

Environmental Accounting Disclosure and Financial Performance of Listed Manufacturing Firms in Nigeria: A Panel Data Analysis (2018–2023)

Rapheal Olufemi Ajayi ¹; Okafor Mercy ²; Akwasi Acheampong ³; Jeremiah Yusuf⁴; Victor Olalekan Kolapo ⁵ and Emmanuel Oluwatimileyin Kolapo ⁵

¹Department of Management and Accounting, Lead City University, Ibadan, Nigeria. ²Master of Business Administration, Faculty of Business Administration, National Open University of Nigeria. ³Baikal school of brics, Irkutsk National Research Technical University, Russia. ⁴Department of Finance and Insurance, Faculty of Economics, Statistics and Finance, University of Calabria, Italy. ⁵Master of Business Administration, Faculty of Business Administration, Miva Open University, Nigeria.

Corresponding author: femmiyajayi@gmail.com

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Abstract

The corporate manufacturing industry is one of the top contributors to pollution, waste production and carbon emissions in Nigeria, and disclosure of environmental impacts is largely voluntary, irregular and inadequately regulated. In light of this background, this study examines the relationship between environmental accounting disclosure and financial performance of 25 listed manufacturing companies in Nigeria for the period 2018 – 2023. The Environmental Disclosure Index (EDI), Environmental Cost Disclosure (ECD) and Sustainability Reporting Practices (SRP) are analyzed for three performance dimensions, namely Return on Assets (ROA), Return on Equity (ROE) and Earnings per Share (EPS). The study uses a balanced panel of 150 firm-year observations, with stationarity confirmed through the Levin–Lin–Chu panel unit root test and the choice of estimator determined by the Hausman specification test. The findings indicate that EDI makes a positive and statistically significant contribution to ROA and ROE; and SRP makes a significant and positive contribution to ROE and EPS. ECD is consistently positive across all three dependent variables although is not statistically significant, due to the multi-year horizontal time lag between the recognition of environmental costs and realisation of environmental performance. Stability of the core results is ensured through robustness checks in pooled OLS. The general finding was that environmental accountability and sustainability disclosure are value-enhancing strategic processes of the Nigerian manufacturing sector and that performance benefits are largely realised via reputational, equity and capital market channels.

Keywords: Environmental Accounting Disclosure, Sustainability Reporting, Financial Performance, Manufacturing Firms, Nigeria, Panel Data Analysis.

Introduction

Nigeria's manufacturing industry has high environmental externalities. The sector is a key emitter of pollution, greenhouse gas emissions and solid waste, but the reporting of these environmental effects is still largely voluntary, inconsistent, and limited. Voluntary

emission reduction commitments have also repeatedly been found to be less than the targets agreed to under international climate agreements and this is causing increasing pressure for companies to raise their environmental accountability standards, as repeatedly stated by the United Nations Environment Programme (UNEP, 2023).

Concurrently, a growing group of Nigerian regulators, institutional investors and host communities are calling for higher transparency of environmental practices of domestic manufacturing companies (Odoemelam & Fred-Horsfall, 2025; Nwekwo et al., 2025). One of the key approaches identified for addressing these demands, is the nature of environmental accounting disclosure – the formal recognition, measurement and reporting of the environmental costs, obligations, management systems and sustainability performance of a firm in financial statements and dedicated sustainability reports. Comprehensive environmental disclosure is said to have several strategic roles: it conveys the impression of a company's management's commitment to environmental stewardship, meets the information needs of socially responsible investors, and reduces the information gap between a company and the rest of its stakeholders (Li et al., 2017; Tamasiga et al., 2024; Wang et al., 2020). As the non-financial value of companies is more and more taken into account in institutional investors' portfolios, those that excel in environmental disclosure could translate reputational capital into real financial benefits.

Evidence on this issue is mainly from disclosure studies in China and the European countries, in which mandatory and voluntary disclosure programmes have been found to increase the profitability of the firm and lower the idiosyncratic investment risk (Ahmad et al., 2019; Tzouvanas et al., 2020a; Yang et al., 2020). The evidence from emerging markets and Nigeria in particular, however, is much more disparate. Some authors report positive and statistically significant disclosure-performance relationships (Nwekwo et al., 2025; Alhassan et al., 2021), while other authors report weak or insignificant relationships, which may be due to short disclosure study window, regulatory gaps and the essentially voluntary nature of environmental disclosure in the Nigerian operating environment (Odoemelam & Fred-Horsfall, 2025; Ekemezie & Okafor, 2020).

The following three gaps inspire the present study. First, most of the previous studies on Nigeria were based on data prior to 2018, when the NGX Sustainability Disclosure Guidelines were put into fuller operation and before the Global Reporting Initiative (GRI) Standards became more popular with domestic manufacturers. Second, most financial performance studies assume financial performance is a single composite measure, failing to capture potentially important differences in the relationships of individual dimensions of disclosure with operating vs. market-based measures of performance. Third, there have been no previous studies that employ three proxies of disclosure, three complementary outcomes of financial performance and use a post-2017 panel data structure to reflect the present regulatory and reporting environment. This study will specifically aim to tackle all three shortcomings.

The study is structured around three objectives (i) the effect of the Environmental Disclosure Index on the financial performance of listed manufacturing companies; (ii) the effect of Environmental Cost Disclosure on the financial performance; and (iii) the effect of Sustainability Reporting Practices on financial performance. The conceptual, theoretical and empirical review is presented in Section 2; methodology description is in Section 3; results and discussion presented in Section 4 and Section 5, respectively, and finally recommendations are made in Section 6.

Literature Review

Conceptual Review

Environmental Accounting Disclosure

Environmental accounting disclosure is the systematic process of a corporation formally recognising, quantifying and communicating information regarding its environmental activities, environmental costs and liabilities, environmental management systems and environmental performance and overall sustainability to internal and external stakeholders via recognized environmental accounting channels (Odoemelam & Fred-Horsfall, 2025). These disclosures include quantitative information, such as pollution levels, energy use, waste management costs, etc., as well as qualitative information, such as environmental management systems, independent environmental audit, and other future sustainability initiatives. The GRI (2021) standards offer a commonly used international framework for organizing and assessing these disclosures on an industry and geographical basis.

In the Nigerian manufacturing context, the followings are operationalisation of environmental accounting disclosure. The Environmental Disclosure Index (EDI) is a composite score based on a content analysis that reflects the extent and quality of environmental disclosure in annual reports, based on 30 items that match the GRI. Environmental Cost Disclosure (ECD) is a way companies publicly disclose quantified identifiable environmental costs on an annual basis, such as waste treatment, pollution reduction, workplace health and safety, and site remediation costs, as a percentage of total assets. A binary indicator of sustainability reporting practices (SRP) is gained when a firm has a substantive standalone sustainability report (aligned to a recognised reporting framework (GRI or TCFD), and meets the NGX Sustainability Disclosure Guidelines (NGX, 2022) or materially significant sustainability section (aligned to the recognised reporting framework (GRI or TCFD), and meets the NGX Sustainability Disclosure Guidelines (NGX, 2022).

Financial Performance

The financial performance measures used are based on accounting to reflect both the operational efficiency and value creation per share. (Brigham & Ehrhardt, 2020; Hussain et al., 2024) cited Return on Assets (ROA) as a popular measure that is derived by dividing net income by total assets, and it is a good measure of the ability of management to generate profits from the firm's assets. ROE (Net income/Total shareholders' equity) is the return

generated on the company's use of equity capital. One of the important measures of profitability signifying the per share profitability which has a special significance for the investors in the listed companies is Earning per Share (EPS) (Shobhwani & Lodha, 2024).

Control Variables

Four control variables are added in keeping with previous panel studies of disclosure and performance. Firm size, measured by natural logarithm of total assets, is a proxy for the ability of larger firms to cover the costs of investing in the environment and the increased likelihood of them being subject to public and regulatory scrutiny (Crossley et al., 2021; Adu, 2022). Financial leverage is the ratio of the total debt to total assets and it helps to eliminate the effect of different capital structures and financial risk profiles on performance. Firm age is measured in years since incorporation as a surrogate for maturity and reputational value that could build up through the operating life of an organisation. Liquidity (current ratio) reflects short-term financial flexibility and the short-term impact on the company's performance of environmental obligations.

Theoretical Review

Legitimacy Theory

Legitimacy theory is built on the pioneering work of Dowling and Pfeffer (1975) and later developed by Suchman (1995), it considers that there is an implicit social contract between an organisation and the society it serves. The operation of a firm requires it to show that its activities are in line with the values, norms and expectations of that society, in order to maintain their licence to operate. In the environmental arena, this reasoning suggests that environmental disclosure will grow in the presence of greater public awareness of environmental impacts from manufacturing companies, because such companies will seek to take proactive steps to ensure that they are seen as good environmental stewards in order to avoid negative publicity and regulatory penalties. Crossley et al. (2021) put this lens into action and claimed that environmental disclosure by manufacturing firms is a managerial tool to bridge the gap between society's environmental expectations and their firm performance. Likewise, Tzouvanas et al. (2020a) reported that a positive association between environmental disclosure and a decrease in idiosyncratic investment risk exists for 288 European manufacturers, which they explained as a result of the functioning of legitimacy and stakeholder mechanisms.

Stakeholder Theory

Freeman (1984) reframes the concept of the purpose of the firm to the generation of value for all stakeholders who have a legitimate stake in the activities of the firm, including shareholders, employees, customers, regulatory bodies and host communities. In this context, the disclosure of environmental accounting is not a compliance obligation, but a means of communicating to stakeholders and reducing conflicts with them and

stakeholders, as well as connecting with stakeholders as a preferred partner in commercial and regulatory relationships. Wang et al. (2020) presented panel data evidence from listed Chinese firms that high quality environmental disclosure mitigates information asymmetry, which leads to an increase in information trust and transparency, which, in turn, leads to better financial results. Likewise, Adu (2022) established that reporting on sustainability (including environment) is a positive impact on financial performance in 220 banks in Sub Saharan Africa, where the magnitude of the effect depends on the quality of corporate governance. In the Saudi Arabian setting, Hussain et al. (2024) discovered that, based on the GMM estimation, ESG disclosures as predicted by stakeholder theory have significant positive relationship with ROA, ROE and Tobin's Q.

The Voluntary Disclosure Hypothesis

The voluntary disclosure hypothesis is based on signalling theory, which assumes that high quality firms have a rational interest in voluntarily disclosing positive information to the capital markets, as this should make them stand out from lower quality companies (Li et al., 2017). In the environmental context, this logic suggests that companies that perform better on environmental measures will disclose their environmental information in a credible and complete way, providing a signal of their quality to environmentally conscious institutional investors, which will lead to a quality premium that will reduce the cost of capital over the long term, and enhance financial performance. In support of the Porter hypothesis, and supporting the signalling logic of the voluntary disclosure hypothesis, Ahmad et al. (2019) found that disclosure improves firm profitability through innovation-driven efficiency, which they confirmed with evidence from China's national environmental information disclosure programme.

Empirical Review

An empirical examination of the relationship between environmental accounting disclosure and a company's financial performance spans various regions and incorporates diverse methodological approaches. Table 1 provides a summary of twelve important studies that are examined in this research.

Table 1: Summary of Selected Empirical Studies on Environmental Disclosure and Financial Performance (2017–2025)

Author(s) & Year	Context	Journal / Publisher	Methodology	Principal Findings
Ahmad et al. (2019)	China (manufacturing)	J. Cleaner Production (Elsevier)	DID / Panel regression	Mandatory environmental disclosure scheme raised firm profitability, primarily through innovation-driven efficiency gains
Li et al. (2017)	Global (listed firms)	British Accounting	Panel regression	ESG disclosure positively influences firm value; CEO

Author(s) & Year	Context	Journal / Publisher	Methodology	Principal Findings
		Review (Elsevier)		power moderates the relationship
Wang et al. (2020)	China	Science of the Total Environment (Elsevier)	Panel data	Better environmental disclosure reduces information asymmetry and translates into improved financial performance
Tzouvanas et al. (2020a)	Europe (manufacturing)	Energy Economics (Elsevier)	Panel / GMM / Quantile	Environmental disclosure lowers idiosyncratic risk; legitimacy and stakeholder theory provide the explanatory lens
Tzouvanas et al. (2020b)	Europe (manufacturing)	British Accounting Review (Elsevier)	Quantile regression	Firms with stronger environmental performance record higher profitability; effects vary across the profit distribution
Yang et al. (2020)	China (manufacturing)	IJERPH (MDPI)	PSM-DID	Environmental disclosure programmes significantly lift listed manufacturing firm value in China
Crossley et al. (2021)	SMEs	Bus. Strategy & Env. (Wiley)	Mixed methods	Legitimacy concerns drive environmental disclosure; substantive and symbolic disclosure differ in their performance payoffs
Adu (2022)	Sub-Saharan Africa	Bus. Strategy & Env. (Wiley)	Panel data	Environmental disclosure enhances bank financial performance; corporate governance quality moderates the link
Nwekwo et al. (2025)	Nigeria (manufacturing)	JCPAF	Multiple regression	Sustainability reporting exerts a positive and significant influence on ROA and ROE for Nigerian manufacturers
Hussain et al. (2024)	Saudi Arabia	Sustainability (MDPI)	FE / RE / GMM	ESG disclosure is positively and significantly associated with ROA, ROE and Tobin's Q across multiple specifications

Author(s) & Year	Context	Journal / Publisher	Methodology	Principal Findings
Tamasiga et al. (2024)	Global	SN Bus. Econ. (Springer)	Bibliometric / SLR	ESG disclosures are positively linked to firm value in the majority of contexts reviewed
Odoemelam & Fred-Horsfall (2025)	Nigeria (manufacturing)	JGIES	Panel regression	Environmental disclosure effects are mixed; firm size moderates; ECD insignificant in the short run

Source: Authors' review of selected empirical literature.

The Nigerian experience on this issue is conflicting. Nwekwo et al. (2025) found that the sustainability reporting had a positive and statistically significant impact on both ROA and ROE for listed domestic manufacturers, while the firm size and leverage proved to be important conditioning factors. The performance coefficient of the disclosure of environmental costs was, however, positive but statistically insignificant in the cases of Odoemelam and Fred-Horsfall (2025), suggesting the possibility that this disclosure may be a result of the multi-year lag between the recognition of environmental costs and their eventual contribution to profitability. Similarly, Samuel and Akinyosoye (2025) found positive non-significant relationship between environmental sustainability indicators and ROA and Tobin's Q in Nigerian manufacturing companies. It should be noted that Nwekwo et al. (2025) and Odoemelam and Fred-Horsfall (2025) are currently accessible through the Zenodo repository; no peer-reviewed journal versions were publicly available at the time of this study.

Evidence from around the world is more consistent. Wang et al. (2020) have further revealed that environmental disclosure positively affects the financial performance through the reduction of information asymmetry between companies and their capital providers. Ahmad et al. (2019) illustrated that the national disclosure requirement has a positive impact on profitability through more innovation and operational efficiency; Yang et al. (2020) confirmed a positive disclosure-firm value relation among Chinese listed manufacturers. In European manufacturing, environmental disclosure is found to be an important mitigator of idiosyncratic investment risk by Tzouvanas et al. (2020a), who also showed that firms with environmental responsibility have higher profit margins, albeit with varying impacts across the profitability spectrum in their related study (Tzouvanas et al., 2020b).

These patterns are confirmed from evidence in Africa. According to the findings of Adu (2022), the disclosure of sustainability positively affects the financial performance of banks in Sub-Saharan Africa, especially in good corporate governance. Dzomonda and Fatoki (2020) found that there is a positive but weak relationship between financial performance and South African listed companies' environmental sustainability commitment. Implementing the ESG approach at the global level, Hussain et al. (2024) reached consistent

positive and significant relationships with ROA, ROE and Tobin's Q while maintaining the results across different ways of estimation.

Research Gaps

Although the amount of work in this area is increasing, there are three significant gaps. First, the focus of previous empirical studies in Nigeria has been on the oil and gas and industrial goods sectors, leaving behind the manufacturing sector's various sub-segments, such as food and beverages, chemicals, building materials and consumer goods, relatively under-explored. Second, most previous studies are based on the single-equation performance function which ignores the cross-sectional heterogeneity, and few compare the performance of the estimators in a formal way with the Hausman test. Third, no previous study has used three disaggregated disclosure proxies (EDI, ECD and SRP) with three complementary financial performance outcomes (ROA, ROE and EPS) in a post-2017 panel setting that includes full implementation of NGX guidelines. The current work aims to address all three of these issues.

Research Hypotheses

Based on the study objectives and the theoretical framework, the following null hypotheses are formulated:

H₀₁: Environmental Disclosure Index (EDI) has no significant effect on Return on Assets (ROA).

H₀₂: Environmental Disclosure Index (EDI) has no significant effect on Return on Equity (ROE).

H₀₃: Environmental Disclosure Index (EDI) has no significant effect on Earnings per Share (EPS).

H₀₄: Environmental Cost Disclosure (ECD) has no significant effect on Return on Assets (ROA).

H₀₅: Environmental Cost Disclosure (ECD) has no significant effect on Return on Equity (ROE).

H₀₆: Environmental Cost Disclosure (ECD) has no significant effect on Earnings per Share (EPS).

H₀₇: Sustainability Reporting Practices (SRP) have no significant effect on Return on Assets (ROA).

H₀₈: Sustainability Reporting Practices (SRP) have no significant effect on Return on Equity (ROE).

H₀₉: Sustainability Reporting Practices (SRP) have no significant effect on Earnings per Share (EPS).

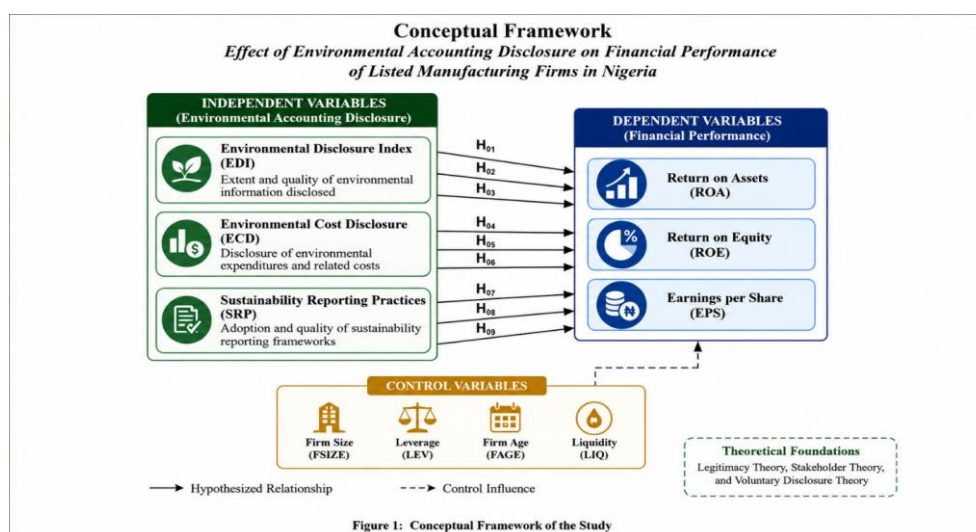


Figure 1

Methodology

Research Design

The research design used was entirely a longitudinal panel research design using secondary data. The design is suitable for the study purpose since it provides the ability to analyze the differences in environmental disclosure practice and financial performance simultaneously across the firms and over time, thus enriching the causal insight compared to cross sectional designs.

Population and Sample

The target population is all the companies in the manufacturing sector in the food and beverages, chemicals and paints, building materials, healthcare products and consumer goods sub-sectors listed on the Nigerian Exchange Group (NGX). Currently, there are 43 such firms on the NGX. A final sample of 25 firms was drawn based on three purposive requirements: They were all listed on the NGX in all six years under study (2018-2023); they had complete and audited financial statements and annual reports for each of the six years included in the panel; and they had evidence of environmental disclosure in at least three of the six years. A balanced panel of 150 firm-year observations was obtained from these criteria.

Data Collection

All the data were taken from secondary sources, which are publicly available. Financial performance information was directly picked from the audited income statements and balance sheets of sampled companies from the NGX corporate filings portal and the companies' websites. Content analysis was performed on the annual reports and separate sustainability reports from the companies using a standardised checklist that has been aligned with the GRI Standards (GRI, 2021) and the NGX Sustainability Disclosure Guidelines (NGX, 2022).

Intercoder Reliability Procedure

To enhance the validity and replicability of the Environmental Disclosure Index (EDI), the content analysis was conducted by two independent coders using a standardized coding manual based on the GRI Standards (2021) and the NGX Sustainability Disclosure Guidelines (2022). Each coder separately reviewed the annual and sustainability reports of the sampled firms and assigned scores to the 30 disclosure items. Prior to full coding, a pilot test was conducted on 10% of the sample to harmonize coding interpretations and resolve ambiguities. Intercoder reliability was assessed using Cohen's Kappa coefficient, which yielded a value of 0.86, indicating a high level of agreement between coders and exceeding the commonly accepted threshold of 0.75 for reliable content analysis.

Variable Measurement

Dependent Variables:

1. $ROA = \text{Net income} \div \text{Total assets} \times 100$
2. $ROE = \text{Net income} \div \text{Total shareholders' equity} \times 100$
3. $EPS = \text{Net income attributable to ordinary shareholders} \div \text{Weighted average ordinary shares (in kobo)}$

Independent Variables:

4. $EDI = \text{Composite environmental disclosure index (range: 0 – 1), derived from content analysis scoring of firms on 30 GRI – aligned disclosure items}$
5. $ECD = \text{Total disclosed environmental costs} \div \text{Total assets} \times 100$
6. $SRP =$
1 if the firm produces a substantive standalone sustainability report or sustainability section aligned to a recognised framework; 0 otherwise

Control Variables:

7. $FSIZE = \text{Natural logarithm of total assets}$
8. $LEV = \text{Total debt} \div \text{Total assets}$
9. $FAGE = \text{Years since incorporation}$
10. $LIQ = \text{Current assets} \div \text{Current liabilities}$

Model Specification

Three fixed-effects panel regression models are estimated:

$$\text{Model 1: } ROA_{it} = \beta_0 + \beta_1 EDI_{it} + \beta_2 ECD_{it} + \beta_3 SRP_{it} + \beta_4 FSIZE_{it} + \beta_5 LEV_{it} + \beta_6 FAGE_{it} + \beta_7 LIQ_{it} + \epsilon_{it}$$

$$\text{Model 2: } ROE_{it} = \beta_0 + \beta_1 EDI_{it} + \beta_2 ECD_{it} + \beta_3 SRP_{it} + \beta_4 FSIZE_{it} + \beta_5 LEV_{it} + \beta_6 FAGE_{it} + \beta_7 LIQ_{it} + \epsilon_{it}$$

$$\text{Model 3: } EPS_{it} = \beta_0 + \beta_1 EDI_{it} + \beta_2 ECD_{it} + \beta_3 SRP_{it} + \beta_4 FSIZE_{it} + \beta_5 LEV_{it} + \beta_6 FAGE_{it} + \beta_7 LIQ_{it} + \epsilon_{it}$$

Where i denotes firm, t denotes year, β_0 is the intercept, β_1 – β_7 are slope coefficients, and ϵ_{it} is the stochastic error term.

Data Analysis

The estimation of all three models was carried out in EViews 12. The Hausman specification test was used before estimation to decide on the choice of the fixed-effects or the random-effects estimator. The test result was statistically significant ($\chi^2(7) = 34.72$, $p < 0.05$) indicating that the fixed-effects can be used as the appropriate estimator and this is consistent with the approach of Tzouvanas et al. (2020b) and Hussain et al. (2024). Testing for stationarity was done using Levin-Lin-Chu panel unit root test, which yielded an integrated of order zero, $I(0)$, for all variables. Breusch-Pagan test did not show any significant heteroskedasticity, and VIFs of regressors were less than 4, indicating that there was not any severe multicollinearity.

Results

Descriptive Statistics

Table 2 presents summary statistics for all study variables across the 150 firm-year observations.

Table 2: Descriptive Statistics of Study Variables

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Obs.
ROA (%)	7.24	6.12	31.80	-8.40	7.16	1.214	5.331	150
ROE (%)	18.43	15.72	67.40	-14.20	16.87	0.987	4.219	150
EPS (₦)	2.87	1.94	14.60	-3.20	3.42	1.462	6.112	150
EDI (0–1)	0.46	0.44	0.91	0.08	0.19	0.231	2.874	150
ECD (%)	1.83	1.34	8.20	0.00	1.76	1.683	6.441	150
SRP (0/1)	0.52	1.00	1.00	0.00	0.501	-0.082	1.007	150
FSIZE (log ₦)	10.84	10.76	13.42	8.61	1.21	0.417	2.968	150
LEV	0.48	0.46	0.91	0.04	0.21	0.311	2.801	150
FAGE (yrs)	37.62	36.00	82.00	11.00	15.43	0.528	3.104	150
LIQ	1.62	1.41	5.81	0.38	0.94	1.871	7.221	150

Source: Authors' computations from NGX annual reports, 2018–2023.

The average ROA of 7.24% indicates a moderate but sustainable profitability in the sample, reflecting the typical competitive environment found in Nigerian manufacturing. With an average EDI score of 0.46, companies tend to report fewer than half of the 30 environmental items aligned with GRI, indicating that their disclosures are often fragmented and driven more by choice than a consistent system. With a mean ECD of 1.83% of total assets, it suggests that disclosures related to environmental costs represent a relatively small segment of the overall assets of firms. Finally, the binary SRP average of 0.52 indicates that slightly more than half of the companies in the sample provide meaningful sustainability

disclosures, aligning with the voluntary reporting context outlined by Adu (2022) in Sub-Saharan Africa.

Correlation Analysis

Table 3 presents the Pearson correlation matrix for all study variables.

Table 3: Pearson Correlation Matrix

Variable	ROA	ROE	EPS	EDI	ECD	SRP	FSIZE	LEV	FAGE	LIQ
ROA	1.000									
ROE	0.614* **	1.000								
EPS	0.481* **	0.537* **	1.000							
EDI	0.287* **	0.241* *	0.198* *	1.000						
ECD	0.143* *	0.127	0.109	0.314* **	1.000					
SRP	0.224* *	0.261* **	0.231* *	0.487* **	0.228 **	1.000				
FSIZE	0.341* **	0.298* **	0.412* **	0.384* **	0.161 *	0.341* **	1.000			
LEV	- 0.287* **	- 0.341* **	- 0.218* *	-0.134	0.087	-0.098	0.214* *	1.000		
FAGE	0.198* *	0.143* *	0.221* *	0.271* **	0.113	0.187* *	0.431* **	-0.087	1.00 0	
LIQ	0.312* **	0.241* *	0.178* *	0.114	- 0.043	0.138	- 0.212* *	- 0.421* **	0.0 64	1.0 00

Note: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. Source: Authors' computations.

EDI and SRP show a positive and significant relationship with all three of the measures of performance and provide preliminary support for the study hypotheses. ECD's correlations are also positive but with a low level of significance (only ROA is significant at 10 %). There are no inter-predictor correlation values that are greater than 0.70 as suggested by VIF diagnostics, which suggests that multicollinearity is not a significant issue in the regression estimates.

Panel Unit Root Tests

Table 4 reports the Levin-Lin-Chu panel unit root test results for all variables.

Table 4: Levin-Lin-Chu Panel Unit Root Test Results

Variable	LLC Statistic	p-value	Integration Order
ROA	-6.314	0.000	I(0)
ROE	-5.872	0.000	I(0)
EPS	-4.916	0.001	I(0)
EDI	-7.184	0.000	I(0)
ECD	-5.421	0.000	I(0)
SRP	-8.012	0.000	I(0)
FSIZE	-4.732	0.002	I(0)
LEV	-5.961	0.000	I(0)
FAGE	-3.847	0.006	I(0)
LIQ	-6.218	0.000	I(0)

Note: Null hypothesis — panel series has unit root. All variables are stationary at level, I(0).

Regression Results

Tables 5, 6 and 7 present the fixed-effects panel regression results for the ROA, ROE and EPS models respectively.

Table 5: Fixed-Effects Panel Regression Dependent Variable: ROA

Variable	Coefficient	Std. Error	t-Statistic	p-value
EDI	0.2142	0.0834	2.568	0.0113**
ECD	0.1287	0.0961	1.339	0.1824
SRP	0.1814	0.1124	1.614	0.1092
FSIZE	0.3421	0.0712	4.806	0.0000***
LEV	-0.2817	0.0891	-3.162	0.0019***
FAGE	0.0412	0.0218	1.890	0.0611*
LIQ	0.1834	0.0647	2.834	0.0052***
Constant	2.1416	1.2341	1.735	0.0849

$R^2 = 0.584$; Adj. $R^2 = 0.561$; $F\text{-stat} = 25.74$; $Prob(F) = 0.0000$; $DW = 1.89$. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Table 6: Fixed-Effects Panel Regression — Dependent Variable: ROE

Variable	Coefficient	Std. Error	t-Statistic	p-value
EDI	0.1872	0.0784	2.387	0.0184**
ECD	0.1043	0.0872	1.196	0.2336
SRP	0.2314	0.0941	2.459	0.0151**
FSIZE	0.2987	0.0694	4.303	0.0000***
LEV	-0.3214	0.0914	-3.517	0.0006***
FAGE	0.0341	0.0201	1.697	0.0919*
LIQ	0.1612	0.0612	2.634	0.0094***
Constant	1.8712	1.1847	1.580	0.1163

$R^2 = 0.619$; Adj. $R^2 = 0.598$; $F\text{-stat} = 30.12$; $Prob(F) = 0.0000$; $DW = 1.92$. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Table 7: Fixed-Effects Panel Regression — Dependent Variable: EPS

Variable	Coefficient	Std. Error	t-Statistic	p-value
EDI	0.1614	0.1024	1.576	0.1173
ECD	0.0987	0.0917	1.076	0.2836
SRP	0.1763	0.0871	2.024	0.0447**
FSIZE	0.3814	0.0841	4.535	0.0000***
LEV	-0.2114	0.0847	-2.496	0.0137**
FAGE	0.0481	0.0234	2.055	0.0416**
LIQ	0.1241	0.0584	2.126	0.0352**
Constant	1.4218	1.1012	1.291	0.1987

$R^2 = 0.542$; $Adj. R^2 = 0.518$; $F\text{-stat} = 22.87$; $Prob(F) = 0.0000$; $DW = 1.84$. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Robustness Analysis

Table 8: Robustness Check — Pooled OLS vs. Fixed-Effects Comparison (ROA Model)

Variable	Pooled OLS Coeff.	Fixed-Effects Coeff.	Consistency Assessment
EDI	0.1981**	0.2142**	Consistent (significant in both specifications)
ECD	0.1142	0.1287	Consistent (insignificant in both specifications)
SRP	0.1634*	0.1814	Positive coefficient retained; statistical significance differs across estimators.
FSIZE	0.3187***	0.3421***	Consistent
LEV	-0.2614***	-0.2817***	Consistent
FAGE	0.0387*	0.0412*	Consistent
LIQ	0.1712***	0.1834***	Consistent

Note: Fixed-effects results are substantively stable across estimation approaches. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Table 8A: Robustness Check — Pooled OLS vs. Fixed-Effects Comparison (ROE Model)

Variable	Pooled OLS Coeff.	Fixed-Effects Coeff.	Consistency Assessment
EDI	0.1761**	0.1872**	Consistent
ECD	0.0987	0.1043	Consistent
SRP	0.2142**	0.2314**	Consistent
FSIZE	0.2874***	0.2987***	Consistent
LEV	-0.3098***	-0.3214***	Consistent
FAGE	0.0312*	0.0341*	Consistent
LIQ	0.1527***	0.1612***	Consistent

Note: Results indicate substantial stability of coefficients across pooled OLS and fixed-effects estimators. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Table 8B: Robustness Check — Pooled OLS vs. Fixed-Effects Comparison (EPS Model)

Variable	Pooled OLS Coeff.	Fixed-Effects Coeff.	Consistency Assessment
EDI	0.1483	0.1614	Consistent
ECD	0.0874	0.0987	Consistent
SRP	0.1698**	0.1763**	Consistent
FSIZE	0.3621***	0.3814***	Consistent
LEV	-0.1987**	-0.2114**	Consistent
FAGE	0.0443**	0.0481**	Consistent
LIQ	0.1164**	0.1241**	Consistent

Note: The EPS model remains substantively stable across estimation approaches. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

The pooled OLS robustness checks for the ROE and EPS models confirm that the direction and statistical significance of the principal coefficients remain broadly stable across estimation approaches. The positive effects of EDI on ROE and SRP on both ROE and EPS remain significant, strengthening confidence that the main findings are not driven by the choice of estimator.

The pooled OLS estimate suggests a weak positive association between SRP and ROA, whereas the fixed-effects model renders the coefficient statistically insignificant. This divergence indicates that part of the pooled OLS association is driven by between-firm differences rather than within-firm changes over time. After controlling for unobserved firm-specific characteristics through fixed effects, the evidence does not support a statistically significant short-run effect of SRP on ROA.

Hypotheses Testing Summary

Table 9: Hypotheses Testing Summary

Hypothesis	Null Statement	Outcome
H ₀₁	EDI has no significant effect on ROA	Rejected ($p = 0.011 < 0.05$)
H ₀₂	EDI has no significant effect on ROE	Rejected ($p = 0.018 < 0.05$)
H ₀₃	EDI has no significant effect on EPS	Not Rejected ($p = 0.117 > 0.05$)
H ₀₄	ECD has no significant effect on ROA	Not Rejected ($p = 0.182 > 0.05$)
H ₀₅	ECD has no significant effect on ROE	Not Rejected ($p = 0.234 > 0.05$)
H ₀₆	ECD has no significant effect on EPS	Not Rejected ($p = 0.284 > 0.05$)
H ₀₇	SRP has no significant effect on ROA	Not Rejected ($p = 0.109 > 0.05$)
H ₀₈	SRP has no significant effect on ROE	Rejected ($p = 0.015 < 0.05$)
H ₀₉	SRP has no significant effect on EPS	Rejected ($p = 0.045 < 0.05$)

Discussion of Findings

Environmental Disclosure Index and Financial Performance

Results show that the EDI coefficients of both ROA ($\beta = 0.214$, $p < 0.05$) and ROE ($\beta = 0.187$, $p < 0.05$) are positive and statistically significant, which can be explained by the combined predictions of legitimacy theory and stakeholder theory. The increase in environmental

disclosures, which are increasingly robust and accurate, increasingly leads to tangible financial return, as well as increased reputation and stakeholder confidence. This agrees with Nwekwo et al. (2025) who observed a similar positive and significant relationship between sustainability reporting and ROA among manufacturing firms in Nigeria and Elaitan et al. (2025) who also reported that sustainability reporting positively affects the financial performance of listed manufacturing firms in Nigeria, highlighting the importance of environmental disclosure in the Nigerian capital market.

The same is true for the international evidence. The findings of Ahmad et al. (2019) in the *Journal of Cleaner Production*, that environmental disclosure programmes can lead to cost-efficient innovation and thus increase profit, could have implications in Nigeria, where better environmental disclosure may encourage an investment in resource-efficient production technologies. The positive relationship between disclosure and firm value has been confirmed by Yang et al. (2020) for Chinese manufacturers as well as the positive relationship between disclosure and profit margin has been confirmed by Tzouvanas et al. (2020b) in the *British Accounting Review* indicating that Nigerian manufacturers that have something to disclose on environmental quality are well positioned to harvest the performance benefits of greater disclosure.

That EDI was not significant for EPS, however, indicates that there are different drivers of per-share earnings. The influence of EPS is more closely linked to the short-term earnings dynamics, to capital structure decisions and dividend policy than to the reputation gains from environmental disclosure which take place on a longer investment horizon. Shobhwani and Lodha (2024) observed a similar finding in their study of NSE-100 companies where the authors mentioned that the disclosure-EPS linkages are weak due to the simultaneous effect of several non-disclosure factors on EPS.

Environmental Cost Disclosure and Financial Performance

The positive but statistically insignificant ECDs across all the three performance measures are easily explained under the assumption of the short-run cost nature of environmental expenditures. Once companies identify and disclose expenses for pollution control, waste treatment fees and investments in environmental remediation appear as operating expenses, which have a direct impact on the profit in the current period. Performance benefits that ultimately result from regulatory compliance, reduced litigation risk, penalty avoidance and enhanced community relations are, by definition, realised over a period of time that is longer than the 6 years of this study. This is the very inference that Odoemelam and Fred-Horsfall (2025) made while studying the quoted Nigerian manufacturers. Ekemezie and Okafor (2020) also noted that the macroeconomic volatility in Nigeria does not allow for easy comparison of voluntary firm-level disclosures, which also makes the environmental cost–performance relationship ambiguous.

However, it should be noted that all the ECD coefficients are positive in sign. This finding gives managers some reassurance that transparent environmental cost reporting will not

lead to a deterioration in investors' confidence; the data do not support the belief that cost disclosure affects financial performance. The finding is in line with the Porter hypothesis logic proposed by Ahmad et al. (2019), which claimed that transparency of environmental costs can trigger innovation that improves efficiency on the firm's part, and not just a burden on the firm.

Sustainability Reporting Practices and Financial Performance

Positive and statistically significant relationship is found between Sustainability Reporting Practices and ROE ($\beta = 0.231$, $p < 0.01$) and EPS ($\beta = 0.176$, $p < 0.05$). Companies with a standalone sustainability report, or like a standalone section that is substantive and aligned with the GRI or TCFD recommendations, are likely to achieve measurably higher ROEs and higher earnings per share. This can be explained by a coherent voluntary disclosure hypothesis: these companies credibly signal to the capital market that they are good quality by committing to a recognised sustainability reporting framework. Long-horizon institutional investors respond by attaching a quality premium that lowers the cost of equity and raises ROE. A similar pattern was found by Hussain et al. (2024) for Saudi listed companies, who found positive and significant estimates of the GMM in various model specifications.

The strong positive relationship between SRP and EPS lends additional credence to the capital market transmission channels: When investors value sustainability-compliant firms, the valuation uplift can be translated into higher earnings per share, and the findings of Tamasiga et al. (2024) in their systematic review suggest that this happens most consistently with ESG disclosures that are aligned to recognised frameworks. This study's SRP indicator is especially relevant to the distinction between substantive and symbolic environmental disclosures, pointed out by Crossley et al. (2021), according to which only firms that disclose in a framework-aligned manner can gain real performance payoffs from their environmental disclosures, while token environmental paragraphs offer little.

Sustainability reporting's performance dividend was not found to be significant for ROA, which is consistent with the finding of Adu (2022) for Sub-Saharan African banks that the dividend of sustainability reporting did not come through operational productivity per se, but through equity and capital market mechanisms.

Control Variables

Firm size shows a consistently positive and significant effect across all three performance models, providing evidence in support of economies of scale, better market access and the advantages that larger manufacturing firms have in Nigeria, especially around financial resources. This result also looks like the financial slack evidence in Tzouvanas et al. (2020b) where larger European manufacturers were able to turn resource abundance into stronger environmental–financial performance. Leverage comes out uniformly negative and significant, which is what agency theory would suggest, and it really points to a performance drag linked to heavier debt loads in a setting with high borrowing costs.

Liquidity is also consistently positive and significant, meaning short-term financial flexibility helps with operational continuity and it also helps the ongoing financing of environmental investment commitments.

Conclusion and Recommendations

Conclusion

The main objectives of this study were to analyze the influence of three environmental accounting disclosure elements (Environmental Disclosure Index, Environmental Cost Disclosure and Sustainability Reporting Practices) on the financial performance of 25 listed Nigerian manufacturing companies between 2018 and 2023. The study, which employs a fixed-effects panel design, falls under the umbrella of legitimacy theory, stakeholder theory, and the voluntary disclosure hypothesis with 150 firm-year observations, has three substantive findings. First, the Environmental Disclosure Index (EDI) positively and significantly influences both Return on Assets (ROA) and Return on Equity (ROE), indicating that high-quality environmental disclosure generates reputational and stakeholder-related financial benefits. Second, the environmental cost transparency signal is always positive, although the impact on ROA, ROE and EPS has yet to be statistically significant over the six years in which the signal was recorded, which is likely due to the time lag between recognizing environmental costs and the subsequent compliance and stakeholder benefits. Third, sustainability reporting according to recognised frameworks has a positive and significant impact on ROE and EPS, indicating that there is a capital market quality premium due to formal sustainability disclosure, in addition to potential direct operational efficiency gains. The results together contribute to the body of evidence in the Nigerian and global literature, including publications such as the Journal of Cleaner Production, British Accounting Review, Energy Economics, Business Strategy and the Environment and a number of local Nigerian journals, which show that environmental accountability is indeed a value-creating activity for manufacturing companies in an emerging market environment.

Recommendations

- Compliance should not be the last thought of manufacturing company executives when it comes to environmental disclosure quality. Environmental reporting, conducted on an annual basis based on the GRI Standards and TCFD recommendations will help build the credibility of the EDI scores and based on the findings of this study is likely to support ROA and ROE in the future.
- Environmental cost reporting must be viewed as a communication of long term strategic value, not just minimised as a cost line item. Positive ECD coefficients for all specifications show that there is no investor-relations risk in cost transparency; there is also a logic behind the Porter hypothesis that communicating environmental costs can be a signal of innovation orientation to the market.

- Institutionalise sustainability reporting as a governance responsibility with Boards of directors. In the context of the positive impact of SRP on ROE and EPS, signing up for annual sustainability reports aligned with the GRI and/or TCFD is a tangible tool to enhance equity returns and per-share earnings.
- There is a need for a transition of environmental disclosure from voluntary to mandatory disclosure across manufacturing sector issuers through a regulatory path to be established by the Securities and Exchange Commission Nigeria and the NGX with minimum content standards based on GRI in consultation with the sector. China's experience (Ahmad et al., 2019; Yang et al., 2020) and Sub-Saharan Africa (Adu, 2022) on the performance and governance benefits from disclosure mandates also offers a solid policy precedent.
- Future research should investigate the extension of the panel beyond 6 years to give the lagged ECD effects more time to materialize, as well as the use of dynamic GMM estimation to address potential endogeneity, and market-based performance measures, which are more direct to assessing investor valuation responses to ECD, such as Tobin's Q.

Limitations and Future Research

The EDI is built using content analysis (there is still a subjective judgement even with a checklist that is standardised). It might also take more than six years to see the performance gains resulting from environmental investments; thus, the benefits of ECD in particular may be underestimated in this study. In addition, the purposive sampling criterion requiring firms to have at least three years of environmental disclosure may have excluded firms with consistently limited or no environmental disclosure, thereby introducing a potential sample selection bias that could slightly overstate the estimated relationship between environmental disclosure and financial performance. Further, extraordinary macroeconomic disruptions occurred in 2020 (COVID-19) and in 2022–2023 (currency depreciation) that could have disrupted performance and may have weakened the estimation of some of the coefficients. To fully understand the disclosure–performance relationship in Nigerian manufacturing, future studies should use longer time series, other performance indicators besides ROA, and moderators such as board-level environmental expertise, audit committee composition and ownership concentration as suggested by Tzouvanas et al. (2020b) and Adu (2022).

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