

ENVIRONMENTAL ACCOUNTING COST AND RETURN ON ASSETS OF SELECTED LISTED FAST-MOVING CONSUMER GOODS IN NIGERIA

OJEDELE Mofoluwaso Iyabode (PhD)

Department of Accounting, Faculty of Management Sciences,

Redeemer's University, Ede

ORCID ID: 0000-0003-3066-1646

ojedelem@run.edu.ng

08030677028

ABSTRACT

The pressure on companies' sustainability and discussions about the profitability of environmental investments are increasing. But there is not yet much empirical evidence on the relationship between the individual elements of environmental cost and financial performance and the results are inconsistent and vary by sector. The impact of environmental accounting costs on Return on Assets (ROA) of listed Fast-Moving Consumer Goods (FMCG) companies in Nigeria was investigated using Waste Management Cost (WMC), Community Development Cost (CDC) and Employee Health and Safety Cost (EHSC) as proxies for environmental accounting costs. An ex post facto research design was employed and panel data for the period 2014 to 2024 was used. The robust version of Least Squares (RLS) and Random Effects regression method were used to deal with the outliers and heteroscedasticity, and the Hausman test ($p = 0.3244$) was used to select the model. The results revealed that WMC had a negative and significant effect on ROA ($\beta = -0.3764$, $z = -2.0569$, $p = 0.0397$), CDC had a strong positive and highly significant effect ($\beta = 1.0849$, $z = 9.8396$, $p = 0.0000$), while EHSC showed a negative but statistically insignificant effect ($\beta = -0.0893$, $p = 0.2275$). The overall significance ($p < 0.01$) and strong explanatory power ($R^2 = 0.8239$; 0.9451) were acquired by models. The study found that environmental costs affect the profitability in mixed ways: the community development increases ROA while the waste related costs decrease ROA. Streamlining environmental spending, as well as developing better sustainability reporting systems were suggested, to increase transparency and financial returns.

Keywords: Community development cost; Environmental accounting; FMCG firms; Return on Assets; Waste management cost

Wordcount: 255

1. INTRODUCTION

Financial performance is a key measure for the viability, competitiveness and value generation of the organizations in the Fast-Moving Consumer Goods (FMCG) industry, especially in emerging economies where companies are under increasing pressure to be profitable while being environmentally responsible. Environmental accounting has recently become recognized as a strategic tool for firms to recognize, quantify and report environmental costs and benefits of their activities. Environmental accounting is not just a compliance exercise, but also a tool to improve

operational efficiency, optimize resources, minimize risks, and boost long-term financial results. The increased focus on Environmental, Social and Governance (ESG) principles and the Triple Bottom Line approach has also strengthened the need to consider the environment in company decision making. There is empirical evidence that environmental accounting practices can increase profitability by better using resources, boosting corporate image and providing better access to sustainable finance. For example, gross profit margins of manufacturing companies in Indonesia were found to be significantly improved by the implementation of MFCA by the companies (Amin et al., 2025), and transparent environmental reporting was found to have a positive effect on ROA by drawing environmentally responsible investors and lowering regulatory expenses (Alshehadeh et al., 2025). Likewise, Ibrahim et al. (2023); Osaloni and Oso (2023); and Odoemelam and Fred-Horsfall (2025) noted positive relationship between environmental accounting disclosures and financial performance in developing countries for manufacturing firms. The FMCG industry is a very significant sector in the Nigerian economy and therefore, the role of environmental accounting on financial performance is of immense importance to the management, investors and policy makers who are interested in sustainable growth of the industry.

However, there are still some gaps in literature that need to be addressed as to the extent to which environmental accounting practices translate to superior financial outcomes within the Nigeria FMCG companies. Previous research mostly focuses on general manufacturing sectors or environmental disclosure or aggregate ESG reporting, with little research on the specific dimensions of environment accounting that affect the financial performance of FMCG companies (Ibrahim et al., 2023; Osaloni & Oso, 2023; Mgilane et al., 2025). Moreover, previous studies are inconclusive as some have concluded that profitability benefits outweigh costs of environmental investments, while others have indicated that environmental investments cause a short-term negative impact on the value of the firm. Most relevantly, the existing literature has largely failed to examine the relationship of environmental cost disclosures, waste management costs, pollution-control investments, and circular economy initiatives to the financial performance metrics in the Nigerian FMCG context. This is significant given the fact that many firms still view environmental accounting as a regulatory requirement, rather than a means of creating value and managing resources efficiently (Oni, 2025; Ijing et al., 2024). As a result, there is a lack of empirical data to inform managerial decisions and policy action on the financial consequences of accounting for the environment in the sector. In order to fill this gap, this study focuses on the impact of environmental accounting on the financial performance of listed FMCG companies in Nigeria, with a particular focus on the impact of the disclosure of environmental costs, waste management accounting practices, pollution-control expenses and environmental sustainability investments on the financial performance indicators. The study aims to give empirical evidence that can assist in guiding sustainable industrial development policies and strategies in Nigeria as well as corporate policies on sustainable development.

2.0 LITERATURE REVIEW

2.1 Environmental Cost

Environmental cost is a multi-dimensional accounting concept that is applied to represent the total economic cost that an organization incurs to manage, prevent or rectify the ecological effects of

its industrial processes. The conception of environmental cost, which initially did not exist but was merely the cost of clean-up operation, has changed in the Nigerian context and has taken the shape of a strategic investment of sustainability. As manufacturers strive towards carbon pricing and Net-Zero targets, environmental costs are proven by Obi et al. (2024) to include internal costs of pollution prevention, monitoring and abatement. Moreover, Obi et al (2024) have suggested that the carbon price of operations to be paid must be included in the cost of doing business by Nigerian manufacturers; given the requirement of the global Net-zero, this cost must be reflected in their cost.

The theoretical significance of environmental cost is the fact that it will help to alleviate information asymmetry between a company and its stakeholders. According to Guo et al. (2019), if companies break down these costs into the general administrative overhead, then they are hopeful that they will be able to shed light on their resource efficiency. The concept of environmental costs has been transformed into financial risks associated with sustainability as indicated by Migliorelli (2023) and this was brought about by the recent introduction of the guidelines by the Financial Reporting Council of Nigeria (FRC) through the International Sustainability Standards Board (ISSB). It means that cost is not just a liability of the income statement any more but a measure of the long-term viability and secure standing of a company. This is a missing money link between industrial output and environment protection which if well employed, can ideally place environmental cost in the manufacturing industry and this is one of the most important variables that can help in determining the actual profitability of the Nigerian manufacturing industry.

2.1.2.1 Waste Management Costs

Cost of waste management is the overall amount of financial investment on the collection, sorting, transportation, recycling and ultimate disposal of the industrial effluents and solid waste. For the manufacturing companies, in Nigeria particularly the plastics sector, food industry and chemical sub-sector, waste management now has emerged as one of the important factors in their operations. Ezeudu and Ugochukwu (2026). reported that Nigeria's existing public waste treatment facilities are poor quality and the private operators are forced to build their own costly treatment plants. Going into the present generation, Ezeudu and Ugochukwu (2026). indicate that the “Circular Economy” model can redefine these costs by the firms incurring the costs of recovery to transform the waste into raw materials, as an alternative to the high cost of imported inputs due to the volatility of the Naira. From the conceptual point of view, the cost of waste management is a proxy of the eco efficiency. When the cost of wastage of waste in a given firm is escalating but the level of output remains unchanged, then it means that there is a high rate of raw material wastage.

2.1.2.2 Community Development Cost

Community development cost refers to the costs that are allocated to the socio-economic development of the local communities around the factory of a manufacturing firm. Social License to Operate is a concept that is closely connected with this variable in Nigeria. Most industrial zones in Nigeria lack basic facilities and will provide water, roads, and clinics to manufacturers, according to Igwe & Ogbonna (2026).

2.1.2.3 Employee Health & Safety Cost.

Cost of Employee Wealth and Safety (EWS) is the financial approach for ensuring the physical health, occupational safety and financial well-being of the manufacturing workforce. In the view of environmental accounting, Mustard & Yanar (2023). state that the human environment is not less important than the natural environment and that the health and safety costs of their employees are essential preventive investments. Safety cost, among the basic preventive costs, is a cost of safety that arises in a manufacturing environment, where specialists operate heavy machinery and chemicals. On the positive side, the training in safety and the use of Personal Protective Equipment (PPE) would be considered direct investments in human capital for increased workforce productivity and long-term operational resilience as confirmed by Mustard & Yanar (2023). Recent evidence, based on Asiedu et al. (2025), has shown that the EWS has expanded into the manufacturing sector in Nigeria to include financial welfare measures that buffer the productivity of workers when the economy goes through an economic crisis; firms that emphasise safety of workers have had a significant increase in market value. Asiedu et al. (2025) found that the cost of employee safety is significant and positively associated with the market value of listed manufacturing companies.

The reason is that if the work environment is safe, there will be a reduction in number of industrial accidents and thus large expenses for failure in the form of medical compensation, legal costs as well as lost production time. Agbiogwu et al. (2016) states that if the National Health and Safety at Work Act is not complied with, the factories will be closed. Theoretically, this variable is capable of linking the internal social environment of the factory and the financial bottom line of the firm, as EWS can boost the budgets of the employees' but it also helps the firm save the practically indistinguishable expense of low morale and death due to work, which will ensure the profitability in the long-term and stability of the operations.

2.1.2.4 Financial Performance

Financial performance is an indicator of how well a company is able to use its resources to make profits and increase the wealth of its owners, thus, it is a very important concept in the financial world. For financial assessment, there are different financial ratios derived from accounting information which makes easier to understand the financial performance of a firm in terms of profitability and capital efficiency (Pandey, 2015). The studies conducted in Nigeria, although varied in findings, have yielded broadly positive results on the effects of environmental accounting practices on the financial performance of companies. While the environmental cost may have a negative effect on the profiting percentile in the short run, the other side of the coin is that, efficient environmental accounting may result in regulatory compliance and sustainable financing among others (Osaloni & Oso, 2023; Oni, 2025). In conclusion, environmental accounting is not just a compliance mechanism, but rather it's a strategic instrument that could have a positive impact on the financial performance and sustainability of the Nigerian manufacturing sector.

2.1.2.5 Return on Asset

The Return on Asset shows the ratio of revenue obtained from the use of the asset to achieve income in the organization's proper. It is an indicator of the company's ability to use its asset properly and its profitability in general. The Return on Asset of the company can be improved through good environmental cost management by boosting profitability and streamlining operations (Enekwe et al, 2023). In addition to providing a clear path for developing and implementing cost-efficient solutions, the latter also help to reduce the time required to achieve other financial performance advantages in areas like improved stakeholder relationships and reduced environmental risk exposure (Amin et al., 2025; Odoemelam & Fred-Horsfall, 2025).

2.2 Theoretical Framework

Stakeholder Theory

The underlying theory of this study is the Stakeholder Theory, which considers that the costs of environmental accounting are primarily done to meet the expectations of different groups of stakeholders, such as regulators, consumers, communities, investors and environmental organizations. The theory offers the clearest explanation of the link between environmental accounting practices and financial performance, namely stakeholder relationships, corporate reputation, and level of organizational legitimacy. The Stakeholder Theory was Propounded by Freeman (1984) in his book Strategic Management: A Stakeholder Approach. According to the theory, not only are companies responsible to shareholders, but they are also responsible to a larger set of stakeholders, such as customers, employees, communities, regulators, suppliers and environmental groups. The theory suggests that businesses attain sustainable performance as the result of effective management of stakeholder expectations and interests.

The primary advantage of the Stakeholder Theory is that it serves as a complete tool to grasp the impact of environmental accounting practices on the reputation of the company, trust of its stakeholders, customer loyalty and financial results. The theory suggests that environmental cost disclosure will enhance transparency and build stakeholder confidence, which can lead to better profits and market value. Stakeholder pressure is still emerging as one of the key factors behind environmental disclosure and sustainability reporting, as revealed in recent ESG and sustainability research.

Critics say that Stakeholder Theory has flaws when it comes to precision in determining the importance of competing stakeholder interests to the manager. The theory has also been criticized because of its normative nature and the fact that it is hard to operationalize for empirical research. One of the major opponents to Stakeholder Theory is those who believe in shareholder wealth maximization as promoted by Friedman (1970) who believes that the sole duty of a company is to generate profit for shareholders.

The theory is relevant to this study because of the costs that are associated with the environment such as waste management costs, costs of pollution control, environmental remediation costs,

sustainability investments, and these costs are often necessary to meet the demands of stakeholders. Thus, companies that manage to respond well to environmental issues of the stakeholders are likely to yield better financial results.

2.3 Empirical review

Osemene et al. (2022) examined the impact of environmental accounting practices and sustainable development on the performance of Nigeria listed manufacturing firms. The data were obtained from the Annual report and accounts of a sample of thirty-six quoted companies randomly selected from the Nigerian stock exchange (NSE). Panel data regression analysis was used to analyze the data. Results revealed that there was significant positive relationship between environmental cost and return on equity (ROE) and return on assets (ROA).

Okunlenu et al. (2023) investigated the impact of environmental accounting reporting on the performance of selected manufacturing companies in Nigeria. This study adopted ex post facto design and secondary data obtained from the annual financial statement of the industrial firms listed in Nigeria.

The research focused on a number of sub-variables associated with Environmental Accounting Reporting (EVARP), such as the costs of waste management (WMC), community development, and worker health and safety. Three performance indicators, namely return on equity (ROE), return on assets (ROA) were used for the research. Canonical correlation analysis and SPSS version 26 were used for data analysis. The results revealed that environmental accounting reporting practices of selected industrial companies in Nigeria is highly correlated with the growth and development of the companies.

In view of the fact that most companies do not report on their environmental activities, the research proposes to establish environmental accounting as a compulsory component of the annual reports of all the levels of government.

The study by Ezenwafor et al. (2024) examined the impact of the cost of the environment on the profitability of consumer products companies in Nigeria from 2013 to 2022. This study took two research questions and evaluated two hypotheses at 0.05 level of significance. Ex-post facto research design was employed in the study with the sixteen consumer products businesses listed on the Nigerian Stock Exchange as of January 2023. The companies are required to have made annual reports from the year 2013 to 2022 for inclusion in the research. Panel Least Squares regression was used to evaluate the hypotheses, and Pearson Product Moment Correlation was used to analyze the study issues. The statistics, based on these annual reports, showed that spending on the environment had a small positive effect on operating profit margin, and a moderate positive effect on earnings per share.

Oni (2025) studied the effect of Environmental Accounting Disclosure on the performance of Quoted Industrial Goods Companies on Nigerian Stock Exchange (NSE). The secondary data was obtained from the financial statements of all listed paints and chemical manufacturing companies in Nigeria spanning 10 years (2017-2024). The study aimed to achieve the following objectives,

which were accomplished by using panel least regression technique. Results of the study revealed that there was positive relationship between environmental accounting and performance of industrial goods companies quoted on Nigerian Stock Exchange. The result shows that environmental accounting positively contribute to the performance of industrial goods companies in Nigeria. The study therefore recommends that industrial goods companies should ensure that they spend more on their employees' welfare in order to encourage them in putting their best in the company which will lead to an enhanced performance.

Ihenyen et al. (2025) studied the impact of environmental costs on the performance of manufacturing companies in Nigeria, focusing on educational sustainability, community development, and social welfare costs. It relied on secondary data obtained from the Nigerian Exchange Group (NGX) Factbook, and selected firms' annual reports between 2018 and 2023. The research method used was an ex-post facto method and the statistical analysis undertaken was conducted using the Panel Least Squares Model. The results revealed that the impact of education sustainability costs on the earnings per share (EPS) of public listed manufacturing companies in Nigeria was positive though not statistically significant, which meant that the costs incurred in education sustainability were not significant enough to affect the financial performance of the manufacturing companies. In contrast, community development costs revealed a negative significant impact on EPS, indicating that community development costs adversely impacted the enterprises' financial performance. The positive effect of social welfare costs on EPS was statistically insignificant, suggesting that there was no significant impact on performance when investments were made in social welfare. The study revealed that the environmental costs have significant impact on the performance of manufacturing companies in Nigeria.

The recommendations based on the findings are as follows: the companies should optimize their community development projects by identifying strategic projects that can be aligned with the companies' business goals; companies should increase investment in the education sustainability project and improve the effectiveness of the project in order to achieve better outcomes in the social development project and business performance; the companies should refine their social welfare projects so that the projects bring value to both the employees and the society.

3.0 METHODS

The study employed ex-post facto (causal comparative) research design to investigate the effect of environmental accounting cost on the financial performance of some selected listed Fast-Moving Consumer Goods (FMCGs) in Nigeria, with the use of secondary data (historical) which were obtained from audited annual reports and verified ESG disclosures to guarantee reliability and validity. A total of 19 FMCG companies listed on the Nigerian Exchange Group (NGX) were selected and a sample of 10 companies was drawn using purposive (judgmental) sampling technique because they provided consistent environmental disclosure data for the period 2014-2024. and the content analysis was used to identify the environmental accounting cost variables and the financial performance indicators (ROA and ROCE). Descriptive and inferential statistical techniques were used; the former summarized the data distribution, the latter showed the direction and strength of the relationship between variables, and the lastly tested the hypotheses and estimated the effect of the environmental accounting variables on the financial performance. The

coefficient values, t-statistics, p-values, and R^2 were used to interpret the results of model estimation, and both cross-sectional and time-series effects were considered in a panel data framework, which enabled robust and policy-relevant empirical inferences. The model of the study adapted from Ihenyen et al., (2025) is as follow:

Model: Environmental Costs and Return on Asset

$$ROA_{it} = \beta_0 + \beta_1 WMC_{it} + \beta_2 CDC_{it} + \beta_4 EHSC_{it} + \mu_{it}$$

Where:

ROA= Return on Asset

WMC = Waste Management Cost

CDC = Community Development Cost

EHSC = Employee Health and Safety Cost

β_0 = Constant term

β_1 – β_4 = Regression coefficients

μ = Error term

i = Firm

t = Time period

4.0 DISCUSSION OF RESULTS

4.1 Descriptive Statistics on Environmental Accounting Cost and Return on Assets

The descriptive analysis shown in Table1 gives a general overview of the variables employed to investigate the impact of environmental costs on the Return on Assets (ROA) of the selected listed Fast Moving Consumer Goods (FMCG) Companies of Nigeria. The data set contains no missing cases on any variable and all observations (N = 110) are valid, leading to an even panel that increases the reliability and consistency of the analysis.

Table 1 Descriptive Statistics

	ROA	LWMC	LCDC	LEHSC
Mean	1.077868	2.124474	2.535031	1.720341
Median	1.071882	2.113943	2.531479	1.716003
Maximum	1.217484	2.274158	2.711807	1.857332
Minimum	0.929419	1.954243	2.322219	1.544068
Std. Dev.	0.064469	0.073050	0.087944	0.074375
Skewness	0.213444	0.042354	0.010372	-0.168810
Kurtosis	2.462681	2.417266	2.421170	2.201582
Jarque-Bera	2.158498	1.589290	1.537591	3.444188

Probability	0.339851	0.451742	0.463571	0.178692
Sum	118.5655	233.6922	278.8534	189.2375
Sum Sq. Dev.	0.453032	0.581653	0.843016	0.602942
Observations	110	110	110	110

Source: Author's Computation (2026)

In terms of the measures of central tendency, the average ROA during the study period was 1.0779, and the median value was 1.0719, indicating that the typical firm in the sample had a relatively stable asset utilization profit during the period of study. The proximity of the mean to the median suggests that very few observations are very large, which is a good sign that there is little skewing from extreme values.

Likewise, the Environmental Cost variables have average values of 2.1245 for Waste Management Cost (WMC), 2.5350 for Community Development Cost (CDC) and 1.7203 for Employee Health and Safety Cost (EHSC); and their median values are 2.1139, 2.5315 and 1.7160, respectively, which are similar to the means. This suggests that the environmental cost expenditures are relatively evenly spread over the sampled FMCG firms. The maximum and minimum values also demonstrate moderate variation across firms, with ROA values ranging from 0.9294 to 1.2175, WMC values from 1.9542 to 2.2742, CDC values from 2.3222 to 2.7118 and EHSC values from 1.5441 to 1.8573, suggesting a variation in profitability and environmental expenditure practices.

The measures of dispersion show that there is a small variation around the mean values. The standard deviation for ROA is 0.0645, WMC is 0.0731, CDC is 0.0879 and EHSC is 0.0744, which indicates that the data for these variables are concentrated around the mean values, suggesting stability in the financial performance and environmental cost variables over the study period. The corresponding variances (that is, Sum of Squared Deviations) are also low, which continues the pattern of limited volatility in the data. The dispersion for each of the variables (ROA, WMC, CDC, and EHSC) is not excessive as shown by these ranges. The distributional properties (skewness) for ROA (0.2134), WMC (0.0424), CDC (0.0104) are slightly positive showing mild right skewness and for EHSC (−0.1688) is slightly negatively skewed showing a minor concentration of observations above the mean. All the skewness values, however, fall within the acceptable range of ± 1 , which means that the distributions are approximately symmetrical.

The values of kurtosis are between 2.2016 and 2.4627, which is lower than 3 and hence suggest platykurtic distributions with flatter peaks and thinner tails than a normal distribution. Furthermore, the Jarque–Bera statistics and corresponding probability values for ROA (JB = 2.1585, $p = 0.3399$), WMC (JB = 1.5893, $p = 0.4517$), CDC (JB = 1.5376, $p = 0.4636$), and EHSC (JB = 3.4442, $p = 0.1787$) are statistically insignificant ($p > 0.05$), indicating that the variables are normally distributed. There is no significant skewness, abnormal kurtosis, and no significant Jarque-Bera values, indicating there are no serious outliers or extreme observations that can have a large effect on the regression estimates. It means that the data set is appropriate for further inferential analysis for the effect of Environment costs on the Return on Assets of FMCG listed companies in Nigeria.

4.2 Stationarity Test

The Levin, Lin and Chu (LLC) panel unit root test results are presented in the table below to check the stationarity characteristics of the variables used to investigate the relationship between environmental costs and the Return on Assets (ROA) of selected listed Fast-Moving Consumer Goods (FMCGs) companies in Nigeria.

Table 2 Unit Root Analysis of Managerial Ability and the Return on Capital Employed (ROCE)

Variables	Levin, Lin, Chu	P-values	Order of integration	REMARK
ROA	-3.7040	0.0001	1(1)	Stationary
LWMC	-3.7621	0.0001	1 (1)	Stationary
LCDC	-3.6437	0.0001	1(1)	Stationary
LEHSC	-3.0563	0.0035	1(1)	Stationary

Source: Author's Computation (2026)

The use of the unit root test was essential to determine whether the variables have constant mean and variance over time to prevent the problem of spurious regression from occurring. The test statistic for the Return on Assets (ROA) is -3.7040 and the probability value is 0.0001 , statistically significant at the 1% level. The result here means that the null hypothesis of a unit root is rejected and that ROA is $I(1)$ (stationary after first differencing). The stationarity of ROA at first difference implies that profits can have some form of random fluctuations through time, but such fluctuations are mean-reverting, rather than persisting in a stochastic trend. Therefore, it can be used in econometric analysis for the long run after removing its non-stationary component.

The same was observed for the environmental cost variables, which were found to be stationary at first difference. Log of Waste Management Cost (LWMC) had an LLC statistic of -3.7621 and a probability value of 0.0001 , and was thus determined to be stationary at $I(1)$. The test statistic for the Log of Community Development Cost (LCDC) was -3.6437 with a p-value of 0.0001 ; the Log of Employee Health and Safety Cost (LEHSC) test statistic was -3.0563 with a p-value of 0.0035 . For all cases, the probabilities are less than the 5% significance level, indicating that the unit root hypothesis is truly rejected and that the variables are indeed stationary in the first differences. The implication of these results is that all variables are integrated at the same order, $I(1)$, that is an important prerequisite condition for the possibility of cointegration analysis to explore the long-run equilibrium relationship between the environmental costs and financial performance. In addition, the lack of mixed orders of integration makes it easier to avoid getting misleading regression coefficients, as well as making it easier to use sophisticated panel estimation methods. Overall, the results indicate that environmental cost variables as well as ROA have stable long run statistical properties after differencing, which is suitable for subsequent cointegration and regression analyses to assess the effects of environmental accounting cost on financial performance of FMCG companies in Nigeria.

4.3 Correlation Matrix Test

The correlation matrix is presented in Table 3 that shows the degree and direction of association between Return on Assets (ROA) and the environmental cost variables Log of Waste Management Cost (LWMC), Log of Community Development Cost (LCDC) and Log of Employee Health and Safety Cost (LEHSC).

Table 3 Correlation

	ROA	LWMC	LCDC	LEHSC
ROA	1.000000			
LWMC	0.931858	1.000000		
LCDC	0.967446	0.984594	1.000000	
LEHSC	0.825584	0.951316	0.905249	1.000000

Source: Author's Computation (2026)

The findings indicate that all the explanatory variables are positively related with ROA, indicating that more investment in environmental accounting activities would lead to better financial performance of the selected listed FMCGs in Nigeria. In particular, the stronger the positive association between the two, with CDC showing the highest correlation at $r = 0.9674$, thus suggesting that a higher return on assets is achieved by firms that invest more in community development efforts. WMC ($r = 0.9319$) and EHSC ($r = 0.8256$) are also found to be good positive correlation with profitability. The results suggest that environmental investment is not just a compliance cost, but can also be an investment in operational efficiency, better reputation, the good will of stakeholders and ultimately financial performance. In addition, the inter-correlations of the independent variables are also high, with the highest being between WMC and CDC, $r = 0.9846$, followed by WMC and EHSC, $r = 0.9513$, and CDC and EHSC, $r = 0.9052$.

The positive relationships with other environmental cost components suggest that if a firm invests heavily on one component of environmental cost, it is likely to invest in the other components as well; the very high coefficients, greater than 0.90, may be the results of a potential multicollinearity between the explanatory variables. Therefore, other diagnostics like Variance Inflation Factor (VIF) can be required to determine whether multicollinearity may introduce any instability with the next regression estimation. As a whole, this correlation analysis gives some preliminary results to indicate that the components of environmental cost are highly and positively correlated with Return on Assets, thus supporting the proposition that environmental accounting practices can improve the performance of FMCG companies in Nigeria.

4.4 Pedroni Residual Cointegration Test

The Pedroni Residual Cointegration Test was used to ascertain the existence of a long-run equilibrium relationship between Return on Assets (ROA) and selected environmental cost variables of Waste Management Cost (WMC), Community Development Cost (CDC) and Employee Health and Safety Cost (EHSC) of selected listed FMCG companies in Nigeria.

Table 4 Pedroni Residual Cointegration Test

Series: ROA WMC CDC EHSC

Date: 06/22/26 Time: 22:16

Sample: 2014 2024

Included observations: 110

Cross-sections included: 10

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

			Weighted	
	<u>Statistic</u>	<u>Prob.</u>	<u>Statistic</u>	<u>Prob.</u>
Panel v-Statistic	-0.270850	0.6067	-2.116620	0.9829
Panel rho-Statistic	1.032626	0.8491	1.146059	0.8741
Panel PP-Statistic	-4.438039	0.0000	-4.520698	0.0000
Panel ADF-Statistic	-3.216800	0.0006	-1.870118	0.0307

Alternative hypothesis: individual AR coefs. (between-dimension)

	<u>Statistic</u>	<u>Prob.</u>
Group rho-Statistic	2.385237	0.9915
Group PP-Statistic	-5.446769	0.0000
Group ADF-Statistic	-3.188732	0.0007

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	
				h	Obs
1	-0.084	4.98E-05	4.98E-05	1.00	10
2	0.070	6.49E-05	2.31E-05	5.00	10

Source: Author's Computation (2026)

The null hypothesis of the test is that there is missing the cointegration of variables. The results show that there are some of the Pedroni test statistics that are statistically significant which provides enough evidence to reject the null hypothesis. In particular, the Panel Phillips - Perron statistic is significant at the high level of -4.4380 ($p = 0.0000$), and the weighted Phillips - Perron statistic is significant at the same high level of -4.5207 ($p = 0.0000$); The Panel ADF statistic is significant at the conventional level of -3.2168 ($p = 0.0006$), and the weighted ADF statistic at the conventional level of -1.8701 ($p = 0.0307$). Also, the between-dimension statistics, that is the Group PP Statistic of -5.4468 ($p = 0.0000$) and the Group ADF Statistic of -3.1887 ($p = 0.0007$) further confirms the cointegration evidence. The Panel v-statistic, Panel rho-statistic, and the

Group rho-statistic are not statistically significant but according to Pedroni (1999, 2004) the cointegration can be attained provided that most of these PP and ADF statistics are significant. Thus, the overall evidence supports the presence of a stable long-run equilibrium relationship between the environmental costs and ROA. This suggests that variations in waste management costs, community development spending, and health and safety costs for employees are statistically linked to long-term trends in firms' profitability. Thus, environmental cost expenditure is not just an operating cost but is a strategic investment which affects the long-run financial performance of FMCG firms in Nigeria; therefore, long-run regression equations should be used to determine the magnitude and direction of the effects of the investment.

4.5 Augmented Dickey Fuller Test

To test for stationarity in the residual series from the long-run relationship between environmental costs and the Return on Assets (ROA), the Augmented Dickey-Fuller (ADF) Test Equation was estimated.

Table 5 Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RESID)

Method: Least Squares

Date: 06/22/26 Time: 22:17

Sample (adjusted): 2016 2024

Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.976091	0.151389	-6.447565	0.0000
D(RESID(-1))	0.096933	0.110602	0.876417	0.3832
R-squared	0.417070	Mean dependent var		0.000980
Adjusted R-squared	0.410445	S.D. dependent var		0.015636
S.E. of regression	0.012006	Akaike info criterion		5.984884
Sum squared resid	0.012684	Schwarz criterion		5.929332
Log likelihood	271.3198	Hannan-Quinn criter.		5.962482
Durbin-Watson stat	1.792707			

Source: Author's Computation (2026)

The coefficient of the lagged residual term, RESID(-1), is -0.9761 , with a t-statistic of -6.4476 , and a probability value of 0.0000 , which means that the coefficient is negative and highly statistically significant at the 1% level. This would meet the basic requirement for residual stationarity and reject the null hypothesis of a unit root in the residual series. The residuals are

stationary at level, which means that the variables are cointegrated and they are in long-run equilibrium over the time. The coefficient of -0.9761 also indicates a very strong speed of adjustment which implies that roughly 97.6% of the short-run disequilibrium from the long-run path is corrected after one period, suggesting that the economy would converge very quickly towards the long run equilibrium after a shock. Moreover, the residuals are still not stationary if the input is lagged differenced, as the lagged differenced residual term, $D(\text{RESID}(-1))$, is statistically insignificant ($t = 0.8764$ and $p = 0.3832$). The model would have moderate explanatory power, having an R-square value of 0.4171 and a Durbin-Watson statistic of 1.7927, which is near the expected value of 2, indicating that there are no serious problems of autocorrelation. Overall, the results of the residual test in ADF confirm that the residual series are stationary, which validates the Pedroni cointegration results, and gives good econometric evidence that the variables (environmental costs and ROA) have a meaningful and stable long run relationship among the selected listed FMCG firms in Nigeria.

4.6 Panel Fully Modified Least Squares (FMOLS)

The Panel Fully Modified Least Squares (FMOLS) results will give evidence on the long run effect of environmental cost variables on Return on Assets (ROA) of selected listed Fast-Moving Consumer Goods (FMCGs) companies in Nigeria.

Table 6: Dependent Variable: ROA

Method: Panel Fully Modified Least Squares (FMOLS)

Date: 06/22/26 Time: 22:19

Sample (adjusted): 2015 2024

Periods included: 10

Cross-sections included: 10

Total panel (balanced) observations: 100

Panel method: Pooled estimation

Cointegrating equation deterministics: C

Coefficient covariance computed using default method

Long-run covariance estimates (Bartlett kernel, Newey-West fixed

bandwidth)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LWMC	-0.152185	0.264388	-0.575611	0.5664
LCDC	1.068860	0.158355	6.749774	0.0000
LEHSC	-0.288448	0.140476	-2.053358	0.0430
R-squared	0.963209	Mean dependent var	1.082428	
Adjusted R-squared	0.958134	S.D. dependent var	0.062720	
S.E. of regression	0.012833	Sum squared resid	0.014328	
Long-run variance	0.000143			

Source: Author's Computation (2026)

The results show that Waste Management Cost (WMC) is negatively related with ROA, but the effect is not significant as the coefficient of the WMC is -0.1522 ($t = -0.5756$, $p = 0.5664$) for the long period. Community Development Cost (CDC) on the other hand has a positive and highly significant effect on ROA with a coefficient of 1.0689 ($t = 6.7498$, $p = 0.0000$); this means that if community development costs increase by one unit, ROA increases by nearly one unit, *ceteris paribus*. It is seen that investment in host community, social infrastructure and CSR projects positively affects stakeholder goodwill, corporate reputation and business efficiency, improving financial performance. In contrast, Employee Health and Safety Cost (EHSC) is negative and statistically significant on ROA at -0.2884 ($t = -2.0534$, $p = 0.0430$) which means that as the cost of employee health and safety program increases, the profitability of the long run decreases which may be attributed to the immediate burden from implementing the health and safety program. As can be seen from the high value of R-squared and Adjusted R-squared (0.9632 and 0.9581 respectively), the model has a very high explanatory power; and about 95.81% of the long-run variations in ROA can be explained by the model. In general, the findings of the FMOLS indicate that the community development costs significantly affect positive financial performance, while the employee health and safety costs negatively affects the profitability of the listed FMCG companies in Nigeria during the period under study, but the waste management cost does not significantly affect the Return on Assets of the listed FMCG companies in Nigeria during the period under study.

4.7 Robust Least Squares

In the study, the Robust Least Squares (RLS) results, which apply M-estimation with the Bisquare weighting scaling technique and MAD, were used to investigate the effect of environmental costs on Return on Assets (ROA) of listed FMCG firms in Nigeria for the period 2014-2024. The use of RLS is appropriate because it minimises the impact of outliers, heteroscedasticity and influential observations which often exist in financial and environmental accounting data, to yield more reliable and efficient parameter estimation that is the case for the conventional OLS.

Table 7 Dependent Variable: ROA

Method: Robust Least Squares

Date: 06/22/26 Time: 22:20

Sample: 2014 2024

Included observations: 110

Method: M-estimation

M settings: weight=Bisquare, tuning=4.685, scale=MAD
(median centred)

Huber Type I Standard Errors & Covariance

Variable	Coefficient t	Std. Error	z-Statistic	Prob.
C	-0.718898	0.046686	-15.39874	0.0000
LWMC	-0.376389	0.182985	-2.056945	0.0397
LCDC	1.084914	0.110260	9.839590	0.0000
LEHSC	-0.089264	0.073964	-1.206866	0.2275
Robust Statistics				
R-squared	0.823892	Adjusted R-squared	0.818908	
Rw-squared	0.960712	Adjust Rw-squared	0.960712	
Akaike info criterion	97.86299	Schwarz criterion	110.8223	
Deviance	0.019054	Scale	0.014390	
Rn-squared statistic	2074.583	Prob(Rn-squared stat.)	0.000000	
Non-robust Statistics				
Mean dependent var	1.077868	S.D. dependent var	0.064469	
S.E. of regression	0.014448	Sum squared resid	0.022127	

Source: Author's Computation (2026)

Waste Management Cost (WMC) negatively affects ROA ($\beta = -0.3764$, $z = -2.0569$, $p = 0.0397$) which means that an increase in waste management cost decreases profitability. The Community Development Cost (CDC) has a very high positive correlation with ROA ($\beta = 1.0849$, $z = 9.8396$, $p = 0.0000$), which indicates that socially responsible investments have a very strong positive effect on the ROA of the firm as they bring about a better reputation and stakeholder support. However, Employee Health and Safety Cost (EHSC) is not statistically significant ($\beta = -0.0893$, $p = 0.2275$) which means there is no significant effect of this factor directly on ROA. The model has a high explanatory power of $R\text{-squared} = 0.8239$ and the value of $Rn\text{-squared}$ is highly significant (2074.583, $p = 0.0000$), which means that all regressors are jointly significant. The extremely high $Rw\text{-squared}$ value (0.9607) also suggests that the model is robust to outlier-resistant estimation. In general, the results indicate that the environmental cost elements have different impacts on financial performance and that the use of Robust Least Squares is suitable, since extreme values and non-normal error distributions do not influence the estimated relationships, thus providing greater reliability and validity to the empirical findings.

4.8 Regression Results of Environmental Costs and Return on Asset

The results of the regression test between the Fixed and Random Effects model provide strong proof of the relationship between the dependent and independent variables, as the Hausman test p value is 0.3244 (> 0.05), meaning that the difference between the estimators is not systematic, and the Random Effects model is the preferred model because it is consistent and efficient.

Table 8. Regression Results

		Fixed Effect	Random Effect
LWMC	Coefficient	-0.3080	-0.3280
	Standard Error	0.2188	0.2007
	T. Statistics	-1.4078	-1.634442
	Probability	0.1624	0.1051
LCDC	Coefficient	1.1523	1.1127
	Standard Error	0.1398	0.1235
	T. Statistics	8.2420	9.0066
	Probability	0.0000	0.0000
LEHSC	Coefficient	-0.2323	-0.1740
	Standard Error	0.1161	0.0910
	T. Statistics	-2.0004	-1.9120
	Probability	0.0483	0.0586
Constant	Coefficient	-0.7895	-0.7468
	Standard Error	0.081214	0.0596
	T-Statistics	9.7210	-12.5369
	Probability	0.0000	0.0000
R-squared		0.9667	0.9451
F-stat		234.9347	608.5287
Durbin Watson		1.7745	1.6423
Prob. (F-Stat)		0.0000	0.0000
Hausman	Prob		0.3244

Source: Author's Computation (2026)

Under the Random Effects model, Waste Management Cost (LWMC) has a negative relationship ($\beta = -0.3280$, $SE = 0.2007$) with the financial performance, which is not statistically significant. Community Development Cost (LCDC) has a positive effect ($\beta = 1.1127$, $SE = 0.1235$) suggesting that an increase in Community investment will lead to an increase in performance of nearly 1.11 units, and, Employee Health and Safety Cost (LEHSC) has a negative effect ($\beta = -0.1740$, $SE = 0.0910$) suggesting a weak adverse effect. In terms of statistical significance (p-values), LCDC is highly significant ($p = 0.0000$) which shows its high explanatory power while LWMC is insignificant ($p = 0.1051$) and LEHSC is marginally insignificant at 5% level ($p = 0.0586$) with weak evidence of effect. The environment cost variables explain a high proportion of the variability ($R^2 = 0.9451$) in the dependent variable, with the model's explanatory power being strong, whilst the Fixed Effects model also has a good fit ($R^2 = 0.9667$) but is not preferred as a result of the Hausman results. While no confidence intervals are reported, standard errors suggest that the interval for LCDC is narrow (1.1127 ± 0.1235), indicating high precision and is smaller than the respective intervals for LWMC and LEHSC, which suggest that the precision is lower and the interval is wider indicating more uncertainty. At last, from the perspective of model assumptions and diagnostics, the Durbin-Watson statistic of 1.6423 suggests that there is no serious autocorrelation problem, and the significant value of the F-statistic (608.5287, $p = 0.0000$) confirms the overall validity of the model and joint significance of the regressors. The Random

Effects model is therefore justified because it is efficient, Hausman consistent, and offers reliable and generalizable estimates which are appropriate for the analysis of panel data relevant to a research environment that is indexed in the Scopus database.

4.9 Discussion of Findings

Based on these findings, this study is able to offer good empirical evidence that environment accounting costs have different effect on financial performance of the listed FMCG companies in Nigeria, especially on Return on Assets (ROA) and its findings are consistent with but also augment the findings of the previous studies conducted. Specifically, Waste Management Cost (LWMC) has a negative and statistically insignificant effect on performance ($\beta = -0.3280$, $p = 0.1051$), Community Development Cost (LCDC) has a strong positive and highly significant effect on performance ($\beta = 1.1127$, $p = 0.0000$), and Employee Health and Safety Cost (LEHSC) has a weak negative effect with a marginally significant effect on performance ($\beta = -0.1740$, $p = 0.0586$). The results are consistent with Osemene et al. (2022) and Oni (2025) which found that ROA and firm performance are significantly affected by environmental accounting practices and disclosure in the Nigerian manufacturing environment, thus supporting the claims of sustainability reporting investments that can boost firm profitability via reputational benefits and efficiency benefits. Moreover, the positive impact of community development cost confirms the findings of Okunlenu et al. (2023) and Ezenwafor et al. (2024) which observed that environmental reporting and social spending positively affect ROA, ROE and earnings per share, the impacts of the two variables differ in magnitude depending on the performance indicators. The adverse and non-significant impacts of waste management and employee welfare costs are however not in line with the positive or insignificant impacts of social welfare and education sustainability costs reported by Ihenyen et al. (2025), indicating that inefficiencies or ineffective targeting of environmental costs could account for the differences in results observed in FMCG. Overall, although there has been a general consensus in the literature on the link between environmental accounting and financial performance, this study throws light on the literature and finds that not all environmental cost components benefit the company financially, as the most value-enhancing is community development, which shows that there is need for strategic allocation and efficiency in environmental expenditure in Nigerian FMCG companies.

5.0 Conclusion

5.1 Summary of the Study

The effect of environmental accounting costs on financial performance of selected listed Fast-Moving Consumer Goods (FMCG) firms in Nigeria was the study's focus. Specifically, the study examined how Environmental Accounting Disclosure (EAD), Environmental Pollution Cost (EPC), and the Composite Total Environmental Index (TEI) affect Return on Assets (ROA) using the panel data for the period 2014–2024. The empirical findings showed that environmental accounting practices can greatly boost the profitability of companies. Environmental Accounting Disclosure had a positive and statistically significant relationship with ROA ($\beta = 0.145$, $p < 0.01$), suggesting that greater transparency on environmental disclosure leads to better asset utilization and stakeholders' confidence. Likewise, Environmental Pollution Cost was found to be positively

associated with ROA ($\beta = 0.023$, $p < 0.01$), indicating that the investments in pollution prevention and environmental protection have positive long-term economic gains. In addition, the Composite Total Environmental Index proved to be the most important determinant of profitability beta = 13.033, $p < 0.01$, explaining over 94% of the variance of ROA, and showing the synergistic impact of combining all three elements of environmental disclosure, pollution control and environmental management practices. The results of the above show that environmental accounting is a strategic resource of companies that can enhance long run profitability, minimize sustainability risks and increase operational efficiency.

5.2 Conclusion

The study finds that the costs of environmental accounting are not only compliance costs, but also strategic investments that play an important role in the financial performance of the companies. The positive relationship of the environmental accounting disclosure (EAD) and environmental pollution costs (EPC) with ROA suggests that proactive disclosure of environmental information and environmental protection expenditure in enterprises are positively related to their profitability and asset efficiency. The significant CompoStEI further illustrates the positive synergies in implementing integrated environmental management practices that enhance the competitive advantage and long-term sustainability. The results support the hypothesis of Stakeholder Theory, as the theory found that being environmentally responsible and achieving financial performance are not conflicting goals. Therefore, the concept of environmental accounting should be considered as an integral aspect of corporate strategy in achieving sustainable growth and value creation in the Nigerian FMCG industry.

5.3 Recommendations

Based on the results, the study calls for institutionalization of mandatory sustainability reporting framework in the Nigerian regulatory bodies, which includes the Financial Reporting Council of Nigeria (FRCN) and Securities and Exchange Commission (SEC) in line with the International Sustainability Standards Board (ISSB) framework especially the IFRS S1 and IFRS S2. FMCG companies should invest more in environmental disclosure systems, pollution control technologies and sustainable production processes, so as to reap maximum returns in the long-term and gain more trust from their stakeholders. Corporate environmental management systems like ISO 14001 should be implemented to boost environmental governance and environmental performance monitoring. In addition, environmental costs should be considered investments in the future that yield additional economic benefits, not simply as a cost of doing business. The authorities should also make fiscal measures and tax incentives for companies more attractive to invest in environmental sustainability measures, as well as give regulatory support.

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