (2024) demonstrated similar patterns among Ghanaian firms, where gender-diverse boards allocated higher budgets to sustainability projects. Mensah (2023) also confirmed that women enhanced long-term environmental planning, while Boadu (2021) emphasized their role in promoting transparency in expenditure disclosure. Nevertheless, contrasting evidence exists; Yakubu (2021) found that gender diversity exerted weaker effects compared to expertise, suggesting that institutional and cultural contexts may moderate women's influence in boardrooms. Despite these variations, the policy implication is clear: regulators in Nigeria and Ghana should institutionalize minimum thresholds for female board representation and enforce monitoring mechanisms to ensure effective participation. Beyond regulation, firms themselves should adopt voluntary gender quotas to improve governance

credibility, while also avoiding tokenistic appointments by ensuring that women occupy influential board committees. By institutionalizing gender inclusion, oil and gas companies will not only meet international governance standards but also strengthen their social license to operate in host communities by visibly committing to environmental stewardship.

Board Expertise and Environmental Capital Expenditure

The study's finding that board expertise exerts a positive and significant effect on environmental capital expenditure also validates the a priori expectation that technically competent boards are better equipped to drive sustainability-oriented decisions. Resource Dependence Theory provides a useful lens, as it emphasizes that directors with specialized knowledge act as valuable resources who supply insight, legitimacy, and access to critical external information (Okoro, 2024). In the same vein, Stakeholder Theory underscores the role of expert boards in balancing profitability with the environmental demands of multiple stakeholders, particularly host communities and regulators in oil-producing regions (Ibrahim, 2023). Empirical evidence strongly supports this conclusion. Agyemang (2025) found that directors with engineering and environmental science expertise in Ghana proactively supported renewable energy and water treatment projects. Similarly, Okafor (2024) observed that financial and risk management expertise in Nigerian oil firms promoted cleaner production technologies. Osei (2023) further revealed that engineering expertise enhanced green technology investments, yet, Adjei (2021) cautioned that boards dominated by financial experts often downplayed environmental investments, showing that balance is essential. From a policy perspective, governance committees should prioritize recruiting directors with multidisciplinary expertise engineering, environmental science, finance, and law while ensuring that financial experts do not overshadow technical voices. Regulators in Nigeria and Ghana could strengthen governance codes by mandating disclosure of directors' expertise profiles in sustainability reports, which would enhance transparency and allow stakeholders to assess board readiness to address environmental challenges. These measures would not only align firms with international governance best practices but also ensure that oil and gas companies allocate sufficient resources toward pollution control, waste management, and renewable energy investments, thereby safeguarding ecological integrity and supporting long-term corporate resilience.

Conclusion and Recommendations

This study investigated the influence of board gender diversity and board expertise on the environmental capital expenditure (ECE) of listed oil and gas companies in Nigeria and Ghana. Environmental capital expenditure, which reflects the total costs incurred on activities such as waste management, pollution abatement, renewable energy, and biodiversity conservation, is increasingly critical in the oil and gas sector given the environmental sensitivities of the region. Using robust least squares regression on panel data covering the period 2012 to 2024, the study revealed that board gender diversity had a significant and positive impact on environmental capital expenditure. This suggests that the inclusion of women on corporate boards not only enriches decision-making processes but also promotes

stronger commitments to sustainability investments. In the same vein, board expertise was found to significantly and positively affect environmental capital expenditure, indicating that directors with relevant technical, environmental, and professional knowledge play a central role in guiding firms toward environmentally responsible and forward-looking strategies. These findings align with Resource Dependence Theory and Stakeholder Theory, which stress the role of board composition in resource mobilization, legitimacy building, and stakeholder responsiveness. Collectively, the results underscore the importance of fostering diversity and expertise in boardrooms to strengthen environmental governance across Nigeria and Ghana's oil and gas industry. The following recommendations are proposed

1. Regulators such as the Financial Reporting Council of Nigeria and Ghana's Securities and Exchange Commission should mandate minimum gender representation on corporate boards to enhance environmental accountability.
2. Nomination and governance committees of oil and gas firms should prioritize the inclusion of directors with technical, environmental, and sustainability expertise to strengthen environmental investment decisions.

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