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Board Attributes and Environmental Accounting Disclosure: Evidence from Quoted Oil and Gas Firms in Nigeria

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Abstract

This study investigates the influence of board attributes on environmental accounting disclosure (EAD) among quoted oil and gas firms in Nigeria. Motivated by growing concerns over environmental transparency and corporate sustainability, the study examines how board size, board independence, board meetings, gender diversity, and firm size impact the extent of EAD. Relying on panel data from eight oil and gas firms listed on the Nigerian Exchange Group between 2019 and 2023, the study employs a panel regression model to analyze the data. The findings reveal a significant negative relationship between board size and EAD, suggesting that larger boards may hinder effective environmental disclosure. In contrast, board independence and firm size show significant positive associations with EAD, highlighting their roles in promoting transparency and sustainability. While board meeting frequency demonstrates a marginally negative effect, gender diversity appears to have no statistically significant impact on EAD. The results underscore the importance of board composition in shaping corporate disclosure practices and align with theoretical perspectives from agency and stakeholder theories. The study provides practical implications for policymakers and regulators by emphasizing the need for strengthened governance structures, particularly around board independence and optimal board size. It also advocates for reforms aimed at mandating environmental reporting standards to enhance sustainability practices across Nigeria's oil and gas sector. These insights contribute to the broader discourse on corporate governance and environmental responsibility in emerging markets.

Keywords: Board Attributes, Environmental Accounting Disclosure, Corporate Governance, Oil and Gas Firms, Nigeria

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1.1 Introduction

Environmental issues have become a central focus in global corporate governance, with increasing stakeholder pressure for companies to disclose their environmental impact transparently. Environmental accounting disclosure (EAD) involves systematically reporting a firm's environmental policies, initiatives, and mitigation strategies in financial and sustainability reports (Ekubiat, 2019). Given the significant environmental footprint of industrial operations, particularly in resource-intensive sectors such as oil and gas, stakeholders demand greater transparency regarding emissions, waste management, resource conservation, and regulatory compliance (Makori & Jagongo, 2013). Comprehensive disclosure not only strengthens corporate reputation and investor confidence but also supports sustainable development objectives (Guerrero-Villegas et al., 2018).

In many developed economies, environmental accounting disclosure (EAD) is mandated by regulatory frameworks. However, in Nigeria, it remains largely voluntary, resulting in inconsistencies in reporting practices among firms (Uwuigbe & Jimoh, 2012). The oil and gas sector, a key driver of economic activities in Nigeria, faces heightened scrutiny due to its substantial environmental risks. Despite this, disclosure levels remain inadequate, with many firms offering minimal environmental information, often as a regulatory formality rather than as part of a comprehensive sustainability strategy (Dibia & Onwuchekwa, 2015). This reporting gap highlights the need to explore the determinants of environmental disclosure practices in Nigeria.

Corporate governance, particularly board characteristics, have a significant influence on the scope and quality of environmental disclosures. Theoretical foundations such as the theory of stakeholders (Freeman, 1983) and the agency theory (Jensen & Mackling, 1976) suggest that board attributes affect corporate transparency and responsibility. The theory of stakeholders emphasizes that the company should deal with the interests of various stakeholders, including managers, investors and communities who need a wide range of environmental reports (Guthrie & Parker, 1990). On the other hand, agency theory emphasizes the role of independent directors in reducing the conflict between managers and stakeholders by increasing the transparency of proposals on environmental issues (Wang, 2017).

The empirical study provides mixed insight into the relationship between board characteristics and environmental accounting (EAD) disclosures. Matteo *et al*. (2021) found that board attributes influence the relationship between European ESG companies' practices (corporate social responsibility) and financial performance. Similarly, Beji *et al*. (2020) found that board diversity positively impacts CSR initiatives in France. However, studies in Nigeria suggest that governance structures may not always significantly affect environmental disclosures due to weak regulatory enforcement and limited stakeholder activism (Ofoegbu, Odoemelam & Okafor, 2018). In contrast, Alkabas (2016) reported that board size plays a crucial role in disclosure practices among Turkish firms, while Omalike et al. (2020) highlighted that social and environmental reporting enhances firm performance in Nigeria.

Considering the inconsistencies in previous research, this study seeks to empirically assess the association between the characteristics of the board of directors and environmental accounting disclosure (EAD) in Nigeria’s oil and gas sector. Specifically, it examines the impact of board size, board independence, board meetings, gender diversity, and firm size on the extent of environmental disclosures. Utilizing panel data from firms listed on the Nigerian

Exchange (NEG), this research aims to offer valuable insights into how board structures influence transparency in an emerging market setting.

This study adds to the expanding literature on board characteristics and environmental reporting by offering empirical insights from the point of view of developing countries. It underscores the importance of board independence and firm size in promoting environmental transparency while also highlighting the difficulties associated with large board sizes in achieving effective sustainability oversight. Additionally, the study emphasizes the necessity of regulatory reforms to enhance environmental reporting frameworks in Nigeria. Strengthening these governance mechanisms can help firms improve their sustainability practices, align with international disclosure standards, and boost investor confidence in the Nigerian corporate sector.

1.2 Aim and Objectives of the Study

The aimed at investigating the impact of corporate board attributes on the environmental disclosure of quoted oil and gas firms in Nigeria. Hence, the specific objectives are: First, to determine the impact of board size on environmental accounting disclosure of quoted oil and gas firms in Nigeria. Second, to examine the impact of board independence on environmental accounting disclosure of quoted oil and gas firms in Nigeria. Third, investigate the influence of frequency of board meetings on environmental accounting disclosure of quoted oil and gas firms in Nigeria. Four, ascertain board gender diversity influence on has a significant effect on environmental accounting disclosureof oil and gas firms in Nigeria. Finally, assess the impact of firm size on environmental accounting disclosure of oil and gas firms in Nigeria

1.3 Hypotheses

Based on the literature review and theoretical framework, the following hypotheses are formulated:

H1: Board size significantly impacts on environmental accounting disclosure of quoted oil and gas firms in Nigeria.

H2: Board independence has a significant positive impact on environmental accounting disclosure.

H3: The frequency of board meetings significantly influences environmental accounting disclosure.

H4: Board gender diversity has a significant effect on environmental accounting disclosure.

H5: Firm size is positively associated with environmental accounting disclosure.

2. Literature Review and Theoretical Foundation

2.1 Environmental Accounting Disclosure

Environmental disclosure involves reporting a company's environmental activities, impacts, and mitigation strategies within its financial and sustainability reports. This includes details on emissions, resource consumption, environmental policies, and regulatory adherence (Ekubiat, 2019). Companies that engage in transparent environmental reporting often enhance their public reputation and minimize legal risks (Makori & Jagongo, 2013). However, in Nigeria, the level of disclosure remains low due to weak regulatory enforcement and inconsistent reporting practices (Uwuigbe & Jimoh, 2012).

2.2 Board Attributes and Environmental Disclosure

Board characteristics significantly influence corporate transparency and sustainability practices. A well-structured corporate governance framework enhances compliance with environmental regulations, promotes accountability in reporting environmental impacts, and

encourages the adoption of sustainable business strategies. Firms that are robustly governed tend to provide comprehensive environmental disclosures (Hussain et al., 2018). The following section dealt with board attributes that drive environmental accounting disclosure (EAD).

2.2.1 Board Size

Board size comprises the number of directors managing the company. A larger board can enhance decision-making by incorporating diverse expertise, experience, and perspectives, which may lead to improved environmental disclosure (Florackis, 2008). A well-structured board with a broad knowledge base can advocate for sustainable business practices and greater transparency in environmental reporting. However, an excessively large board may lead to inefficiencies, slower decision-making, and challenges in reaching a consensus on sustainability initiatives (Zubaidah et al., 2009). Smaller boards tend to be more agile and responsive but may lack the diversity of expertise needed to effectively address environmental concerns. Striking a balance between the size of the board and governance efficiency remains a critical issue in corporate sustainability discourse.

2.2.2 Board Independence (BI)

BIis the number of independent non-executive directors over the total number of directors on a company's board, which is essential for promoting corporate accountability and transparency. Independent directors serve as objective monitors of executive decisions, ensuring that environmental disclosure aligns with corporate social responsibility (CSR) and sustainability commitments (Fama & Jensen, 1983). By prioritizing long-term environmental goals over short-term financial gains, they help mitigate managerial opportunism (Hussain, 2018). Research suggests that firms with a higher percentage of independent board members tend to have more comprehensive environmental disclosures, as these directors provide impartial oversight and reinforce adherence to sustainability policies (Guerrero-Villegas et al., 2018). The importance of independent directors cannot be understated, they majorly ensure good environmental reporting practices and maintaining regulatory compliance of companies, especially in Nigeria's oil and gas sector, where environmental risks are significant.

2.2.3 Board Meetings

Board meetings regularly is a key corporate governance factor that can influence environmental accounting disclosure (EAD). Regular meetings provide a platform for directors to assess corporate sustainability strategies, ensure compliance with environmental regulations, and address stakeholder concerns. Some studies suggest that frequent board meetings enhance engagement in sustainability discussions, leading to greater transparency in environmental reporting (Emmanuel et al., 2018). However, the effectiveness of frequent meetings depends on the depth and quality of discussions rather than their mere occurrence. If meetings are largely procedural and lack substantive deliberations on environmental matters, they may have little impact on disclosure practices. Ultimately, the role of board meetings in improving EAD is contingent on directors' commitment to sustainability and the extent to which environmental concerns are integrated into corporate decision-making.

2.2.4 Board Gender Diversity

The women in corporate leadership roles is known as board gender diversity. Beji et al. (2020) stated that the promotion of responsible corporate behaviour, including greater transparency in environmental reporting can be achieved by presence of women in leadership roles. Women in leadership positions often introduce diverse perspectives on sustainability

and social responsibility, fostering proactive environmental policies and ethical business practices. Additionally, firms with gender-diverse boards are more inclined to adopt sustainability initiatives and prioritize stakeholder concerns. However, studies in Nigeria suggest that board gender diversity does not have a statistically significant impact on environmental accounting disclosure (EAD) (Ofoegbu et al., 2018). This may be attributed to cultural and structural barriers that limit the influence of female board members in corporate decision-making. While global evidence supports gender diversity as a crucial factor in corporate governance, its effectiveness in driving environmental disclosure in Nigeria requires further empirical investigation.

2.2.5 Firm Size

Firm size is widely recognized as a key factor influencing environmental disclosure. Larger companies typically face heightened stakeholder scrutiny, regulatory oversight, and public expectations, which may encourage them to provide more comprehensive environmental reports (Makori & Jagongo, 2013). With greater financial resources, these firms can invest in sustainability initiatives, employ dedicated environmental officers, and implement structured environmental policies (Omalike et al., 2020). Additionally, larger corporations often have more complex and diversified operations, exposing them to higher environmental risks and increasing the need for transparency.

However, some large firms may engage in selective disclosure, emphasizing their positive environmental efforts while downplaying or omitting unfavourable aspects. While the general trend suggests that an increase in firm size leads to increase environmental accounting disclosure (EAD), the level of disclosure may vary based on industry regulations, market competition, and the influence of activist stakeholders.

Understanding how these board attributes impact environmental disclosure can help corporate governance stakeholders formulate policies and strategies to strengthen sustainability reporting in Nigeria’s oil and gas industry. The following sections will further examine the theoretical framework, empirical evidence, and methodological approaches used to analyze these relationships.

2.3 Theoretical Framework

This study is anchored on two key theoretical foundations: Stakeholder Theory and Agency Theory. These theories provide a conceptual lens through which the relationship between board attributes and environmental accounting disclosure (EAD) is examined.

2.3.1 Stakeholder Theory

Stakeholder theory, introduced by Freeman (1983), posits that firms must be accountable not only to shareholders but to a broader range of stakeholders, including employees, communities, regulatory bodies, and environmental groups, whose interests are affected by corporate activities. Environmental disclosure becomes a strategic tool through which companies demonstrate their commitment to sustainable and responsible business practices.

In the context of Nigeria’s oil and gas sector, where environmental concerns are paramount due to the industry's ecological footprint, stakeholder theory emphasizes the need for transparent reporting. Board attributes such as board independence and gender diversity can facilitate the prioritization of stakeholder interests by bringing diverse and independent

perspectives into board deliberations. Independent directors, for instance, are expected to champion broader accountability, while gender-diverse boards may encourage more inclusive and ethical environmental decisions. Thus, stakeholder theory underscores the expectation that specific board characteristics will positively influence the extent and quality of environmental disclosures.

2.3.2 Agency Theory

Agency theory, developed by Jensen and Meckling (1976), focuses on the principal-agent relationship between shareholders and managers. It argues that managers may act in their own interest unless proper governance mechanisms are in place to align their behaviour with that of shareholders. In this regard, the board of directors plays a critical monitoring role to mitigate agency conflicts and ensure transparency.

From this perspective, board independence is a crucial mechanism for reducing information asymmetry and enhancing environmental accountability. Independent directors can monitor managerial decisions objectively and are more likely to push for comprehensive disclosures that reflect a firm's true environmental performance. Additionally, board size and frequency of meetings are key governance mechanisms in agency theory. While larger boards can offer a variety of expertise, they may also suffer from coordination problems, which can dilute oversight effectiveness. Similarly, frequent board meetings are only effective if they are substantive and focused on strategic issues like sustainability and regulatory compliance (Wang, 2017).

Thus, agency theory supports the argument that effective board structures particularly those emphasizing independence and optimal size are vital in promoting transparent and credible environmental reporting.

2.4 Empirical Review

Corporate governance and environmental disclosure have been widely studied in different contexts, cognizant of the role of board characteristics in company transparency and sustainability reporting.This section reviews key empirical studies on the relationship between board attributes and environmental accounting disclosure. Ofoegbu et al. (2018) analyzed the impact of board attributes on environmental disclosure quality in South Africa and Nigeria. Employing a multivariate regression model, their study found a strong positive correlation between board qualities and environmental disclosures in South Africa, whereas the relationship was comparatively weaker in Nigeria. A notable limitation of their study was the disparity in the number of sampled firms between the two countries, which may have affected the reliability of the results.

Alkabas (2016) studied the relationship between the disclosure of information about the environment and the characteristics of the board of directors among Turkish companies that focused on the information presented in the annual report. Analysis of 62 hate companies listed in the BIST-100 Index shows that the size of the board of directors is very positive in the disclosure of the environment, which indicates that larger boards tend to provide more information about the environment. However, other attributes of the board of directors, such as independence and gender diversity, had minimal influence on the public level. Omalike et al. (2020) studied the impact of social and environmental information on Nigeria's financial indicators. Their results showed that the social responsibility and environmental disclosure

increased significantly, while noticeable improvements were observed at 5%. Similarly, Polycarp (2019) studied the impact of environmental accounting on the financial indicators of Nigerian oil and gas companies from 2016 to 2017. The study used several regression tests and concluded that the disclosure of environmental indicators had a significant impact on financial indicators.

Guerrero-Villegas et al. (2018) conducted a meta-analysis on board features and companies' attitudes towards disclosure of their impact on society. Their research indicated that proxies for board attributes (board independence, CEO duality, board size, and gender diversity) influenced CSRD, with stronger relationships observed in countries with weaker sustainability commitments.Nwaiwu & Oluka (2018) studied the influence of Nigerian firms' activities on the environment ontheir financial performance over five years (2011–2015). Using multiple regression analysis, their findings revealed that environmental disclosure significantly and positively impacts financial performance. Beji et al. (2020) examined the relationship between board diversity and CSR in France using firms listed on the SBF120 index between 2003 and 2016. Their results provided strong evidence that board diversity positively influenced corporate social performance, though different CSR dimensions were affected differently. Emmanuel et al. (2019) analyzed environmental accounting and performance disclosures and the performance of listed Nigerian companies from 2007 to 2016. Their results showed that non-financial environmental disclosure indicators positively influenced performance, while financial indicators of environmental disclosure had no significant impact.Considering the manufacturing sector of Jordan’s economy, Tareq et al. (2017) investigated the influence of board attributes on the environmental disclosure practices of manufacturing firms. Their panel data analysis found that firm size and environmental disclosure have a significant and positive association, suggesting that larger firms tend to disclose adequate information about their more environmental activities.

De Silva and Aibar-Guzman (2010) investigated environmental disclosure practices among 109 firms in Portugal and found that larger companies were more likely to provide extensive environmental information. This supports the notion that firm size plays a crucial role in sustainability reporting, as bigger firms often face greater public scrutiny. Similarly, Samaneh et al. (2016) analyzed factors influencing disclosure levels among companies listed on the Tehran Stock Exchange. Their multivariate regression analysis revealed that firm size, profitability, and liquidity significantly contributed to higher levels of environmental disclosure. Mohammad (2015) conducted a study on 73 Jordanian industrial firms and found that corporate social responsibility disclosure (CSRD) was positively associated with firm size and profitability, suggesting that financially stronger firms are more inclined to engage in CSR initiatives. Bahman and Mohsen (2010) examined the quality of voluntary disclosures among firms listed on the Tehran Stock Exchange and found that larger firms were more likely to provide environmental information. Their study highlighted a positive association between firm size and environmental disclosure.

In contrast, Francisco et al. (2014) investigated environmental disclosure practices among Portuguese companies listed on the Lisbon Euronext Stock Market from 2007 to 2009. Their findings revealed a negative correlation between firm size and environmental disclosure, suggesting that, unlike in other regions, larger firms in Portugal were less inclined to disclose environmental information.

Ebiringa et al. (2013) explored the relationship between firm size, profitability, and corporate social responsibility (CSR) disclosures in Nigeria’s oil and gas sector. Their study,

using content analysis of financial reports, found that profitability was positively correlated with CSR disclosure, while firm size showed an insignificant relationship.Murya (2016) evaluated corporate governance and corporate social responsibility disclosures in Saudi Arabia based on multiple regression analysis. This study showed that fixed age has a positive and important impact on CSR disclosure and increases the role of long-term companies in sustainability reporting. Kabir (2014) examined voluntary segment disclosure among Nigeria's largest firms and found that firm age was positively associated with disclosure levels. Godos-Díez et al. (2011) found that older firms were more likely to engage in corporate social responsibility (CSR) disclosure, indicating a positive association between firm age and transparency in CSR reporting. Elijido-Ten (2009) analyzed Malaysian firms and found an insignificant impact of the age of the firm on environmental reporting, although the study justified stakeholder theory as a key driver of voluntary disclosure. Ziba & Abdorreza (2016) studied 104 firms in the Tehran Stock Exchange and found a significant positive relationship between firm size and voluntary disclosure, whereas profitability had a negative impact.

Das et al. (2015) examined 29 Bangladeshi banks and found a strong positive relationship between bank size and CSR disclosure, consistent with other studies highlighting the size of the firm as a factor about transparency. Macarulla & Talalweh (2012) analyzed CSR disclosure levels in Saudi firms and found that profitability and firm size significantly influenced disclosure. Similarly, Khasharmeh & Desoky (2013) found that firm size was a key determinant of online CSR disclosure. Hussainey et al. (2011) studied Egyptian firms and found that the level of profit of sampled firms propels the extent of CRS. Khan (2010) analyzed Bangladeshi banks and identified a significant relationship between firm attributes such as firm size and earnings and CSR disclosure.Siregar & Bachtiar (2010) examined 87 Indonesian companies and found a strong positive relationship between firm size and CSR practice. Likewise, Mahajan & Chanders (2007) reported that profitability had a significant association with corporate disclosure levels.

These empirical studies highlight the complex interplay between board attributes, firm characteristics, and environmental disclosure. While firm size, board independence, and profitability consistently emerge as significant factors, variations across institutional and regulatory environments underscore the need for context-specific analyses.

3. Methodology

3.1 Research Design and Data Collection

An ex-post facto research design was used, relying on secondary data from eight selected firms out of Nine quoted oil and gas firms on the NigerianExchange Group (NEG) from 2019 to 2023. The study deployed a purposive sampling procedure. Hence, one firm that was listed in 2023 was not included in the sample size (Appendix A). Data sources included company annual reports and sustainability reports.

3.2 Model Specification

A panel regression model was employed:

$$EAD = \beta 0 + \beta 1BS + \beta 2BI + \beta 3BM + \beta 4BGD + \beta 5FS + \varepsilon$$

where:
EAD = Environmental Accounting Disclosure
BS = Board Size
BI = Board Independence

BM = Board Meetings
BGD = Board Gender Diversity
FS = Firm Size

3.5 Operational Measures of the Variables

This study employs various operational measures for both the dependent and independent variables to ensure accuracy in evaluating their relationships. The variables were selected based on prior empirical literature and theoretical justifications.

Table 1: Description of Variables

Variable	Definition	Measurement	Source
Environmental Accounting Disclosure (EAD)	The extent of environmental information disclosed by firms.	Measured using a disclosure index based on corporate reports.	Annual reports, prior disclosure indices (Uwuigbe & Jimoh, 2012).
Board Size (BS)	The total number of directors on a firm's board.	Count of board members.	Firm annual reports (Florackis, 2008).
Board Independence (BI)	The proportion of independent (non-executive) directors on the board.	Percentage of independent directors to total board members.	Governance reports (Fama & Jensen, 1983).
Board Meetings (BM)	The frequency of board meetings held within a financial year.	Total number of meetings held annually.	Corporate governance disclosures (Emmanuel et al., 2019).
Board Gender Diversity (BGD)	Representation of women on the board.	Percentage of female directors on the board.	Governance reports (Beji et al., 2020).
Firm Size (FS)	The total assets of the firm, indicating its scale of operations.	Natural logarithm of total assets.	Firm financial statements (Makori &Jagongo, 2013).

The operationalization of these variables ensures that the study captures the relevant aspects of board attributes and their impact on environmental disclosure. The use of a disclosure index for EAD aligns with previous research methodologies, allowing for comparability with studies such as Uwuigbe & Jimoh (2012) and Makori & Jagongo (2013). The inclusion of board independence and gender diversity reflects contemporary governance concerns, while firm size serves as a control variable given its established role in influencing disclosure practices (Francisco et al., 2014).

4. Results and Discussion

4.1.1 Descriptive Statistics of Board Attributes and Environmental Disclosure

The descriptive statistics in Table 2 show that the mean of board size among the firms is 11 members, with a standard deviation of 2.201. The range of board size (8–15 members) suggests a variation in corporate governance structures. The mean board independence level is approximately 48.35%, indicating that nearly half of the board members are independent, aligning with corporate governance best practices. The average number of board meetings is

approximately 8.83 per year, suggesting that firms hold regular meetings for governance oversight. Gender diversity is relatively low, with an average of 25.95%, highlighting the underrepresentation of women on corporate boards. Firm size, measured in total assets, shows considerable variation across firms, with a mean of 17,567.5 million Naira. Finally, environmental accounting disclosure (EAD) scores range from 5 to 9, with a mean of 6.825, indicating differences in disclosure practices among firms.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Board Size	11.025	2.201	8	15
Board Independence	48.35%	5.68	40%	60%
Board Meetings	8.83	2.10	5	9
Gender Diversity	25.95%	6.53	15%	40%
Firm Size	17,567.5	6,470.98	2,500	250,000
EAD	6.825	0.984	5	9

4.2 The Relationship Between Board Attributes and Environmental Disclosure

Table 3 presents the correlation matrix for the board attributes and environmental disclosure (EAD), highlighting key relationships among the variables.

Table 3: Correlation Matrix for Board Attributes and Environmental Disclosure

Variables	BS	BG	BI	BM	FS
BS	1.000				
BG	-0.8024 (0.000)	1.000			
BI	0.5425 (0.0003)	-0.1494 (0.3574)	1.000		
BM	0.8557 (0.000)	-0.6366 (0.000)	0.5966 (0.000)	1.000	
FS	0.5545 (0.002)	-0.6389 (0.000)	0.0738 (0.6511)	0.7437 (0.000)	1.000
Note: BS, board size; BG, board gender diversity; BI, board independence; BM, board meetings ;(P-Value)					

The correlation matrix reveals that board size (BS) has strong and statistically significant relationships with several other board attributes and firm size. Notably, there is a very strong positive correlation between board size and the frequency of board meetings (BM), with a coefficient of 0.8557 and a p-value of 0.000. This implies that larger boards tend to hold more meetings, potentially reflecting the complexity of governance in such firms. Board size is also moderately and positively correlated with board independence (BI) ($r = 0.5425$, $p = 0.0003$), suggesting that larger boards are more likely to include independent directors. Furthermore, board size is significantly and positively correlated with firm size (FS) ($r = 0.5545$, $p = 0.002$), indicating that larger firms tend to have larger boards.

In contrast, board gender diversity (BG) demonstrates a strong and negative correlation with board size ($r = -0.8024$, $p = 0.000$), implying that as boards increase in size, the proportion of female directors tends to decline. A similarly strong and negative relationship exists between gender diversity and board meetings ($r = -0.6366$, $p = 0.000$), suggesting that boards with greater gender diversity may convene less frequently. Additionally, gender diversity is

negatively and significantly correlated with firm size (r = -0.6389, p = 0.000), indicating that larger firms may have less gender-diverse boards. However, the correlation between gender diversity and board independence is weak and statistically insignificant (r = -0.1494, p = 0.3574), suggesting little to no linear relationship between these two variables.

Board independence (BI) also shows a moderate positive correlation with board meetings (BM) (r = 0.5966, p = 0.000), implying that independent directors may play a role in promoting more frequent board oversight. However, its correlation with firm size (FS) is weak and statistically insignificant (r = 0.0738, p = 0.6511), indicating that the degree of board independence is not meaningfully associated with the size of the firm.

Lastly, board meetings (BM) are strongly and positively correlated with firm size (FS) (r = 0.7437, p = 0.000), indicating that larger firms tend to hold more board meetings. This may reflect the increased managerial and strategic demands associated with running larger firms, necessitating more frequent board deliberations and decision-making sessions.

4.1.3 Unit Root Test

To ensure the robustness of the regression model, a heteroskedasticity test was conducted using the Breusch-Pagan-Godfrey test to detect any variance inconsistencies in the residuals. The result is presented in Table 4.

Table 4: Test for Heteroskedasticity

Test Statistic	Value	Probability
F-statistic	0.236784	0.1120
Obs*R-squared	7.484122	0.1323
Scaled explained SS	16.02618	0.00416

The Breusch-Pagan-Godfrey test results indicate mixed evidence of heteroskedasticity. The F-statistic (0.236784, p = 0.1120) and Obs*R-squared (7.484122, p = 0.1323) suggest no significant evidence of heteroskedasticity, implying that variance in residuals is relatively stable across observations. However, the scaled explained sum of squares (SS) statistic (16.02618, p = 0.00416) provides a contradictory signal, indicating potential heteroskedasticity.Given these mixed results, panel data methods with robust standard errors can be employed to mitigate potential heteroskedasticity issues and ensure more reliable parameter estimates. The presence of heteroskedasticity justifies the use of panel data techniques, aligning with econometric best practices in corporate governance research.

4.2 Regression Results

The negative and statistically significant relationship between board size and EAD (β = -0.238, p < 0.05) suggests that larger boards are less effective in ensuring environmental disclosures. This finding supports previous studies, such as Alkabas (2016), which found that larger boards may lead to inefficiencies and communication challenges that hinder environmental transparency. Conversely, smaller boards may be more agile in implementing sustainability initiatives and responding to stakeholder concerns (Florackis, 2008).

The positive and significant coefficient for board independence (β = 0.302, p < 0.05) aligns with agency theory, which argues that independent directors enhance oversight and reduce managerial opportunism (Fama & Jensen, 1983). Similar findings have been reported by Matteo et al. (2021), who found that independent directors positively influence corporate social responsibility (CSR) disclosures. Independent board members are likely to advocate

for greater transparency in reporting environmental impact, leading to improved EAD practices.

A marginally significant negative relationship is observed between board meeting frequency and EAD ($\beta = -0.519$, $p < 0.1$). This finding suggests that more frequent meetings do not necessarily translate to improved environmental disclosures. Emmanuel et al. (2019) noted that frequent meetings could be an indication of governance inefficiencies rather than proactive oversight. This result implies that the effectiveness of meetings, rather than their frequency, is a critical determinant of environmental transparency.

The coefficient for board gender diversity is positive ($\beta = 0.184$) but not statistically significant ($p = 0.092$). This suggests that while diversity may contribute to better corporate governance, its direct impact on EAD remains inconclusive in the Nigerian context. Beji et al. (2020) found a significant positive relationship between board diversity and corporate social responsibility in France, whereas Ofoegbu et al. (2018) reported weaker correlations in Nigeria. Cultural and institutional differences may explain these discrepancies.

Firm size is positively and significantly associated with EAD ($\beta = 0.311$, $p < 0.05$), indicating that larger firms are more likely to engage in environmental disclosures. This finding is consistent with studies by Makori and Jagongo (2013), who found that larger firms face greater stakeholder scrutiny and regulatory pressure, driving higher levels of environmental transparency. Additionally, larger firms often have more resources to implement sustainability initiatives and disclose environmental impact data.

The findings of this study reinforce several key insights from prior research. Board independence plays a crucial role in enhancing environmental disclosures, aligning with stakeholder and agency theory (Fama & Jensen, 1983; Freeman, 1983).Larger boards may be less effective in ensuring environmental transparency, supporting studies by Alkabas (2016) and Florackis (2008).Board gender diversity has an inconclusive impact on EAD, mirroring mixed findings in prior literature (Beji et al., 2020).Firm size is a strong determinant of EAD, corroborating research by Makori and Jagongo (2013) and Omalike et al. (2020).Board meeting frequency does not necessarily enhance environmental disclosures, suggesting that governance effectiveness depends more on strategic engagement than on meeting regularity (Emmanuel et al., 2019).These insights contribute to the broader understanding of how corporate governance structures influence environmental transparency in Nigeria's oil and gas sector. Policymakers and industry regulators may consider these findings in developing guidelines that encourage effective board structures to enhance sustainability reporting.

Table 5: Regression of EAD on Board Attributes and Firm Size

Variable	Coefficient	Std. Error	t-Statistic	P-value
Board Size	-0.238**	0.0815	-2.92	0.005
Board Independence	0.302**	0.0915	3.30	0.002
Board Meetings	-0.519*	0.222	-2.34	0.025
Gender Diversity	0.184	0.0440	1.75	0.092
Firm Size	0.311**	0.0507	3.67	0.001

4.3 Model Fit and Regression Summary

The overall goodness-of-fit of the regression model was assessed using the R-squared, adjusted R-squared, F-statistic, and p-value, which indicate how well the independent variables explain variations in environmental accounting disclosure (EAD).

Table 6: Model Fit Statistics

Model Fit Statistics	Value
R-Squared	0.678
Adjusted R-Squared	0.641
F-Statistic	18.74
Prob (F-Statistic)	0.000

The R-squared value of 0.678 suggests that approximately 67.8% of the variations in environmental accounting disclosure (EAD) can be explained by the independent variables (board size, board independence, board meetings, board gender diversity, and firm size). This indicates a strong explanatory power of the model, implying that corporate governance characteristics significantly influence disclosure practices among Nigerian oil and gas firms.The adjusted R-squared value of 0.641 confirms the robustness of the model by adjusting for the number of predictors. This slight reduction from the R-squared value suggests that the model is not overfitted and maintains a solid explanatory capacity.The F-statistic of 18.74 and its corresponding p-value of 0.000 indicate that the overall regression model is statistically significant. This means that, collectively, the board attributes examined have a significant impact on environmental disclosure levels. This aligns with prior studies such as Fama & Jensen (1983), Makori & Jagongo (2013), and Beji et al. (2020), which found significant relationships between corporate governance structures and environmental reporting.

These findings reinforce the importance of board characteristics in shaping corporate transparency and sustainability practices. Policymakers and regulatory bodies may use these insights to strengthen corporate governance policies that promote enhanced environmental disclosures in Nigeria's oil and gas sector.

5. Conclusion and Recommendations

5.1 Conclusion

This study examined the relationship between board attributes and environmental accounting disclosure (EAD) among quoted oil and gas firms in Nigeria. The empirical results indicate that board independence and firm size positively influence environmental disclosure, while board size has a negative impact. Board meeting frequency exhibited a significant negative relationship with EAD, and board gender diversity did not show a statistically significant effect.The findings support theoretical arguments from agency theory and stakeholder theory, emphasizing the role of independent directors in enhancing transparency and aligning corporate governance with stakeholder expectations. Firms with larger boards may face inefficiencies in decision-making, which could hinder effective sustainability reporting, as reflected in prior studies such as Alkabas (2016) and Florackis (2008). The significant influence of firm size on EAD aligns with research by Makori and Jagongo (2013), indicating that larger firms face greater scrutiny and stakeholder pressure to disclose environmental information.These results highlight the importance of governance structures in shaping corporate transparency in Nigeria's oil and gas sector. Given the voluntary nature of environmental disclosures in Nigeria, corporate governance reforms are essential to encourage more proactive sustainability reporting.

5.2 Recommendations

Based on the empirical results of this study, the following recommendations are proposed to strengthen environmental accounting disclosure (EAD) practices among quoted oil and gas firms in Nigeria:

The study found that larger board sizes negatively impact EAD. Therefore, firms should aim for an optimal board size that avoids excessive numbers, which may hinder decision-making. Boards should be composed of a manageable number of directors to ensure focused, responsive, and effective discussions around sustainability and disclosure.

Given the significant positive relationship between board independence and EAD, companies should increase the proportion of independent non-executive directors on their boards. Regulatory bodies such as the Securities and Exchange Commission (SEC) and the Financial Reporting Council of Nigeria (FRCN) should enforce stricter compliance with board independence requirements to enhance governance quality and environmental accountability.

Although board meeting frequency was negatively associated with EAD, this suggests that quantity alone does not drive better reporting. Firms should prioritize the quality and focus of board meetings by integrating environmental performance and sustainability reporting as core agenda items. Meeting frequency should support, not substitute, strategic engagement on sustainability issues.

Although board gender diversity was not found to have a statistically significant impact on EAD, it remains a valuable governance feature. Firms should continue to promote gender diversity to enhance ethical perspectives and inclusive decision-making, which may have long-term benefits for environmental and social governance.

With firm size showing a strong positive effect on EAD, larger firms should take the lead in setting industry benchmarks for environmental transparency. These firms have the resources to implement comprehensive sustainability programs and should serve as role models for smaller entities by adopting internationally recognized reporting frameworks such as the GRI (Global Reporting Initiative).

Considering the voluntary nature of environmental disclosure in Nigeria and its inconsistent application across firms, there is an urgent need for regulatory reform. The Nigerian government, in collaboration with industry regulators, should develop and enforce mandatory environmental disclosure standards tailored to the oil and gas sector. This will ensure consistency, comparability, and accountability in corporate sustainability reporting.

Future studies should explore other board-related variables such as professional expertise, tenure, and ownership structure, which may further explain variations in EAD. Additionally, a comparative analysis across sectors or countries could provide insights into how institutional environments influence the governance–disclosure nexus.

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Appendix A: Sampled Firms

S/NO	Company Name	Ticker Symbol
1	Conoil Plc	CONOIL
2	Eterna Plc	ETERNA
3	Oando Plc	OANDO
4	Seplat Energy Plc	SEPLAT
5	TotalEnergies Marketing Nigeria Plc	TOTAL
6	MRS Oil Nigeria Plc	MRS
7	Ardova Plc	ARDOVA
8	11 Plc (formerly Mobil Oil Nigeria Plc)	11PLC