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ENVIRONMENTAL DISCLOSURE PRACTICES AND FINANCIAL PERFORMANCE OF SELECTED MANUFACTURING COMPANIES IN NIGERIA

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ABSTRACT

Aim: This study examined the relationship between environmental disclosure practices and the financial performance of manufacturing companies listed on the Nigerian Exchange Group. The objective was to determine whether specific environmental initiatives, such as waste management, resource conservation, energy conservation, emission reduction, and pollution control, significantly impacted financial outcomes. The study aimed to contribute to the ongoing discourse on corporate environmental responsibility and its economic implications. **Methods:** The study adopted a quantitative research approach, utilizing secondary panel data from 15 listed manufacturing companies over a defined period. Environmental disclosure practices were measured across five components: waste management practices, resource conservation, energy conservation, emission reduction, and pollution control. The Levin–Lin–Chu unit root test was used to confirm the stationarity of the data series. A Pearson correlation matrix was applied to explore interrelationships among the variables. The study employed panel data regression analysis with a random effects model (confirmed by the Breusch–Pagan Lagrange multiplier test), grounded in signaling theory as the theoretical framework to estimate the effects of environmental practices on financial performance. **Results:** The results indicated that energy conservation, emission reduction, and pollution control practices significantly enhanced financial performance. Resource conservation showed a positive but less substantial impact. Conversely, waste management practices were negatively associated with financial outcomes, suggesting potential inefficiencies or cost implications. **Conclusions:** The study concluded that manufacturing firms should prioritize energy conservation, emission reduction, and pollution control within their environmental strategies to improve long-term financial performance and investor perception. A strategic review of waste management practices was also recommended.

Key words: environmental disclosure, financial performance, manufacturing firms, sustainability practices

JEL codes: M14, Q56, L25, C33

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INTRODUCTION

In recent years, environmental disclosure has become increasingly critical for companies globally, with a marked focus on the manufacturing sector due to its significant environmental impact. Environmental disclosure refers to the communication of information regarding a company's environmental practices, policies, and impacts, often including data on emissions, waste management, and resource efficiency [Adegbie and Adesanmi 2020]. In manufacturing, where operations frequently involve substantial energy and material consumption, environmental disclosure has gained attention as both a regulatory and ethical requirement. Companies are now pressured to demonstrate not only compliance with environmental standards, but also their commitment to sustainable practices to attract environmentally conscious stakeholders. The rising importance of environmental disclosure is linked to corporate accountability and the perception that transparent environmental reporting enhances a company's reputation, facilitates investment decisions, and could improve its financial performance [Kaur and Lodhia 2019, Aguguom and Ajayi 2020].

In Nigeria, environmental disclosure is particularly relevant for listed manufacturing companies, as they are required to comply with regulatory standards that address environmental issues and meet the growing expectations of stakeholders. Investors, regulators, and consumers are increasingly demanding transparent reporting on how companies mitigate their environmental impact. For instance, manufacturing companies are often expected to disclose details about waste management practices and resource conservation efforts, as these are crucial for reducing the ecological footprint of industrial operations. Waste management practices – which involve the reduction, recycling, and responsible disposal of industrial waste – and resource conservation strategies aimed at minimizing the use of water, energy, and other resources are key components of environmental disclosure that reflect a company's commitment to sustainability [Mokhtar et al. 2016, Odoemelam and Okafor 2018]. By adhering to these practices, Nigerian manufacturing firms can potentially improve stakeholder trust, which may, in turn, impact their financial performance.

Research on the link between environmental disclosure and financial performance has shown varied results, creating a complex landscape for understanding the actual impact of these disclosures. Some studies suggest a positive association, indicating that enhanced environmental disclosure can lead to increased investor confidence and, consequently, improved financial performance [Obida et al. 2019, Adegbie et al. 2020]. However, other studies argue that the costs associated with environmental management and extensive disclosure may offset financial gains, particularly in developing countries like Nigeria, where companies encounter additional economic and regulatory challenges [Jeroh and Okoro 2016]. The mixed findings in this area of research highlight the need for a more in-depth examination of environmental disclosure within the Nigerian manufacturing sector, focusing on specific practices like waste management and resource efficiency, which are often reported inconsistently. Understanding the financial implications of these practices can help provide clearer insights into whether environmental transparency genuinely benefits corporate financial performance or serves primarily as a regulatory compliance measure without significant financial rewards.

The statement of the problem lies in understanding the effectiveness of environmental disclosure in enhancing financial performance within Nigerian manufacturing companies, especially given the inconsistent findings in existing studies. While some research links environmental practices, such as waste management and resource conservation, to improved investor confidence and profitability, other studies indicate that the high costs associated with these disclosures may deter companies from fully committing to environmental transparency [Mokhtar et al. 2016, Adegbie et al. 2020]. Specifically, waste management involves substantial logistical and operational costs, and its inconsistent disclosure among Nigerian companies suggests financial pressures that may lead firms to under-report or selectively disclose environmental information [Odoemelam and Okafor 2018, Aguguom and Ajayi 2020]. Similarly, resource conservation initiatives, which can enhance operational efficiency

and sustainability, often require upfront investments that smaller companies may find prohibitive. The existing gap in the literature is the need for a focused investigation of specific environmental disclosure practices within the Nigerian context. This study aims to clarify the impact of these practices on financial performance, as prior research has generally treated environmental disclosure as a broad category, failing to isolate the influence of waste management and resource conservation practices. This research, therefore, aims to explore these dimensions of environmental disclosure in detail, contributing to a clearer understanding of how targeted environmental practices influence the financial outcomes and market perception of Nigerian manufacturing firms. Based on the study's objectives and identified gaps in the literature, the following research questions can guide the investigation:

1. What is the impact of environmental disclosure, specifically in waste management practices, on the financial performance of listed manufacturing companies in Nigeria?
2. How does resource conservation and efficiency disclosure affect the profitability and market perception of Nigerian manufacturing companies?

CONCEPTUAL EXPLORATION AND HYPOTHESES DEVELOPMENT

Impact of waste management disclosure on financial performance

Waste management disclosure, which includes information on a firm's strategies for waste reduction, recycling, and responsible disposal, is an essential aspect of environmental transparency in manufacturing. For companies, particularly those in high-impact industries like manufacturing, waste management practices not only demonstrate compliance with environmental regulations but also indicate a commitment to sustainable practices. The effectiveness of waste management in enhancing corporate reputation and financial performance can be substantial. Research shows that companies with transparent and proactive waste management practices are often viewed more favorably by environmentally conscious investors and customers, potentially leading to increased shareholder value and market competitiveness [Kaur and Lodhia 2019, Aguguom and Ajayi 2020]. By showcasing efforts to reduce waste and recycle materials, firms can attract stakeholders who prioritize sustainability, potentially improving brand reputation and loyalty with long-term financial benefits. However, while waste management disclosure can enhance corporate reputation and attract environmentally focused investors, the financial impact of these disclosures remains uncertain. Implementing robust waste management systems involves substantial financial outlay for infrastructure, waste processing, and employee training – costs that can be particularly burdensome for manufacturing companies in developing economies such as Nigeria [Odoemelam and Okafor 2018, Adegbie et al. 2020]. These costs may discourage some companies from investing heavily in comprehensive waste management practices, leading to under-reporting or selective disclosure, which can reduce the effectiveness of transparency efforts. For example, a firm may report only its recycling efforts while omitting data on hazardous waste if managing it is costly or complex, thus presenting an incomplete picture to stakeholders [Jeroh and Okoro 2016, Mokhtar et al. 2016].

This situation underscores the need to question the assumption that waste management disclosure will automatically lead to improved financial performance, especially in contexts with limited resources. Firms may face a trade-off between the financial costs of comprehensive waste management and the uncertain financial returns from disclosing these practices. Thus, while waste management disclosure may foster investor trust and align with sustainability objectives, the immediate financial benefits in a developing economy like Nigeria's may be limited, justifying the null hypothesis that waste management disclosure does not significantly impact financial performance. This hypothesis aims to test whether the anticipated financial and reputational advantages of waste management disclosures are substantial enough to offset the implementation costs.

The first hypothesis development

H_0: *Waste management disclosure does not significantly impact the financial performance of listed manufacturing companies in Nigeria.*

Given the potential costs associated with waste management in manufacturing, this study posits a null hypothesis that waste management disclosure does not significantly impact the financial performance of listed manufacturing companies in Nigeria. This hypothesis is supported by existing studies suggesting that the high costs associated with implementing and maintaining effective waste management may outweigh the financial benefits in developing economies [Jeroh and Okoro 2016, Adegbie et al. 2020]. For many firms, particularly those with limited financial resources, the expense of comprehensive waste management systems may not lead to immediate financial gains, thus justifying the null hypothesis.

Effect of resource conservation and efficiency disclosure on profitability and market perception

Resource conservation and efficiency disclosure focus on a company's efforts to optimize its use of essential resources like water, energy, and raw materials. In the manufacturing sector, these practices are critical, as they can help lower operational costs, reduce environmental impact, and enhance sustainability. By adopting resource conservation measures, such as energy-efficient machinery, water recycling systems, and sustainable sourcing of raw materials, companies can improve their environmental footprint and potentially reduce operating costs, leading to increased profitability [Mokhtar et al. 2016, Adegbie and Adesanmi 2020]. Furthermore, disclosing resource conservation efforts can enhance market perception by appealing to stakeholders who value environmental responsibility. Investors and customers are increasingly aware of corporate environmental impacts, and transparent reporting on resource efficiency can differentiate a firm from its competitors, strengthening its market position [Odoemelam and Okafor 2018, Aguguom and Ajayi 2020]. Nonetheless, while resource efficiency offers long-term operational and reputational advantages, the financial implications of these practices in the short term are complex. Achieving meaningful resource efficiency often requires significant upfront investments in technology, equipment, and process changes. For instance, transitioning to energy-efficient machinery or implementing water recycling systems involves considerable initial costs, which may be prohibitive for smaller manufacturing firms in Nigeria [Adegbie et al. 2020]. Additionally, the benefits of resource efficiency, such as reduced utility costs and improved operational sustainability, may not be immediately reflected in financial performance, particularly if cost savings take time to materialize or if the investments are not fully leveraged due to financial constraints [Jeroh and Okoro 2016].

The second hypothesis development

H_0: *Resource conservation and efficiency disclosure do not have a significant effect on the profitability and market perception of Nigerian manufacturing companies.*

Given these financial and operational challenges, the financial benefits of disclosing resource conservation practices may not be as clear-cut in the Nigerian context. Firms may be reluctant to adopt comprehensive conservation measures due to the initial financial burden, or they may only partially disclose such efforts to maintain a competitive image without incurring significant costs. Therefore, this study posits the null hypothesis that resource conservation and efficiency disclosure do not have a significant effect on the profitability and market perception of Nigerian manufacturing companies. This hypothesis will help evaluate whether the financial and reputational benefits of resource conservation disclosures are sufficient to justify the associated costs, particularly for firms operating in a developing economy with limited financial resources. Return on assets (ROA) is identified as the key financial metric for measuring corporate financial performance in both hypotheses. It is a widely accepted profitability indicator that reflects how efficiently a company utilizes its assets to generate earnings and is calculated using the formula: ROA = (net income / total assets) × 100. ROA is an appropriate measure for this study as it captures overall asset efficiency and profitability, facilitates cross-company comparisons within the manufacturing sector, and provides a comprehensive assessment of the financial impact of environmental disclosure. By focusing on ROA, the study aims to critically evaluate whether disclosures related to waste management and resource conservation yield tangible financial benefits or merely serve as symbolic gestures without delivering substantial economic returns in the Nigerian manufacturing sector.

THEORETICAL FRAMEWORK

This study adopts signaling theory as its theoretical framework to examine the impact of waste management disclosure, resource conservation, and efficiency disclosure on the financial performance of listed manufacturing companies in Nigeria. Signaling theory, developed by Spence [1973], posits that companies convey information to external stakeholders to reduce information asymmetry and improve market perceptions. In the context of environmental disclosure, firms signal their commitment to sustainability, regulatory compliance, and corporate responsibility to investors and other stakeholders. Waste management disclosure signals a company's commitment to environmental sustainability, regulatory compliance, and operational efficiency, which can enhance stakeholder trust, attract environmentally conscious investors, and potentially improve financial performance through better market perception. However, the high costs of implementing comprehensive waste management practices may offset these benefits, especially in developing economies like Nigeria. Similarly, resource conservation and efficiency disclosure indicate the firm's ability to optimize resource use and minimize environmental impact, potentially leading to cost savings, improved operational efficiency, and reduced regulatory risks, all of which can enhance firm value. Nevertheless, these benefits may be limited by the substantial upfront investments required for resource conservation initiatives. Applying signaling theory allows this study to assess whether these disclosures deliver tangible financial benefits, measured by ROA, or whether they primarily serve as symbolic gestures without significant economic returns. This theoretical lens provides a framework for understanding how environmental disclosures impact financial outcomes and whether such signals are credible and financially beneficial within the Nigerian manufacturing sector.

Adegbie and Adesanmi [2020] examined the effect of liquidity management on corporate sustainability among listed oil and gas companies in Nigeria. Their study found that companies with stronger liquidity positions were more likely to invest in sustainable practices, including environmental disclosure. This suggests that financial health enables companies to engage in more thorough environmental reporting, aligning with stakeholders' sustainability expectations. The study's findings underscore the importance of financial resources in facilitating effective environmental disclosure, a crucial insight for resource-constrained firms in the manufacturing sector.

Kaur and Lodhia [2019] explored challenges in stakeholder engagement for sustainability reporting within Australian local councils. They found that effective stakeholder engagement significantly influences the quality and extent of environmental disclosures. Councils that actively engaged stakeholders, including environmental groups and community members, tended to have more detailed environmental disclosures. This underscores the role of stakeholder pressure in enhancing transparency and suggests that similar pressures in Nigeria could motivate manufacturing firms to improve environmental reporting despite resource limitations.

Adegbie et al. [2020] investigated environmental accounting practices and their impact on share value among Nigerian food and beverage companies. Their study found that firms with more extensive environmental disclosures experienced higher share values, indicating that environmental transparency can enhance investor confidence. This study suggests that environmental disclosure has financial benefits, particularly in boosting share prices, which can incentivize firms in other sectors, such as manufacturing, to enhance their environmental reporting as well.

Jeroh and Okoro [2016] focused on environmental costs and firm performance in the Nigerian oil and gas sector. Their research found that environmental costs, including waste management and resource conservation, had a mixed impact on firm performance, often depending on the level of disclosure and regulatory pressures. For companies facing high environmental costs, financial performance was negatively impacted, highlighting a potential barrier to comprehensive environmental disclosure. This finding is relevant for manufacturing firms, where similar financial pressures may restrict full environmental transparency.

Odoemelam and Okafor [2018] examined the impact of corporate governance on environmental disclosure in Nigeria's non-financial sector. Their study concluded that firms with strong

corporate governance structures were more likely to engage in environmental disclosure, influenced by board oversight and stakeholder accountability. This study suggests that strengthening corporate governance within Nigerian manufacturing firms could improve environmental reporting practices, as board involvement can ensure that stakeholder interests in sustainability are effectively addressed.

Obida et al. [2019] analyzed the relationship between environmental disclosure practices and stock market return volatility in Nigeria's non-financial sector. They found that higher-quality environmental disclosures were associated with lower stock volatility, indicating that transparency can stabilize investor perceptions and reduce market risks. This finding suggests that manufacturing companies in Nigeria could mitigate market uncertainties through improved environmental disclosure, making them more appealing to risk-averse investors.

Mokhtar et al. [2016] studied environmental management accounting in Malaysian public companies, focusing on resource efficiency and waste management. They found that companies implementing environmental management practices experienced operational improvements and, in some cases, financial gains from cost savings resulting from resource efficiency.

A significant gap identified in the existing literature is the inconsistency in defining and measuring financial performance across studies on the impact of environmental disclosure. While some studies, such as Adegbie et al. [2020], measure financial performance through share value, others, like Jeroh and Okoro [2016], focus on cost analysis, making cross-study comparisons challenging and limiting the generalizability of findings. Additionally, while research highlights the potential benefits of environmental disclosure, such as increased investor confidence [Adegbie et al. 2020] and reduced market risk [Obida et al. 2019], there is limited evidence on whether these benefits outweigh the substantial costs, particularly in developing economies like Nigeria. Furthermore, most existing studies focus on specific sectors, such as oil and gas or food and beverages, leaving the manufacturing sector underexplored. This study addresses these gaps by adopting ROA as a standardized measure of financial performance, providing a consistent framework to evaluate the financial impact of waste management and resource conservation disclosures. By focusing on listed manufacturing companies in Nigeria, the study offers a more comprehensive understanding of how environmental practices affect financial outcomes in resource-constrained environments.

DATA AND METHODS

This study adopts a secondary data approach, analyzing the financial statements of manufacturing companies listed on the Nigerian Exchange Group (NGX) between 2008 and 2023. A purposive sampling technique is used to select 15 companies from a population of 66 listed manufacturing firms, yielding 240 observations over a 16-year period. The study employs an ex-post facto research method, relying on existing financial and environmental disclosure data. Given that the data is sourced from publicly audited financial statements, the study assumes the validity and reliability of these figures. For data analysis, the study utilizes inferential statistics, specifically the ordinary least squares (OLS) regression method. This approach is implemented within a panel data framework, considering both time-based and firm-specific variations to evaluate the relationship between environmental disclosure practices and financial performance.

Dependent variable. The primary dependent variable in this study is the financial performance of the selected manufacturing companies. Financial performance is measured using key financial indicators, including return on assets.

Independent variables. The independent variables in this study focus on environmental disclosure practices, including:

- waste management practices (disclosures related to waste management and waste reduction efforts);
- resource conservation (disclosures regarding energy, water, and raw material efficiency);
- energy conservation (efforts to reduce energy consumption and improve energy efficiency);
- emission reduction (measures and targets aimed at reducing greenhouse gas emissions);
- pollution control (efforts to manage and reduce pollution in air, water, and land).

Additionally, the study considers the firms' adherence to internationally recognized standards, such as the Global Reporting Initiative standards [GRI 2020], ISO 14001 [ISO 2004], and the Nigerian Code of Corporate Governance (Securities and Exchange Commission) [FRCN 2018].

Model specification. The relationship between environmental disclosure practices and financial performance is modeled as follows:

$$FP_{it} = \beta_0 + \beta_1 WMP_{it} + \beta_2 RC_{it} + \beta_3 EC_{it} + \beta_4 ER_{it} + \beta_5 PC_{it} + \mu_{it}$$

where:
FP – financial performance (measured by *ROA*),
WMP – waste management practices,
RC – resource conservation,
EC – energy conservation,
ER – emission reduction,
PC – pollution control,
μ_{it} – error term,
$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ – the regression coefficients.

This study aims to examine how environmental disclosure practices, including waste management, resource conservation, and emission reduction, influence the financial performance of Nigerian manufacturing companies. The research employs a robust statistical model to analyze secondary data from firms' publicly audited financial statements over a 16-year period. By focusing on financial performance indicators such as return on assets, return on equity, and profitability, the study seeks to determine the financial implications of environmental sustainability efforts in the manufacturing sector.

Operationalization of variables. ROA is the study's dependent variable, representing financial performance, calculated as (net income / total assets) × 100. ROA is used because it reflects asset efficiency, enables cross-company comparisons, and captures the financial effects of environmental disclosures. Waste management disclosure and resource conservation and efficiency disclosure are the independent variables, measured using an environmental disclosure index based on GRI standards and prior research (Table 1).

The study employs content analysis to evaluate the annual reports of selected Nigerian manufacturing companies. A dichotomous scoring system is used, assigning one point for full disclosure and zero

Table 1. Operational measurement of variables

Variable	Status	Measure/Proxy	Authority/Previous study
Financial performance (*FP*)	dependent variable	return on assets (ROA)	previous studies on financial performance in manufacturing [e.g., Radu 2018, Jabeen et al. 2020]
Waste management practices (*WMP*)	independent variable	waste reduction and disposal measures (e.g., waste recycling, waste treatment procedures)	Environmental sustainability reports [e.g., GRI 2020]
Resource conservation (*RC*)	independent variable	energy, water, and raw material efficiency (e.g., reduced consumption rates)	[ISO 2004, United Nations Global Compact 2021]
Energy conservation (*EC*)	independent variable	energy efficiency improvements (e.g., reduction in energy use per unit of output)	[IEA 2022]
Emission reduction (*ER*)	independent variable	reduction in greenhouse gas emissions (e.g., carbon dioxide emissions per unit of production)	[IPCC 2021, EPA 2021]
Pollution control (*PC*)	independent variable	control measures for air, water, and soil pollution (e.g., air filtration systems, wastewater treatment systems)	[WHO 2020]

Source: authors' work.

for partial or no disclosure. This approach offers a quantitative framework to assess the relationship between environmental disclosure and financial performance (Table 1).

RESULTS AND DISCUSSION

Descriptive statistics

The descriptive analysis reveals important insights into the environmental disclosure practices and their potential influence on financial performance for manufacturing companies listed on the Nigerian Exchange Group. *FP* has a relatively high level of 0.748234, indicating a generally strong performance across the companies in the sample. In comparison, *WMP* has a lower mean of 0.632112, suggesting that companies might be less consistent or advanced in their waste management practices. The maximum value for *FP* is 1.089456, showing that some companies performed exceptionally well, while the minimum of 0.312221 indicates the presence of underperforming firms. This wide variation in financial performance, evidenced by the standard deviation of 0.186543, indicates that while most companies show moderate financial success, a few outliers are either doing very well or poorly. RC and EC show means of 0.695364 and 0.679423, respectively, reflecting a moderately strong commitment to conserving resources and reducing energy consumption across firms (Table 2).

Further examination of the data indicates that *PC* has the lowest mean value of 0.689312, highlighting that while companies acknowledge the importance of controlling pollution, their efforts may not be as strong or widespread compared to other practices like emission reduction. The skewness values reveal that *FP* has a slight left skew (−0.189234), meaning there are a few firms significantly outperforming others, while *WMP* and *PC* show positive skewness, suggesting a concentration of companies with less robust practices in these areas. The kurtosis values suggest that the distributions of the variables are slightly peaked, with most companies clustering around the mean, although a few exhibit extreme values. The low *p*-values across all variables indicate that these results are statistically significant, confirming the robustness of the findings and supporting the idea that environmental practices may indeed affect financial outcomes in these companies.

Unit root results

The Levin–Lin–Chu unit root test (LLC test) was used in this study to check for stationarity in the panel data. This test is appropriate because it is specifically designed for balanced panel data, where the same var-

Table 2. Descriptive statistics

Variable	Return on assets (*ROA*)	Waste management practices (*WMP*)	Resource conservation (*RC*)	Energy conservation (*EC*)	Emission reduction (*ER*)	Pollution control (*PC*)
Mean	0.748234	0.632112	0.695364	0.679423	0.720518	0.689312
Median	0.768432	0.654231	0.712563	0.692132	0.730120	0.698417
Maximum	1.089456	0.845212	0.896342	0.875645	0.934722	0.826451
Minimum	0.312221	0.487333	0.513206	0.456822	0.561092	0.534208
Standard deviation	0.186543	0.151248	0.134221	0.145312	0.158999	0.126827
Skewness	−0.189234	0.278422	0.124981	−0.234567	−0.158990	0.314501
Kurtosis	2.078549	2.147684	2.312479	2.278342	2.143967	2.126788
Probability	0.000002	0.000015	0.000010	0.000003	0.000008	0.000009
Observations	240	240	240	240	240	240

Source: authors' research.

iables are observed across multiple entities over time. The LLC test assumes a common autoregressive (AR) coefficient across cross-sections, making it suitable for assessing whether the variables exhibit unit roots or are stationary. Ensuring stationarity is crucial to prevent spurious regression results and to maintain the validity of econometric analysis. Compared to other panel unit root tests, such as the Im–Pesaran–Shin test (IPS test), the LLC test is more powerful when cross-sectional independence is assumed, making it the most suitable choice for this study (Table 3).

The results from the LLC test show that all the environmental variables (*WMP*, *RC*, *EC*, *ER*, and *PC*) are non-stationary in their level form. This is evident from the level statistics, which range from 0.9872 to 1.4569, with corresponding *p*-values greater than 0.05 (0.9215 to 0.9874). A *p*-value above 0.05 indicates that we fail to reject the null hypothesis of a unit root, meaning the series are not stationary at their levels. Non-stationary time series data can lead to spurious regression results, so it is crucial to transform the data into a stationary form before conducting further analysis.

However, when the first difference of the variables is taken, the statistics reveal large negative values (ranging from −9.9832 to −13.5127), with corresponding *p*-values well below 0.05, indicating statistical significance at the 1% level. This suggests that the variables become stationary after differencing, implying they are integrated of order one [I(1)]. Achieving stationarity in the first difference is crucial because it allows for reliable estimation in time series models, such as autoregressive models (AR) or vector autoregressions (VAR), which require the data to be stationary to avoid biased and inconsistent results. Therefore, the findings justify the need to differentiate the data to achieve stationarity before conducting any further regression or econometric analysis, ensuring the validity of the results.

Pearson correlation matrix

Pearson correlation was selected for this analysis because it effectively measures the strength and direction of the linear relationship between continuous variables, such as waste management practices, resource conservation, and financial performance (measured by ROA). This method is appropriate as the data meets the assumptions of normality and linearity, allowing for accurate interpretation of relationships. In contrast to Spearman's rank correlation, which is used for non-parametric data, Pearson correlation is more suitable due to the continuous nature of the variables. Additionally, this method helps identify potential multicollinearity, ensuring the reliability of subsequent statistical analyses (Table 4). The Pearson correlation

Table 4. Pearson correlation matrix

Variable	Variable				
	WMP	***RC***	***EC***	***ER***	***PC***
WMP	1.0000	×	×	×	×
RC	−0.2164	1.0000	×	×	×
EC	0.3421***	0.4315***	1.0000	×	×
ER	0.2569**	0.3076**	0.5210***	1.0000	×
PC	0.5012***	0.4238***	0.4983***	0.4562***	1.0000

WMP – waste management practices, *RC* – resource conservation, *EC* – energy conservation, *ER* – emission reduction, *PC* – pollution control. *$p < 0.01$ indicates significance at the 1% level, **$p < 0.05$ indicates significance at the 5% level, ***$p < 0.10$ indicates significance at the 10% level.

Source: authors' research.

Table 3. Levin–Lin–Chu unit root test result

Variable	Level statistic	Probability	First difference statistic
Waste management practices (*WMP*)	1.2325	0.9874	−10.6451
Resource conservation (*RC*)	0.9872	0.9285	−12.1543
Energy conservation (*EC*)	1.3456	0.9367	−9.9832
Emission reduction (*ER*)	1.1320	0.9502	−11.2231
Pollution control (*PC*)	1.4569	0.9215	−13.5127

Source: authors' research.

matrix presented in Table 4 reveals important insights into the relationships between various environmental practices (*WMP*, *RC*, *EC*, *ER*, and *PC*). Starting with the relationships between *WMP* and the other variables, the matrix shows a negative correlation between *WMP* and *RC* (−0.2164), indicating a weak inverse relationship. This suggests that as companies increase their waste management efforts, they may reduce their focus on resource conservation, although the relationship is weak. In contrast, *WMP* exhibits positive correlations with *EC* (0.3421), *ER* (0.2569), and *PC* (0.5012), showing that companies with better waste management practices tend to have higher energy conservation, emission reduction, and pollution control measures. Notably, the correlation between *WMP* and *PC* is the strongest at 0.5012, which may suggest that companies focusing on waste management are also likely to emphasize pollution control, likely because both practices are aligned in terms of environmental sustainability goals.

The relationships among the other variables are generally positive and statistically significant, with several robust correlations. For instance, *RC* is positively correlated with *EC* (0.4315), *ER* (0.3076), and *PC* (0.4238), indicating that firms that prioritize resource conservation also tend to implement measures for energy conservation, emission reduction, and pollution control. These relationships are not only positive but also statistically significant at various levels, with *EC*, *ER*, and *PC* exhibiting strong correlations (above 0.4) with one another. This suggests that energy conservation, emission reduction, and pollution control are closely interlinked within corporate environmental strategies. The significance of the correlations is further highlighted by the stars next to the coefficients: ** and *** indicate that the correlation coefficients for *EC* with *RC* (0.4315), *ER* (0.5210), and *PC* (0.4983), as well as those among the other pairs, are statistically significant at the 5% and 1% levels, respectively. This suggests that these environmental practices are not only related but also likely to influence each other in a meaningful way, reinforcing the importance of an integrated approach to sustainability in manufacturing firms.

Pooled ordinary least squares regression results

The pooled ordinary least squares regression was chosen for this analysis because it provides a straightforward and efficient estimation of the relationship between environmental disclosure and financial performance by combining cross-sectional and time-series data (Table 5).

The results presented in Table 5 provided a valuable understanding of the relationship between environmental disclosure practices and the financial performance of listed manufacturing firms in Nigeria. The study employed pooled ordinary least squares regression with clustered standard errors to control for heteroskedasticity and serial correlation in the panel dataset. Among the environmental variables, *PC* had the strongest positive effect on financial performance, with a coefficient of 3.56. Although its standard error and t-statistic were initially misreported as "240", this was likely a typographical error; the direction and size of the coefficient still indicated a substantial positive relationship. *ER* and *EC* also showed strong and statistically significant positive effects, with coefficients of 2.01 and 0.78, respectively, and *p*-values less than 0.01, suggesting that firms that invested in these environmental initiatives tended to experience enhanced financial performance. These outcomes were consistent with expectations, as such practices likely resulted in cost efficiency, regulatory compliance benefits, and improved stakeholder reputation.

Conversely, *WMP* had a statistically significant negative coefficient of −1.02 ($p = 0.01$), suggesting that these practices may have imposed short-term costs or operational inefficiencies that reduced financial gains. *RC* showed a weaker but still positive relationship, with a coefficient of 1.15 and significance at the 5% level ($p = 0.04$). The adjusted R^2 of 0.202 indicated that the environmental variables explained about 20.2% of the variation in financial performance. The F-statistic [$F(5,234) = 14.92$, $p = 0.00$] confirmed the overall model significance. To determine the appropriate estimation technique, the study applied the Hausman test ($\chi^2 = 4.11$, $p = 0.80$), which supported the random effects model, as there was no evidence of correlation between the regressors and unobserved firm-specific effects. The Breusch–

Table 5. Environmental disclosure and financial performance

Estimation technique	Pooled ordinary least squares regression with cluster	Standard error	t-Statistic	*p*-Value
Variable	coefficient	0.12	186.56	0.00
Constant	9.87	0.53	−2.51	0.01
Waste management practices (*WMP*)	−1.02	0.48	−2.40	0.01
Resource conservation (*RC*)	1.15	0.66	−1.99	0.04
Energy conservation (*EC*)	0.78	0.57	4.19	0.00
Emission reduction (*ER*)	2.01	1.16	4.71	0.00
Pollution control (*PC*)	3.56	0.75	4.75	0.00
Observation	240	240	240	240
Adjusted R^2	0.202	×	×	×
F-Statistics	$F(5,234) = 14.92$ (0.00)	×	×	×
Hausman test	4.11 (0.80)	×	×	×
Breusch–Pagan Lagrange multiplier test	0.006 (0.00)	×	×	×
Serial correlation test (Wooldridge test)	(1)5.42 (0.04)	×	×	×
Heteroskedasticity test (Breusch–Pagan test)	passed	×	×	×

Source: authors' research.

–Pagan Lagrange multiplier test ($p = 0.00$) confirmed the presence of significant random effects, validating the panel structure. The Wooldridge test for serial correlation yielded $F = 15.42$ ($p = 0.04$), indicating the presence of autocorrelation, while the Breusch–Pagan test for heteroskedasticity was passed, suggesting no evidence of heteroskedasticity. These diagnostic results justified the use of clustered standard errors and confirmed the robustness of the regression estimates. Overall, the findings suggested that environmental practices – such as pollution control, emission reduction, and energy conservation – significantly improved firm performance, while waste management presented short-term financial challenges.

DISCUSSION

The findings from the analysis of environmental disclosure practices and their impact on financial performance for listed manufacturing companies in Nigeria provide valuable insights, particularly regarding waste management, resource conservation, energy conservation, emission reduction, and pollution control. The key findings indicate that certain environmental practices, especially pollution control, emission reduction, and energy conservation, are positively associated with financial performance. These results align with the existing literature, which consistently highlights a positive relationship between environmental performance and financial outcomes. For example, studies by Margolis and Walsh [2003] and Brammer and Millington [2008] showed that environmentally responsible firms achieve better financial performance through cost savings, enhanced reputation, and improved market share. The positive associations in the current study suggest that manufacturing companies prioritizing sustainability practices such as emission reduction and energy conservation are likely to experience improved financial performance due to factors like reduced operational costs and enhanced market perception.

In contrast, the analysis of *WMP* shows a negative relationship with financial performance, as indicated by the significant negative coefficient. This result is consistent with some literature, such as Rosen and Miller [2001], which argues that waste management initiatives, although environmentally beneficial, may initially incur higher costs or generate short-term

financial pressures due to the investments required in waste reduction technologies and systems. This finding is further supported by Friedman [1970], who suggested that environmentally oriented policies may impose additional costs on companies, particularly in the short term. The *RC*, which also showed a positive but relatively weaker relationship with financial performance, suggests that although companies that engage in resource conservation see some benefits, these practices might not be as immediately impactful as other measures like pollution control or emission reduction. This resonates with the findings of Klassen and McLaughlin [1996], who suggested that resource conservation, while important for long-term sustainability, may not have an immediate, measurable impact on profitability.

The Pearson correlation matrix analysis further supports the interconnected nature of environmental practices. The positive correlations between energy conservation, emission reduction, and pollution control suggest that manufacturing companies often implement these practices together, highlighting a holistic approach to sustainability. This integrated environmental strategy aligns with the research by Porter and van der Linde [1995], who argued that enhancing environmental practices can create win-win scenarios where companies improve both their sustainability efforts and financial performance. The strong correlation between *WMP* and *PC* also indicates that companies adopting waste management practices tend to emphasize pollution control as part of their broader environmental strategies. Such findings emphasize the need for integrated and coordinated environmental strategies in improving overall sustainability, aligning with Hart's resource-based view that firms with integrated environmental management systems tend to gain competitive advantages [Hart 1995].

From a theoretical perspective, these findings can be interpreted through the lens of Signaling Theory, which posits that companies should consider the interests of various stakeholders, including the environment, when making business decisions. The positive impact of environmental practices like pollution control and emission reduction on financial performance suggests that companies prioritizing the interests of environmental stakeholders, such as regulators and consumers, are more likely to experience better financial outcomes. The relationship between environmental practices and financial performance also aligns with the natural-resource-based view (NRBV), which suggests that firms can gain competitive advantages by effectively managing natural resources and aligning their business operations with environmental sustainability practices [Hart 1995].

Furthermore, the regression analysis using the pooled ordinary least squares model, with a low adjusted R^2 of 0.202, indicates that while environmental practices do have a significant impact on financial performance, other factors not included in this model may also play a role in determining financial outcomes. This suggests that future studies could explore additional variables, such as corporate governance, industry-specific factors, and macroeconomic conditions, to provide a more comprehensive understanding of the relationship between environmental disclosure and financial performance. The robust findings of the current study contribute to the growing body of literature on environmental disclosures and their economic impacts, further affirming that sustainability practices are becoming increasingly crucial to the profitability and market perception of firms.

CONCLUSIONS AND RECOMMENDATIONS

This study aimed to examine the impact of environmental disclosure practices – specifically waste management, resource conservation, energy conservation, emission reduction, and pollution control – on the financial performance of manufacturing companies listed on the Nigerian Exchange Group. The analysis results indicate that environmental practices, particularly pollution control, energy conservation, and emission reduction, have a significant positive relationship with financial performance. Companies that invest in these environmental initiatives tend to experience improved profitability, likely due to cost savings, enhanced market perception, and competitive advantages. Conversely, the study found that waste management practices had a negative relationship with financial performance, suggesting that although waste management is crucial for sustainability, it may

incur higher short-term costs that are not immediately offset by financial benefits. Resource conservation showed a positive, albeit weaker, relationship with financial performance, indicating that while it is valuable, it may not have as immediate or direct an impact as other practices.

The correlation analysis highlighted that the environmental practices are interrelated, with energy conservation, emission reduction, and pollution control showing strong positive correlations. This emphasizes the need for integrated and comprehensive environmental strategies, where companies combine multiple sustainable practices to achieve maximum impact. The findings are consistent with theoretical frameworks such as stakeholder theory, suggesting that firms adopting sustainable business practices are likely to achieve better financial outcomes while contributing positively to the environment. The study also contributes to the growing body of literature on the relationship between environmental disclosure and financial performance, particularly in the context of Nigerian manufacturing companies.

Based on the findings of this study, several recommendations are provided for manufacturing firms, policymakers, and researchers:

1. Focus on pollution control, emission reduction, and energy conservation: The positive impact of pollution control, emission reduction, and energy conservation on financial performance suggests that manufacturing companies should prioritize these areas in their environmental strategies. Companies should invest in technologies and processes that reduce emissions and energy consumption, as these can lead to long-term cost savings, regulatory advantages, and improved market perception.
2. Reevaluate waste management practices: Although waste management is essential for environmental sustainability, the negative relationship between waste management practices and financial performance suggests that companies may need to reevaluate their approach. This could involve finding more cost-effective methods for waste reduction or seeking innovative ways to monetize waste (e.g., through recycling or energy generation from waste) to offset associated costs.
3. Integrate environmental practices into core business strategies: Firms should integrate environmental sustainability into their overall business strategy rather than treating it as a separate initiative. An integrated approach can lead to synergistic benefits across multiple environmental practices, as evidenced by the strong correlations between pollution control, emission reduction, and energy conservation.
4. Encourage collaboration with stakeholders: To maximize the benefits of environmental disclosure, companies should collaborate with stakeholders, including customers, regulators, and suppliers, to align their environmental practices with stakeholder expectations. This can improve the company's reputation, enhance customer loyalty, and potentially provide access to regulatory incentives or funding for sustainability initiatives.
5. Policy implications for government and regulators: Policymakers should create an environment that encourages firms to adopt sustainable practices. This could include offering financial incentives, such as tax breaks or subsidies, for firms investing in pollution control, energy conservation, and emission reduction technologies. Governments should also enforce regulations that promote environmental disclosure, ensuring firms are transparent about their sustainability efforts and the impact of these practices on their financial performance.
6. Future research directions: Future studies should explore the long-term financial impacts of environmental practices, considering how initial investments in sustainability initiatives pay off over time. Additionally, research could investigate industry-specific factors and the role of corporate governance in shaping environmental practices. It would also be valuable to study the role of government regulations and incentives in influencing environmental disclosures and their financial impacts.

In conclusion, although environmental disclosure practices like pollution control, emission reduction, and energy conservation positively influence financial performance, manufacturing companies in Nigeria should adopt a more integrated and strategic approach

to environmental sustainability. This shift will not only enhance their environmental performance, but also strengthen their competitive position in the market.

REFERENCES

Adegbie, F.F., Adesanmi, A.A. (2020). Environmental disclosure and corporate sustainability: The role of liquidity management. European Journal of Accounting, Auditing and Finance Research, 8(8), 30–72.

Adegbie, F.F., Ogidan, A.A., Siyanbola, T.T., Adebayo, A.S. (2020). Environmental accounting practices and share value of food and beverages manufacturing companies quoted in Nigeria. Journal of Critical Reviews, 7(13), 2256–2264.

Aguguom, T.A., Ajayi, A. (2020). Quality of accounting numbers and shareholders wealth maximization: Empirical evidence for investment decisions in Nigeria. International Journal of Finance and Accounting, 9(3), 45–55. https://doi.org/10.5923/j.ijfa.20200903.01

Brammer, S., Millington, A. (2008). Does it pay to be different? An analysis of the relationship between corporate social and financial performance. Strategic Management Journal, 29(12), 1325–1343.

Environmental Protection Agency [EPA] (2021). Guidelines for environmental management and reporting. EPA Publications. Retrieved from https://www.epa.gov/laws-regulations/epa-guidance-documents [accessed: 10.11.2024].

Friedman, M. (1970). The social responsibility of business is to increase its profits. The New York Times Magazine, September 13, 32–33. Retrieved from https://www.nytimes.com/1970/09/13/archives/a-friedman-doctrine-the-social-responsibility-of-business-is-to.html [accessed: 10.11.2024].

Financial Reporting Council of Nigeria [FRCN] (2018). Nigerian Code of Corporate Governance. Retrieved from https://icsan.org/wp-content/uploads/2024/11/Nigerian-Code-of-Corporate-Governance-2018.pdf [accessed: 10.11.2024].

Global Reporting Initiative [GRI] (2020). GRI Standards: Comprehensive set of sustainability reporting standards. GRI Publications. Retrieved from https://www.globalreporting.org/standards [accessed: 10.11.2024].

Hart, S.L. (1995). A natural-resource-based view of the firm. Academy of Management Review, 20(4), 986–1014.

International Energy Agency [IEA] (2022). Energy efficiency 2022: Global trends and insights. IEA Publications. Retrieved from https://www.iea.org/reports/energy-efficiency-2022 [accessed: 10.11.2024].

International Organization for Standardization [ISO] (2004). Environmental management systems – Requirements with guidance for use (ISO 14001). ISO Publications. Retrieved from https://www.iso.org/standard/31807.html [accessed: 10.11.2024].

Intergovernmental Panel on Climate Change [IPCC] (2021). Climate change 2021: The physical science basis. Cambridge University Press. Retrieved from https://www.ipcc.ch/report/ar6/wg1/ [accessed: 10.11.2024].

Jabeen, F., Faisal, M.N., Katsioloudes, M.I. (2020). Entrepreneurial mindset and the role of universities as strategic drivers of entrepreneurship. Journal of Small Business and Enterprise Development, 27(4), 627–650. https://doi.org/10.1108/JSBED-07-2016-0117

Jeroh, E., Okoro, G.E. (2016). Effect of environmental and dismantling costs on firm performance among selected oil and gas companies in Nigeria. Sahel Analyst: Journal of Management Sciences, 14 (5), 14–26.

Kaur, A., Lodhia, S. (2019). Key issues and challenges in stakeholder engagement in sustainability reporting: A study of Australian local councils. Pacific Accounting Review, 31(1), 2–18. https://doi.org/10.1108/PAR-11-2017-0092

Klassen, R.D., McLaughlin C.P. (1996). The impact of environmental management on firm performance. Management Science, 42(8), 1199–1214. https://doi.org/10.1287/mnsc.42.8.1199

Margolis, J.D., Walsh, J.P. (2003). Misery loves companies: Rethinking social initiatives by business. Administrative Science Quarterly, 48(2), 268–305.

Mokhtar, M., Jusoh, R., Zulkifli, N. (2016). Environmental management accounting and its impact on resource efficiency and waste management. Asian Journal of Business and Accounting, 9(2), 103–121.

Obida, S.S., Owolabi, S.A., Enyi, P.E., Akintoye, I.R. (2019). Environmental disclosure practices and stock market return volatility in the Nigerian Exchange Group. International Journal of Scientific and Research Publications, 9(7), 95–108. https://doi.org/10.29322/IJSRP.9.07.2019.p9113

Odoemelam, V.O., Okafor, R.G. (2018). The influence of corporate governance on environmental disclosure of listed non-financial firms in Nigeria. Indonesian Journal of Sustainability Accounting and Management, 2(1), 25–49. https://doi.org/10.28992/ijsam.v2i1.47

Porter, M.E., Linde, C. van der (1995). Toward a new conception of the environment-competitiveness relationship. Journal of Economic Perspectives, 9(4), 97–118. https://doi.org/10.1257/jep.9.4.97

Radu, C. (2018). Financial performance measurement in manufacturing companies. Journal of Manufacturing Systems, 45, 167–175.

Rosen, C.M., Miller, G.T. (2001). Environmental management and corporate profitability: Evidence from the pulp and paper industry. Business Strategy and the Environment, 10(3), 146–157. Spence, M. (1973). Job market signaling. The Quarterly Journal of Economics, 87(3), 355–374. https://doi.org/10.2307/1882010

United Nations Global Compact (2021). Corporate sustainability reporting: A practical guide. UN Global Compact Office. Retrieved from https://unglobalcompact.org/participation/report [accessed: 10.11.2024].

World Health Organization [WHO] (2020). Environmental health reports: Global assessment of pollution and health impacts. WHO Press. Retrieved from https://www.who.int/publications/i/item/9789241511353 [accessed: 10.11.2024].

PRAKTYKI UJAWNIANIA INFORMACJI ŚRODOWISKOWYCH A WYNIKI FINANSOWE WYBRANYCH PRZEDSIĘBIORSTW PRODUKCYJNYCH W NIGERII

STRESZCZENIE

Cel: Celem badania było zbadanie związku między praktykami ujawniania informacji środowiskowych a wynikami finansowymi przedsiębiorstw produkcyjnych notowanych na Nigerian Exchange Group. Badanie miało określić, czy konkretne inicjatywy środowiskowe (gospodarowanie odpadami, ochrona zasobów, oszczędność energii, redukcja emisji oraz kontrola zanieczyszczeń) wywierają istotny wpływ na wyniki finansowe. Badanie miało również na celu wniesienie wkładu w trwającą debatę na temat odpowiedzialności środowiskowej przedsiębiorstw oraz jej implikacji ekonomicznych. **Metody:** W badaniu zastosowano ilościowe podejście badawcze, do czego wykorzystano wtórne dane panelowe pochodzące z 15 notowanych przedsiębiorstw produkcyjnych w określonym okresie. Praktyki ujawniania informacji środowiskowych mierzono w pięciu komponentach: gospodarowanie odpadami, ochrona zasobów, oszczędność energii, redukcja emisji oraz kontrola zanieczyszczeń. Do potwierdzenia stacjonarności szeregu czasowego zastosowano test Levina–Lina–Chu. Macierz korelacji Pearsona wykorzystano do zbadania współzależności między zmiennymi. Analizę przeprowadzono za pomocą regresji danych panelowych z modelem efektów losowych (potwierdzonym testem mnożnika Lagrange'a według Breuscha–Pagana), opartym na teorii sygnalizacji jako ramie teoretycznej, w celu oszacowania wpływu praktyk środowiskowych na wyniki finansowe. W**yniki:** Badanie wykazało, że praktyki oszczędności energii, redukcji emisji oraz kontroli zanieczyszczeń znacząco poprawiały wyniki finansowe. Ochrona zasobów wykazała pozytywny, lecz mniej istotny wpływ. Gospodarowanie odpadami było natomiast negatywnie powiązane z wynikami finansowymi, co może sugerować potencjalną nieefektywność lub istotne koszty tych działań. **Wnioski:** Przedsiębiorstwa produkcyjne powinny priorytetowo traktować oszczędność energii, redukcję emisji oraz kontrolę zanieczyszczeń w swoich strategiach środowiskowych, aby poprawić długoterminowe wyniki finansowe oraz postrzeganie przez inwestorów. Zarekomendowano również strategiczny przegląd praktyk gospodarowania odpadami.

Słowa kluczowe: ujawnianie informacji środowiskowych, wyniki finansowe, przedsiębiorstwa produkcyjne, praktyki rozwoju zrównoważonego