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# Corporate environmental disclosure and market value. Do board independence matter?

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**Abstract**

**Purpose:** This paper aims to examine the relationship between three measures of corporate environmental disclosure and market value using Nigerian non-financial listed companies. The paper also explores the effect of moderating role of board independence.

**Methodology:** We use DICTION software to obtain the measurements of environmental disclosure volume, general disclosure tone and specific disclosure tone as well as regression analysis using GMM model to take care of endogeneity issues.

**Results and conclusion:** The empirical studies revealed that general environmental disclosure & Specific environmental disclosure has a positive and statistically significant impact on the Tobin's Q. We document that board independence positively moderates the relationship between general and specific environmental disclosure on Tobin's Q. We recommend that firms should focus on environmental responsibility reporting as a driver for better performance and value enhancement and will help to achieve the SDG 12 as enshrined in united nation SDG's 2030 agenda. The paper considers only environmental dimension of sustainability with the use of only non-financial listed Nigerian companies for twelve (12) years (2011-2022).

**Implication of findings:** Management, investors, professionals, policymakers and authorities should consider the environmental disclosure requirements for proper informed decision. The study tests the progress in achieving the sustainable development goals (SDG 12) as well as the role of moderating variable of board independence in Nigerian listed non-financial firms.

***Keywords:*** Environmental disclosure, Tobin's q, Board independence, Diction software, Stakeholder theory.

## 1. Introduction

Evidence documented from literature argued that the independence of directors influences the financial aspect of a firm as well as the environmental policies and strategies of the firms to achieve the desired aim and objective(Alipour et al., 2019). Moreover, the global warming and environmental degradation are some of the major challenges faced by the world especially in less-developed country which characterized with vulnerability and exploitability in their economy (Joyce, 2020) .The environmental degradation and other challenges faced by world lead to the adoption of SDGs by members countries of the United Nations in 2015 and such SDGs consists of 17 major objectives that every country must meet in order to attain the 2030 global agenda(United Nation, 2015). This paper tries to address the SDG 12 on "responsible consumption and production" in ensuring that companies maintain and improve environmental activity which could help to enhance the firm value (Jibril et al., 2024).

The world has seen a great population boom from European industrial revolution to the present, along with the high increases in the production of goods and services to suit the consumption requirement of the growing global populous. The rapid population expansion is driving the worldwide consumption and production components of these geometrically growing scenarios, which are part of the long-term phenomena known as economic development (Azam et al., 2020). Economic development is generally referring to the process that seeks to improve the economic well-being and quality of life for a community (Schumpeter and Swedberg, 2021).

But over time, it has become clear that the procedure being used to achieve economic development necessitates the extensive use of non-renewable natural resources and is negatively affecting the planet's ecosystem(Hassan, 2023). Furthermore, it is obvious that the problems with the environmental degradation are not just affecting the current generation but also the ability of future generations to live comfortably and healthy (United Nations, 2015; Fenichel et al., 2019).

Concerned parties have over the years developed strategies through the United Nations' 17 Sustainable Development Goals (SDGs) to achieve sustainable consumption, production and utilization of natural resources without compromising the ability of future generations to meet their needs (Gasper, D. et al., 2019). One of the key subobjectives of SDG 12 (responsible consumption and production) is to ensure the maintenance and improvement of earth's environmental health. With regard to Earth's environmental well-being, the United Nations (2015, p.2) declares that "We are determined to protect the planet from degradation and managing its natural resources and taking action on climate change so that the well-being of present and future generation will be improved." To fulfil the goal of SDG 12, UN (2015) provides that countries are to ensure the achievement of efficient environmental management of corporate firms in conformity to international laws and reduce the water, air and land pollution. A critical look of this provision shows the intensions to urge and/or compel corporate firms to ensure improved environmental management. Moreover, UN provides procedures and guidelines on accountability and transparency of environmental responsibility and firm's performance and directing large and sensitive companies to adopt sustainable practices and integrate sustainability information into their reporting system (2015, p.22)."

Many studies have been conducted to investigate the relationship between corporate environmental disclosure and firm's financial performance(Hassan, 2023). However, there is a paucity of literature focusing on the evaluation of environmental disclosure in relation to the progress of attaining SDG 12. On the moderation effects of board independence, Mohammad Alipour et al, (2019) concludes that there is a significant and positive link between environmental disclosure quality (EDQ) and firm performance and confirmed that board independence significantly reinforces the positive impact oof EDQ on firm performance. Similarly, Zabihollah Rezaee et al., (2020) reported a negative link between environmental disclosure quality and firm risk while board independence moderates the relationship. Furthermore, Toukabri M. et al., (2022) confirmed the influential role of corporate governance including board independence between climate change disclosure and sustainable development goals and suggested that a better governance structure is likely to reduce emission and improve firm performance. Jibril et al, (2023) conducted research on Audit committee attributes, board of director's independence and energy disclosure for environmental sustainability in Nigeria and concludes that the moderating variable of board independence was insignificant related to energy disclosure. Based on the contradictory findings, the research paper motivates us to revisit the link between corporate environmental disclosure and firm value with moderating role of board independence. Nigerian industries were characterized with high environmental sensitive operations which may have adverse consequences on the host community and environment at large (Muhammad Sani. D 2018), and non-environmental sensitive companies have less adverse consequences.

The paper is structured as follows. The next section is devoted to reviewing relevant literature, sustainable development goals 12 and development of the research hypotheses and revisiting theoretical underpinnings. Such methods as Diction software and regression with generalized method of movement (GMM), fixed effect model with Driscoll & Kraay standard errors and empirical results are discussed and conclusion as well as recommendations were drawn.

## 2. Literature review

### *The stakeholder theory*

Freeman et al. (2010) defined a stakeholder as "any group or individual who can affect or is affected by the achievement of an organization's objectives. In defining the stakeholder, freeman et al (2010) considers both internal and external parties that affect and are affected by the firm. External parties often create more pressures on firms to eliminate or minimize corporate effects and improve positive outcomes (Sarkis et al., 2010). The theory suggests that firms must effectively manage their relationships with their stakeholders to ensure their sound survival. On this note, Alipour et al., (2019),explain that reporting on specific information can be utilized to attract or maintain specific stakeholder groups. For instance, to attract or retain influential individuals or groups interested in a firm's social or environmental activities, it is crucial to provide information about its performance. Thus, a company is based not only on profit maximization but also on sustainable development and value maximization (Buallay, 2021). Stakeholder theory has been employed by many studies in the environmental accountability and reporting research to underpin the link between several variables (Ullmann, 1985; Altuwaijri et al., 2004; Liao et al., 2015; Lu & Taylor, 2018; Theodoulidis et al., 2017; Haninun et al, 2018).

Regarding the notion of the last group of studies after adoption of UN 17 SDGs in 2015 to be attained by the year 2030 (Theodoulidis et al., 2017; Haninun et al, 2018), the requirement on pursuing the achievement of SDG 12 has added a layer of intensity and complexity to the management of environmental stakeholder groups and this may affect the nature of the link between corporate environmental disclosure and firm's value. In this regard, and consistent with the last cohort, the current study employs the theory to underpin the relationship between volume, specificity, and general measures of environmental disclosure and firm's value in a less-developed country and the firms operating therein pursued the achievement of SDG 12. The relationship will be investigated through the moderating role of board independence.

### *Corporate environmental reporting, firm value and the SDG 12*

Different studies have been conducted to find out the relationship between environmental disclosure and market value, but their findings were inconclusive and mixed in nature (Brooks & Oikonomou, 2018). Previous researchers confirmed that improving environmental disclosure enhances the corporate firm's value (Cai et al., 2023; Nguyen et al., 2021; Wang et al., 2020; Zhang & Yang, 2023),and this confirmed a positive influence of corporate environmental disclosure on the firm's value. Similarly, Osama F et al., (2023) concludes that the Bloomberg ESG disclosure index is a valid proxy for sustainability and has a significant impact on the relationship with stock performance. This implied that an ESG disclosure index helps to improve the performance of firms in FinTech industry. Buallay et al., (2019), it was discovered from the findings that ESG positively affects firm's performance via return on assets, return on equity and Tobin's Q in the manufacturing sector. This indicates that a sound ESG disclosure will enhance the firm's performance both operational, financial and market and hence improve the firm's value as well. Ahmad Yuosef et al., (2023) reported a significant and positive link between corporate sustainable disclosure and firm's performance. This shows that the corporate sustainable disclosure enhances the firm's value via return on assets, return on equity and Tobin's Q and subsequently the ultimate goal of wealth maximization could be achieved. Ni Wang et al., (2022) report that ESG practices play a vital role in avoiding harm and create value for companies. This justifies the fact that proper and sound management of ESG practices tend to improve the firm's value and thereby boost the profitability of the firms.

The study of (Trumpp & Guenther, 2017) contends that since it might fully appreciate the financial benefits of sustainable environmental practices and enhanced environmental disclosure for stakeholder satisfaction could result in additional expenses and hence claiming that performance may suffer from proactive environmental measures. This confirmed the adverse effect whereby affecting the profit margin of the firm negatively. Munro, (2021) on China's heavy pollution industry has found a negative correlation between the extent of environmental information disclosure and enterprise market value and this signifies that firm's value will be significantly affected adversely.

Additionally, conflicting findings supported a mixed results in the relationship between environmental disclosures and financial performance(Kim Lim Tan et al., 2020). The research conducted by (Nor et al., 2016; Plumlee et al., 2015) revealed conflicting findings about the relationship between environmental disclosure and financial performance as determined by return on equity, earnings per share, return on assets, and predicted future cash flow and this reported a mixed results and hence inconclusive in nature. In a similar vein, the findings of (Abdullah Maizatulakma et al., 2020) indicate conflicting conclusions about the relationship between corporate performance and environmental disclosure and such findings reported a mixed results which justify the need for further investigations.

Recently, there has been a rising issues of research assessing corporate environmental disclosure based on the pursuit of SDGs (Erin et al., 2022; Lodhia et al., 2022; Hummel & Szekely; Hatayama, 2022; Partzsch, 2023; Toukabri and Mohamed Youssef, 2023; Erin and Olajede, 2024). However, these studies share an evaluation of progress in achieving the SDGs via environmental disclosure as a common interest. For example, Hatayama (2022) found that the implementation of sustainability reporting based on SDGs, including the disclosure of environmental information, focuses more on some SDGs and less on others. Erin et al., (2022) evaluates the extent to which the top 50 companies in Nigeria have performed in reporting ESG information based on SDGs. Toukabri and Yousef (2023) used the level carbon disclosure score (CDS) to assess the extent to which SDG 7 and 13 are achieved by sampled US firms. Di vaio et al. (2021) assessed the nature and orientation of sustainability disclosures to attain the 17 SDGs. Erin and Olajede (2024) whether non-financial reporting contribute to the attainment of SDGs by African companies. Lodhia et al. (2022) found out the nature and substantiveness of SDGs reporting with the aim to find out which SDGs are achieved. Nonetheless, our careful and critical review shows that some studies focus on specific SDGs see (Hatayama, 2022; Toukabri and Yousef, 2023; Vallet-Bellmunt, 2022), while others focus on the whole SDGs (Di Vaio et al. 2021). However, our study specifically focused on the pursuit of the attainment of SDG 12 (Responsible Consumption & Production).

The debate on whether it pays to be green, now to be sustainable or not has been on-going for a number of years (Ulmann, 1985; Porter and Linde, 1995; Hart and Ahuja, 1996; Orlitzky et al., 2003; Ambec and Lanoei, 2008; Dixon-Fowler, 2013; Zhou et al., 2023; Azeem et al., 2024), and evidences documented by Previous studies within the large body of research is inconclusive and mixed in nature. As a specific area of research with CSR performance and corporate financial performance link, studies that explore whether it pays to pursue SDGs or not have begun to emerge. These studies find out whether doing well in achieving SDGs improves or worsens firm's financial performance. This study stands as an extension of main body of knowledge concerning the relationship between Corporate environmental disclosure and firm value. Empirical studies documented on the relationship between SDG performance and firm's financial performance is mixed, ranging from positive (Muhmad and Muhamad, 2020), neutral (Lassala et al., 2021), to negative (Lassala et al., 2021; Ahmad and Buniamin, 2021). Some studies reported multiple relationships (Lassala et al., 2021; Khan et al., 2021). Therefore, the inconclusiveness of the findings within this research justifies the conduct of the current research. An investigation into the transparent reporting of the environmental information aspect of SDG 12, including its relation to firm's financial performance, is justifiable and worth conducting. We hypothesize as follows:

H1: Measures of environmental disclosure significantly affect the market value of firms operating in the non-financial sector of a less-developed economy.

$H_{1a}$: The general environmental disclosure tone significantly affects the market value of firms operating in the non-financial sector of a less-developed economy.

$H_{1b}$: Specific environmental disclosure tone significantly affects the market value of firms operating in the non-financial sector of a less-developed economy.

$H_{1c}$: The volume of environmental disclosure significantly affects the market value of firms operating in the non-financial sector of a less-developed economy.

***The role of board independence:***

Board independence was proved to have a positive and significant impact on corporate environmental disclosure (Abdur Rouf and Md. Hossan 2020; Raimo N et al., 2022) and concludes that the proportion of independent directors has been found to have a positive and significant relationship with the corporate social responsibility (CSR) disclosure and on the other hand reported a negative effect (Kilincarslan E et al., 2020) and concludes that independence has a negative influence. Other researcher reported no significant impact of independent directors on environmental disclosure of both industry groups (P.S. Raghu Kumari et al., 2022), and finally some researchers conclude the findings as inconclusive in nature (Rao K. et al., 2016) on the impact of board independent and corporate social responsibility (CSR) reporting in Australia and reported that the relationship between independent/non-executive directors and CSR disclosure however is unclear.

On the moderation effects of board independence, (Alipour et al., 2019) concludes that there is a significant and positive link between environmental disclosure quality (EDQ) and firm performance and confirmed that board independence significantly reinforces the positive impact of (EDQ) on firm performance. Similarly, (Rezaee et al., 2020) reported a negative link between environmental disclosure quality and firm risk while board independence moderates the relationship. Furthermore, (Toukabri & Mohamed Youssef, 2023) confirmed the influential role of corporate governance including board independence between climate change disclosure and sustainable development goals and suggested that a better governance structure is likely to reduce emission and improve firm performance. Similarly, (Jibril et al., 2024) conducted research on audit committee attributes, board of director's independence and energy disclosure for environmental sustainability in Nigeria and concludes that the moderating variable of board independence was insignificant related to energy disclosure.

Based on the contradictory findings and especially with regards to the influence of independent directors on the board to influence the environmental disclosure and firm value, this study was motivated to find out the relationship between environmental information disclosure and firm's value with moderating role of board independence.

Therefore, as established by Baron and Kenny (1986), the moderating variable can change, modify, weaken or strength the direction of the relationship. This study introduces board independence as a moderator on the relationship between corporate environmental disclosure and firm's value. Our broad hypothesis on board independence moderation is stated as follows:

H2: Board independence moderates the relationship between corporate environmental disclosure and market value in the non-financial sector of a less-developed country.
$H_{2a}$: Board independence moderates the relationship between the general environmental disclosure and market value in the non-financial sector of a less-developed country.
$H_{2b}$: Board independence moderates the relationship between the specific environmental disclosure and market value in the non-financial sector of a less-developed country.
$H_{2c}$: Board independence moderates the relationship between the environmental disclosure volume and market value in the non-financial sector of a less-developed country.

## 3. Methodology

***Research design***

We used quantitative research techniques which enable statistical testing of the hypotheses generated above. This involves measuring and collecting data on quantitative variables shown on figure 1 below.

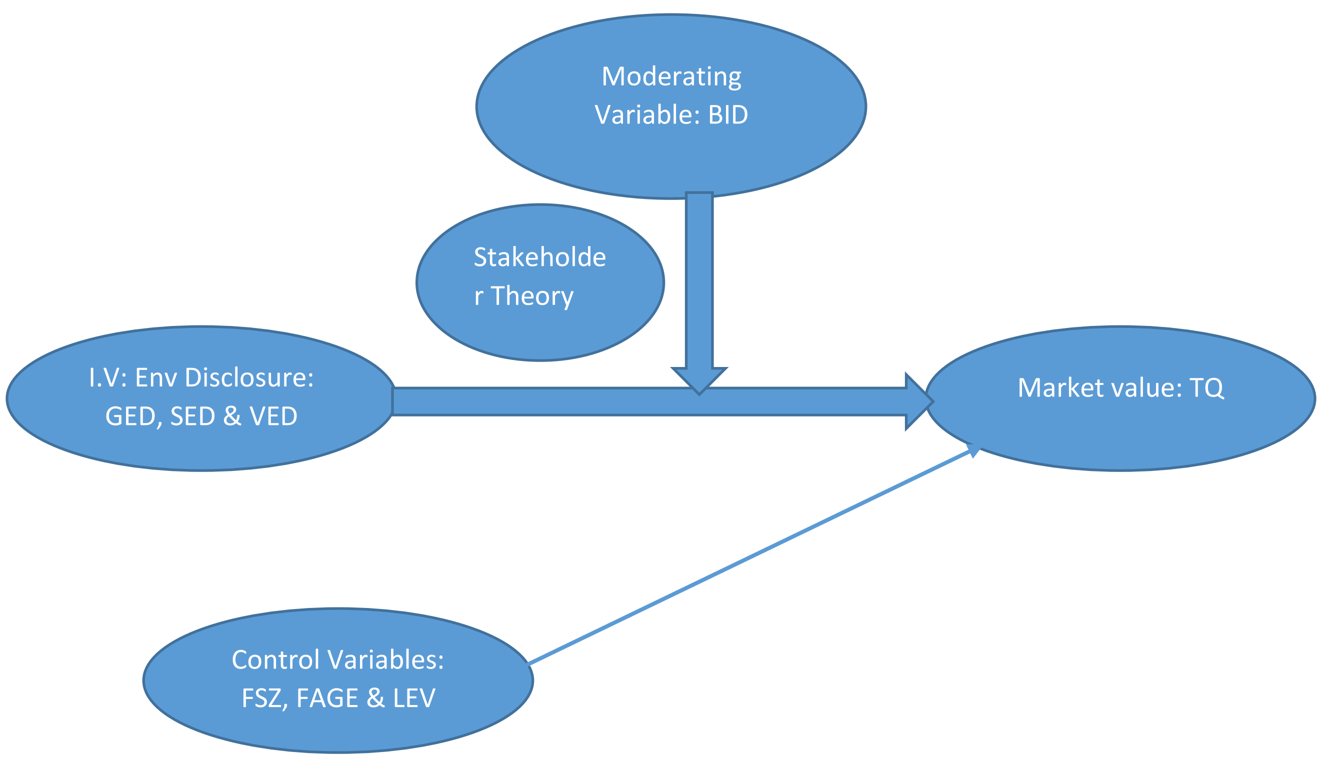


**Figure 1. Research framework.**

The population for this study is made up of 105 companies derived from 10 Nigerian listed industries. Environmental reports were generated from Sustainability reports, or stand-alone reports, or environmental report or annual reports in a few cases of the firms from (2011 – 2022) were carefully examined to identify those firms that provide environmental information disclosure and those that did not. The output of the examination revealed that out of 105 companies, only 42 companies provide the complete information for the said period, whereas 63 did not. The author adopted the 42 companies out of 105 as the tentative sample of the study. The sample industries include the ten industries namely, Agriculture, Construction/real estate, Healthcare, Industrial goods, Natural resources, Oil & gas, Conglomerate, Consumer goods, and ICT & Services. Environmental information disclosure extracted were imported into **DICTION 7.1** as Microsoft Word documents. Fifteen environmental information disclosure (EID) reports were extracted as pictures and because **DICTION** does not support pictures files, these reports were converted to texts using optical character recognition software. By so doing, EID reports converted to editable Word files were edited based on the original picture files. All the 504 files entered **DICTION 7.1** were carefully extracted in the form of general environmental disclosure, specific environmental disclosure and volume environmental disclosure, while other variables (TQ, board independence, firm size, firm age, and leverage) were extracted purely from annuals accounts of the selected companies from the 10 industries identified.

***Variables measurement:***
The dependent Variable, Tobin's Q, is used to measure the market's assessment of a firm's long-term expected value(Cahan et al., 2016) and reflects the market reaction to the firm's environmental decisions (Lee et al., 2015). The use of Tobin's q effectively and efficiently captures the reputational benefits of positive environmental disclosure (Dixon-Fowler et al., 2013). It is a means of estimating whether a given business or market is overvalued or undervalued. Tobin's Q is calculated as the firm's market capitalization (market value of equity plus book value of liabilities, divided by book value of total assets.

For independent variables Diction, a powerful computer-based software, is used to content-analyze texts in documents, and it facilitates meaning-oriented interpretive content analysis(Beck et al., 2010) through a sophisticated word frequency analysis underpinned by communication theories (Villiers & Van Staden, 2011). A unique characteristic of the programme is its ability to enable robust analysis of verbal tones used in communicating text messages based on five (5) master variables, namely, certainty, optimism, activity, realism, and commonality (Diction 7.1, Hart, 1984).

In this research work, Diction 7.1 is used to generate three important variables from the information communicated by sustainability reports regarding environmental aspects of the non-financial firms listed in the Nigerian exchange group plc. These variables include General environmental disclosure, specific environmental disclosure and volume environmental disclosure. Optimistic tone (General environmental disclosure) describes optimism as "language endorsing some person, group, concept, or event or highlighting their positive entailments". This implies a deliberate language style that paints a favourable picture of a communicator (Goel et al., 2010), and the certainty score (Specific environmental disclosure) describes certainty as "language indicating resoluteness, inflexibility and completeness and tendency to speak ex cathedra". As such verbal certainty represents a language style used by professional individuals who speak confidently and authoritatively due to objectivity, independence, and high technical proficiency, while words character analyzed (Volume environmental disclosure) are words character related to environmental information that was critically analyzed by the Diction software.

In the case of the moderating variable, the board independence is used. Board independent directors, who are not directly involved in the firm's daily management, provide objective recommendations without financial interest, ensuring sound financial advice. (Kabir & Thai, 2017). It is computed as independent directors divided by total number of directors on board.

For control variables, firm size was selected as a control variable and is measured using Log of total assets (Partalidou et al., 2020), while firm age was computed using number of years firms listed (Kabir Tahir Hamid and Mohammed Ibrahim, 2020) and finally leverage was computed as total liability/total equity (Nor et al., 2016).

**Table 1: Variables measurement:**

| Variables | Measurements | SOURCE |
|---|---|---|
| Dependent; TQ | The market value of equity + book value liabilities/Book value of assets | (Buallay, 2021) |
| Independents: Environmental disclosure using diction software | | |
| i. GED<br>ii. SED<br>iii. VED | Using Diction software analysis | Hassan A (2019) |
| Moderating variable; Board independence | Independent directors/total number of board directors | (Kabir & Thai, 2017). |
| Controls: Firm size | Log of total assets | (Partalidou et al., 2020) |
| Firm age | Number of years firms listed. | (Kabir Tahir Hamid and Mohammed Ibrahim, 2020) |
| Leverage | Total liability/total equity | (Nor et al., 2016) |

Source: Compiled by the Author, 2024.

***Model specification:***

This study proposed two econometric models in the analysis. Model 1 tests the direct effect of Corporate environmental disclosure (GED, SED & VED) on the market value of the listed firms (Tobin's Q). The model specification is defined below:

$$TQit = \beta_0 + \beta_1 GED_{it} + \beta_2 SED_{it} + \beta_3 VED_{it} + \beta_4 FSZ_{it} + \beta_5 FAGE_{it} + \beta_6 LEV_{it} + a_i + \mu_{it1} \qquad 1$$

The second model is built based on the moderating effect of board independence in the relationship between corporate environmental disclosure and market value. The model is defined as:

$$TQit = \beta_0 + \beta_1 GED_{it} + \beta_2 SED_{it} + \beta_3 VED_{it} + \beta_4 BIDit \;\; \beta_5 \; GEDit * BID_{it} + \beta_6 SEDit * BID_{it} + \beta_7 VEDit * BID_{it} + \beta_8 FSZ_{it} + \beta_9 FAGE_{it} + \beta \quad LEV_{it} + a_i + \mu_{it1} \qquad 2$$

Where: TQ stand for Tobin's Q, GED stand for General Environmental Disclosure, SED stand for specific environmental disclosure, VED stand for Volume environmental disclosure. Moreover, BID stands for Board of independence, FSZ stands for firm size, FAGE stands for Firm age, LEV stands for leverage.

## 4. Results and discussion

*Descriptive Statistics*

**Table 2: Descriptive statistics**

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **TQ** | 504 | 1.173 | 1.405 | 0.010 | 9.764 |
| **GED** | 504 | 53.180 | 3.769 | 36.77 | 62.28 |
| **SED** | 504 | 47.718 | 5.609 | 33.10 | 109.75 |
| **VED** | 504 | 947 | 1534 | 192 | 21871 |
| **BID** | 504 | 0.671 | 0.111 | 0.333 | 0.909 |
| **FSZ** | 504 | 10.485 | 0.739 | 8.583 | 12.487 |
| **FAGE** | 504 | 29.696 | 13.145 | 1 | 58 |
| **LEV** | 504 | 0.157 | 0.181 | 0 | 0.799 |

***Note:*** TQ; Tobin's Q, GED; General environmental disclosure, SED; Specific environmental disclosure, VED; Volume environmental disclosure, BID; Board independence, FSZ; Firm size, FAGE; Firm age. LEV; Leverage.

From the above Table 2 displayed, the mean, minimum and maximum value of TQ is 1.173, 0.010 and 9.764, respectively. This implies that the highest market value of non-financial listed firms in Nigeria is 9.764 with the lowest value of 0.010. The mean value of GED is 53.180 with minimum and maximum of 36.77 & 62.28 respectively. This signifies that the environmental disclosure of the listed firms in Nigeria averagely disclose 53.18% of the environmental activities of the companies. SED has a mean value of 47.71 with a minimum and maximum of 33.10 and 109.75 respectively. This implies that non-financial firms listed in Nigeria disclose an environmental activity up to 47.71%. The mean value of VED is 947 with a minimum and maximum of 192 & 21871 respectively.

Regarding the control variables, firm size has a mean value of 10.48 with a minimum and maximum size of 8 & 12. This implies that the average firm size of the Nigerian listed firms is 10.48. Similarly, firm age (FAGE) has an average age of 29.69, signifying that non-financial listed firms in Nigeria have 29 years after listing on the floor of the Nigerian Exchange Group plc, with minimum and maximum years of 1 & 58 respectively. The mean value of Leverage is 0.15, with a minimum and maximum of 0 & 0.77 as the external finances. This indicates that averagely 15% of the total assets is financed by external source.

***Correlation matrix***

**Table 3: Correlation matrix**

| | TQ | GED | SED | VED | FSZ | FAGE | LEV | VIF |
|---|---|---|---|---|---|---|---|---|
| **TQ** | 1.000 | | | | | | | 1.50 |
| **GED** | 0.0448 | 1.000 | | | | | | 1.11 |
| **SED** | 0.1247 | -0.1176 | 1.000 | | | | | 2.34 |
| **VED** | -0.0100 | -0.2142 | 0.7476 | 1.0000 | | | | 2.44 |
| **BID** | 0.0789 | -0.1731 | 0.0743 | 0.0453 | 1.000 | | | 1.44 |
| **FSZ** | 0.2388 | -0.0161 | 0.0140 | 0.1007 | 0.1200 | 1.000 | | 1.02 |
| **FAGE** | -0.0754 | -0.2200 | -0.0046 | -0.0288 | -0.0319 | 0.342 | 1.000 | 1.06 |
| **LEV** | 0.0791 | 0.0349 | 0.0784 | -0.0135 | -0.0223 | -0.0111 | 1.000 | 1.02 |

The correlation coefficient presented in table 3 above shows a positive association between general environmental disclosure (GED) and Tobin's Q (TQ) with a coefficient of 0.044, and a positive association between specific environmental disclosure (SED) and Tobin's Q (TQ) with a coefficient of 0.124 and a negative association between volume environmental disclosure (VED) and Tobin's Q (TQ) with a coefficient of -0.010. This indicates the corporate environmental disclosure measured by GED & SED has a positive impact on the firm's value measured by Tobin's Q and hence will improve the value, while VED has a negative effect on the firm's value measured by Tobin's Q and subsequently will reduce the firm's value. BID has a positive correlation with firm value (0.078).

In addition to the above interpretation, the table ii also suggest the absence of multicollinearity problem, as the highest variance inflation factor is 2.44 which is less than 5 threshold (Gujarati, 2004). This is confirmed by the variance inflation factor (VIF) test carried out, as the results of the test are within the acceptable range of less than five (5) threshold and hence the data does not suffer from multicollinearity problems.

***Regression results***

Table 4 presents the regression result on the relationship between the dependent, moderating and independent variables. However, as the data contained both cross-sectional and time series variant, we conducted a test for heteroscedasticity, autocorrelation and cross-sectional dependency to avoid presenting biased inferences. In addition, the study performed Hausman specification test, and the results indicate insignificant value, which means that random effect model is better. However, we cannot use the random effect since our data indicates the presence of heteroskedasticity, first-order (AR1) and second order (AR2) autocorrelation. To correct the problems and avoid potential endogeneity issues among the selected variables, the study employs the GMM model. Blundell et al, (2001) show that GMM corrects the problem of unobserved heteroscedasticity, autocorrelation, endogeneity, measurement error and omitted variables. If variables are endogenous, the co-variance between the explanatory variables and error term are non-zero, which may amount to biased and inconsistent inferences.

The results of the Hensen test as displayed in Table 4 show that the instruments are valid as the p-value is 0.212 and 0.542 for models 1 and 2, respectively. Likewise, the test for first and second order serial correlation indicates that the error terms are not serially correlated after the GMM. In Table 4, evidence from the regression results (Model 1) indicates that GED is positive and statistically significant impact on Tobin's Q, ($\beta$ 0.003, $p<0.05$). This signifies that corporate environmental disclosure improves the market value of non-financial firms listed in Nigeria. This is consistent with prior studies (Cai et al., 2023; Nguyen et al., 2021; Wang et al., 2020; Zhang & Yang, 2023), and concludes that corporate environmental disclosure influences the firm's value positively thereby increasing the performance of the companies and long-term value creation. These findings support our hypothesis that the general environmental disclosure tone significantly affects the market value of firms operating in the non-financial sector of a less-developed economy. Also, from model 1 the regression results show that SED is positive and statistically significant impact on Tobin's Q ($\beta$ 0.010, $p<0.01$). This shows that corporate environmental disclosure enhances the market value of listed firs in Nigeria and this align with previous research (Shi et al., 2021; S. Wang et al., 2020; H. Wu & Li, 2023; Zhang & Yang, 2023), and concludes that improving environmental disclosure positively enhances the corporate value and the findings concur with the predictions of stakeholder theory which states that firms must effectively and efficiently manage the relationship with their stakeholders to ensure survival and corporate sustainable development goals.

Lastly, Volume environmental disclosure has insignificant effect on the market value measured by Tobin's Q. This indicates that corporate environmental disclosure measured by volume has no impact on the firm's value. This aligns with the prior studies (Benlemlih et al., 2018; Okpala & Iredele, 2019; Qiu et al., 2016), and concludes that corporate environmental disclosure has no significant impact on corporate value and hence no effects on the market value as measured by Tobin's Q.

For control variables in the model 1, the regression results show that firm size (FSZ) (β 0.002, $p<0.05$) is found to have positive and significant impact on market value. This means that the size of the firm has impact on the firm with large size higher value. On the other hands, firm age (FAGE) & leverage (LEV) has found it to be insignificant related to market value with (β 0.000, $p>0.1$), (β -0.068, $p>0.1$) respectively. This indicates that firm age and leverage have no significant effect on the market value as measured by Tobin's Q.

**Table 4: Multiple regression results using GMM*** Introduce MV_BID**

| **GMM** | **Model 1** | | **Model 2** | |
|---|---|---|---|---|
| **TQ** | Coeff | p-value | Coeff | p-value |
| **GED** | 0.003 | 0.042** | 0.342 | 0.047** |
| **SED** | 0.010 | 0.008*** | 0.348 | 0.057* |
| **VED** | -0.000 | 0.316 | -0.002 | 0.443 |
| **FSZ** | 0.002 | 0.029** | 0.010 | 0.094* |
| **FAGE** | 0.000 | 0.622 | 0.003 | 0.757 |
| **LEV** | -0.068 | 0.463 | 0.278 | 0.655 |
| **BID** | 0.4817 | 0.044** | 135.875 | 0.010** |
| **GED*BID** | | | 0.554 | 0.044** |
| **SED*BID** | | | 0.510 | 0.057* |
| **VED*BID** | | | 0.003 | 0.440 |
| **Constant** | -0.800 | 0.092 | -1.546 | 0.503 |
| **Prob>F** | 0.000 | | 0.000 | |
| **AR1** | 0.017 | | 0.077 | |
| **AR2** | 0.249 | | 0.334 | |
| **Hansen test** | 0.212 | | 0.542 | |

*Note:* Model 1= Direct effect, Model 2= Moderating effect, TQ= Tobin's Q, GED= General environmental disclosure, SED=Specific environmental disclosure, VED=Volume environmental disclosure, BID= Board independent, FSZ= Firm size, FAGE= Firm age, LEV= Leverage; ***; **; * indicate 1, 5 and 10% levels, respectively.

For model 2 using board independence as a moderator, our regression results shows that board independence has a positive and significant impact on the relationship between corporate environmental disclosure both (GED & SED) and Tobin's Q (β 0.342, $p<0.05$), (β 0.348, $p<0.1$) and these results aligns with prior studies (Alipour et al., 2019; Hamrouni et al., 2022; Rezaee, 2016; Toukabri & Mohamed Youssef, 2023). The possibly reason for this finding may be associated with the influence of independent directors that has little or no financial interest which give them opportunities to scrutinize the management activities to ensure effective and efficient utilization of firm's resources, while board independence plays an insignificant effect on the relationship between volume environmental disclosure and Tobin's Q (β -0.002, $p>0.1$), and concludes that there are no moderation effects between the link. Moderating variable of board independent has significant impact in both model 1 and 2 (0.044 & 0.010) respectively. Moderating role has a positive impact on both models (1&2) with 0.044 and 0.010 respectively.

***Robustness checks using alternative estimation method***

In this section, we robust our findings by using Driscoll & Kraay standard error as an alternative method of estimation. This is essential in validating whether the findings are robust to alternative estimation model. We compare the two results and interestingly, the result in Table IV (Additional analysis) is closely related to what is obtained from the main analysis. Specifically, the coefficient and direction of corporate environmental disclosure on Tobin's Q are positive and statistically significant in both the robust and the main analysis in model 1.

Similarly, in model 2, the moderating variable played a positive and significant impact on the link between corporate environmental disclosure and Tobin's Q in both robust and the main analysis, which justify that independent directors play a role in scrutinizing the management actions and certainly help in improving the market value of the non-financial firms listed in Nigeria. Exceptionally, the coefficient of GED, VED and FAGE in additional analysis is opposite to what is found in the main analysis due to potentially endogeneity which has been taken care of in the GMM model.

**Table 5: Alternative estimation on the effect of corporate environmental disclosure on market value**.

| TQ | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | Coeff | p-value | Coeff | p-value |
| **GED** | 0.003 | 0.779 | 0.037 | 0.580 |
| **SED** | 0.081 | 0.007*** | 0.023 | 0.771 |
| **VED** | 0.000 | 0.003*** | 0.000 | 0.768 |
| **GEDBID** | | | 0.043 | 0.063* |
| **SEDBID** | | | 0.080 | 0.054* |
| **VEDBID** | | | -0.000 | 0.377 |
| **FSZ** | 0.497 | 0.002*** | 0.500 | 0.002*** |
| **FAGE** | -0.007 | 0.074* | -0.008 | 0.020** |
| **LEV** | 0.421 | 0.493 | 0.489 | 0.422 |
| **Constant** | -7.742 | | -7.855 | 0.005*** |
| **Prob>F** | 0.000 | | 0.000 | |
| **R-Square** | 11.61% | | 12.44% | |

*Note:* Model 1= Direct effect, Model 2= Moderating effect, TQ= Tobin's Q, GED= General environmental disclosure, SED=Specific environmental disclosure, VED=Volume environmental disclosure, FSZ= Firm size, FAGE= Firm age, LEV= Leverage; ***; **; * indicate 1, 5 and 10% levels, respectively.

***Discussion and policy implementation***

In this paper, we argued that board independence plays a significant role in creating a long-term value of the firms. Specifically, the outcome of the regression results shows that corporate environmental disclosure improves the market value of the non-financial listed firms in Nigeria which justify the positive and direct impact. Moreover, using board independence as a moderator, it moderates the link between corporate environmental disclosure and market value of the listed firms. Consistent with the stakeholder theory, our findings suggest that independent directors play a vital role in regulating the management activities thereby enhancing the firm's value.

This study has some important policy implications for the practice and future research. Firstly, our result indicates that corporate environmental disclosure has significant impact on the firm's value and concludes that firm should maintain environmental disclosure report as a tool in enhancing the market value of the listed firms in Nigeria and will help in attaining SDG 12 as planned to be attained by the

United nation (UN 2030). Secondly, board independence plays a vital role as a moderating factor and the management should try to strengthen the independent directors so that they can exercise their power in scrutinizing the actions of the management, which can lead to the improvement of the firm's value.

## 5. Conclusion

Using the GMM, the study examined impact of corporate environmental disclosure on market value and confirmed that environmental disclosure enhances the firm value of listed firms in Nigeria. Moreover, the study used board independence as a moderator in the relationship between corporate environmental disclosure and firm value and concludes that the moderating variable improves and strengthens the relationship nexus. The study evidence that presence of board independence as a moderator in the relationship between corporate environmental disclosure and firm value was confirmed to have significant impact and therefore the moderating role improve the effective and efficient management activities.

Based on the above conclusions, the following suggestions and recommendations was proposed:

i. Managers are advised to treat environmental disclosure as a key strategy to enhance firm's value of the listed non-financial companies in Nigeria.
ii. Companies should ensure adequate representation of external directors as its play a vital role in improving and enhancing the firm's value of listed non-financial firms in Nigeria.

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