E-ISSN: 1116 - 3240 P-ISSN: 3026-9334
MPRI-JAIMR | INTERNATIONAL JOURNAL OF AFRICAN INNOVATION & MULTIDSCIPLINARY RES.
VOL. 12 NO. 2 – APRIL, 2026

CORPORATE GOVERNANCE STRUCTURE AND CARBON ACCOUNTING INFORMATION REPORTING

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DOI: https://doi.org/10.70382/mejaimr.v12i2.0113

Abstract

This study examined corporate governance structure and carbon accounting information reporting. The specific objectives were to investigate whether board independence, board gender diversity, board shareholding and board size have significant effect on carbon accounting information reporting of listed oil and gas firms in Nigeria. The secondary source of data collection was adopted in the study where the purposive sampling technique was used to select a sample size of six (6) listed oil and gas firms for the study. Least Square regression analysis was used in this study and the findings revealed that board independence, board gender diversity, board shareholding and board size all has no significant effect on carbon accounting information reporting of listed oil and gas firms in Nigeria. The study concluded that a number of companies' activities and operations may cause nuisance and damages to the societal and environmental condition of the host communities in which they operate, hence, the need to take carbon accounting information reporting

Keywords: Board shareholding, board size, board gender diversity, carbon accounting, corporate governance structure.

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seriously. The study recommended among others that in other to enhance carbon accounting, deliberate efforts should be made to maintain the independence of the board by increasing the number of non-executive directors on the board. Particular emphasis and preference should be given to persons of calibre and credibility who possess the required skills and experience to positively impact the functions of the board.

Introduction

Global economic developments are typically marked by environmental activities that lead to issues such as increasing pollution, climate change, deforestation, desertification, and indiscriminate waste disposal, among others. These developments have intensified stakeholder pressure on firms to disclose their initiatives for environmental protection and resource conservation. Environmental reporting entails the dissemination of information regarding the effects of an organization's activities on the natural environment, which encompasses waste management, recycling, carbon management, emission and pollution control, tree planting, and wildlife conservation, among others (Eze & Akaegbobi, 2023). Environmental reporting refers to the public dissemination of information regarding an entity's environmental activities to specific interest groups and society as a whole. Environmental reporting has emerged as a significant aspect of contemporary business practices due to heightened stakeholder awareness regarding the detrimental impacts of environmental activities in regions where oil and gas companies in Nigeria operate (Isibor *et al.*, 2023).

Over the years, significant climate changes have occurred due to the emission of Greenhouse Gases (GHG), which pose a primary threat to the survival of life on Earth. The excessive release of greenhouse gases (GHGs) into the Earth's atmosphere has resulted in adverse effects on the ecosystem, contributing to global warming and climate change (Olayinka, 2022). The global socioeconomic impact of climate change can be significant, as a shifting climate influences both human populations and physical and natural capital. Climate change may result in diminished worker productivity and negatively impact global GDP growth (Hardiyansah *et al.*, 2021). There is no doubt that firms have consistently played a significant role in exacerbating climate change issues, as they are among the largest emitters of greenhouse gases (GHG).

The examination and swift expansion of carbon disclosure over the years has significantly advanced awareness and action against climate change among firms and their stakeholders through environmental disclosures. The outcome of carbon disclosure is driven by three primary factors: regulatory compliance, pressure from non-governmental organizations, and managerial information systems designed to enhance participation in

carbon markets, decrease energy costs, and manage reputational risks (Mohammad *et al.*, 2020). Carbon disclosure benefits not only a firm's stakeholders but also enables the monitoring and regulation of carbon emissions, thereby enhancing the firm's carbon performance. A stable and significantly enhanced carbon performance of a firm results in substantial long-term improvements in its financial performance (Mohammad & Aisa, 2020).

The organization's board committee significantly influences the quality of decisions regarding carbon disclosure. Corporate business operations are often blamed for being the principal contributors to climate change due to their greenhouse gas (GHG) emissions (Omaliko & Okpala, 2020). Carbon disclosure predominantly emphasizes external pressures, with minimal or no regard for internal governance structures within businesses. Prior research has examined the relationship between the overall characteristics of board members and corporate sustainability disclosure. The characteristics include board size, gender diversity, board independence, and the presence of a sustainability-related committee.

Research by Hardiyansah *et al.* (2021) indicated that increased diversity within a board of directors enhances managerial decision-making capabilities. A supervisory team possessing a diverse array of knowledge, skills, experiences, and professional network connections can exhibit greater inventiveness and creativity. In the realm of climate change, directors possessing diverse social and environmental acumen are more inclined to comprehend carbon disclosure and recognize transparent avenues for engaging various stakeholders, such as responding to annual inquiries from the Carbon Disclosure Project (CDP) for institutional investors and incorporating carbon-related data into their sustainability reports for the general public. Consequently, it is logical to infer that the board will be positively associated with the likelihood of disclosing carbon-related information. Moreover, a board with greater embeddedness can acquire more industry-specific data to aid the organization in navigating various uncertainties (Gayo & Vera, 2020). A gap exists in the research regarding the true motivations behind companies' disclosure of their environmental information, despite the substantial impact of carbon emissions on the environment. A review of prior research, including Omaliko and Okpala (2020), examined the influence of firm size, characteristics, and leverage on carbon disclosure levels in developing countries outside Nigeria. This study aims to investigate corporate governance structure and carbon accounting information reporting in listed oil and gas companies in Nigeria.

Carbon Accounting

The concept of carbon disclosure has become increasingly significant in recent years, enabling firms to convey their climate change initiatives to stakeholders via

environmental disclosures (Eze & Akaegbobi, 2023). These disclosures assist stakeholders, including shareholders and creditors, in making more informed investment decisions. Carbon disclosure enables stakeholders, including regulatory bodies, institutional investors, and the public, to more effectively monitor and regulate a firm's carbon emissions, likely enhancing its carbon performance. A carbon disclosure rating assesses a company's environmental sustainability, derived from the company's voluntary disclosures. The practice aims to assist investors in integrating environmental, social, and governance (ESG) factors into their investment decision-making process. The predominant carbon disclosure ratings are managed by CDP, a non-profit organization based in the United Kingdom, previously referred to as the Carbon Disclosure Project.

Amidst unprecedented global challenges such as climate change, water scarcity, and deforestation, disclosure serves as an essential initial measure in managing and mitigating environmental impact (Egolum *et al.*, 2019). A carbon disclosure rating assesses a company's environmental sustainability, derived from the company's voluntary disclosures. The practice aims to assist investors seeking to integrate environmental, social, and governance (ESG) factors into their investment decision-making process.

Corporate Governance

The concept of corporate governance has gained heightened significance in the global business landscape, particularly following the global financial crisis that incapacitated numerous companies worldwide. The failure and collapse of prominent companies in recent times have prompted stakeholders in the corporate sector to reevaluate the concept of corporate governance. Nonetheless, existing literature lacks a comprehensive definition of corporate governance (Yahaya *et al.*, 2023).

Corporate governance functions within a broader context. Specific mechanisms, often termed controls, are employed to attain corporate governance objectives. Governance is categorized as controls or mechanisms that are either internal or external. This classification facilitates the assessment of governance practices' effectiveness. Internal governance pertains to the overarching control framework, encompassing the decision-making authority held by the board of directors and CEOs, the mechanisms for altering such authority, the composition and size of the board, as well as the remuneration and equity stakes of both managers and board members (Yahaya *et al.*, 2023).

Board Independence and Carbon Accounting Information Reporting

Independent directors are individuals who possess no personal or professional affiliations with a company, aside from their role as board members. They are frequently designated as external directors. The inclusion of independent directors on a board can facilitate the separation of management and control functions within a company, thereby mitigating the opportunistic behaviors of internal members.

Moreover, independent directors typically exhibit enhanced and prolonged engagement with diverse stakeholder groups, which often affords them a more comprehensive perspective, likely leading to increased exposure to performance expectations (Oudat, 2020). Independent non-executive directors are professional managers who do not engage in the firm's direct daily operations, as they are not full-time employees. The inclusion of independent directors strengthens the Board's oversight function, as they are more attuned to societal issues and possess heightened ethical awareness.

Al-Amosh and Khatib (2022) examined the correlation between board independence and environmental, social, and governance performance (ESG). The study examined the Jordanian context as empirical evidence, employing content analysis to extract information from the annual financial reports of 51 publicly traded Jordanian companies. The study was conducted from 2012 to 2019 over an eight-year span. The study's findings indicate that board independence significantly enhances the quality of environmental, social, and governance disclosures among publicly listed companies in Jordan during the study period.

Ezekiel *et al*. (2024) examined the impact of board characteristics on carbon emission disclosure among Nigerian listed oil and gas companies. Board characteristics are categorized into board composition (including board size, board independence, and board structure) and board diversity (encompassing gender diversity, ethnicity, and background). The research evaluated data from 22 publicly traded oil and gas firms over a fifteen-year span (2009–2023). The study employed ordered regression for data analysis and concludes that board structure, board independence, board gender diversity, and board ethnicity significantly affect the probability of high-quality carbon emission disclosure. The findings demonstrated the crucial functions of the board in distributing resources to sustainable initiatives, overseeing managerial actions, and ensuring that companies fulfill their commitment to environmentally responsible operations.

Akhanolu *et al*. (2023) investigated the obstacles of carbon disclosure and its effect on the performance of publicly listed manufacturing companies in Nigeria. The study employed panel data analysis to examine secondary data collected from 2014 to 2020, utilizing equity return (ROE) as the dependent variable and carbon performance (disclosure), board response, board independence, and board environmental committee as independent variables. The Hausman test indicated the application of fixed effect regression. The regression results indicated that all independent variables; carbon performance (disclosure), board response, board independence, and board environmental committee negatively and significantly influence ROE.

Joel *et al*. (2023) analyzed the internal corporate governance mechanisms and environmental disclosures of publicly traded oil and gas companies in Nigeria. A secondary data source was utilized, extracting information from seven publicly listed oil

and gas companies from 2013 to 2022. The data was analyzed using a panel regression with random effects. Research indicated that board independence, board size, and the presence of foreign directors significantly enhance environmental disclosure.

H1: ***From the above, we hypothesize that board independence has no significant effect on carbon accounting information reporting of listed oil and gas firms in Nigeria***

Board Gender Diversity and Carbon Accounting Information Reporting

Recent years have witnessed a rise in studies examining the correlation between board gender diversity and firm performance across various countries, attributed to the distinctive knowledge, information, and diverse experiences, skills, and networks that gender-diverse boards offer (Owolabi *et al.*, 2023). A board comprising female members is more adept at reconciling the interests of various stakeholders, including employees, customers, suppliers, and communities, with the performance-driven interests of shareholders. This assertion is corroborated by Vo and Phan (2018), who identified three distinct reasons to acknowledge the significance of female representation on a board. Female board members typically possess a superior comprehension of the market relative to their male counterparts.

For boards to function effectively, diverse perspectives are essential to challenge management's thinking, thereby necessitating board diversity. Board diversity refers to the inclusion of individuals with varying acceptable characteristics within the board's composition. Diversity in corporate governance refers to the composition of the board and the amalgamation of various qualities, characteristics, and expertise of individual members concerning decision-making and other board processes. Board diversity represents the diverse personal attributes that contribute to a heterogeneous workforce. García-Sánchez *et al.* (2020) presented evidence regarding the impact of female directors on the reporting of gender issues. Furthermore, the study investigated the moderating influence of gender diversity on boards in relation to country-level factors associated with stakeholder orientation. An international sample of 8,609 firm-year observations from 2007 to 2016 revealed through the regression of various logit models for panel data that female directors enhance the likelihood of voluntary reporting on gender issues. Furthermore, the findings indicated that institutional factors associated with stakeholder pressures amplify this effect; the extent of reporting on gender issues by female directors is significantly greater in firms situated in stakeholder-oriented countries.

Wang (2020) analyzed the influence of gender diversity on corporate performance and governance in Taiwan from 2007 to 2019. Evidence from Taiwan indicates that enhanced gender diversity on boards does not positively influence financial and governance performance. The ratio of female independent directors is the only factor that

demonstrates a significantly positive correlation with a firm's performance, corroborating previous research indicating that more independent directors enhance their monitoring capabilities and, consequently, improve performance.

Zaid *et al.* (2020) investigated the influence of female directors on the financial performance of both family-owned and non-family Jordanian enterprises. A sample of 103 Jordanian public companies listed on the Amman Stock Exchange was selected for the period from 2009 to 2015. The research employed a quantitative approach and utilized a panel data methodology. The data analysis employed Ordinary Least Squares Regression. Return on Assets (ROA) and Tobin's Q were utilized as metrics for financial performance evaluation. The inclusion of female directors does not significantly affect the financial performance of family-owned enterprises. Conversely, in non-family enterprises, female directors seemed to adversely affect the performance of these firms.

Martínez *et al.* (2019) analyzed data from leading Spanish publicly traded companies between 2003 and 2017 to examine whether an increased presence of women on corporate boards affects corporate social responsibility (CSR), as evidenced by adherence to Global Reporting Initiative reporting standards and inclusion in the Dow Jones Sustainability Index. The study employed probit models and instrumental variable estimation to mitigate endogeneity and reverse causality issues, revealing a positive correlation between female representation in management and the voluntary disclosure of CSR reports, as well as inclusion in a sustainability index, thereby endorsing gender legislation.

H2: ***From the above, we hypothesize that board gender diversity has no significant effect on carbon accounting information reporting of listed oil and gas firms in Nigeria***

Board Shareholding and Carbon Accounting Information Reporting

Shareholders are individuals who invest in equity capital and assume the associated risks of the company. The directors present their stewardship to the shareholders at the annual general meeting. Shareholders designate directors to oversee the company's management on their behalf. In a publicly traded company, shareholders are classified into various categories. Some individuals may be part of the management team, while others may possess controlling shares, or may be foreign or institutional investors. Public companies possess ownership structures classified as managerial, concentrated or block ownership, institutional ownership, and foreign ownership (Qeshtaa, 2020). The ownership distribution among investors is inequitable.

The ownership structure refers to the proportion of ownership claims held by insiders (management) versus outsiders (investors without direct involvement in the firm's

management). The ownership structure pertains to the internal organization of a business entity and the rights and responsibilities of individuals possessing a legal or equitable interest in that entity. The capital structure serves as a supplementary mechanism of corporate governance alongside the ownership structure.

Okudo *et al*. (2022) determined the correlation between corporate governance and carbon disclosure practices of publicly listed manufacturing companies in Nigeria from 2011 to 2020. This research utilized an ex post facto design. The Pearson correlation coefficient and Panel Least Squares (PLS) regression analysis were utilized using E View 10.0 statistical software. The research revealed that ownership concentration, board gender diversity, and the presence of a sustainability committee are significantly positively correlated with carbon emission disclosure among publicly listed manufacturing firms in Nigeria at a 5% significance level.

Adaobi and Nestor (2021) determined the correlation among ownership concentration, board gender diversity, sustainability committees, and carbon emission disclosure in eighteen (18) publicly listed manufacturing firms in Nigeria. The research utilized an ex post facto design. The Pearson correlation coefficient and Panel Least Squares (PLS) regression analysis were conducted using E-Views 10.0 statistical software. The research revealed that ownership concentration, board gender diversity, and the presence of a sustainability committee are significantly positively correlated with carbon emission disclosure among publicly listed manufacturing firms in Nigeria.

Okeke *et al.* (2021) examined the impact of carbon emission disclosure on the economic value added of oil and gas firms listed on the Nigerian stock exchange during the years 2018-2019. The Panel Least Squares (PLS) method of data analysis was employed. Secondary data sources were utilized; the relevant variables were obtained from the annual reports of the listed oil and gas companies. The analysis revealed that the disclosure of effluent and waste treatment costs significantly impacts economic value added, while revenue growth of the firm also has a positive significant effect on economic value added. The ownership of a firm has an insignificant negative impact on economic value added.

Diah and Efita (2016) sought to examine the correlation between corporate governance and the quality of sustainability reporting among publicly listed companies in Nigeria. The study evaluates corporate governance through board governance factors (board size, board independence, board gender diversity, and board ownership). Their study utilizes a sample of 120 companies from the 165 listed on the NSE over a six-year span (2013–2018). Employing the ordered logistic regression approach, businesses are categorized into distinct sectors utilizing a stratified sampling technique, specifically from eight sectors on the NSE. The study revealed that corporate governance (board size, board independence, board gender diversity and board ownership) significantly influenced SRQ, based on a

sample of 120 enterprises and employing ordered probit and logistic regression methods from 2013 to 2018.

H3: ***From the above, we hypothesize that board shareholding has no significant effect on carbon accounting information reporting of listed oil and gas firms in Nigeria***

Board Size and Carbon Accounting Information Reporting

Tivde & Hussaini (2023) asserted that as a company's size increases, it attracts greater governmental scrutiny, leading managers to exhibit either compliance or aggressive tax avoidance behaviors, which can diminish corporate income. Additionally, taxes influence shareholders to engage in tax avoidance strategies aimed at enhancing cost efficiency or mitigating tax liabilities. The size of a company is determined by its equity value, sales value, or asset value.

Research by Tijjani (2019) demonstrates a significant correlation between company size and tax avoidance. As a company's size increases, its fixed assets also expand, leading to higher depreciation expenses. This, in turn, diminishes profits, resulting in a reduced tax burden, thereby facilitating tax avoidance by the company.

Ubiomoh and Okoye (2025) determined the impact of board characteristics on the environmental disclosures of publicly listed oil and gas companies in Nigeria and Ghana over a twelve-year period from 2012 to 2023. This study determined the impact of board size and board independence on effluent disclosure. This study utilized panel data derived from the annual reports and accounts of twelve (12) publicly listed oil and gas companies for the years 2012 to 2023. The results of the tested hypotheses indicated that board independence and board size significantly and positively influence effluent disclosure.

Adenikinju *et al.* (2023) investigated the correlation between the financial performance of publicly listed Nigerian financial services firms and carbon emission disclosure. The research utilized an ex-post facto design and secondary data derived from the annual reports of publicly listed Nigerian financial services firms. A multiple regression analysis was conducted on a panel data set. The results indicated that the variables significantly affecting returns on equity are 'other indirect emission' disclosure - scope 3, board size, capital intensity, and growth. This study determined that carbon emission disclosure substantially affects the return on equity of the chosen publicly listed Nigerian financial services firms. The study determined that carbon emission disclosure substantially affects the return on sales of the chosen publicly listed Nigerian financial services firms.

Atang and Eyisi (2020) investigated the factors influencing environmental disclosures of publicly traded manufacturing companies in Nigeria. The study's data was obtained from a sample of 22 publicly listed firms in the industrial sector. The study employed an ex post facto research design and utilized multiple regression analysis for data evaluation.

Descriptive and inferential statistics were employed to generalize the results and derive conclusions. The findings indicated that board composition accounted for approximately 13% of the variance in environmental disclosures among manufacturing firms in Nigeria.
Shuaibu *et al*. (2019) investigated the influence of corporate governance on the environmental information disclosure of publicly listed cement companies in Nigeria. Data were obtained from the annual reports and financial statements of the publicly traded cement companies for the period 2008–2017. The annual reports of the firms were examined through content analysis to assess the degree of environmental information disclosure, and the data were analyzed using descriptive statistics, correlation, and multiple regression techniques with STATA 13.0. The study's findings indicated that board independence, board size, frequency of board meetings, and firm size have a negative significant correlation with environmental information disclosure.

H4: ***From the above, we hypothesize that board size has no significant effect on carbon accounting information reporting of listed oil and gas firms in Nigeria***

Methodology

The *ex-post facto* research design was used in this study due to the fact that the variables cannot be manipulated by the researcher. This method was adopted since social scientific research problems do not lend themselves to experimental and controlled inquiry of the ex-post factor kind. The population comprises of one hundred and fifty one (151) firms listed on Nigerian Exchange Group as at 31st December, 2024. Since the entire listed firms cannot be used for the study, the study is limited to six (6) listed oil and gas firms in Nigeria. In selecting the sample, purposive sample technique was used to derive the sample size which used to ensure that the sample represents a diversity of perspectives. The secondary source of data collection was used for this study where data was gathered from audited annual reports of selected listed healthcare in Nigeria. However, for the purpose of this study, ten (10) years annual reports of six (6) selected oil and gas firms were adopted. The study employed multiple regression technique of analysis using Least Squares regression estimation. This method was adopted because it enhances easy presentation and interpretation of data. The empirical model of the study is mathematically expressed as follows:

$CAR_{it} = \alpha + \beta_1 BIN_{it} + \beta_2 BGD_{it} + \beta_3 BSH_{it} + \beta_4 BZ_{it} + \varepsilon_{it}$

Where;

CAR_{it} = Carbon Accounting Information Reporting
BIN_{it} = Board Independence
BGD_{it} = Board Gender Diversity

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BSH_{it} = Board Shareholding
BZ_{it} = Board Size
ε_{it} = Error term
α = intercept
$\beta_1 - \beta_3$ = Coefficients of parameters estimated

Measurement of Variables

The variables used in this study were measured as follows:

S/N	Variables	Measurement
1.	Carbon Accounting Information Reporting	This forms a company's total greenhouse gas emissions, including carbon dioxide, methane, nitrous oxide, and other gases.
2.	Board Independence	This forms the proportion of independent directors on the board.
3.	Board Gender Diversity	This forms proportion of female directors on the board.
4.	Board Shareholding	This forms the proportion of the company's outstanding shares owned by its directors.
5.	Board Size	This forms the total number of directors on the board.

Source: Researcher's Compilation, 2025

Table 1: Summary of Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
CAR	60	.00	1.00	.0167	.12910	60.000	.608
BIN	59	40.00	90.00	66.1481	13.62261	-.837	.613
BGD	59	.00	37.50	15.0705	9.78876	-.540	.613
BSH	60	.00	78.20	16.5125	22.10377	1.511	.608
BZ	59	4.00	14.00	8.6102	2.05121	.260	.613
Valid N	59						

Source: Output of data analysis by author using SPSS (2025)

From the above table, the dependent variable, carbon accounting information reporting (CAR) has a mean value of 0.0167, standard deviation of 0.12910, minimum value of 0.00 and maximum of 1.00. The independent variables; Board independence (BIN) has a mean value of 66.1481 and a standard deviation of 13.62261, a minimum and maximum value of 40.00 and 90.00 respectively. Board gender diversity (BGD) has a mean value of 15.0705,

standard deviation of 9.78876, minimum value of 0.00 and maximum value of 37.50. Board shareholding (BSH) has a mean value of 16.5125, standard deviation of 22.10377, minimum value of 0.00 and maximum of 78.20. Board size (BZ) has a mean value, standard deviation, minimum and maximum values of 8.6102, 2.05121, 4.00 and 14.00 respectively.

Table 2: Summary of Coefficient of Correlation

Correlations

		CAR	BIN	BGD	BSH	BZ
CAR	Pearson Correlation	1	.086	.303	-.096	-.039
	Sig. (2-tailed)		.517	.019	.464	.767
	N	60	59	59	60	59
BIN	Pearson Correlation	.086	1	.385	-.195	-.187
	Sig. (2-tailed)	.517		.003	.139	.156
	N	59	59	59	59	59
BGD	Pearson Correlation	.303	.385	1	.090	-.306
	Sig. (2-tailed)	.019	.003		.496	.019
	N	59	59	59	59	59
BSH	Pearson Correlation	-.096	-.195	.090	1	-.153
	Sig. (2-tailed)	.464	.139	.496		.248
	N	60	59	59	60	59
BZ	Pearson Correlation	-.039	-.187	-.306	-.153	1
	Sig. (2-tailed)	.767	.156	.019	.248	
	N	59	59	59	59	59

Source: Output of data analysis by author using SPSS (2025)

Table 2 above shows the 2-tailed correlation analysis of the variables at 5% (0.05) level of significance. This shows that carbon accounting information reporting (CAR) is positively correlated with board independence (BIN), board gender diversity (BGD) while negatively correlated with board shareholder (BSH) and board size (BZ). Board independence (BIN) is positively correlated with carbon accounting information reporting (CAR) and board gender diversity (BGD) while negatively correlated with board shareholder (BSH) and board size (BZ). Likewise, board gender diversity (BGD) is positively correlated with carbon accounting information reporting (CAR), board independence (BIN) and board shareholder (BSH) while negatively correlated with board size (BZ).

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Table 3: Summary of Regression Result

Model Summary

	Multiple R	.337
	R Square	.114
	Adjusted R Square	.048
	Std. Error of the Estimate	.127

Coefficients

		Unstandardized Coefficients		Beta	t	Sig.
		B	Std. Error			
	(Constant)	-.014	.129		-.110	.913
	BIN	-.001	.001	-.071	-.491	.626
	BGD	.005	.002	.354	2.438	.018
	BSH	-.001	.001	-.139	-1.034	.306
	BZ	.002	.009	.034	.251	.803

Source: Output of data analysis by author using SPSS (2025)

The B column discusses the coefficient of the model. This indicates that a 1.4% decrease in carbon accounting information reporting is as a result of 0.1% decrease in board independence, 0.5% increase in board gender diversity, 0.1.6% decrease in board shareholder and 0.2% increase in board size.

The cumulative adjusted R^2 (0.048) which is the multiple coefficient of determination gives the proportion or percentage of the total variation in the dependent variable as explained by the independent variables jointly. Hence, it signifies that 4.8% of the total variation in carbon accounting information reporting of the sample firms is caused by the proxies of determinants of corporate governance reporting. This is quite low so predictions from the regression equation are fairly reliable. It also means that 95.2% of the variation is still unexplained so adding other independent variables could improve the fit of the model. This indicated that the model is fit and the explanatory variable are properly selected, combined and used. The findings have theoretical, practical and regulatory significance. This significance represents the contributions of the study which are expected to benefit the existing body of knowledge within the accounting and finance research, regulators and providers of accounting services.

Considering the significant effect of board independence on carbon accounting information reporting of listed oil and gas firms in Nigeria, the regression result in table 4 indicates that board independence has a negative and insignificance influence on carbon accounting information reporting of listed oil and gas firms in Nigeria. This was proved by the beta coefficient value of 0.071 and a t-value of -0.491 and a significance value 0.626

which is insignificance at 5% significance level. This leads to the acceptance of the null hypothesis and rejection of alternative hypothesis. Hence, it is concluded that board independence has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria.

Considering the significant effect of board gender diversity on carbon accounting information reporting of listed oil and gas firms in Nigeria, the regression result in table 4 indicates that board gender diversity has a positive and insignificance influence on carbon accounting information reporting of listed oil and gas firms in Nigeria. This was proved by the beta coefficient value of 0.354 and a t-value of 2.438 and a significance value 0.018 which is insignificance at 5% significance level. This leads to the acceptance of the null hypothesis and rejection of alternative hypothesis. Hence, it is concluded that board gender diversity has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria.

Considering the significant effect of board shareholding on carbon accounting information reporting of listed oil and gas firms in Nigeria, the regression result in table 4 indicates that board shareholding has a negative and insignificance influence on carbon accounting information reporting of listed oil and gas firms in Nigeria. This was proved by the beta coefficient value of 0.139 and a t-value of -1.034 and a significance value 0.306 which is insignificance at 5% significance level. This leads to the acceptance of the null hypothesis and rejection of alternative hypothesis. Hence, it is concluded that board shareholding has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria.

Considering the significant effect of board size on carbon accounting information reporting of listed oil and gas firms in Nigeria, the regression result in table 4 indicates that board size has a positive and insignificance influence on carbon accounting information reporting of listed oil and gas firms in Nigeria. This was proved by the beta coefficient value of 0.034 and a t-value of 0.251 and a significance value 0.803 which is insignificance at 5% significance level. This leads to the acceptance of the null hypothesis and rejection of alternative hypothesis. Hence, it is concluded that board size has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria.

Discussion of Findings

The results indicate that almost all the variables are significantly normally distributed at 5% level of significance. The correlation matrix indicates the variables have mixed relationships. The results also indicate the absence of multi-colinearity.

Board independence and carbon accounting information reporting

The findings from the first hypothesis revealed that board independence has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria. This findings is in agreement with the findings of Al-Amosh and Khatib (2022) whose results revealed that board independence significantly enhances the quality of environmental, social, and governance disclosures among publicly listed companies in Jordan during the study period. It also corroborate with the study of Ezekiel *et al*. (2024) whose findings revealed that board structure, board independence, board gender diversity, and board ethnicity significantly affect the probability of high-quality carbon emission disclosure. The findings demonstrated the crucial functions of the board in distributing resources to sustainable initiatives, overseeing managerial actions, and ensuring that companies fulfill their commitment to environmentally responsible operations. The study however, negates the findings of Akhanolu *et al*. (2023) whose result revealed that all independent variables; carbon performance (disclosure), board response, board independence, and board environmental committee negatively and significantly influence return on equity.

Board gender diversity and carbon accounting information reporting

The findings from the second hypothesis revealed that board gender diversity has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria. This result agrees with the findings of García-Sánchez *et al*. (2020) whose result revealed that institutional factors associated with stakeholder pressures amplify this effect; the extent of reporting on gender issues by female directors is significantly greater in firms situated in stakeholder-oriented countries. Wang (2020) result also noted that the ratio of female independent directors is the only factor that demonstrates a significantly positive correlation with a firm's performance, corroborating previous research indicating that more independent directors enhance their monitoring capabilities and, consequently, improve performance. The study disagrees with the result of Zaid *et al.* (2020) whose results revealed that the inclusion of female directors does not significantly affect the financial performance of family-owned enterprises. Conversely, in non-family enterprises, female directors seemed to adversely affect the performance of these firms.

Board shareholding and carbon accounting information reporting

The findings from the third hypothesis revealed that board shareholding has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria. This findings correlates with the findings of Okudo *et al*. (2022) whose result revealed that ownership concentration, board gender diversity, and the presence of a sustainability committee are significantly positively correlated with carbon emission disclosure among

publicly listed manufacturing firms in Nigeria. It also agree with the result of Adaobi and Nestor (2021) whose research revealed that ownership concentration is significantly positively correlated with carbon emission disclosure among publicly listed manufacturing firms in Nigeria. The study however disagrees with the study of Okeke *et al.* (2021) whose study revealed that ownership of a firm has an insignificant negative impact on economic value added.

Board size and carbon accounting information reporting

The findings from the forth hypothesis revealed that board size has no significant effect on carbon accounting information reporting of oil and gas firms in Nigeria. This is further strengthened by the position of Ubiomoh and Okoye (2025) whose result revealed that board independence and board size significantly and positively influence effluent disclosure. It also agree with the result of Adenikinju *et al.* (2023) whose result revealed that board size and capital intensity significantly affecting returns on equity. The study however disagrees with the result of Shuaibu et al. (2019) whose result revealed that board independence and board size have a negative significant correlation with environmental information disclosure.

Conclusion

Companies operate with the aim of maximizing shareholders wealth. As a result of this, a number of companies' activities and operations may cause nuisance and damages to the societal and environmental condition of the host communities in which they operate. Companies should make effort to safeguard societal and environmental conditions of the communities, since by operating in the communities, companies make financial gains. It is logical for the companies to use part of these financial gains to compensate the communities. Hence, board complexities are known to influence carbon accounting reporting of a firm. Hitherto, the study concludes that board independence, board gender diversity, board shareholding and board size all has no significant effect on carbon accounting information reporting of listed oil and gas firms in Nigeria.

Policy Recommendations

The following recommendations are hereby made:

i. In other to enhance carbon accounting, deliberate efforts should be made to maintain the independence of the board by increasing the number of non-executive directors on the board. Particular emphasis and preference should be given to persons of calibre and credibility who possess the required skills and experience to positively impact the functions of the board.

ii. More female members should be appointed into boards to stimulate more objective and critical perspectives to board decision making. This is because women generally exhibit more independent thinking and are more risk-averse and less prone to overconfidence than male directors on corporate boards.

iii. Undue increase in management shareholding in listed oil and gas firms in Nigeria should be discouraged. This is justifiable on grounds of the entrenchment effect whereby controlling management shareholders appropriate private benefits to themselves at the expense of other shareholders through accounting method choice and carbon accounting; a situation that creates agency problem at the point of separating ownership from management with the managers who are part-owners running the business activities in favour of their own interests to the disadvantage of other shareholder.

iv. Board's size should be increased so as to promote more efficient environment friend business succession.

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