Effect of Firm Characteristics on Environmental Disclosure: The Moderating role of Board Independence

Godwin David[1], Prof. Salisu Mamman[2] and Dr. Haruna Muhammed Musa[3]
Department of Accounting, Faculty of Management Sciences, Ahmadu Bello University, Zaria.
Corresponding email address: godwindavid4@gmail.com

Abstract
This study examined effect of firm characteristics on environmental disclosure (ED) of listed manufacturing firms in Nigeria: The moderating role of board independence. The study aimed to assess the moderating influence of board independence on the relationship between firm size and environmental disclosure of listed manufacturing firms in Nigeria and to investigate the moderating effect of board independence on the relationship between firm age and environmental disclosure of listed manufacturing firms in Nigeria. A correlational research design was employed, with data extracted from the annual reports of 53 manufacturing firms listed on the Nigerian Exchange Group (NGX) for six years (2019–2024). The study measured the extent of ED by calculating an annual ratio based on the total number of GRI items a firm reported. This ratio was derived through content analysis. Data were analyzed using Ordinary Least Squares (OLS) regression technique. The findings indicated that for listed manufacturing firms in Nigeria, firm size has a significant positive influence on ED, whereas firm age exerts a significant negative impact. Furthermore, the presence of independent directors differentially affects ED depending on firm characteristics, it reduces disclosure in larger firms but enhances it in older ones. The study recommends that firms in Nigeria's listed manufacturing sector particularly smaller ones should aim to increase their asset base. This suggestion is grounded in the evidence that larger firms tend to disclose more environmental information, likely to maintain legitimacy and address societal concerns. Additionally, because the presence of independent directors is found to increase ED in older firms, shareholders of such firms should leverage this finding to advocate for structural changes. Specifically, they can pressure company boards to raise the number of independent directors, thereby achieving a majority of independent directors on the board, as recommended by the Nigerian Code of Corporate Governance (NCCG) 2018.

Keywords: Firm Characteristics, Environmental Disclosure, Board Independence.

1. Introduction

The worsening state of the global environment and the impact of industrial activities have resulted to increase attention by researchers and consequently, a closer examination on environmental disclosure. Industrialization has been a key driver of global economic growth, yet it has also contributed significantly to environmental degradation, including air and water pollution, biodiversity loss, deforestation, soil erosion, and increased flooding (Modozie & Amahalu, 2022). These stem from industrial activities, vehicle emissions, improper waste disposal, and deforestation, among other factors. In 2024, the United Nations Climate Change Conference (COP29) in Baku, Azerbaijan, highlighted the urgent need for climate finance, which led to high-income nations pledging $300 billion annually to support low- and middle-income countries in mitigating climate shocks and transitioning to renewable energy (Vartanian, 2025). Among these, air pollution remains one of the greatest global health threats, causing approximately seven million deaths each year (Olawuni, 2022). Countries like Nepal (ranked the most polluted) and Chad (in the top ten) exemplify the severity of environmental challenges, underscoring the critical need for stronger policies and interventions to curb pollution and its devastating health impacts (Muanya, 2023).

Similarly, Nigeria grapples with severe environmental challenges, including pollution, gas flaring, global warming, climate change, oil spills, and deforestation (Nwaichi & Osuoha, 2022). The country's pollution crisis has worsened significantly rising from the 18th most polluted nation in 2022 to the 8th in 2023 (Muanya, 2023). A striking example is Nestlé Nigeria Plc., which contributes substantially to environmental degradation. Annually, the company emits over 87.5 million metric tons of CO_2, withdraws 95.6 million cubic meters of water (with more than 36% sourced from water-stressed regions), and utilizes vast land areas for raw materials, exacerbating deforestation, soil degradation, and biodiversity loss. Additionally, Nestlé Nigeria generates more than 1.5 million tons of waste each year (Green, 2024). These figures underscore the urgent need for stricter environmental regulations and sustainable corporate practices in Nigeria.

Nigeria's severe environmental challenges have heightened public awareness, with widespread media coverage amplifying societal pressure on corporations to reduce their ecological footprint. To enhance corporate transparency on environmental impact, the National Environmental Standards Regulation Enforcement Agency (NESREA) Act was introduced in 2007. As Nigeria's foremost environmental regulatory body, NESREA is tasked with enforcing environmental laws, standards, and policies, as well as overseeing environmental management initiatives. However, despite these measures, weak enforcement persists as a major obstacle, significantly hampering environmental protection efforts (Odey, 2023).

To address environmental disclosure challenges, firm characteristics particularly firm size and firm age play a crucial role in enhancing transparency. The inclusion of independent directors further strengthens accountability and ensures effective environmental disclosure by monitoring

management decisions (Cooray et al., 2020; Moshud et al., 2021).

Although environmental reporting remains voluntary in Nigeria, companies often engage in it to balance stakeholder expectations, manage reputational risks, or gain strategic advantages (Sugiyarti & Rahmadhianti, 2024). The combined influence of firm size and firm age and independent directors oversight may shape a company's approach to environmental disclosure.

However, despite the significant environmental impact of both listed and non-listed firms, many still neglect comprehensive environmental reporting in their annual reports (Sabo, 2020). Environmental disclosure in Nigeria remains weak, with firms providing minimal financial and non-financial environmental information (Udo, 2019). Challenges such as inefficiency, weak corporate engagement, and poor transparency further hinder progress (Ogunkan, 2022). Notably, listed manufacturing firms in Nigeria often fail to disclose environmental data adequately across their operations (Sanni et al., 2023).

Existing researches on the relationship between firm characteristics and environmental disclosure presents mixed results. Some studies report a positive association (Asuelimen, 2024; Junita et al., 2023: Masum et al., 2023; Mohamed et al., 2020; Obehioye & Owaghianye, 2024; Onyekachi et al., 2025), while others indicate a negative or insignificant relationship (Akhter et al., 2023; Manasseh et al., 2023; Moshud et al., 2021; Salawu et al., 2021). This study focuses on Nigeria's manufacturing sector, as these firms are expected to prioritize environmental disclosure more than service-oriented businesses due to their higher environmental footprint.

The main objective of this study is to examine effect of firm characteristics on environmental disclosure (ED) of listed manufacturing firms in Nigeria: The moderating role of board independence. While the Specific Objectives are to:

i. to analyze the relationship between firm size and environmental disclosure of listed manufacturing firms in Nigeria.

ii. to evaluate the effect of firm age on environmental disclosure of listed manufacturing firms in Nigeria.

iii. to examine the influence of board independence on environmental disclosure of listed manufacturing firms in Nigeria.

iii. to assess the moderating influence of board independence on the relationship between firm size and environmental disclosure of listed manufacturing firms in Nigeria.

iv. to investigate the moderating effect of board independence on the relationship between firm age and environmental disclosure of listed manufacturing firms in Nigeria.

In line with the objectives of the study, the following hypotheses were formulated in null form:

Ho_1**:** Firm size has no significant effect on environmental disclosure (ED) of listed manufacturing firms in Nigeria.

Ho_2: Firm age has no significant effect on environmental disclosure of listed manufacturing firms in Nigeria.

Ho_3: Board independence has no significant moderating effect on the relationship between firm size and ED of listed manufacturing firms in Nigeria.

Ho_4: Board independence has no significant moderating effect on the relationship between firm age and ED of listed manufacturing firms in Nigeria.

2. Literature Review

Conceptualization

Firm Characteristics

Firm characteristics encompass attributes that can enhance and sustain a company's performance, including factors such as firm size, age, profitability, management expertise, leverage, liquidity, sales growth, asset growth, and turnover (Omeghie et al., 2024). According to Nurvita and Priambodo (2022), each company has distinct characteristics that vary significantly, posing a challenge in research, these differences can affect a company's willingness to participate voluntarily in various initiatives.

Firm Size

A firm's size is indicated by the measure of its operations, which is typically assessed through its total assets (Orajekwe & Ogbodo, 2023). The firm size is usually measured by its total assets or their natural logarithmic values (Omeghie et al., 2024). Firm size refers to the total value of all assets owned by a company.

Firm Age

The age of a firm is defined as the time duration since its formation until now. It can also be quantified as the number of years since the firm went public (Omeghie et al., 2024). According to Tanko et al. (2024), firm age can be the years of existence of a firm since its incorporation (Tanko *et al*.,2024). Firm age simply means the duration of time a company has lived since its establishment.

Board independence

Board independence is defined as the proportion of independent non-executive directors in relation to the total number of directors on a board at a giving period of time (Modozie & Amahahu, 2022). It also means the ability of board members to offer unbiased opinions without undue influence from management, or major shareholders and is measured as the proportion of independent non-executive directors to total directors on the board (Obaje et al., 2021). A higher proportion of independent directors on the board can create a stronger oversight function, because they are less subject to internal pressures, they are better positioned to encourage management to disclose information on carbon emissions and other relevant environmental matters, focusing on the company's long-term sustainability (Sabiya et al., 2024).

Environmental Disclosure

Environmental disclosure (ED) refers to the comprehensive reporting of both financial and non-financial data regarding a company's environmental practices, including but not limited to resource consumption, pollution levels, and sustainability initiatives (Asuelimen, 2024). This disclosure serves to inform stakeholders about the organization's environmental management strategies and performance. Wahyuningrum et al. (2024) further characterize ED as either voluntary or mandatory reporting of information pertaining to environmental management systems and associated development costs. In practice, ED is typically quantified using: disclosure scores which enhance the quality and utility of environmental reporting (Nuskiya et al., 2021).

Empirical Review

Firm size and Environmental Disclosure

From the Nigerian oil and gas sector, Obehioye and Owaghianye (2024), investigated the effect of firm size, leverage and profitability on environmental disclosure among oil and gas companies in Nigeria over a ten-year period from 2012 to 2021. The results revealed a positive relationship between firm size and environmental disclosure. In the Bangladesh. Context, Masum et al. (2023) investigated the impact of size of the firm on voluntary information disclosure. The study used purposive sampling to choose a sample of ninety-eight (98) listed companies on Dhaka Stock Exchange (DSE) from a population of 318 listed firms from 2019 to 2020. Multiple regression analysis was used. The study's findings revealed that size of the firm significantly and positively influences voluntary disclosures. Also the study from Nigeria by Similarly, a study from US by Junita et al. (2023) investigated the relationship between company size and environments disclose environmental information on their corporate websites. The study found that firm size has a significant effect on ESG disclosure levels.

A Nigerian study from the oil and gas sector by Manasseh et al. (2023), investigated the impact market structure attribute represented by firm size and environmental disclosure. Ex post facto research design was employed, the research analyzes a sample of seven out of ten companies listed on the exchange, with data sourced from annual reports covering a decade from 2012 to 2021 and found firm size negatively affected environmental disclosure. Also, Moshud et al. (2021) assessed the impact of firm size on environmental disclosure among quoted firms in Nigeria from 2012 to 2016. It focused on a sample of 82 firms out of 176 listed on the Nigerian Stock Exchange (NSE). Data were collected through annual reports. The result showed a negative significant relationship between firm size and environmental disclosure. Suggesting that firm size is a determinant of environmental disclosure.

Firm Age and Environmental Disclosure

The relationship between firm age and environmental disclosure has yielded mixed findings across various sectors and geographical contexts, as demonstrated by recent empirical studies:

From Cross-National Evidence (Consumer Goods Sector), Onyekachi et al. (2025) conducted a comparative study of listed consumer goods firms in Nigeria and Ghana (2015-2023) using panel regression analysis. Their findings revealed a positive and significant relationship between firm age and environmental disclosure in both countries, suggesting that mature firms demonstrate greater environmental transparency. Contrasting Evidence (Nigerian Oil & Gas Sector), Salawu et al. (2021) examined Nigerian oil and gas firms (2012-2018) using Generalized Least Squares analysis. Their study of nine listed firms found no significant relationship between firm age and environmental disclosure, indicating sector-specific variations in disclosure practices.

From the Middle Eastern Context (Saudi Industrial Firms), Mohamed et al. (2020) analyzed 63 Saudi industrial firms (2016-2018) using fixed-effect panel analysis with GRI-based content analysis. The results showed *a* positive association *between* firm age and disclosure levels, supporting the institutional maturity hypothesis. Also, from the financial sector perspective Asuelimen (2024) studied Nigerian deposit money banks (2015-2021) using panel binary logistic regression. The analysis of 19 banks revealed a positive and significant relationship, with older banks demonstrating better environmental disclosure practices.

From the divergent findings (Cross-Sectoral Study), Akhter et al. (2023) conducted a comprehensive analysis of 345 annual reports (2015-2019) from financial and non-financial institutions. Their content analysis and panel regression approach found negative significant impact of environmental firm age on disclosure quality.

Board Independence and Environmental Disclosure

Orumwense and Osa-Izeko (2023), Modozie and Amahalu (2022), and Chouaibi et al. (2023) collectively examine how board characteristics, particularly board independence, affect environmental disclosure or sustainability reporting. These studies share a focus on corporate governance's role in promoting transparency on environmental issues.

Orumwense and Osa-Izeko analyzed secondary data from eight Nigerian oil and gas firms listed on the Nigerian Exchange Group (2011–2020), using an ex-post facto design; they found board independence positively linked to environmental disclosure, though statistically insignificant. Modozie and Amahalu studied 19 years of panel data (2002–2020) from Nigerian industrial goods firms, also via ex-post facto methods, revealing a significant positive effect of board independence on sustainability reporting.

In contrast, Chouaibi et al.(2023) targeted 220 European firms, drawing from Data Stream ASSET4 to create a Corporate Environmental Disclosure Index (CEDI) and applying multiple linear regression; board independence showed a statistically significant positive impact on environmental disclosure. These studies consistently highlight board independence's beneficial influence on environmental/sustainability disclosures, with stronger statistical evidences. However, differences arise in geographic scope, sectors and data periods, underscoring the need for context-specific governance examination of board independence and ED.

Theoretical Framework

Legitimacy theory underpinned the study, the theory was propounded by Dowling and Pfeffer (1975), posited that "the legitimacy of an entity is maintained through the alignment of its values with the values of the larger social system. When the two value systems diverge or show signs of potential divergence, the entity's legitimacy is threatened.

3. **Methodology**

The study adopted a correlational research design, because it predicts outcome and explains the relationship among variables. Secondary data from the audited annual reports of the sampled used. The population of the study is made up of all the 71 manufacturing firms listed on the Nigerian Exchange Group (NGX) from 2019 to 2024. Filters were applied to which eliminated firms that did not meet certain criteria essential. First, firm must be listed on the NGX at least one year before 2019. Secondly, it must not be delisted during the period of study 2019 to 2024 and finally, it has

published audited annual report from the year 2019 to 2024. After applying these filters, 18 firms were eliminated leaving an adjusted population of a total of 53 firms which double as the sample size of the study. The study's model is stated below:

The functional form of the model of the study is shown as:

ED = *f* (FSZ, AGE, BIN)

The specification of the econometric model for the study is detailed as follows:

$ED_{it} = \beta_0 + \beta_1 FSZ_{it} + \beta_2 AGE_{it} + \beta_3 BIN_{it} + \beta_4 FSZ*BIN_{it} + \beta_5 AGE*BIN_{it} + \varepsilon_{it}$

Where:

ED = Environmental Disclosure
FSZ = Firm Size
AGE = Firm Age
BIN = Board Independence
FSZ*BIN = Interaction between Firm Size and Board Independence
AGE*BIN = Interaction between Firm Age and Board Independence
β_0 = Constant
β_1 to β_2 = Parameters of the independent variables
β_3 = Parameter of the moderator
β_4 to β_5 = Parameters of the moderating variables
it = Panel data indicator
ε = Error term

Variables Measurement

Table 3.1 below shows the dependent variable, the independent variables, the moderating variable of the study and their measurements.

Table 3.1 Measurement of variables

Variable Name	Variable Type	Label	Measurement	Sources
Environmental Disclosure	Dependent Variable	ED	Total environmental disclosure scores (GRI) divided by maximum disclosure scores.	Nuskiya et al. (2021),
Firm Size	Independent Variable	FSZ	Natural logarithm (Ln) of total assets.	Omeghie et al. (2024).
Firm Age	Independent Variable	AGE	Years of existence of a firm since its incorporation	Tanko et al. (2024).
Board Independence	Moderating Variable	BIN	Number of independent directors divided by total directors on the board.	Modozie and Amahahu (2022).

Source: Authors' compilation from the literature review (2025).

Environmental disclosure (ED) was measured using a ratio of total GRI items disclosed by a firm each year through content analysis of the company's annual report. An environmental disclosure checklist was adopted from the Global Reporting Initiative (GRI, 2016) consisting of 30 items. The disclosure of each aspect was measured using a ratio of total GRI items disclosed by a firm each year to measure ED. This method involves summation of all the items from the firm's environmental disclosures and divided by the total expected items to determine a firm's ED. (Nuskiya et al., 2021). It is calculated using the formula below:

$$ED = \frac{\sum_{i=1}^{n} di}{n}$$

Where:

ED is the environmental disclosure,
di is the number disclosure score by a firm, and
n is the number of total expected GRI disclosure scores.

4. Results/Discussion

Table 4.1 Descriptive statistics

Table 4.1 below presents the descriptive statistics of the dependent variable, the independent variables and the moderating variable of the study.

Table 4.1 Descriptive Statistics of the variables

	Obs	Mean	Std. Dev	Min	Max
ED	318	0.299	0.0923	0.133	0.533
FSZ	318	17.297	2.400	7.758	29.279
AGE	318	50.217	20.3026	6.000	101.00
BIN	318	0.328	0.08317	0.11	0.429

Source: Authors Computation (2025).

Table 4.1 revealed that the average environmental disclosure (ED) among the listed manufacturing firms is 0.299, meaning these firms disclose about 30% of environmental on average. The minimum ED observed is 0.133, indicating no firm discloses less than 13.3%, while the highest ED recorded is 0.533 meaning no firm discloses 53.3%. The standard deviation of 9.14% is relatively low compared to the mean, suggesting high variability in the dataset. This indicates that, overall, the manufacturing firms perform below average in ED, highlighting the need for compliance to enhance ED practices in Nigeria.

Regarding firm size, it has a mean of value of ₦219.01 billion, meaning the size of these firms averages around this figure. The smallest firm has a total assets value of ₦57.3 million, while the largest firm with a total assets value of ₦5.19 trillion. The firm size deviates from the mean by ₦703.8 billion, this implies that these firms vary significantly in size.

For firm age, the average firm in the dataset is 50 years old, the youngest firm is 6 years old and the oldest firm is 101 years old, by this it means that these firms are dominated by matured firms. The standard deviation of 20 years indicates a significant variation of firm age showing that some firms are much older or younger than the average age.

Finally, board independence on average, 33% of board members are independent, suggesting a moderate but not majorly independent. This implies that many firms still have significant influence of management. The board independence differs from the average by 8%, this implies that the firms vary significantly in independence of their boards. The least independent company, Dangote Sugar Refinery Plc. has 11% independent directors, suggesting an absolute control by insiders. On the other hand, the Nigerian Code of Corporate Governance (NCCG) 2018, desires that most of a company's directors should be non-executive, the code further desires that most of the non-executive directors should be independent. UAC Nigeria Plc. exemplifies this

best practice, as its board the most independent is comprised of 43% independent directors.

Table 4.2 Correlation Matrix

	ED	FSZ	AGE	BIN
ED	1.0000			
FSZ	0.3565	1.0000		
AGE	-0.1025	0.0743	1.0000	
BIN	-0.0903	-0.1335	-0.0537	1.0000

Source: Authors Computation (2025).

According to Field (2018), a threshold of 0.40 to 0.60 and 0.60 and above indicates moderate and strong correlation respectively. The values in table 4.2 suggests that there is no possibility of existence of multicollinearity which is strong correlation between the independent variables, since there is no correlation having a value which is higher than 0.60. But whether multicollinearity exists or not cannot be said with precision until after multicollinearity test is been conducted. Correlation matrix is pertinent in knowing the degree of relationship among all independent variables and high correlation could lead to Multicollinearity, which may consequently lead to misleading findings and conclusion. However, from the correlation matrix one cannot draw statistical inference, but it is relevant in deducing the direction of the relationship between the variables according (Gujarati,2004).

Multicolinearity Test

The research used Variance Inflation Factor (VIF) which checks whether the independent variables are extremely correlated with one another. Therefore, the table below presents the VIF result**.**

Table 4.3 Multicollinearity Test

Variable	VIF	1/VIF
FSZ	1.02	0.977651
BIN	1.02	0.980242
AGE	1.01	0.992533
Mean VIF	1.02	

Source: Authors Computation (2025).

According to Gujarati (2004), a variable is considered less harmful if it has a VIF of less than 10 and the tolerance value is not less than 0.1. VIF value greater than 10 and tolerance value less than 0.1 suggests the presence of strong multicollinearity The result from table 4.3 above revealed that all the values for VIF on the independent variables are less than 10 and the tolerance values are greater than 0.1 which connotes absence of multicollinearity among the explanatory variables of the study.

Hausman's Specification Test

The selection of the model is followed by the Hausman's test, this is done to determine which model among the random and fixed effects is more appropriate. The explanation of the model is presented in Table 4.4 below.

Table 4.4: Hausman's Specification Test

Test: Ho: difference in coefficients not systematic	
Chi2 (5)	0.07
Prob > chi2	0.9999

Source: Authors computation (2025).

Table 4.4 shows the chi-square coefficient of 0.07 with a non-significant probability value 0.9999. based on this result, the study failed to reject the null hypothesis suggesting that the random effects model is more appropriate than the fixed effects for this analysis, due to the reason that individual effects are not correlated with independent variables (Hausman, 1978).

Table 4.4: Breusch-pagan / cook-weisberg test for Heteroskedasticity

Ho: Constant variance

Variables: fitted values of ED

Chi2 (1)	1.89
Prob > chi^2	0.1696

Source: Authors computation (2025).

According to Gujarati (2004) if the probability > chi^2 of heteroskedasticity test is significant, it signifies that the data is heteroskedastic. Therefore, the above table shows a non-significant Breusch-Pagan test with probability value of 0.1696. Hence, the study found no statistically significant evidence of heteroskedasticity across the firms. Thus, the study considered OLS regression for analysis confirming the dataset is homokedastic provided random effect was chosen as the technique of data analysis, hence, this study used OLS regression model.

Table 4.5 Regression Results

Variables	Coefficient	Std. err.	t-statist	P-values
FSZ	.04099	0.0082	5.00	0.000
AGE	-.0021	0.0008	-3.89	0.000
BIN	.7079	0.3172	2.23	0.026
FSZBIN	-.0645	0.0185	-3.49	0.001
AGEBIN	.0065	0.0019	3.35	0.001
Constant	-.2165	0.1432	-1.51	0.132
R-Square	0.2036			
Adjusted R^2	0.1908			
F –Stat	15.95			0.0000

Source: Authors computation (2025).

Table 4.5 indicates that the independent variables in the model account for approximately 19.08% of the total variation in the dependent variable, as shown by the coefficient of determination ($R^2 = 0.1908$). This means that about 19% of the changes in ED can be attributed to firm size, firm age and the moderating variable (board independence), while the remaining 81% is influenced by factors not included in the study's model. Additionally, the table shows that the model is well-fitted, with an F-statistic of 15.95, which is statistically significant at the 1% level, evidenced by a p-value of 0.000.

Firm size and environmental disclosure shows a positive and significant relationship with environmental disclosure at 1% significance level with a p-value of 0.000, with coefficient of 0.0409 this indicates that a 1% increase in firm size will lead to a 4% increase in ED. This may be due to the demands for environmental disclosure by manufacturing firms in Nigeria from stakeholders compel them to be transparent as a way of maintaining their legitimacy.

Firm age and environmental disclosure (ED) shows a negative and significant relationship with ED at 1% significance level with a p-value of 0.000, with coefficient of -0.0021 this indicates that a 1% increase in firm age will lead to a 0.21% decrease in environmental disclosure.

The regression result in the table above shows the interaction of board independence on the relationship between firm size and ED has a coefficient of -0.0645 and a p-value of 0.001. The significant negative effect implies that independent directors act as a moderating force, dampens the positive effect of firm size on ED. This suggests that a 1% increase in firm size results in a 6% decrease in ED. However, this finding contradict the apriori expectation of the study that independent directors are expected to play an oversight

function which could lead to increase environmental disclosure. The possible reasons could be larger firms faces serious scrutiny, therefore, independent directors of these firms who are more concern of their reputation can advocate for limited ED. Furthermore, environmental disclosure in Nigeria is mostly voluntary and subject to less regulation which may help explain why smaller firms disclose greater environmental information perhaps as a way of striving to gain their legitimacy.

The interaction between board independence, firm age and ED shows a coefficient of 0.0065 with a p-value of 0.001, indicating that firm age has a significant positive relationship with ED, this further suggests that a 1% increase in firm age results in a 0.65% increase in ED. This finding implies that older firms disclose greater environmental information due to the moderating effect of independent directors.

All the null hypotheses that had been formulated were tested:
Ho_1: Firm size has no significant relationship with the environmental disclosure of listed manufacturing firms in Nigeria.

The test of hypothesis that linked firm size and environmental disclosure of listed manufacturing firms in Nigeria shows that there is a positive significant relationship between firm size and ED. This means that firm size is positive and significantly influencing environmental disclosure of listed manufacturing firms in Nigeria. The finding of the study is in agreement with legitimacy theory. The result provides an evidence to reject the hypothesis one of the study. Thus, hypothesis one is rejected. The finding of this work is supported by the studies of Aprilia and Kusumawati (2024), Ekpulu et al. (2023), Junita et al. (2023). Conversely, the result is contrary to the findings of Abubakar (2017), Egbunike and Tarilaye (2017).

Ho_2: Firm age has no significant relationship with the environmental disclosure of listed manufacturing firms in Nigeria.

The test of hypothesis that connected firm age and environmental disclosure of listed manufacturing firms in Nigeria shows that there is a negative significant relationship between firm age and ED. This means that firm age is negative and significantly influencing environmental disclosure of listed manufacturing firms in Nigeria. The finding of the study is in contrary with legitimacy theory. The result provides an evidence to reject the hypothesis two of the study. Therefore, hypothesis one is rejected. The finding of this work is supported by the studies of Asuelimen (2024), Ghosh et al. (2023), Jafar and Hassan (2020), but negating the finding by Akhter et al. (2023).

Ho_3: Board independence has no significant moderating effect on the relationship between firm size and ED of listed manufacturing firms in Nigeria.

The test of hypothesis that connected the effect of board independence on the relationship between firm size and environmental disclosure of listed manufacturing firms in Nigeria shows that there is a negative significant relationship between firm size and ED. This means that firm size is negative and significantly influencing environmental disclosure of listed manufacturing firms in Nigeria. The finding of the study is in agreement with legitimacy theory. The result provides an evidence to reject the hypothesis five of the study. As a result, hypothesis three is rejected. This finding this study is intern dent with studies of (Manasseh et al., 2023; Moshud et al., 2021), but negates the outcome of (Junita et al., 2023: Masum et al., 2023; Obehioye & Owaghianye, 2024).

Ho_4: Board independence has no significant moderating effect on the relationship between firm age and ED of listed manufacturing firms in Nigeria.
The test of hypothesis that linked the effect of board independence on the relationship between firm age and environmental disclosure of listed manufacturing firms in Nigeria shows that there is a positive significant relationship between firm age and ED. This means that firm age is positive and significantly influencing environmental disclosure of listed manufacturing firms in Nigeria. The finding of the study is in agreement with legitimacy theory. The result provides an evidence to reject the hypothesis six of the study. Thus, hypothesis four is rejected. The finding of this research work is supported by the studies of Asuelimen (2024), Jafar & Hassan (2020), Mohammed et al. (2020), and Onyekachi et al. (2025), though they contradict the studies by Akhter et al. (2023) and Salawu et al. (2021).

5 Conclusion and Recommendations

The study concludes that firm size is an important factor influencing ED. in listed manufacturing firms in Nigeria. Finally, firm age is also a key factor affecting ED. in listed manufacturing firms of Nigeria with board independence playing a significant moderating role by changing the direction of the relationship.

Emanating from the findings and the conclusion of the study. The study recommends that firms in the Nigerian listed manufacturing sector, especially the smaller ones should strive to increase their asset base. Since it is evident that larger firms tend to disclose more environmental information, likely to maintain their legitimacy and address societal concerns. Also, since the presence of independent directors lead to increase ED in older firms, shareholders of these firms should leverage on this finding to pressure the company boards for structural changes by increasing the number of independent directors in order to maintain a majority of independent directors on their boards, as desires by the Nigerian Code of Corporate Governance (NCCG) 2018.

REFERENCES

Akhter, F., Elrehail, H., Rehman, S., & Almansour, B. (2023). Environmental disclosures and corporate attributes, from the lens of legitimacy theory: a longitudinal analysis on a developing country. *European Journal of Management and Business Economics*, *32*(3), 342-369.

Asuelimen, P. (2024). Effect of firm-based characteristics on environmental disclosure responsibility of deposit money banks in Nigeria. *International Journal of Accounting Business and Entrepreneurship (IJABE)*, *3*(1), 171–186.

Chouaibi, J., Miladi, E., & Elouni, N. (2023). Exploring the relationship between board characteristics and environmental disclosure: Empirical evidence for European firms. *Accounting and Management Information Systems*, *21*(1), 51-76. DOI: http://dx.doi.org/10.24818/jamis.2022.01003

Cooray, T., Nuwan, G., & Samanthi, S. (2020). Does corporate governance affect integrated reporting? *Sustainability*. https://doi.org/10.3390/su12104262

Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values organizational behaviour. *The Pacific Sociological Review*, *18*(1), 122–136. https://doi.org/10.2307/1388226

Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics (*5th ed.). Sage.

Green, D. (2024, May 16). What is the impact of the world's largest food company? A deep dive into Nestlé's environmental and social impact. *Green Digest*. https://www.greendigest.co/p/nestle-environmental-and-social-impact#

Gujarati, D. N. (2004). *Basic Econometrics* (4th ed.). McGraw-Hill.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, *46*(6), 1251-1271

Junita, A., Lindrianasari, & Widiyanti, A. (2023). The effect of firm size and industry type on environmental social governance disclosure. 1–9. https://doi.org/10.4108/eai.13-9- 2023.2341229

Kaoje, N. A., Nurudeen, M. M., Jamiu, O. O., & Haruna, H. R. (2024). Firm age and environmental disclosure of listed oil and gas marketing companies in Nigeria: Global reporting initiative 11 perspectives. *Lapai International Journal of Management and Social Sciences*, *16*(1), 135–148.

Manasseh, L. T., Tsegba, I. N., Soomiyo, M., & Henry, Y. (2023). Effect of firm characteristics on environment disclosure of listed oil and gas companies on the Nigeria Exchange Group. *African Banking and Finance Review Journal (ABFRJ)*, *7*(7), 120–138.

Masum, M. H., Latiff, A. R. A., Osman, M. N. H., Sarkar, J. B., Rahman, M. M., & Khan, S. (2023). Impact of corporate characteristics on voluntary disclosure: A managerial insight. *Olish Journal of Management Studies*, *28*(1), 204–217. https://doi.org/10.17512/pjms.2023.28.1.12

Modozie, E. C., & Amahalu, N. N. (2022). Effect of board structure on sustainability reporting of listed industrial goods firms in Nigeria. *International Journal of Management Studies and Social Science Research*, *4*(1), 204–215.

Mohamed, E. B., Garoui, N., & Sweiti, I. (2020). On the determinants of environmental disclosure: Evidences from industrial Saudi listed firms. *Agrociencia*, *54*(1), 62–77.

Moshud, N. M., Sani, A. B., & Olanrewaju, O. J. (2021). Firm size and environmental disclosure of quoted firms in Nigeria. *International Journal of Innovative Research & Development*, *10*(3), 26–31. https://doi.org/10.24940/ijird/2021/v10/i3/MARCH21009

Muanya, C. (2023, June 6). Nigeria is eighth world's most polluted country. *The Guardian Nigeria*. https://guardian.ng/features/nigeria-is-8th-worlds-most-polluted-country-says-

Nuskiya, M. N. F., Ekanayake, A., Beddewela, E., & Meftah Gerged, A. (2021). Determinants of corporate environmental disclosures in Sri Lanka: The role of corporate governance. *Journal of Accounting in Emerging Economies*, *11*(3), 367–394. https://doi.org/10.1108/JAEE-02-2020-0028

Nurvita, T., & Priambodo, A. (2022). The effect of environmental performance, company's characteristics and good corporate governance (GCG) on environmental disclosure: Empirical study of mining companies listed on the Indonesia Stock Exchange (IDX) 2015–2019. *Journal of Business and Entrepreneurship*, *4*(2), 145–162.

Nwaichi, E. O., & Osuoha, J. O. (2022). Has the national policy on environmental pollution control in Nigeria been neglected in the Niger Delta region? An update. *Environment, Development and Sustainability: A Multidisciplinary Approach to the Theory and Practice of Sustainable Development*, *24*(11), 12494–12517. https://doi.org/10.1007/s10668-021-01973-1

Obaje, F. O., Abdullahi, S. F., & Ude, A. O. (2021). Moderating effect of firm size on the relationship between board structure and firm financial performance. *Journal of Good Governance and Sustainable Development in Africa (JGGSDA)*, *6*(3), 97–117. https://doi.org/10.36758/jggsda/v6n3.2021/10

Obehioye, A. U., & Owaghianye, U. I. (2024). Determinants of environmental disclosure. *African Development Finance Journal*, *7*(1), 1–23. http://journals.uonbi.ac.ke/index.php/adfj

Odey, S. A. (2023). Environmental law enforcement in Nigeria: A reevaluation. *Jurnal Ilmu Dialektika Kontemporer*, *11*(1), 91–108.

Ogunkan, D. V. (2022). Achieving developmental sustainable governance in Nigeria: A review for policy consideration. *Urban Governance*, *2*(1), 212–220. https://doi.org/10.1016/j.ugj.2022.04.004

Olawuni, O. (2022, April 22). World most polluted countries in 2021. *Data Phyte*. https://www.dataphyte.com/chart-of-the-day/chartoftheday-nigeria-ranks-18th-among- the-worlds-most-polluted-countries

Omeghie, J., Ero, O., Anthonia, N., Chiejine, C., & Erhinyoja, F. E. (2024). Firm characteristics and non-financial disclosures of elite issuers firms in Nigeria Exchange Group. *Journal of Accounting and Management*, *14*(1), 7–20.

Onyekachi, N. O., Nkechi, E. N., & Nkechi, O. T. (2025). Firm attributes and environmental disclosure of listed consumer goods firms in Nigeria and Ghana. *Advance*

Journal of Management, Accounting and Finance, 10(2), 1–30.

Orajekwe, J. C., & Ogbodo, O. C. (2023). Firm-specific characteristics and environmental disclosure of energy firms in Sub-Saharan Africa. *International Journal of Financial, Accounting, and Management, 5*(2), 251–264.

Orumwense E. K., & Osa-Izeko, E. (2023). Board Diversity and Environmental Sustainability Disclosure in Oil and Gas Companies: Evidence from Nigeria, *European Journal of Accounting, Auditing and Finance Research, 11*(5), 1-13. doi: https://doi.org/10.37745/ejaafr.2013/vol11n5113

Sabiya, A., Ndirmbitah, B. A., & Bashiru, M. (2024). Moderating effect of firm attributes on sustainability reporting quality of listed oil and gas companies in Nigeria. *International Journal of Intellectual Discourse (IJID), 7*(2), 256–272.

Sabo, B. (2020). Determinants of environmental accounting. *International Journal of Science and Research (IJSR), 9*(12), 110–120. https://doi.org/10.21275/SR201124103455

Salawu, M. A., Mamman, S., Tahir, M. D., Ado, G., & Yunusa, N. (2021). Firm-specific attributes and environmental disclosure of listed oil and gas. *Global Journal of Accounting, 7*(1), 1–14.

Sanni, M., Abdulrauf, L. O., & Alabere, A. J. (2023). Firm innovativeness and environmental disclosure: Evidence from Nigerian manufacturing firms. *Malete Journal of Accounting and Finance, 4*(1), 1–10.

Soomiyol, M. K., Theophilus, W. T., & Henry, Y. (2024). Effect of firm characteristics on environmental disclosure practices of listed manufacturing companies in Nigeria. *International Journal of Social Sciences and Management Research, 10*(7), 110–129. https://doi.org/10.56201/ijssmr.v10.no7.2024.pp110-129

Sugiyarti, L., & Rahmadhianti, T. (2024). Environmental disclosure: Environmental performance, institutional ownership and audit committee part of good corporate governance. *International Journal of Accounting, Management, Economics and Social Sciences, 2*(3), 908–917. https://doi.org/10.61990/ijamesc.v2i3.256

Tanko, A. A., Liman, M. M., Salisu, Z. M., & Babatunde, M. O. (2024). Impact of firm characteristics on environmental performance of listed consumer goods firms in Nigeria. *Kashere Journal of Management Sciences, 7*(1), 23–37.

Tarus, J. K. (2020). Do board size and firm size affect environmental accounting disclosure? Evidence from selected listed firms in Kenya. *Journal of Business Management and Economic Research (JOBMER), 4*(1), 21–37.

Udo, E. J. (2019). Environmental accounting disclosure practices in annual reports of listed oil and gas companies in Nigeria. *International Journal of Accounting & Finance (IJAF), 8*(1), 1–20.

Vartinian, A. (2025). COP29 limps forwards agreement on climate finance. *Nature Reviews Materials, 10*, 87. https://doi.org/10.1038/s41578-00771-9

Wahyuningrum, I. F. S., Agustina, L., & Jati, K. W. (2024). A slight look at environmental disclosure score trends during COVID-19 outbreak: What's driving the environmental disclosure in Indonesian mining and manufacturing companies. *International Journal of Energy Economics and Policy, 14*(2), 160–171. https://doi.org/10.32479/ijeep.15387

Warokka, A., Barroso, M. M., & Aqmar, A. Z. (2024). From emissions to economy: Company characteristics and carbon disclosure in Southeast Asia. *Journal of Sustainable Economics, 2*(1), 10–23. http://doi.org/10.32734/jse.v2i1.16440