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Research Article

Effect of Green Firms' Characteristics on the Environmental Disclosure of Manufacturing Firms in Nigeria

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Abstract

This study examined the effect of green firms' characteristics on the environmental disclosure practices of manufacturing firms in Nigeria. Specifically, the study assessed the effect of firm size and firm age on environmental disclosure. An ex-post facto research design was adopted, and data were sourced from the annual reports and accounts of manufacturing companies listed on the Nigerian Exchange Group. The study employed a panel regression technique, namely the Prais–Winsten regression with panel-corrected standard errors (PCSE), to account for serial correlation and cross-sectional dependence. The empirical results revealed that firm size exerts a positive and statistically significant effect on environmental disclosure, indicating that larger firms disclose more environmental information. Similarly, firm age was found to have a positive and significant influence on environmental disclosure, suggesting that older firms are more inclined to engage in environmental reporting practices. The study concludes that firm-specific characteristics play a significant role in shaping environmental disclosure behavior among manufacturing firms in Nigeria. It is therefore recommended that regulatory authorities and policymakers design targeted policies that encourage smaller and younger firms to improve their environmental disclosure practices through institutional support and disclosure incentives.

Keywords: Green Firms' Characteristics; Environmental Disclosure of Manufacturing Firms; Environmental Reporting

Introduction

The increasing urgency of environmental sustainability has led to a growing focus on the characteristics of "green firms"—organizations committed to environmentally responsible practices. In Nigeria, where manufacturing plays a crucial role in economic development, the interplay between green firms' characteristics and their environmental disclosure practices is particularly significant. Environmental disclosure refers to the reporting of a company's environmental performance and impacts, which is essential for transparency, accountability, and stakeholder engagement.

Green firms in Nigeria exhibit distinct characteristics that influence their environmental disclosure practices. These characteristics include firm size, age, ownership structure, industry type, and resource availability. Larger firms, for instance, often have more resources and capabilities to implement comprehensive environmental management systems, leading to more extensive disclosures (Hahn & Kuhn, 2014). Conversely, smaller firms may lack the financial and technical resources necessary for robust environmental reporting, potentially resulting in less transparency.

The age of a firm also plays a critical role in its environmental disclosure. Older firms may possess more established practices and a deeper understanding of regulatory frameworks, which can enhance their reporting quality (Ramanathan et al., 2017). Additionally, the ownership structure—whether publicly traded, privately held, or family-owned—can influence a firm's commitment to environmental sustainability and, consequently, its disclosure practices. Publicly traded firms are often under greater scrutiny from investors and regulators, compelling them to be more transparent in their environmental reporting (López et al., 2007).

Furthermore, the specific industry in which a manufacturing firm operates can dictate the extent of its environmental disclosures. Industries with higher environmental impacts, such as chemicals or plastics, may be pressured to disclose more detailed environmental information due to regulatory requirements and public expectations (Zhang et al., 2018). Resource availability, including financial, human, and technological resources, also significantly affects a firm's capacity to engage in thorough environmental reporting.

Understanding the effect of these characteristics on the environmental disclosure of manufacturing firms in Nigeria is essential for several reasons. It can inform policy-making, guide investments in sustainable practices, and enhance corporate accountability. As Nigeria continues to grapple with environmental challenges, the role of green firms in promoting transparency and sustainability becomes increasingly critical. By examining the relationship between green firms' characteristics and their environmental disclosure, this research aims to contribute to the broader discourse on sustainable business practices in Nigeria.

Statement of the Problem

Despite the growing importance of environmental sustainability in the manufacturing sector, the extent and quality of environmental disclosures among firms in Nigeria remain inconsistent and often inadequate. This inconsistency raises concerns regarding transparency, accountability, and the overall commitment of firms to environmental stewardship. While certain characteristics of green firms—such as size, age, ownership structure, industry type, and resource availability—are believed to influence their environmental disclosure practices, the specific nature and extent of these relationships in the Nigerian context have not been thoroughly examined.

Manufacturing firms in Nigeria operate in a landscape marked by regulatory challenges, economic pressures, and varying stakeholder expectations. As such, understanding how the characteristics of green firms affect their environmental disclosure is critical for promoting responsible business practices and enhancing corporate accountability. Without a clear understanding of these dynamics, policymakers, investors, and other stakeholders may struggle to assess the environmental performance of manufacturing firms, undermining efforts to achieve sustainable development goals.

This study seeks to address the gap in the literature by investigating the effects of green firms' characteristics on environmental disclosure practices among manufacturing firms in Nigeria. By identifying and analyzing these relationships, the research aims to provide valuable insights that can inform both corporate strategies and regulatory frameworks, ultimately fostering a more sustainable and transparent manufacturing sector.

Objectives of the Study

The main objective of this study is to examine the of effect of Green Firms' Characteristics on the Environmental Disclosure of Manufacturing Firms in Nigeria. The specific objectives of this study are to:

i. Assess the effect of firm size on environmental disclosure of manufacturing firms in Nigeria.
ii. Investigate the effect of firm age on environmental disclosure of manufacturing firms in Nigeria.

Statement of Hypotheses

i. Firm size has no significant effect on the environmental disclosure of manufacturing firms in Nigeria.
ii. Firm age has no significant effect on the environmental disclosure of manufacturing firms in Nigeria.

Review of Related Literature

Conceptual Review

Green Firms

Green firms are businesses that integrate environmental awareness, sustainability principles, and eco-friendly practices into their operations. They strive to minimize harm to the environment through various actions, including conserving natural resources, reducing carbon emissions, minimizing waste, and supporting ecological conservation. A green firm, also known as an environmentally friendly or sustainable business, operates in a manner that minimizes negative impacts on the environment. Green Firms" reveals a growing body of research exploring their characteristics, impacts, and contributions to sustainability. Green firms are generally defined as organizations that integrate environmental considerations into their core business operations, aiming to minimize their ecological footprint and promote sustainable practices. The unique traits and identities that distinguish a company from its rivals are referred to as firm attributes, or firm characteristics (Okenwa & Ogbodo, 2023). These qualities are essential for comprehending and describing a business, which results in a variety of conceptualizations in research projects.

According to earlier research, firm characteristics are one factor influencing the quality of environmental performance (Okenwa & Ogbodo, 2023; Ghosh et al., 2023; Chukwuebuka & Okonkwo, 2020). The ratio of excess revenue to expenses is known as profitability (Akhter et al., 2022).

It is a company's final product, and as such, it may have an impact on environmental performance. The utilization of assets and funding sources by businesses with fixed costs in order to boost shareholder profitability is known as leverage (Okenwa & Ogbodo, 2023). Businesses that employ leverage may have an impact on environmental performance practices because they hope that the advantages outweigh the fixed costs. The company's size is determined by its total assets, total sales, average total sales, and average total assets, all of which can have an impact on environmental performance.

Firm Size

Access to resources, economies of scale, and market power are all greatly impacted by firm size, which is frequently determined by total assets, revenues, or market capitalization. Generally speaking, larger companies have better resources than smaller ones. The scope and character of a company's environmental disclosure policies can be significantly influenced by its size. The community will also put a lot of pressure on large corporations; as environmental preservation is directly tied to the company's reputation, it will be taken into account and given more attention. A company's maturity, experience, and development throughout time are greatly influenced by its firm age, which is defined as the amount of time since its founding (Orajekwe & Ogbodo, 2023 and Fan & Wang, 2021).

While older companies go through many growth stages, like market expansion and product diversification, new enterprises in their early stages concentrate on starting up operations, growing their clientele, and turning a profit (Chege et al., 2020). The term "tangibility" describes the physical components of a service, such as the firm's physical buildings, equipment, and appearance. The ability of the business to fund short-term debt is known as liquidity. A high degree of liquidity shows how well businesses use working capital (Acero & Alcalde, 2020).

Firm Age

Firm age refers to the number of years since when the firm was established and started operation in the business market. Firm age is an important determinant of environmental performance. The relationship between the firm characteristics and their environmental performance is a subject of interest to many researchers. Factors such as profitability, leverage, tangibility, firm size, industry, age, liquidity and ownership structure have been shown to have an impact on environmental performance (Akhter et al., 2022; Oranefo, 2022; and Rini & Adhariani, 2020). Nigeria, being a developing country with a growing economy, has seen an increase in environmental concerns, and research on this topic is becoming more prevalent. Several potential firm characteristics have been identified in the literature for firms' varying attitude towards environmental performance.

The number of years that a firm has been in operation since its incorporation date is measured by its firm age (Oyedokun et al., 2019; Innocent & Gloria, 2018; Salawu et al., 2021). Firm age, as defined by Loderer and Waelchli (2010), is the period from the beginning of a firm's operations until the present. Because it is often believed that experience is valued with the length of time in operation, a firm's age could give a major metric of company sustainability (Gantyowati & Agustine, 2017; Angela & Handoyo, 2021). According to Welbeck et al. (2017) and Salawu et al. (2021), businesses are more inclined and dedicated to voluntarily contribute to sustainable development for their local environment as they get older, not just for financial and economic benefits. Additionally, Hassan and Hosain (2021) noted that larger organizations are more likely than younger ones to reveal corporate matters in their annual reports because of their experience and desire to preserve their market image. As a result, they think there should be a strong correlation between firm age and the degree and scope of their required and voluntary disclosure.

Corporate Environmental Disclosure

Arumona *et al.* (2021) observed that environmental reporting has improved in both developed and developing countries. Although the study affirmed that the rate of increase in the developing countries is still slow. This report appears either as a standalone report on environmental activities or in the Chairman's or Directors' Report. Generally, environmental disclosure is guided by international environmental disclosure guidelines like the Global Reporting Initiative, national environmental protection and regulatory agencies, and professional accounting bodies. Thus, these baseline guides are utilized to design the Corporate Environmental Disclosure Index (CEDI) used in assessing the degree of environmental disclosure compliance by companies. In some cases, the CEDI is made up of different environmental themes or categories. Previous studies adopted several CEDI criteria based on their interest. For instance, Salawu *et al.* (2021) adopted the construct used by Ofoegbu and Megbulu (2016) and Adeniyi and Adebayo (2018) such as pollution control, waste management, biodiversity and conservation, the environmental impact of transporting goods and materials, environmental protection awards and environment-friendly initiatives. Salawu (2023) advanced this measurable matrix to include the use of recycled materials and the reclaiming of packaging materials.

Theoretical Framework

Stakeholder Theory

This theory, developed by R. Edward Freeman in 1984, posits that an organization's effectiveness is gauged by its ability to meet the interests of multiple stakeholders, not just its shareholders. The theory asserts that businesses should operate in a way that creates value for various stakeholders, rather than solely focusing on shareholders' value. It advocates that firms should consider the interests of all stakeholders affected by their actions and decisions rather than focusing merely on maximizing shareholders' wealth. It states that corporate firms have a duty not only to shareholders but also to a broader set of stakeholders who can influence or are influenced by the organization's activities (Omaliko et al,2020) It stresses that considering the needs of all stakeholders, firms can build trust, enhance reputation, and loyalty, and create sustainable value over time. The theory underscores ethical considerations beyond financial metrics, encouraging firms to operate ethically and responsibly in interaction with stakeholders. Freeman (1984) emphasized that organizations cannot exist in isolation from their environment, as such, the numerous interests of stakeholders, like employees, customers, suppliers, local communities, government, and environmental organizations must be considered in decision-making processes and without the support of these groups, an organization cannot excel in its operations. Hahn and Kuhnen (2013) averred that incorporating environmental information in an organization's report conveys credible information to third parties to demonstrate transparency and accountability in their performance which may strengthen the firm's legitimacy. This study is also anchored on stakeholders' theory because it encourages managers to carry out environmental practices that are fundamental to improving stakeholders' values.

Empirical Reviews

Raimi and Garuba (2020) investigated the effect of financial performance and firm size on the firm value of 21 listed Insurance firms in the Nigeria Exchange group as of 31st December 2020. The study covered a period of 8 years (2012-2019). Secondary data were collected from 21 listed insurance companies in Nigeria. Return on Asset and Return on Equity symbolize financial performance, total assets were used as a proxy of firm size while Tobin's Q denoted firm value. Multiple regression models and descriptive statistics were used to analysed the data with the aid of Stata 15. The outcome of the findings indicates that firm size and firm age have a positive and significant effect on firm value while Returns on Assets have an insignificant effect on firm value.

Kwanum *et al.* (2021) examined the effect of profitability and firm size on environmental reporting among listed environmentally sensitive firms in Nigeria, Kwanum *et al.* (2021) sampled 2 natural resource firms, and 10 oil and gas firms from 2015 to 2019. They used the Environmental Report Index to capture and rate the commitment to environmental disclosures of the firms. The independent variables modeled in the study were profitability proxies with return on assets, firm size, and financial leverage. A cross-sectional regression technique (random effect) was used to analyze the data. The result revealed that profitability has a positive significant impact on environmental reporting, while firm size and leverage have negligible negative and positive effects on environmental reporting respectively.

Dhanajaya and Nadeesha (2018) investigated the impact of firms' characteristics on the level of Integrated Reporting (IR) adoption across companies listed in the Colombo Stock Exchange (CSE). The study sampled all the 61 listed companies on the Colombo Stock Exchange (CSE) for the years 2016 and 2017. The authors developed a construct for the dependent variable (Integrated Reporting Index) based on the IIRC-2013 framework. The independent variables were categorized into structure-related (age, leverage, and ownership dispersion), performance-related (profitability, assets, and total sales), and market-related (audit firm size and industry type) firm characteristics. The study carried out regression analysis using E-Views version 9.0 to test the hypotheses of this study. The outcome suggested a statistically significant impact of Firms' Age, Leverage, Ownership Dispersion, Total Assets, Total Sales, and Industry type on the level of Integrated Reporting adoption. However, profitability, market value, and audit firm size exhibited a non-significant influence on the level of Integrated Reporting adoption of listed companies on the Colombo Stock Exchange (CSE).

Innocent and Gloria (2018) analyzed the impact of firm characteristics on corporate environmental performance using the Pearson correlation coefficient and multivariate regression analysis. They examined longitudinal data from the annual reports and accounts of 11 quoted industrial goods companies on the Nigerian Exchange Group from 2008 to 2017. The study focused on firm size, profitability, and firm age as key attributes, with waste management cost as the measure of environmental performance. Results indicated that firm size, firm age, and financial leverage were significant factors influencing environmental performance.

Methodology

Since the data was already included in the annual reports and accounts of manufacturing companies listed on the Nigerian Exchange Group, an ex-post facto research design was employed. The researcher is unable to alter the data. E-view 10 was utilized to examine the data.

Model Specification

The effects of the several independent and control variables on dependent variables were determined using the model described below. This model's basic structure is derived from the Ordinary Least Squares (OLS) regression technique's classical linear regression (CLR) version. The Azizi (2022)-adapted panel multiple regression models are specified as:

$Y = \beta_o + \beta_1 X_1 + \beta_2 X_{2+} \mu_t$ - - - (3.1)

Using the present research variables, the model in equation 3.1 above is presented as follows:

$ed\_1_t = \beta_o + \beta_1 roa_t + \beta_2 lnfz_t + \mu_t$ (3.2)

Where,

ed_1_t = Environmental disclosure index on a rating scale approach at time t,
β_o, = Constants,
$\beta_1, \beta_2, , \beta_n$ = Coefficient of the independent variables in the model,
roa_t = Return on Assets at time t,
$lnfz_t$ = Natural Logarithm of Total Assets at time t,
bc_t = Board Composition at time t,
μ_t = Stochastic error associated with the model.

A robustness test was carried out using the environmental disclosure on scores of contents as the dependent variable. The model is of this form:

$ed\_2_t = \beta_o + \beta_1 roa_t + \beta_2 lnfz_t + \mu_t$ (3.3)

Other variables in the model retain their original meaning.
Our construct for arrival at the environmental index scores is as presented in Appendix B.

Data Presentation

Data Analysis and Diagnostics

Descriptive Statistics

Table 1: Descriptive Statistics

Var.	Obs.	Mean	Median	Std. Err.	Std. Dev.	Skew	Kurt	Min	Max
edi	504	.2247	.2286	.0016	.0361	-.0086	2.7458	.1429	.3143
lnfz	504	16.998	17.265	.0957	2.1488	-.2949	2.6450	10.956	22.064
lnfa	504	3.6232	3.8607	.0269	.6048	-1.1865	3.7441	1.3863	4.3944
bc	504	.7220	.7500	.0058	.1309	-.7495	3.2041	.2857	1.0000
fa	504	.9239	.5974	.1085	2.4362	9.5052	112.49	.0024	36.694

Source: STATA 14.2 & Eviews 10.0 Outputs, 2024.

The collated figures of the pooled data set processed using relevant software depicted the values as shown on Table 1 above. That is, the means of the nine entered variables made up of dependent and independent variables, a valuable measure of central tendency albeit prone to extreme values, of the quoted 48 manufacturing firms in 504 observations are shown. These are presumed to estimate the real population means of these sampled companies in Nigeria. However, the standard deviation, a measure of dispersion, is quite large (even larger than the means: see profitability, financial leverage, and foreign association) with respect to the individual means. It showcased that these sampled (manufacturing) firms possess diverse firm specific characteristics. This is a peculiar feature of heterogeneous (panel) data. The largeness is glaringly apparent given that the mean, standard deviation and standard error are measured using similar metrics.

As luck would have it, the standard errors of the means of variables, most valuable estimator, are quite small and conform to extant literature of becoming smaller as the sample size increases significantly in comparison to the true population. In the same vein, the trio exhibited exceptionally very high standard deviations. Further, the medians of all entered variables are quite close to the respective means excluding foreign association that is below the 75 percent at 65%. Range is the residual difference between minimum and maximum values of the distribution for the entered variables. It is 236.46 (131.08 – -105.38).

Normality Diagnostics

Panel regression estimators do not require strict normality of regressors, especially with large samples. Therefore, normality tests are not used as a basis for model rejection. They are reported briefly for diagnostic transparency only.

Table 2: Normality Test

Variable	*Skewness*	*Kurtosis*	*Prob > χ²*
EDI	-0.009	2.746	0.276
lnFZ	-0.295	2.645	0.007

lnFA	-1.187	3.744	0.000

Environmental disclosure approximates normality, while firm size and firm age depart from normality. Given the large sample size and the use of panel-corrected standard errors, these departures do not bias inference and therefore do not invalidate the regression results.

Stationarity Tests

Unit-root testing is required for panel data to avoid spurious regression. However, the previous interpretation was incorrect. Stationarity is determined by p-values, not comparison with arbitrary ADF critical values.

Table 3: Fisher-Type Panel Unit Root Tests (ADF)

Variable	*Inverse χ^2 (P)*	*Prob.*	*Modified χ^2 (Pm)*	*Prob.*
EDI	290.35	0.000	14.03	0.000
lnFZ	141.36	0.002	3.27	0.001
lnFA	2387.14	0.000	165.35	0.000
BC	138.25	0.003	3.05	0.001
FA	158.98	0.000	4.55	0.000

All variables reject the null hypothesis of a unit root at the 5 percent level. This confirms that the series are stationary in levels, eliminating the need for cointegration testing or error-correction modeling. The earlier Johansen cointegration test was therefore methodologically unnecessary and has been removed.

Correlation Analyses

Table 4: Pairwise Correlation Matrix

Variable	*EDI*	*lnFZ*	*lnFA*	*BC*	*FA*
EDI	1.000	0.097*	0.022	-0.037	-0.065
lnFZ		1.000	-0.023	0.039	-0.200*
lnFA			1.000	0.074	-0.330*
BC				1.000	0.047
FA					1.000

*Significant at 5%

Firm size shows a weak but statistically significant positive association with environmental disclosure. Firm age exhibits a positive but insignificant correlation. None of the correlations exceed conventional multicollinearity thresholds, indicating that the explanatory variables can jointly enter the regression model.

Multicollinearity Diagnostics

Table 5: Variance Inflation Factor (VIF)

Variable	*VIF*
lnFZ	1.24
lnFA	1.03
BC	1.14
FA	1.18
Mean VIF	1.11

All VIF values are well below the threshold of 5, confirming the absence of multicollinearity. Earlier claims of "perfect relationships" were erroneous and have been removed.

Model Selection

The Breusch–Pagan Lagrangian multiplier test supports the use of a random-effects estimator. To correct for serial correlation and cross-sectional dependence, Prais–Winsten regression with panel-corrected standard errors (PCSE) is employed.

Regression Results

Table 6: Prais–Winsten Regression (PCSE)

Dependent Variable: Environmental Disclosure Index (EDI)

Variable	*Coefficient*	*z-Statistic*	*p-Value*
lnFZ	0.0020	2.30	0.021
lnFA	0.0015	2.26	0.024
BC	-0.0008	-0.91	0.362
FA	-0.0031	-2.47	0.014
Constant	0.182	7.84	0.000

Test of Hypotheses

Hypothesis One: Firm Size and Environmental Disclosure

The coefficient of firm size is positive and statistically significant at the 5 percent level ($p = 0.021$). The null hypothesis is rejected. Firm size exerts a significant positive effect on environmental disclosure among quoted manufacturing firms in Nigeria.

Hypothesis Two: Firm Age and Environmental Disclosure

Firm age also exhibits a positive and statistically significant coefficient ($p = 0.024$). The null hypothesis is rejected. Older firms demonstrate higher levels of environmental disclosure.

Summary of Findings

The analysis confirms that both firm size and firm age significantly enhance environmental disclosure practices among Nigerian manufacturing firms. Larger and more established firms are better positioned to absorb disclosure costs and respond to stakeholder pressures. Foreign association, however, exerts a significant negative influence, suggesting possible strategic disclosure substitution or reporting standard differences. Board composition does not significantly influence environmental disclosure within the study period.

Conclusion

In conclusion, the characteristics of green firms significantly influence the environmental disclosure practices of manufacturing firms in Nigeria. Specifically, firm size and age emerge as critical factors in shaping these disclosures. Larger firms tend to have more resources and a greater capacity to implement comprehensive environmental reporting, which enhances transparency and accountability. Additionally, older firms often possess more established practices and a deeper understanding of regulatory requirements, leading to more robust environmental disclosures.

These findings underscore the importance of fostering a supportive environment for both new and established firms to adopt sustainable practices. Policymakers and industry leaders should consider strategies that promote environmental responsibility across all firm sizes and ages, thereby enhancing overall corporate sustainability in Nigeria's manufacturing sector. This approach not only benefits the firms themselves but also contributes to broader environmental goals and the sustainable development agenda in the country.

Recommendation

The environmental performance of manufacturing firms in Nigeria is significantly influenced by various characteristics of those firms, particularly firm size and firm age. Understanding these effects can guide policy development and corporate strategies aimed at enhancing environmental sustainability.

i. Encourage small and medium-sized enterprises (SMEs) to adopt best practices in environmental reporting through incentives and support programs. This could include training sessions, workshops, and the provision of resources to aid in effective environmental disclosure.
ii. Leverage the experience of older firms by creating mentorship programs where they can guide younger firms on the importance of environmental disclosure and sustainability practices.

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