

Determinants of Environmental Sustainability Among Listed Manufacturing Firms in Nigeria

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Abstract

The escalating degradation of the environment has raised concerns about the ability of ecosystems to sustainably support human needs without compromising ecological balance. In view of this, this study examined the determinants of environmental sustainability among listed manufacturing firms in Nigeria specifically focusing on consumer goods sector. The study adopted an ex-post facto research design and utilized a panel data of one hundred and twenty (120) pooled observations gathered from twelve (12) listed consumer goods firms in Nigeria over ten (10)-year period (2014-2023). The study however employed panel multiple regression technique to analyze the data via E-views 10.0 statistical package. The study findings revealed that firm age has a significant positive effect (Coeff. = 0.7181{0.0035}) on environmental sustainability of listed manufacturing firms in Nigeria while firm leverage has a non-significant negative effect (Coeff. = -12.2477{0.4483}) on environmental sustainability of listed manufacturing firms in Nigeria. It also revealed that firm size has a significant negative effect (Coeff. = -7.5880{0.0025}) on environmental sustainability of listed manufacturing firms in Nigeria. It was thus concluded that firm attributes pose a significant effect on environmental sustainability of listed manufacturing firms in Nigeria. The study recommended, amongst others that listed manufacturing firms in Nigeria focus on adopting environmentally-friendly practices and investing in waste management infrastructure, regardless of their age. This can be achieved through training and capacity-building programs for employees, as well as investments in cleaner production technologies.

Keywords: *Environmental Sustainability, Waste Management Cost, Firm Age, Firm Leverage, Firm Size.*

1.0 Introduction

The environmental impact of firm's operation has become a concern for the society and the demand for accountability has been on the increase in recent time. Environmental impact in business refers to the effects of business operations, practices, and products on the environment, including the consumption of resources, emission of pollutants, and contribution to climate change. According to Gamble et al. (2023), these issues include movement of waste, climatic change, emissions, protection of ozone layer and toxic waste destruction. Although the criticism on the harmful environmental impact of firms slightly faded in the 1980s, the 1990s re-present a new focus of attention for natural environmental disclosure (Kolk, 2022). This renewed attention for the natural environment has not been isolated in a particular region or culture but it has drawn global attention (Gamble et al., 2023). The trend in environmental awareness has led to a growing demand for environmental accountability by firms. Firm attributes are traits or features specific to the firm, which can affect positively or negatively the performance of the firm. Firm attributes include factors such as the age of the firm, the size of the firm, asset structure, profitability, risk and growth, the availability of collateral and business information (Campello, 2022).

Firm attributes are factors that affect the firm directly and these are internally generated within a firm. They include financial and non-financial factors. Financial factors include: efficiency, liquidity, leverage, firm size and investment among others. Non-financial factors include; Shareholding, labour, age of the firm and board of director characteristics etc. (Hu, 2023). Firms may have to disclose their environmental information to create awareness about the future prospects of the firms and reduce the negative thinking of investors and shareholders on the ethical behavior by those firms. Indeed, providing information on the recognition, measurement and environmental waste management cost of the accounting items in the financial statements increase the confidence investors may have on the activities of a firm. Environmental sustainability is a method to explain corporate social responsibility policies and to take responsibilities for ethical, social and environmental actions (Adams, 2022; Brammer & Pavelin, 2022). In addition, one of the important reasons of demand for environmental sustainability is representative issues and information asymmetry as opined by Healy and Palepo (2022). Environmental sustainability or sometimes known as "green reporting" is one of the voluntary social reporting included in the financial statements.

Several literatures have attempted to address the numerous contradictions and debates surrounding environmental sustainability issues, yet there are lots of disagreement, controversy and conflict of interests amongst the business theorists, corporate managers, academics and the public. Firm profitability, firm size, Firm liquidity, firm leverage, independent directors and female directors of a firm, have often considered to be key firm attributes and that influence environmental sustainability disclosure and practice in many previous studies, these studies however revealed mixed results which includes; (Enny & Yulita, 2020; Jurica & Lady, 2020; Amole et al. 2023), found a positive impact between firm attributes, and environmental sustainability, while other studies; such as that of Abu (2020), reported no evidence of a significant relationship. In view of these two ends with respect to firm attributes, it is of interest therefore to empirically evaluate the determinants of environmental sustainability among listed manufacturing firms in Nigeria.

2.0 Literature Review

2.1 Conceptual Framework

2.1.1 Environmental Sustainability

There has been a rise in awareness of environmental consequences in recent years. For environmental disclosure to be considered sustainable, it must be possible to meet human needs without impairing the ability of the world's ecosystems to regenerate the resources on which humans depend or cause a loss of biodiversity. A sustainable environment is one in which human needs are addressed without jeopardizing the ecological balance of the area (Kumar et al., 2021). To be environmentally sustainable means to meet current needs with available resources without depleting them to the point where future generations will suffer. The idea of resiliency is fundamental to the concept of sustainability. Measures of environmental effects include the company's efforts to reduce or eliminate emissions of greenhouse gases including carbon monoxide, carbon dioxide, and nitrogen; the company's efforts to recycle water; and the company's management of solid waste. This facet emphasizes against putting the environment in a situation that could endanger its people, and instead concentrates on preventing harm to the environment and enhancing its protection). There are four primary factors that make up the environmental sustainability: energy, water, emissions, and materials. Enforcement of environmental disclosures is more important now than ever before, as traditional concerns are no longer as influential as environmental issues (Azzam et al. 2020). Stakeholders' priorities have altered, and they now give more weight to the impact that enterprises' day-to-day activities have on the natural world. For instance, a company's success in the greenhouse market is not bolstered by its efforts to reduce its gas emissions to their absolute minimum (Gnanaweera & Kunori, 2018).

Al-Naser (2022) made the optimistic assumption that modern businesses are increasingly aware of environmental concerns and the needs of their business partners, and are working to improve as corporate citizens. The result is that managers need to adopt significant adjustments to adapt more appropriately to their environmental impact, regardless of the source of inspiration (concern for partner pressures or financial advantage, government standards, society, or the environment). The current debate's lack of resolution on the topic of social and environmental costs' relationship to company efficiency offers new avenues for inquiry, particularly when considering companies operating within the energy sector. Waste generated in a process typically requires raw materials processing before being discharged into the environment. While some of the waste can be managed internally by the company, there are instances of external waste treatment where companies are not equipped to handle certain types of waste. In either case, the management of waste incurs environmental costs. According to Sukholthaman and Sharp (2020), waste reduction involves the process of waste collection and transportation, that involves a significant amount of expenditure, and has dynamic and very complex operational problems. D'onza (2023) also indicated that waste collection and disposal process is tedious to the extent that it is difficult to evaluate and track the cost.

Waste management costs are costs associated with the reduction and disposal of waste generated by the companies via their activities (Nwanwu, 2022). It is important to note that these costs are both in expenses and expenditures forms. Costs such as investments in production equipment might be made in order to reduce environmentally hazardous emissions are not one-off costs due to the fact that such equipment is subject to depreciation and other capital costs which can spread out for more than one fiscal year. On the other hand, there also exist one off costs or expenses associate with environmental waste management, example; costs incurred to transport waste,

dispose waste, environmental repairs, compensation packages; including health schemes for both employees and other stakeholders such as the community, and even environmental levies, etc. Summarily, the environmental waste management cost is considered an environmental cost to cater for the depletion of natural resources, noise and other aesthetic impacts a company's activities might have on the environment; and is a very good factor for the measurement of environmental waste management.

2.1.2 Determinants of Environmental Sustainability

Companies are distinguished from one another on the basis of different financial and nonfinancial attributes. These attributes according to Rabi (2021) are unique to specific companies and raise a perception in the minds of the users of the information regarding the performance and future of the company. Companies can be differentiated from each other based on certain attributes they possess. Such attributes are referred to as characteristics' – which exist at the firm's level and have the potential to influence the decisions of the managers in the firm. These attributes are generally termed firm attributes. Hassan and Bello (2022) described firm attributes as those incentive variables that relatively stick at company's level across time. Firm attributes are the specified features that differentiate an individual in terms of uniqueness of its resources being utilized in operation from cooperative entity. These attributes include: firm age, size and leverage (Kwatommai et al., 2019). This implies that firms' attributes are those unique individualities that set a business firm apart from its peers which relatively are the strategic drivers of the firm's decision-making processes and performance parameters both endogenously and exogenously. But Frouk et al. (2019) differently viewed firms' attributes as structural external to the company's strategic decision. Firm attributes specific firm factors that either negatively or positively affect the operations of a firm. Such attributes include leverage, market share, liquidity, firm age, firm size, and capital and dividend and similarly, Siyanbola et al. (2020) viewed firms attributes as those attributes that are typical to a business firm, which include: profitability, size and age. Firms' attributes are specific factors that exert controlling influence on the performance of the firm both in the short, medium and long-terms of the business organizations. Hence, firms' attributes are specific internal resource based corporate elements, factors, elements, traits, peculiarities and features that enhance a firm's smooth functioning, operations, performance and growth sustainably thereby differentiating a firm from the other across industries. They could also be categorized into firm structure (firm size and leverage), performance (profitability, liquidity and growth) and monitoring (board composition and institutional shareholding) attributes (Shehu & Ahmad, 2013). Kazeem (2015), however, categorized firm attributes into financial (firm size, growth, risk, liquidity, tangibility and leverage) and non-financial (firm age, management competencies and scope of operation) attributes.

2.1.2.1 Firm Age

Firm age based on this study is the number of years since incorporation. Therefore, firm age is measured as number of years since incorporation or number of years from the time when it was listing. Company age as well has been assessed in different studies (Owusu-Ansah, 2023; Alsaed, 2023) even though some studies take it as a control variable. Older companies are more likely to disclose information than new ones, because of the ease and low cost of collecting and analyzing data, the presence of track records and stability in the market. The extent of a company's disclosure may be influenced by its age, which is a stage of development and growth

(Owusu-Ansah, 2023; Alfaraih & Alanezi, 2022). Older firms that are well-established are likely to disclose more than younger companies (Sejjaaka, 2022). This is based upon arguments that new companies may encounter difficulty in making changes to comply with the requirements of the law (Abbott et al. 2021). The age of a firm is considered as a factor that improves firm's performance. But contrary to this view, Muhammad and Shahimi (2020), Claudio and Urs (2022) believed that older firms are not flexible enough to make rapid adjustment, reduce barriers to innovation and make profit owing to the fact that their organizational rigidities limit their growth by inhibiting change as they become harder to change over time. According to Claudio and Urs, (2022) explained that older firms are better performer than newly listed firms. But the findings of Alex et al., (2021), counter this assertion with their view that firms improve with age that is, ageing firms experience rising level of productivity since they are able to understand their strength over time.

2.1.2.2 Firm Leverage

Leverage is the ratio between total debts to total company assets. Leverage indicates the percentage of funds used by creditors to finance company assets. Companies that have a high degree of leverage will be more careful in taking actions relating to expenditures as well as involvement in earnings management. This happens because of the limited allocation of funds owned; companies are required to choose to use these funds to pay off all obligations. In stakeholder theory, high leverage indicates that the company's responsibility is towards large creditors (Choi et al. 2023). There seems to be a common consensus in the literature that leverage has to do with the use of debt capital, by a firm in relation to equity capital. Syed (2020) described leverage as the extent to which a business or investor is using borrowed money. This means that leverage shows the extent to which the total assets of the company are funded by loans. It is necessary to state that an increase in the ratio ensures an increase in the amount of the business's financing sources. John et al. (2024) examined the moderating effect of firm size on the nexus between financing decisions and financial stability of listed industrial goods firms in Nigeria. The study employed Altman's Z-score in evaluating the financial stability of listed industrial goods firms in Nigeria and a combination of debt-equity ratio, interest coverage ratio, and total debt ratio as key predictors. It was thus concluded that firm size has a significant moderating effect on the relationship between financing decisions and financial stability of listed industrial goods firms in Nigeria.

Leverage is measured as the ratio of total debt to total assets. This is in alignment with the measurement basis of Hassan and Bello (2022) who measure leverage as the ratio of total debt to total assets. This study adopts the definition offered by Syed (2020) and concludes that leverage involves extent of use of borrowed money in financing a firm and is measured as total debt to total assets. Ho and Wong (2021) stipulate that when a firm is closed to debt covenants, it discloses more optimistic information in order to signal future positive perspectives for both investors and debtors. As such, the level of disclosure is positively related to the leverage ratio. They argued that companies with higher levels of debt financing will be subjected to more scrutiny than firms that mainly depend on equity financing. Consequently, it is predicted that higher leveraged firms tend to disclose more information in order to lower different costs of debt.

2.1.2.3 Firm Size

Firm size reflects how large a firm is in assets and number of employees. The size of the company is indicated by total assets, level of sales, and stock market value (Luo, 2023). Ayila (2022) asserted that firm size is represented by total assets influences disclosure due to the fact that large firms usually operate over wide geographical areas and deal with multiple products and have several divisional units. They are likely to have a well-built information system that encourages them to track all financial and non-financial information for operational, tactical and strategic purposes. Among such information system is voluntary accounting disclosure which may have a significant effect on firm size. McKinnon and Dalimunthe (2023) noted that bigger listed companies are in a better position to disclose more information in order to win public mind in view of the fact that none disclosure may be perceived as a signal of bad news which may influence stakeholder's decisions. According to stakeholder theory, firm size is an insight that as the firm becomes bigger, the number of stakeholders will equally assume to be higher than before (Amran et al., 2023). Firm size as an internal factor of a company has been considered a very important attribute of profitability. This is because the size of a firm determines its level of economic activities and the possible economics of scale enjoyed by the firm. Therefore, bigger firms are likely to generate larger returns on assets. Hence, firms should consider their size when making financing decisions and adjust their strategies accordingly for enhanced financial stability, growth prospects, and overall success (John et al., 2024)

2.1.3 Firm age and Environmental Sustainability

Firm age is expected to have the positive relationship with natural wealth disclosure. Older firms are more likely to know the details of business as they are familiar with the working environment and community where they operate. They have the experience of belonging to the surrounding environment and expect to act as a good citizen in the community by disclosing more natural wealth information. In addition, old firms realize more than other the value of high disclose towards attracting investors and shareholders. Widiastuti (2020) noted that firm age can demonstrate that the company still exists and compete favorably. When profitability is high, management is more willing to disclose information about natural wealth by firms which will ultimately improve company performance. Unprofitable firms will be less inclined to release more information to hide their poor performance. However, Ndukwe and John (2020) find that profitability does not cause an increase in the environmental disclosure. There are different measures of profitability such as net income, profit margin, return on assets, and return on equity. In this study return on assets was chosen as a proxy for profitability.

2.1.4 Firm leverage and Environmental Sustainability

Corporate entities obtain loans and invest in bonds to raise finance to establish and expand their business activities. In many developing countries, corporate debts have been growing, and in some cases increasing rapidly. Thus, concerns have been expressed about the adverse consequences of a high level of leverage on environmental sustainability (International Monetary Fund, 2015). Kini et al. (2017) argued that a high level of financial leverage could lead to business failure, and as a result, business stakeholders are likely to be interested in the economic sustainability of businesses, especially concerning their level of debt-holding. Some firms may desire to conceal information on sustainable development, especially when they are not sure if stakeholders will appreciate their level of leverage. In such cases leverage may be negatively associated with the level of sustainability performance disclosure (Kumar et al., 2021; Soyinka et

al., 2017). Prior research has also reported that leverage is not associated with economic sustainability disclosures in Nigeria (Adeniyi & Adebayo, 2018) and sustainability reporting in other countries (Kilic & Kuzey, 2017). Despite the findings, it seems reasonable to expect that debt holders will pressure management to disclose relevant information that will give assurance on the long-term economic performance of the entity. This will also reduce information asymmetry, support transparency, and serve as evidence of corporate sustainability in the foreseeable future. Some studies have documented a positive relationship between leverage and economic sustainability disclosure (Ariyani et al., 2018; Sulistyaguna, 2021).

2.1.5 Firm size and Environmental Sustainability

Large firms are usually well known and they strive to protect their reputation in order to sustain and possibly enhance their competitive advantage in the foreseeable future; therefore, they are more likely to disclose their sustainability investments. Large-sized firms also have more resources to invest in sustainability activities, and they enjoy higher economies of scale than smaller firms through more cost savings and higher levels of production activities. Moreover, larger firms are likely to have more vociferous stakeholders that will demand information on sustainability. In a study anchored on stakeholder theory, and based on data from a developing economy, Lourenco and Branco (2013) documented that larger firms recorded higher levels of sustainability performance, possibly because they have greater incentive and resource to engage in sustainability activities. In a multi-country setting, Chih et al. (2010) found that larger firms are more interested in sustainability disclosures than smaller firms. A number of other studies based on different research settings have documented a positive association between firm size and sustainability disclosures (Akhter et al., 2022; Wang, 2017). Some studies, however, failed to find a significant relationship between firm size and sustainability disclosures (Ariyani et al., 2018; Oyewo & Badejo, 2014), and some studies even documented an inverse relationship between firm size and sustainability disclosures (Isa, 2014; Ruhana & Hidayah, 2020). This is possible in the situation where some large firms may desire to minimize public scrutiny.

2.2 Theoretical framework

2.2.1 Stakeholder Theory

Stakeholder theory, introduced by R. Edward Freeman in 1984, defines stakeholders as "any group or individual who can affect or is affected by the achievement of the organization's objectives." This theory advocates that businesses should take into account the interests of all stakeholders, not just shareholders when making decisions. Stakeholders encompass a wide range of groups, including employees, customers, suppliers, communities, and the environment. Over time, stakeholder theory has undergone further development and refinement through contributions from various scholars. It builds upon agency theory, which primarily prioritizes the interests of shareholders and expects the board of directors to safeguard those interests. However, stakeholder theory expands upon the narrow focus of agency theory by acknowledging the concerns of diverse groups and individuals, including those representing social, environmental, and ethical interests (Hassan & Bello, 2022). Stakeholder theory posits that the primary purpose of a corporate entity is to serve and align the interests of its varied stakeholders, which may include shareholders, employees, creditors, customers, suppliers, government entities, and the local community. This study is anchored on the stakeholders' theory. The basic proposition of the stakeholder's theory is that the firm's success is dependent upon the successful management of all the relationships that a firm has with its stakeholders a term originally

introduced by Stanford research institute (SRI) to refer to those groups without whose support the organization would cease to exist (Freeman 1983).

2.2.2 Trade-off Theory

According to Kraus and Litzenberger (1973), debt financing offers the firm a tax shield, and that firms that pursue higher levels of debt gain the maximum tax benefit and ultimately enhance profitability, though higher levels of debt financing in the firm may also increase the possibility and adverse effects of bankruptcy. The trade-off theory emphasizes on the fact that a firm will choose a financial leverage level by balancing the costs and benefits of both the debt and equity financing. That is as the firm increases their debt, the marginal benefit of the debt begins to decline as the marginal cost increases. Therefore, the managers need to establish an optimal mix that will ensure that the marginal cost remain minimum as the marginal benefit move to maximum (Topal, 2011). The Static Trade-off Theory argued that although the benefit of tax shields may encourage the firms to employ more debt than other external sources available to them, this mode of finance is not free from costs. Myers (1977) observed that as much as levered firms enjoy tax deductibility as a benefit of their leverage, care needs to be taken such that the cost of financial distress associated with the inclusion of debt financing in the capital structure. Myers (1977) observed that the firm's capital structure is at optimal at the point where the cost of using debt and equity is at minimum as compared to the benefit that accrues as a result of using the mix, to allow the firms to trade them off. The firms therefore should seek to establish this optimal point in their capital structure irrespective of their size and earnings.

Dynamic Trade off Theory on the other hand argues that the firm's capital structures may not always be as per their target leverage ratios, but firms may allow the ratio to vary considering the costs and the benefits of the use of debt and equity and also the financing margin that the firm anticipates in the next period. Fischer, Heinkel and Zechner (1989) argued that a dynamic optimal capital structure is an appropriate choice in a case where the firm requires recapitalization. Unlike the static trade off theory where the emphasis is on the targeted leverage ratio that the firm will not be willing to deviate from, the dynamic trade off theory emphasizes on the firm having an optimal leverage range within which they let their leverage ratios vary. The firm only adjusts their capital structure when leverage reaches either of the two boundaries defining the range. The levels of the boundaries vary cross-sectional with firm characteristics such as the volatility of cash flows, size, earnings of the firm, interest rates and bankruptcy costs (Davydenko, 2012).

2.3 Empirical Framework

John et al. (2025) examined the moderating effect of the firm size on the relationship between the corporate social responsibility disclosure and the financial reporting quality of the listed manufacturing firms in Nigeria. The ex-post facto research design was taken, and manufacturing firms listed on the Nigerian Exchange Group were used to conduct the study and selected 12 out of 13 firms were continuously listed during 10 years (2014-2023). Descriptive statistics and multiple linear regression analysis of E-views 10.0 statistical package were used to analyze the data obtained. It was found that firm size does not affect the relationship between environment responsibility disclosure (Coeff. = -0.000124{0.2983}) and financial reporting quality of listed manufacturing firms in Nigeria whereas firm size has significant effect on the relationship between social responsibility disclosure and economic responsibility disclosure and financial reporting quality. The recommendations made included that firms should leverage their

economic responsibility disclosure to improve their financial reporting quality for enhanced investors' confidence at all times.

Uyagu et al. (2023) examined the effect of firm characteristics on environmental reporting practices of listed manufacturing firms in Nigeria for the period of 2017- 2021. The population of the study comprised of sixty-one (61) manufacturing firms with a sample size of 29 firms drawn using judgmental sampling technique. Data were gathered using annual reports and accounts of the sampled firms through content analysis. Multiple regression technique was used for the analysis of the data. The study found out that the firm characteristics of firm size, leverage, return on assets and firm age have significant and positive effect on environmental reporting practices of listed manufacturing firms in Nigeria. The study recommended that listed manufacturing firms should raise fresh funds by retaining a good portion of their profits for the acquisition of assets to enhance environmental reporting practices in Nigerian listed manufacturing firms.

Salawa (2023) assessed the effect of different company characteristics on environmental disclosure dedication of all listed firms in Nigeria. The study used the Kinder Lydenberg Domini (KLD) indices to evaluate companies' dedication to environmental disclosure (ED). The work was anchored on legitimacy and stakeholders' theories. Data was collected for nine years (2012-2020). Data collected was estimated using ordinary least squares and the results were considered accurate. The study demonstrated that ED is significantly and positively associated to firm size and foreign company affiliation. Also, firm commitment efforts and ED were not significantly impacted by board size, financial performance and leverage. Even though the study used majorly the variables of the present study, the present study used all listed companies in Nigeria.

Ekpulu and Iyoha (2023) examined the effect of company characteristics and environmental disclosure of environmental sensitive and environmentally non sensitive companies in Nigeria for the period of 2015-2022. Ex post facto design was adopted. A random sample of 23 environmentally sensitive companies and environmentally non sensitive companies was used from the population of 50 companies. The data were extracted from the financial statement of the companies and the ordinary least square technique was used to analyze the data. The results show that, financial leverage is a strong determinant of disclosure but does not determine the intensity of disclosure while firm size and profitability are significant determinants of both the decision to disclose and the extent of disclosure.

Chariri (2023) examined the effect of business size, industry, profitability and ISO certification on the disclosure of carbon emissions in Nigeria for the period between 2017- 2022. The population was 31 enterprises that are included in the Nordic Carbon Disclosure Project (CDP and a sample size of 20 enterprises was adopted using convenient sampling techniques). Multiple regressions were used to analyze the data collected and the result shows that firm size and profitability have a favorable impact on carbon emission disclosure. Meanwhile, the industry and ISO certification had little bearing on the disclosure of carbon emission of the studied firms. Apart from the need to replicate this study in Nigeria, there is the need to conduct a study using more themes of environmental disclosure to validate the findings.

Moshud (2023) assessed the effect of firm size on environmental disclosure of quoted firms in Nigeria from 2018 – 2022. The study made use of cross-sectional research design focusing on a sample of 82 firms from a population of 176 listed firms in Nigeria. The data were extracted from the financial statement of the quoted firms. Binary regression technique was used for analysis of the formulated hypotheses and the result reveals that, size of quoted Nigerian firms

has a negative relationship with environmental disclosure even though the effect is insignificant. Zayol (2023) examined the effect of firm characteristics and corporate environmental disclosure by Nigerian less sensitive listed companies from 2013 – 2022. Ex post facto design was used. Secondary data was sourced from 13 sampled firms out of the total population of 14 firms. The formulated hypotheses of the study were analyzed using panel regression. The result shows that, Environmental Disclosure by less-sensitive listed companies in Nigeria is low but increased steadily over the study period. In addition, age of a firm and leverage are positively and significantly related to the level of corporate environmental disclosure by less-sensitive listed companies in Nigeria while firm size and size of audit firm are positive but insignificantly related to environmental disclosure.

Ziba and Abdorreza (2023) studied the effect between corporate characteristics and voluntary disclosure in Tehran stock Exchange of 104 firms over the period of 2016-2022. The study made use of cross-sectional research design focusing on the sample of 90 firms. Secondary data was sourced from the audited financial statement of the firms. The independent variable includes firm size, firm age and profitability while voluntary disclosure was selected as dependent variable. The study used linear regression model to test the hypotheses. The findings reveal that there is a positively and significantly relationship between firm size and voluntary disclosure whereas there is negative relationship between profitability and voluntary disclosure.

Mgeni and Nayak (2023) studied the effect between structural firm attributes and business performance of agribusiness SMEs in Tanzania for the period of 2017- 2022. The study was based on field data collected by mailed questionnaires from 60 agro business small and medium scale enterprises and analyzed quantitatively by Pearson product moment correlation and multiple regressions by SPSS. The findings suggested that firm age has a significant moderate positive correlation with business performance of SMEs while firm size and ownership have insignificant and weak negative correlation with business performance.

Soomiyol (2023), studied the effect of sustainability reporting on the performance of sampled Oil and Gas firms in Nigeria for the period of 2014- 2022. Performance was proxied by return on assets (ROA) was the independent variable while sustainability reporting was surrogated by economic reporting, environmental reporting and social reporting. The population of the study consisted of (9) nine oil and gas companies and all was adopted as the sample size. Data was sourced from the annual published statement of the firms. The major analysis to achieve the specific objectives was performed using the generalized least square (GLS) regression techniques. The significance of the association and relationships was at 5% confidence level. Z-test statistics were used to test the significance of the relationships. The results of the model revealed that the explanatory variables account for as low as 69.51% of the overall variation in the financial performance of sampled Oil and Gas firms in Nigeria. The findings show that economic reporting and environmental reporting have a significant effect on the financial performance of sampled oil and gas firms in Nigeria while social reporting has no significant effect on the financial performance of sampled Oil and Gas firms in Nigeria. The study recommends among others that, listed oil and companies in Nigeria should intensify the economic dimension of sustainability reporting as this could lead to increased performance in addition to satisfying their information needs and assisting them to hold firms to account for not only economic reporting but also environmental and social reporting as it impacts them.

Erhun (2022) examined the effect of firm characteristics on segment reporting in Nigeria for the period of 2012- 2021. Independent variable, firm characteristic was decomposed into firm size, profitability, audit firm and leverage. Proxies were used to measure them and secondary data

were collected from the annual reports of 121 companies' sampled from the population of 150 companies for the period of study and using simple random sampling method. Data collected was analysed using linear regression analysis. The results revealed low level of segment reporting among firms. Firm size, was found to have positive significant relationships with adequate segment reporting. Profitability however showed no relationship.

3.0 Methodology

This study adopted ex-post facto research design. This design is suitable because the data for the analysis had already existed, leaving no room for the researcher to manipulate the variables under study. The scope of this study was delimited to only consumer goods sector. Hence, the population consisted of twenty (20) consumer goods firms as at 31st December, 2023 (NGX, 2023) from 2014 to 2023. The basis of selecting this time range is the availability of published annual reports and accounts for the selected firms, as well as the availability of reasonably priced, reliable and up-to-date financial data. A sample of twelve (12) consumer goods firms were drawn from the total of listed consumer goods firms of twenty (20) on the floor Nigerian Exchange Group purposively. This is however subjected to a validity test using Tabachnick and Fidell (2007) formula. The study adopted panel least squares regression in analyzing the data via Eviews 10.0. The data conformed to the standardized regression assumptions, that is, linearity, homoscedasticity, normality and independence of data. The descriptive statistics was used to evaluate the characteristics of the data: mean maximum, minimum, and standard deviation and also check for normality of the data. Correlation analysis was employed to evaluate the association between the variables and to check for multicollinearity. OLS regression analysis technique was employed to find the cause effect relationship between the independent variables and the dependent variables. However, this method of analysis helps to establish the relationship between the independent variables and the dependent variable of interest and to identify the direction of the relationship. It reflects the level to which a set of variables is capable of predicting a specific outcome. In order to test the three-hypothesis formulated in the study and achieve the objectives of the research, the following model was formulated.

Environmental sustainability= f (firm attributes)

WMC= f (FA, FL, FZ,)

$WMC_{it} = \alpha_0 + \beta_1 FAge_{it} + \beta_2 FLev_{it} + \beta_3 Fsize_{it} + \epsilon$

Where:

WMC= Environmental waste management cost

FA = Firm age

FL = Firm leverage

FZ = Firm size

i = Cross Section (sample companies)

t = Time Frame (2014-2023)

ϵ_{it} = Stochastic error Term

4.0 Data Analysis and Discussion of Findings

4.1 Data Analysis

4.1.1 Descriptive Statistics

The result for the descriptive statistics analysis is as presented in table 4.1 below;

Table 4.2 Descriptive statistics results

	WMC	FAGE	FLEV	FSIZE
Mean	58.79723	44.33333	0.485164	17.95867
Median	54.53009	48.00000	0.507720	18.39628
Maximum	307.8157	73.00000	2.229656	20.53172
Minimum	11.70000	9.000000	0.033328	14.36926
Std. Dev.	44.43576	16.12625	0.255595	1.656431
Skewness	2.819558	-0.763952	2.387922	-0.352964
Kurtosis	13.91820	2.832435	19.56084	1.957648
Jarque-Bera	755.0335	11.81284	1485.350	7.924155
Probability	0.000000	0.002722	0.000000	0.019024
Sum	7055.667	5320.000	58.21963	2155.040
Sum Sq. Dev.	234969.9	30946.67	7.774109	326.5079
Observations	120	120	120	120

Source: Researcher's computation (2025) using E-views 10.0

The results in table 4.1 above indicates that the dependent variable-environmental waste management cost and the independent variables which were firm age, firm leverage and firm size of listed manufacturing firms in Nigeria have mean scores of approximately 58.797, 44.33, 0.485 (48.5%), and 17.95 respectively. The median values obtained for these variables were approximately 54.53, 48, 0.507 (50.7%) and 18.39 respectively. These constitute the middle values for the distributions of these variables under the period covered in this study (2014-2023). In terms of the level of variability and dispersion in the distribution of these variables, the standard deviations obtained for the dependent variable- environmental waste management cost and the independent variables which were firm age, firm leverage and firm size of listed manufacturing firms in Nigeria were approximately 44.43, 16.12, 0.255 and 1.656 respectively. This indicates varying levels of variability in the distribution. Similarly, the skewness values obtained for these variables were 2.819558, 0.763952, 2.387922 and -0.352964 respectively. This quantifies the asymmetry of the distributions. In addition, the Kurtosis values obtained for these variables were given as approximately 13.91820, 2.832435, 19.56084 and 1.957648 respectively. Since the values of the kurtosis are greater than zero, it indicates a leptokurtic distribution, hence the presence of outliers in the data.

4.1.2 Model Evaluation

Residual and coefficient diagnostics were however conducted to assess the suitability of the model as stated in the previous section. These include normality test, multicollinearity test, heteroscedasticity test and autocorrelation assessment.

4.1.2.1 Normality test

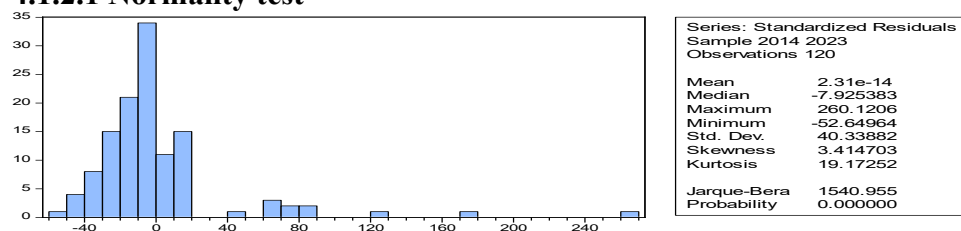


Fig. 4.1 Jarque-Bera Normality test results

Source: E-views 10.0 Output (2025)

The essence of a normality test is to determine if a dataset or sample follows a normal distribution. This is important because many statistical models assume normality, and deviations from normality can affect the validity of statistical inference. The Jarque-Bera test was employed in this case. As applied, if the p-value associated with the Jarque-Bera test is below a predetermined significance level ($p < 0.05$), then we reject the null hypothesis and conclude that the data do not follow a normal distribution. With a p-value of 0.0000, there is sufficient evidence to conclude that the data were not normally distributed.

4.1.2.2 Multicollinearity Test

In examining the association among the variables, the study employed the Spearman Rank Correlation Coefficient (correlation matrix), and the results are as presented in the table below.

Table 4.2 Spearman's rank correlation matrix

	WMC	FAGE	FLEV	FSIZE
WMC	1.000000	0.219313	0.187313	-0.316583
FAGE	0.219313	1.000000	0.087169	-0.104488
FLEV	0.187313	0.087169	1.000000	-0.395470
FSIZE	-0.316583	-0.104488	-0.395470	1.000000

Source: Researcher's computation (2025) using E-views 10.0

The correlation analysis showed that all independent variables had coefficients lesser than 0.80 respectively confirming absence of multicollinearity issues.

4.1.2.3 Heteroscedasticity Test

Table 4.3 Breusch-Pagan LM test

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	195.3211	66	0.1543
Pesaran scaled LM	10.21149		0.0739
Pesaran CD	2.596591		0.4352

Source: Researcher's computation (2025) using E-views 10.0

The statistics and probability value associated with the Breusch-Pagan LM test otherwise known as the Breusch-Pagan Godfrey test help determine whether there is evidence of heteroscedasticity in the regression model. A low p-value ($p < 0.05$) suggests evidence against the null hypothesis in

favour of the alternate hypothesis which indicates the presence of heteroscedasticity in the regression model. With a p-value of 0.1543, there is sufficient evidence to accept the null hypothesis, thus, conclude that the predictor variables in the regression model were homoscedastic.

4.1.2.4 Autocorrelation

The Durbin-Watson statistic is commonly used to test for autocorrelation, with values close to 2 indicating no significant autocorrelation. The Durbin-Watson statistic as obtained from the panel regression results (See Table 4.4) was utilized in this case. The Durbin-Watson statistic value of 1.7503 suggests that there is a low negative autocorrelation in the data.

4.2 Test of Hypotheses

Each of the hypotheses in this study was tested based on the result obtained from the panel multiple regression analysis. The result that relates to these hypotheses is summarized in table 4.4 below;

Table 4.4 Panel multiple regression results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	169.1721	50.43289	3.354400	0.0011
FAGE	0.718160	0.240957	2.980445	0.0035
FLEV	-12.24778	15.40703	-0.794947	0.4283
FSIZE	-7.588039	2.452199	-3.094382	0.0025
R-squared	0.875898	Mean dependent var	58.79723	
Adjusted R-squared	0.854585	S.D. dependent var	44.43576	
S.E. of regression	40.85711	Akaike info criterion	10.29080	
Sum squared resid	193639.2	Schwarz criterion	10.38372	
Log likelihood	-613.4482	Hannan-Quinn criter.	10.32854	
F-statistic	8.253082	Durbin-Watson stat	1.750299	
Prob(F-statistic)	0.000050			

Source: Researcher's computation (2025) using E-views 10.0

The multiple regression line is as written below:

$$\text{WMC} = 169.172072896 + 0.718160057664 \cdot \text{FAGE} - 12.2477750413 \cdot \text{FLEV} - 7.5880392341 \cdot \text{FSIZE} + \mu$$

The regression equation indicates that for every one-unit increase in Firm Age (FAGE), Waste Management Cost (WMC) increases by approximately 0.72 units. Conversely, for every one-unit increase in Firm Leverage (FLEV), WMC decreases by approximately 12.25 units, and for every one-unit increase in Firm Size (FSIZE), WMC decreases by approximately 7.59 units. These coefficients suggest that firm age is positively associated with waste management costs, while firm leverage and size are negatively associated with waste management costs, indicating potential economies of scale or more efficient resource utilization in larger and more leveraged firms.

4.2.1 Hypothesis One

Ho: Firm age has no significant effect on environmental sustainability of listed manufacturing firms in Nigeria

H₁: Firm age has significant effect on environmental sustainability of listed manufacturing firms in Nigeria.

In order to test whether the variations in environmental sustainability as measured by waste management cost of listed manufacturing firms in Nigeria caused by changes in firm age is significant, the T-test was carried out at .05 significance level with Ttab of 2.1788 given at $T_{0.05,12}$. From the result above, the Tcal of 2.98044 is greater than Ttab given at $T_{0.05,12}$. Hence, the null hypothesis which states that firm age has no significant effect on environmental sustainability of listed manufacturing firms in Nigeria fails to hold, thus rejected, and the alternative hypothesis accepted. The null hypothesis is further rejected given that at $T_{0.05,12}$, its probability value (p-value = 0.0035) is less than 0.05 ($p < 0.05$).

4.2.2 Hypothesis Two

Ho: Firm leverage has no significant effect on environmental sustainability of listed manufacturing firms in Nigeria

H₁: Firm leverage has significant effect on environmental sustainability of listed manufacturing firms in Nigeria

From the result above, the Tcal of 0.7949 is less than Ttab given at $T_{0.05,12}$. Hence, the null hypothesis which states that firm leverage has no significant effect on environmental sustainability of listed manufacturing firms in Nigeria holds, thus accepted, and the alternative hypothesis rejected. The null hypothesis is further accepted given that at $T_{0.05,12}$, its probability value (p-value = 0.4283) is greater than 0.05 ($p > 0.05$).

4.2.3 Hypothesis Three

Ho: Firm size has no significant effect on environmental sustainability of listed manufacturing firms in Nigeria

H₁: Firm size has significant effect on environmental sustainability of listed manufacturing firms in Nigeria

For firm size, the Tcal of 3.09438 is less than Ttab given at $T_{0.05,12}$. Hence, the null hypothesis which states that firm size has no significant effect on environmental sustainability of listed manufacturing firms in Nigeria fails to hold, thus rejected, and the alternative hypothesis accepted. The null hypothesis is further accepted given that at $T_{0.05,12}$, its probability value (p-value = 0.0025) is less than 0.05 ($p < 0.05$).

4.3 Discussion of Findings

The study found that firm age has a significant positive effect on environmental sustainability of listed manufacturing firms in Nigeria. This finding suggests that the age of a firm significantly determines its commitment to environmental sustainability. This implies that older firms are more likely to prioritize environmental sustainability, possibly due to their established reputation, experience, and accumulated knowledge. This finding supports the notion that firm age is a significant determinant of environmental sustainability, suggesting that older firms are more committed to reducing their environmental footprint. However, this result contradicts Ziba and Abdorreza (2023), who found a positive and significant relationship between firm age and voluntary disclosure, implying that older firms may prioritize disclosure over actual

sustainability practices.

The study also revealed that firm leverage has a non-significant negative effect on environmental sustainability of listed manufacturing firms in Nigeria. This finding suggests that high levels of debt may not necessarily lead to a decrease in environmental sustainability. This suggests that high levels of debt may not necessarily compromise environmental sustainability, possibly because firms prioritize debt repayment over environmental investments. This result is consistent with Salawa (2023) and Ekpulu and Iyoha (2023), who found that leverage does not significantly impact environmental disclosure.

In addition, the study found firm size has a significant negative effect on environmental sustainability of listed manufacturing firms in Nigeria. This implies that larger firms may have more resources, but they may not necessarily allocate these resources to improve environmental sustainability. This result is inconsistent with the findings of Uyagu et al. (2023) who found that firm size has a significant and positive effect on environmental reporting practices. However, it is consistent with the findings of Moshud et al. (2023) who found that size of quoted Nigerian firms has a negative relationship with environmental disclosure, although the effect is insignificant. Similarly, Mgeni and Nayak (2023) found that firm size has an insignificant and weak negative correlation with business performance.

5.0 Conclusion and Recommendations

This study examined the determinants of environmental sustainability of listed manufacturing firms in Nigeria specifically focusing on consumer goods sector. The findings revealed that firm age has no significant positive effect on environmental sustainability, suggesting that the age of a firm significantly determines its commitment to environmental sustainability. Firm leverage was also found to have a non-significant negative effect, implying that high levels of debt may not necessarily lead to a decrease in environmental sustainability. However, firm size had a significant negative effect, indicating that larger firms may not be utilizing their resources effectively to improve environmental sustainability.

Based on the findings of this study, the following recommendations should be followed.

1. Listed manufacturing firms in Nigeria focus on adopting environmentally-friendly practices and investing in waste management infrastructure, regardless of their age. This can be achieved through training and capacity-building programs for employees, as well as investments in cleaner production technologies.
2. Listed manufacturing firms in Nigeria should prioritize debt management and financial sustainability, while also investing in environmental sustainability initiatives. This can be achieved through effective financial planning, debt restructuring, and investments in environmentally-friendly projects.
3. Listed manufacturing firms in Nigeria should prioritize environmental sustainability in their operations and invest in waste management infrastructure. This can be achieved through the adoption of environmentally-friendly technologies, implementation of waste reduction and recycling programs, and regular environmental audits.
4. The government should implement policies that promote capacity utilization in the manufacturing sector, such as providing access to affordable credit, investing in technology, and promoting local content. This could help to increase productivity and efficiency in the sector, leading to economic growth and development.

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