



ENVIRONMENTAL MANAGEMENT ACCOUNTING AND PERFORMANCE OF LISTED CONSUMER GOODS MANUFACTURING COMPANIES IN NIGERIA

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Abstract

This study explores the effect of environmental management accounting (EMA) on the financial performance of 17 listed consumer goods companies in Nigeria from 2021 – 2024. The study utilized environmental management accounting ratings, return on assets (ROA) and earnings per share (EPS) whereas firm size, age and leverage were included as control variables. The fixed-effect panel regression with Driscoll–Kraay standard errors was employed, supported by robustness checks using bootstrapping and PCSE estimators. The findings suggested that EMA has a significant negative effect on ROA and EPS, implying that environmental investments may initially reduce profitability and shareholder earnings due to compliance costs and implementation challenges. Due to the outcome of the robustness checks, the study concluded that EMA's impact on financial performance of Nigeria's consumer goods sector is weak, inconsistent, and highly sensitive to model specification. It was therefore recommended that implementation of EMA by consumer goods companies should done strategically in order to minimize the financial disadvantage that may occur in the short-term.

Keywords: EMA, Financial Performance, Sustainability Reporting, Stakeholders' Theory, Pollution, Consumer Goods Companies.

Introduction

Firms in any aspect of manufacturing or production in Nigeria are expected to be environmentally friendly to their host communities. These firms are expected to properly dispose their waste and not emit them freely or dangerously into the environment. But on the contrary, there has been a long-term environmental problem in the physical areas where they operate. This may be largely due to their ever-increasing strategy to ensure that profit is maximized; hence they hardly make provision for resources availability for proper waste disposal or treatment. These unwholesome attitudes of discharging waste into the environment have caused great harm to the host communities in terms of loss of farm

lands, contaminated water and air. It is unfortunate that despite the significant benefits that these firms get from their host, the majority of these firms continue to hold the belief that any costs associated with environmental issues will often result in additional costs for them, which may also lower their effectiveness and efficiency in the long run. However, the value creation perspective to environmental costs (Akinlo & Iredele, 2014) submits a contrary perspective which attributes outflows on environmental management to possible increased performance hence the need for current empirical evidence for firms in the consumer goods sector of the Nigerian capital market on the subject of environmental management accounting.

Despite the growing environmental concerns, investors and larger business stakeholders still find it difficult to gather information on the environmental management practices of reporting organizations to aid them have a perspective about them (Iredele et al, 2020) as companies often fail to adequately report on their environmental management strategies. Ezechukwu et al (2024) opine that Nigerian firms are lately experimenting on various ecological and environmental mitigation reporting strategies in order to satisfy growing stakeholders' needs for environmental management reports. Therefore, a timely empirical thrust on the relevance of this corporate environmental reporting effort especially with respect to increased financial performance cannot be trivialized. It is also important to ascertain the environmental reporting practice of firms in the Nigerian consumer goods sector in terms of comparison amongst peers and compliance with legal standards on environmental management reporting.

Evidence shows that consumer goods firms in Nigeria and like any other contribute to environmental problems and there is a need to examine ways to reduce this and at the same time improve the performance of such firms. Lawrence & Bernard (2023) submits that the Nigerian environment is endangered with hazards of enormous degree due to the activities of different companies operating within the nation citing the case of Koko village in Delta State Nigeria, as one of the several cases of irresponsible waste emissions that pose threat to inhabitants of the host communities. This situation is neither advantageous to the firm, government nor the society and therefore validates the need for environmental accounting research that provides updated

views on the condition of the Nigerian ecosystem on a consistent basis.

So, this study sought to establish the extent environmental management accounting has impacted on the corporate performance of listed consumer goods firms in Nigeria. It specifically sought to address the following specific objectives:

- i. To examine the effect of environmental management accounting on return on assets of listed consumer goods companies in Nigeria
- ii. Evaluate the extent environmental management accounting affect earnings per share of listed consumer goods firms in Nigeria.

Review of Related Literature Environmental Management Accounting

Environmental management accounting (EMA) is defined as a system that provides a systematic approach to resources allocation efficiently, thereby mitigating the negative impact of operations on the environment (Qian et al., 2022). Environmental management accounting is one method that is increasingly being used to achieve a balance between financial performance and environmental issues. (Abdelhalim et al., 2023). According to Schaltegger and Burritt (2017), EMA is an accounting system that concentrates on identifying, measuring, and managing environmental costs and performance of a company's operations and performance. The growth of EMA is related to stakeholder requirement for environmental transparency and the company's internal needs to optimize resources (Qian et al., 2022). EMA practices differ depending on industry characteristics and regulatory pressures, but invariably aim to create long-term value through enhanced environmental cost efficiency and adherence with sustainability standards (Yusoff et al., 2024).

Thus, EMA serves as a bridge between business needs and corporate environmental responsibilities.

The evolution of environmental management accounting could be traced as far back as mid 1970s with framework such as Ullmann (1976), and Dierkes and Preston (1977) which propose an integrated environmental and financial system. It focused on external reporting and social accounting. Then, there was a growing environmental awareness due to pollution and global warming. In the 1990s, EMA became a managerial tool. In 2001, the United Nations Division for sustainable development (UN-DSD) gave rise to the first official EMA principles and procedures. From their view, EMA is not just tool but a set of principles and procedures that inform many other environmental management activities and programs (Jasch, 2006).

Environmental management accounting continues to gain recognition by year 2005 with IFAC providing guidelines for internal environmental cost management (Asiri et al, 2020). The focus shifted to identification of environmental cost, tracking of material and energy flow and integration of EMA into budgeting and performance. In contemporary time, EMA now cover a wider range with its integration into carbon accounting, green budgeting, sustainability accounting, circular economy strategies and corporate sustainability reporting.

In Nigeria, the adoption of EMA could be traced back to increased demand for regulation, academic research and stakeholder's pressure. Prior to 2005 the term environmental management accounting was missing from corporate and regulatory practice in Nigeria. It was mostly seen as corporate social reporting or community related expenses. In spite of its development,

Nigeria is still in the early stage of embracing IFRS S1 and S2 as a mandatory policy enforcing EMA across all industry and firms.

Mokhtar et al (2016) noted that there are two broad classifications of EMA information; monetary environmental information and physical environmental information. Monetary environmental information which covers environmental expenses such as pollution control cost, protection cost etc. which are stated in currencies (such as Naira). But physical environmental information, on the other hand, uses data on the use of materials, energy, water and waste. It's usually measured (such as hours, liters, or kWh).

Firm Performance

Performance is of multidimensional essence covering areas such as financial, market, operational, stakeholder satisfaction and governance. Almatrooshi et al (2024) defined organizational performance as an organization's ability to meet its strategic goals, operational efficiency and managerial effectiveness. Hamann and Schiemann (2021) identified four key areas that are important to an organization performance which is stated as profitability, liquidity, growth, and stock market performance. Organizational performance in recent time has attempted using balance scorecard method where performance is being tracked and measured using various methods such as financial performance, customer service, social responsibility and employee stewardship.

The effect of EMA on a company performance depends mainly on how well an organization can apply environmental practices into its main business strategies and operations (Qian et al., 2022). Schaltegger (2025) study further revealed that companies with strong governance systems tend to be more successful in converting environmental investments into financial returns. Thus, the relationship between

EMA and profitability is complex and multidimensional, requiring a holistic and contextual approach (Christ & Burritt, 2020). A deep understanding of these dynamics is essential for companies seeking to achieve competitive advantage while fulfilling environmental responsibilities (Zhang & Wang, 2024).

Tudose and Avasilcai (2020) acknowledged that performance can be viewed as an artifact that determines how successful an organization is, taking into account the views of those who came before it as well as the difficulty in defining the notion. The following explains the arguments in support of this classification. First and foremost, managerial decisions are solely attributable to the human element, with performance being the product of human invention. The attainment of performance, or obtaining a particular degree of performance, necessitates specific behaviors that are unique to each organization and cannot be replicated, resulting in an original outcome. Third, it is possible to improve performance in the future by adapting prior activities to the present (Tudose et al, 2022). Sakunasingha (2006) opined that performance measurement serves as the life blood of economic unit because it builds on result which helps organization to make strategic decisions by comparing the actual with budgeted.

When examining performance from a financial standpoint, the financial outcomes that a business achieved during a specific time frame were taken into consideration. Therefore, a company's financial outputs must exceed the costs associated with their realization in order for them to be considered financially successful. According to Suhadak et al (2019), the most recent definitions of financial success take into account factors

including a company's effectiveness and efficiency in reaching goals and using resources (Egbunike & Okerekeoti, 2018; Mahrani & Soewarno, 2018). Therefore, a company's financial performance reflects its capacity to attract and generate returns for investors as well as to create economic value (Al-Sa'eed, 2018).

Hansen and Mowen (2005) states that firm performance is very essential to management as it is an outcome which has been achieved by an individual or a group of individuals in an organization related to its authority and responsibility in achieving the goal legally, not against the law, and conforming to the moral and ethics. Performance is the function of the ability of an organization to gain and manage the resources in several different ways to develop competitive advantage. Furthermore, the main objective of financial performance measuring is to determine the operating and financial characteristics and the efficiency and performance of economic unit's management, as reflected in the financial records and reports (Bhunia, 2010).

The need to reassess the value of performance indicators arises from the economies' dynamism, changes in the business environment, and adjustments to organizational strategy (Tudose et al, 2022). Over the past century, worries over the creation of performance measuring models and methods have grown. According to Rajnoha et al (2016), who conducted an analysis of the literature on the evaluation of financial performance, performance evaluation systems have evolved in two stages. The first stage was centered on productivity, profit, and profitability; the second stage was influenced by shifts in the global market and placed greater emphasis on strategic priorities, with business flexibility and quality indicators of products and services becoming crucial for securing and preserving competitive advantage.

Tudose et al (2022) summarized the study on financial indicators and underlined the adoption and validation of four generations of financial performance indicators over time;

1. Additional value for the business and shareholders;
2. Profit margin;
3. Profit growth rate;
4. Return on equity (ROE), return on investment (ROI), and return on assets (ROA).

The perspectives of additional value and returns were adopted for this research paper in the measurement of financial performance hence earnings per share and returns on assets were covered.

Theoretical Grounding and Hypotheses Formulation

This research built on the principles of stakeholder's theory as was propounded by Freeman (1984). The tenet behind this theory is the ability of an organization to meet the demands of various stakeholders while pursuing its goals and objective. These stakeholders are very important in any organization because they have the ability to affect its performance. Stakeholders are typically classified as follows: suppliers, buyers and customers, competitors, governments, banks and other creditors, owners and shareholders, and employees. Qian et al., (2022) stated that EMA promotes a company's anticipatory response to stakeholder pressures such as governments, consumers, and investors who are increasingly concerned about sustainability issues by identifying and allocating environmental cost more transparently.

EMA increases environmental cost efficiency through three main strategies based on recent research findings which are

an integrated environmental cost tracking system (Schaltegger & Burritt, 2017), product life cycle cost analysis which helps companies optimize packaging design and production processes to minimize waste (Qian et al., 2022) and an environmental performance measurement system such as creating internal competition to achieve efficiency (Jalaludin et al., 2021). This theory implies that a positive stakeholder commitment by maintaining environmental best practices, will invariably have a positive impact on an organization financial performance even though it appears to increase costs at face value.

This theory is relevant to this study because it states the importance of actively managing stakeholders and the corporate environment. Hence it proposes that management should attempt to create a structure that will be sensitive to the needs of its stakeholders and improve the company's performance. In alignment, the study hypothesizes thus in the null form;

Ho1: Environmental management accounting of listed consumer goods companies in Nigeria have no significant effect on their returns on asset.

Ho2: Environmental management accounting has no impact on earnings per share of listed consumer goods firms in Nigeria.

Empirical Literature Review

Various researchers have explored environmental management accounting practices of firms as well as assessed its relationship with some important performance metrics in order to highlight its importance to operations, performance and reporting of companies in the contemporary times. Some of the works have been consulted and presented in this section.

Komarudin (2025) studied the relationship between EMA and long-term financial performance using extensive literature

review method. The study relied on reputable journal websites to collect secondary data which were thematically analyzed to reflect profitability of firms in the selected studies, their environmental cost management and company competitiveness. The findings show that implementation of EMA is important for positive long-term financial performance. Also, Portillo-Tarragona (2025) posited through qualitative case analysis, that EMA extensions notably temporal circular reporting and material-flow cost accounting adaptations, improve firms' ability to budget, measure and disclose the environmental and economic impacts of circular investments. Ajinwo and Dokubo (2025) concluded that environmental costs of consumer goods manufacturing firms have significant and positive influence on the financial performance of 10 companies out of 21 listed as the time of the study. Barani et al (2025) conducted a meta-analysis examining how environmental management accounting is associated with organizational performance and how national EMA maturity, performance type and firm size influence the relationship. The study incorporated 36 studies with a combined total of 13,010 observers. The data was collected from Future of Growth Report (2024) to form national EMA maturity index. It found that EMA on performance is positive and significant but the strength of the association depends heavily on regulatory and national institutions.

Furthermore, Adepoju and Adeagbo (2025) studied the effect of environmental disclosure practices on the financial performance of manufacturing companies in Nigeria, using return on assets and Tobin's Q as proxies of financial performance. The panel regression empirical results showed that environmental disclosure has a

significant positive effect on both return on assets and Tobin's Q. However, Ifi (2025) utilized *ex-post facto* research design to study the link between environmental accounting and performance of 16 listed consumer goods companies in Nigeria. The results of the panel least squares regression showed that environmental cost has positive but non-significant effect on NPM, but on ROCE, the coefficients obtained showed that environmental cost has positive and significant effect on profitability of the selected companies.

Asa'd et al (2024) examined the relationship between EMA information and organizational environmental performance (OEP) among firms listed on the Amman Stock Exchange in Jordan by sourcing primary data from 121 firms. It employed partial least squares structural equation modeling to analyze the variables while assessing the mediating role of environmental decision quality (EDQ). The findings indicated that EMA information has a significant positive impact on both EDQ and OEP, while EDQ partially mediates the link between EMA and OEP. Swalih et al (2024) conducted a systematic literature aimed at identifying successful implementations of EMA and how it is utilized for strategic decision-making. So, the research contributed to body of knowledge by emphasizing that initial adoption of EMA is merely fueled by firms' need for acceptance by the society and not for improving financial performance. Magoba et al (2024) advanced evidence on EMA practices of mining companies in Bindura, Zimbabwe with primary data, using descriptive statistics and spearman coefficient of correlation for analyses. The study found that EMA practices promote environmental performance of firms which subsequently leads to financial performance of these organizations.

In Nigeria, Adebayo and Adegbe (2024) dealt with the adoption and implementation of EMA practices among manufacturing firms and

further assessed its influence on corporate sustainability and environmental accountability by sampling 310 managers across various industries and found that the adoption of EMA significantly improves environmental accountability through cost management efficiency. Huy and Phuc (2024) investigated the role of environmental management accounting practices in achieving strategic flexibility and green innovation management among Small and Medium Enterprises (SMEs) in Vietnam. The research employed non-probability convenience and snowball sampling method and concluded that EMA practice had a positive and significant effect on strategic flexibility, but had a positive and moderate effect on Green innovation management. Huynh and Nguyen (2024) while studying the role of environmental management accounting (EMA) in promoting sustainability using a survey of 397 industry respondents in Vietnam; concluded that environmental uncertainty, market competition, firm size and corporate governance positively influence EMA adoption.

Ezechukwu et al (2024) applied secondary data and examined the impact of EMA practices on the performance of consumer goods companies in Nigeria. The results of the analyses showed that EMA practices have significant impact on ROA but the effect was not significant in the case of ROE. Akinleye and Ogundipe (2024) evaluated the effect of environmental sustainability disclosure (ESD) on the market performance of listed consumer goods firms in Nigeria and found that strategic environmental disclosures enhance investor confidence and market valuation, recommending regulatory support and incentives for such disclosures. Akpan et al (2024) considered the effect of EMA practices

disclosure on the cost of equity of listed consumer goods companies in Nigeria. the EMA practices disclosures has significant effects on cost of equity, implying that environmental practices disclosure has a critical stake in the value and performance of companies' stock in the capital market. Olatunji and Akinyemi (2024) found that EMA practices gave a positive and significant effect on earnings per share and therefore concluded that EMA is a critical factor to organizational financial performance especially in the manufacturing sector of Nigeria.

Agweda et al (2024) and Eshiett and Eshiet (2024) obtained similar outcomes for industrial goods and oil sectors while using market value added as the dependent variable. Fristanti et al (2024) explored the effects of environmental cost, environmental disclosure, and environmental performance on corporate value of 10 firms listed on the industrial and chemical sector of Indonesia Stock Exchange between the periods of 2018 – 2022. And results showed that environmental cost had a negative significant effect on firm value while both environmental disclosure and environmental performance had no significant direct effect on firm value. But in Nigeria, Olayiwola and Adebisi (2024) maintained that EMA practices are essential for long term sustainability while its immediate impact on financial performance may be limited. On the other hand, Ezekwere and Ikilidi (2024) found that green accounting disclosure has no significant relationship with returns on equity ($\beta = 0.12, P > 0.05$) but yet concluded that green accounting disclosure provides a perfect avenue for companies to disclose their commitment towards environmental responsibility and improve their market value as a consequence. Bakare et al (2024) took another angle by assessing the influence of environmental reporting of listed consumer goods companies on profitability using secondary data. Its findings showed that returns

on equity elicits positive and significant variations from environmental reporting index whereas leverage has no significant effect.

Bresciani et al (2023) drawing on survey of primary data from manufacturing firms and structural equation modeling as the analytical technique, found that EMA adoption positively impacts on environmental performance, but this relationship is significantly strengthened when firms implement EKMPs. Likewise, Gerged et al (2023) using primary data from 204 companies in Pakistan, posited that EMA significantly and positively influenced firm performance. Interestingly, Mbonu and Amahalu (2023) explored the interaction between strategic management practices and environmental cost disclosure among listed consumer goods firms in Nigeria, using secondary data which were analyzed with Pearson correlation and OLS regression. The results showed that all the four strategic management proxies significantly and positively influence environmental disclosure.

From the foregoing, it is evident that most of the studies adopting secondary panel data approaches are domiciled in Nigeria and they utilized either environmental cost or researcher-designed checklist of content analysis to measure EMA leading to lack of standardization in the measurements. Environmental accounting researches are obviously undermined due to lack of standardized measurement. However, there are organizations providing guides and uniform values for environmental accounting to aid research and accountability. The Analysts' Data Services and Resources Ltd (ADSRL) present an independent and standardized rating of EMA for all listed companies in Nigeria thus this study intends to utilize these standardized indicators of

EMA to measure environmental management accounting prior to estimating its effect on financial performance of listed consumer foods companies in Nigeria. The study also provided a contemporaneous information on the impact of EMA on two measures of financial performance for the consumer goods sector of Nigeria which will serve as point of reference for future studies and also aid insights in the sector.

Methodology

This study adopted ex-post facto research design to facilitate the examination of the influence of environmental management accounting of listed consumer goods companies on their financial performance. Area of study is Nigeria as the study's focus is on consumer goods companies listed on Nigeria Exchange Group (NGX) from 2021 – 2024. The study's population comprises of the 19 listed companies out of which 17 were selected based on judgmental sampling technique for unavailability of financial reports for all the periods. The analytical technique utilized in achieving objectives of the study was the panel regression framework (fixed/random effects) combined with Driscoll–Kraay standard errors to provide consistent inference in the presence of heteroscedasticity, autocorrelation, and cross-sectional correlation. This approach ensures that the regression results are both statistically valid and methodologically rigorous though it was preceded by descriptive analyses of the variables, cross-section dependence and correlation test of the explanatory variables, which was intended to provide prior insights on the behavioral pattern of each of the variables in the study as part of the diagnostics.

The model therefore captures environmental management accounting as a function of each proxy for financial performance of listed consumer goods companies;

$$EMA = f(FP)$$

Where EMA = environmental management accounting

FP = Financial performance proxies

The above expression is therefore broken to match the two financial performance proxies in the study objectives hence the model will be specified according to proposed hypotheses;

$$ROA_{it} = \beta_0 + \beta_1 EMA_{it} + \beta_2 FS_{it} + \beta_3 AGE_{it} + \beta_4 LEV_{it} + \mu_i + \lambda_t + \epsilon_{it} \quad (1)$$

$$EPS_{it} = \beta_0 + \beta_1 EMA_{it} + \beta_2 FS_{it} +$$

$$\beta_3 AGE_{it} + \beta_4 LEV_{it} + \mu_i + \lambda_t + \epsilon_{it} \quad (2)$$

ROA = Return on assets

EPS = Earnings per share

FS = Firm size

AGE = Firm age

LEV = Leverage ratio

μ_i captures firm-specific fixed effects, λ_t captures year fixed effects whereas ϵ_{it} is the error term

The variables are further described in Table 1.

Table 1: Specification of research variables

Variable	Source	Description
Environmental management accounting (EMA)	Environmental rating from ADSRL publication	Figures provided by Analysts' Data Services and Resources Ltd (ADSRL)
Return on assets	Financial reports	Calculated as Net Income ÷ Total Assets
Earnings per share	Financial statement of each selected company	The profit attributable to ordinary shareholders for the period divided by the weighted average number of ordinary shares outstanding during the period, measured in Naira (₦) per share. Calculated as Profit for the year/Weighted average outstanding shares
Firm size	Financial statement	Calculated as Natural Logarithm of Total Assets (LnTA).
Firm age	Nigerian Exchange Group publication	Number of years since when the company was incorporated.
Leverage	Financial statement	Measures the extent to which a company uses debt to finance its operations. Calculated as the total debt divided by total assets

Source: Researcher's conceptualization 2025

Results and Discussion of Findings

Descriptive Analyses of Variables

The importance of descriptive analyses of environmental management accounting disclosures and other variables studied in this thesis predominantly lies in the need to understand the flow and behavior of each of

the series, and more importantly, to aid the selection of a suitable estimation framework. Hence descriptive analyses of the study's variables were performed on the raw data prior to transformations. The result is presented on Table 2.

Table 2: Descriptive Analyses

	EMA	ROA	EPS	FS	AGE	LEV
Mean	3.485294	0.264544	-3.227618	24.40951	51.20588	1.124853
Median	3.000000	0.035500	0.280000	24.84000	52.00000	0.660000
Maximum	8.500000	34.40000	61.77000	28.29000	101.0000	13.20000
Minimum	0.000000	-38.70000	-207.6500	18.00040	7.000000	0.040000
Std. Dev.	2.577125	7.320633	30.30708	2.631518	23.45498	2.051819
Skewness	0.361614	0.215511	-4.882624	-0.786334	0.030630	4.328030
Kurtosis	2.033914	23.23238	33.44220	2.944204	2.430583	22.25997
Jarque-Bera	4.126409	1160.349	2895.914	7.016456	0.929300	1263.310
Probability	0.127046	0.000000	0.000000	0.029950	0.628355	0.000000
Observations	68	68	68	68	68	68

Source: Researcher's Computations on Eviews 13

The descriptive statistics of the raw dataset have several important implications for the next diagnostic and estimation measures; and also, for distribution of the financial data in this thesis.

The means and medians of EPS and ROA are far apart, which is a clear indication of skewness and the presence of extreme values. For example, EPS has a mean of -3.23 but a median of 0.28 , suggesting that a handful of very large negative values are pulling the average down. Similarly, ROA shows a mean of 0.26 compared to a median of 0.035 , again reflecting the influence of extreme outliers. The range of values as evidenced by the minimum and maximum values of each series further confirms this. EPS spans from -207.65 to 61.77 , ROA from -38.7 to 34.4 . These ranges are unusually wide for financial ratios, which typically cluster around modest positive values. Leverage (LEV) also exhibits extreme variation, with a minimum of 0.04 and a maximum of 13.2 , far beyond what is considered normal capital structure behavior. This suggests on the face value that these companies, though they operate in the same industry, may have considerably varying degrees of performance, dividend policies and financing structures. It is also a possibility that the after COVID-19 effect

has altered trends of companies to behave inconsistently (Malik, 2024). Furthermore, the skewness and kurtosis statistics reinforced the picture already painted by the measures of central tendencies. EPS has a skewness of -4.88 and kurtosis of 33.44 , indicating a heavily left-skewed distribution with extreme tails. ROA and LEV also show excessive kurtosis (23.23 and 22.26 respectively), meaning their distributions are sharply peaked with heavy tails. These characteristics are confirmed by the Jarque-Bera test, which strongly rejects normality for most variables (probabilities of 0.000), except for AGE and FS which are relatively normal.

The environmental management accounting (EMA) scores obviously had a wide range from 0.00 to 8.50 but the mean and median values are close suggesting that there may not be too much many outliers in the series. Its behaviour tends to align with that of firm size and age, as the Jarque-Bera probability indicates that the distribution is normally behaved, based on the 5% benchmark, which implies that the null hypothesis that the data are normally distributed is accepted.

From the foregoing, the raw descriptive statistics has highlighted the presence of

extreme outliers and non-normal distributions in key financial ratios that form the explained variables: EPS and ROA. These characteristics justify the application of acceptable and appropriate measures to stabilize the series such as winsorization, which ensures that subsequent regression analyses are not unduly driven by a handful of extreme cases. By stabilizing the distributions of EPS, ROA, and LEV, winsorization enhances the robustness and reliability of the empirical results, making the findings more credible and suitable for academic and statistical inferences. Thus, the descriptive analyses of all variables after the transformation of these three variables are attached as Appendix 1 of this research.

The descriptive analyses conducted with the transformed EPS, ROA and LEV series yielded comparable mean and median values. By capping extreme values at the 5th and 95th percentiles, the distributions of EPS, ROA and LEV have been brought within more reasonable bounds. For instance, EPS now ranges between -17.23 and 5.56, compared to the raw extremes of -207.65 and 61.77. Similarly, ROA is contained between -0.67 and 0.21, and LEV between 0.24 and 4.59. These ranges are far more consistent with typical firm-level financial performance and reduce the undue influence of outliers. While normality is still rejected for the variables, the test statistics are significantly smaller than in the raw dataset. This indicates that the winsorized data, though not perfectly normal, are more suitable for regression analysis and less prone to distortion from outliers.

Cross-Section Dependence and Multicollinearity Analyses of Variables

To ascertain the cross-section dependence of the variables in this study, the data were tested for cross-sectional dependence. The results of the cross-sectional dependence tests of all the eight variables

which includes the three control variables were extracted and attached as Appendix 2. However, the results show that the probability outcomes of the variables suggest presence of cross-section dependence and thereby requires estimation method that accounts for cross-sectional dependence of the panel data.

Variance Inflation Factor was employed to test possible presence of multicollinearity of the explanatory variables. The result of the VIF on Appendix 3 revealed that all variables exhibit VIF values that are well below the conventional threshold of 10, with a mean VIF of 1.37. These findings indicated that multicollinearity does not distort the model specification so all variables were retained in the subsequent panel estimations.

Test of Hypotheses

This section contains the main estimation which were employed to test the hypotheses formulated by the study. In the light of the pre-estimation tests of the variables, although the descriptive results based on the transformed data on Appendix 1 still showed that the residuals of the variables did not satisfy the Jarque–Bera normality test, this did not invalidate the application of panel regression. The estimation method adopted was fixed effect regression with Driscoll–Kraay standard errors intended to address the concerns of robustness of inference under heteroscedasticity, autocorrelation, and cross-sectional dependence. Driscoll and Kraay (1998) demonstrated that their covariance matrix estimator remains valid under very general forms of spatial and temporal dependence, without requiring normally distributed residuals. Subsequent work by Hoechle (2007) confirmed through Monte Carlo simulations that Driscoll–Kraay standard errors are well-calibrated even when residuals deviate from normality, making them particularly suitable for financial panel data

where non-normality is common. Thus, the failure of the JB test as well as the cross-section dependence were effectively mitigated by the use of this robust estimation technique, ensuring reliable statistical inference. The estimation of each model is presented in the following subsections.

Testing the influence of environmental management accounting on return on assets of listed consumer goods companies in Nigeria

Ho1: Environmental management accounting of listed consumer goods companies in Nigeria have no significant effect on their returns on asset.

To test the first hypothesis as restated in this subsection, the study applied

fixed/random effects panel regression with Driscoll-Kraay standard errors to achieve this. The fixed-effect regression is preferred for the ROA model based on the outcome of the Hausman test, which yielded a chi-square probability of 11.61 and was significant at the 5% level. This suggests that the null hypothesis of selecting a random-effect regression should be rejected in favor of the fixed-effect alternative. Hence, the fixed-effect regression was applied to test the hypothesis. The results are shown in Table 3, alongside bootstrapped and panel-corrected standard errors as robustness checks of the baseline fixed-effect Driscoll-Kraay regression estimates.

Table 3: Fixed-effects regression of EMA on ROA

Variable	FE-DK (Baseline, ROA)	Bootstrapping (ROA, robustness)	PCSE (ROA, robustness)	Interpretation
EMA	$\beta = -0.0512$ $p = 0.046$	$\beta = -0.0512$ $p = 0.242$	$\beta = -0.0085$ $p = 0.523$	Baseline shows significant negative effect; robustness checks show non-significance.
FS (Firm Size)	$\beta = -0.0190$ $p = 0.359$	$\beta = -0.0190$ $p = 0.871$	$\beta = -0.0042$ $p = 0.798$	No consistent significance; direction did not vary, always non-significant.
AGE	$\beta = -0.0014$ $p = 0.908$	$\beta = -0.0014$ $p = 0.961$	$\beta = -0.0024$ $p = 0.219$	Insignificant across all models; weak negative tendency.
LEV (Leverage)	$\beta = -0.4447$ $p = 0.088$	$\beta = -0.4447$ $p = 0.137$	$\beta = -0.1242$ $p = 0.223$	Marginal negative effect in baseline; robustness checks show non-significance.
Constant	$\beta = 1.0747$ $p = 0.394$	$\beta = 1.0747$ $p = 0.729$	$\beta = 0.3239$ $p = 0.485$	Intercept not significant in any model.
Hausman test	Chi2=11.61 $p=0.021$			Shows that fixed effect regression is valid
F-stat	11.45($p=0.037$)			
R-squared	0.224			

Source: Researcher’s computations from STATA 13 extracted from Appendices 4(a) – 4(d)

The outcome of the fixed effects regression with Driscoll–Kraay robust standard

errors showed that Environmental Management Accounting (EMA) and the three

control variables can explain the variations on firm performance (ROA). The model yielded a within R-squared of 0.2244, indicating moderate explanatory power and F-statistics probability of 5% statistical significance thereby suggesting that the regression is acceptable for inference. However, the results of the baseline regression suggested that environmental management accounting, firm size, firm age and leverage influence return on assets negatively. The influence of EMA on ROA is the only significant one among all the variables, albeit the level of significance is on the borderline at 4.6% as against 5% acceptable benchmark.

This implies that EMA may not always have strong influence on ROA across these companies, a fact confirmed by the bootstrapped and Prais–Winsten regression with panel-corrected standard errors (PCSE) conducted to account for panel-specific error

correlation, which revealed the statistical significance of EMA on ROA is sensitive to model specification. Nonetheless, the direction of all the variables remained consistent across the estimates suggesting that the baseline fixed-effect with Driscoll-Kraay standard error is robust.

Based on the coefficient of baseline regression, the study rejects the null hypothesis as restated in this subsection and accepts that EMA has significant effect on ROA of listed consumer goods companies in Nigeria.

Analyzing the effect of environmental management accounting on earnings per share of listed consumer goods companies in Nigeria

Ho2: Environmental management rating has no impact on earnings per share of listed consumer goods firms in Nigeria.

Table 4: Fixed-effects regression of EMA on EPS

Variable	FE-DK (Baseline)	Bootstrapping	PCSE	Interpretation
EMA	-1.206 (p=0.028)	-1.206 (p=0.330)	-0.109 (p=0.761)	Consistently negative effect. Significant only in baseline; robustness checks show non-significance.
FS	-1.132 (p=0.067)	-1.132 (p=0.590)	-0.465 (p=0.308)	Marginal in baseline; non-significant in robustness checks.
AGE	-0.114 (p=0.662)	-0.114 (p=0.884)	-0.081 (p=0.201)	Always non-significant.
LEV	-14.384 (p=0.071)	-14.384 (p=0.074)	-2.416 (p=0.065)	Marginal negative effect across models, but unstable magnitude.
Constant	49.652 (p=0.141)	49.652 (p=0.444)	17.025 (p=0.188)	Always non-significant.
Hausman test	Chi2=23.25 p=0.000			Shows that fixed effect regression is more appropriate
F-stat	26.64(p=0.01)			
R-squared	0.318			

Source: Researcher's computations from STATA 13 extracted from Appendices 5(a) – 5(d)

According to the result depicted on Table 4, it is evident from the probability of the

Chi-square of the Hausman test that fixed-effects regression is more appropriate instead

of the random-effects estimation. This decision is based on the fact that the result favours the rejection of the null hypothesis assuming the adoption of the random-effects regression for explaining the influence of EMA on earnings per share of listed consumer goods companies in Nigeria. Furthermore, fixed-effects regression of the earnings per share (EPS) model yielded a within R-squared of 0.3181 and F-statistics probability of 0.01, indicating moderate explanatory power and credibility of the model at 1% level of statistical significance. So, the estimation was accepted for testing the second hypothesis as restated in this subsection.

Table 4 showed that EMA consistently had negative effect on earnings per share of the selected companies for the period covered in this study across the baseline and two robustness estimations. However, as is also the case in subsection 4.3.1, EMA showed significant effect on earnings per share which was lost in the two robustness checks thereby signaling the possibility that the strong influence of EMA on earnings per share of these companies may not be robust at the introduction of alternative error structures.

The study also observed that the control variables; firm size, age and leverage all have negative influence on earnings per share of the selected companies, reflecting the post-COVID struggles of listed consumer goods companies in Nigeria (Malik, 2024). The coefficients are largely robust in terms of direction of influence however there are still some variations in terms of the coefficients' magnitude.

The study therefore concluded based on the fixed-effects regression with Driscoll-Kraay standard errors that, EMA has significant and negative effect on earnings per share of the selected listed consumer goods companies in Nigeria thus it rejected the null hypothesis as

restated in this subsection.

Discussion of Findings

The analyses conducted in the study uncovered the nature of the financial performance data and environmental management accounting of listed consumer goods companies on Nigeria. First the descriptive analyses showed that the data were not normally distributed and were highly skewed in their raw forms. On the face value, the data collected highlighted the possible post-pandemic struggles of the Nigerian consumer goods sector as the sampled firms recorded inconsistent profits and losses, and many of them failed to demonstrate proper accounting of their environmental commitments as is evident in the raw scores of the EMA. The cross-section dependence analyses also showed that the data from different companies that made up the panel were largely responsive to common external shocks such as inflation, economic pressures of the pandemic, low economic activities and other market issues. All these influenced the choice of estimation method which tackled the observed tendencies in the financial data. ROA, EPS and LEV were winsorized to neutralize disproportionate distortions that could be introduced into the estimation by some outliers. The fixed effect panel regression with Driscoll-Kraay standard errors was utilized for the data estimation to account for cross-section dependence, heteroscedasticity and autocorrelation.

The data estimation for the first and second hypotheses showed that EMA exerted a weak and unstable influence on financial performance, with the fixed-effects Driscoll-Kraay specification suggesting a significant negative effect on ROA and EPS, but this relationship disappearing once bootstrapping and PCSE corrections are applied. This

contrasts sharply from existing empirical literature, where EMA is usually reported to enhance profitability, efficiency, or investor confidence. For instance, both Komarudin (2025) and Barani et al. (2025) emphasized its positive long-term impact, while Olatunji and Akinyemi (2024) found a significant effect on EPS. But the methodological sensitivity and contextual variation recorded in this study aligned with Fristanti et al (2024), who observed a negative effect of environmental costs on firm value in Indonesia, and Ezechukwu et al. (2024), who found EMA's effect to be significant on ROA. Firm size and leverage, which appeared consistently insignificant under robustness checks, compared with Bakare et al. (2024), who reported leverage as non-significant, and Adegbeie et al. (2020), who found that firm size did not moderate EMA's effect on share value. Firm age, similarly, showed no explanatory power, which is consistent with the broader literature where age is rarely found to be a significant predictor of financial performance. This study contributed to knowledge by proving that methodological corrections seem to weaken the effects implying that EMA's effect on financial performance is highly context-dependent and sensitive to model specifications.

Conclusions and Recommendations

In the ROA and EPS models, EMA was associated with statistically significant negative effects which suggest that the immediate costs of adopting environmental practices, whether through compliance, reporting, or investment, can reduce profitability and earnings in the short term. The broader implication is that EMA's value may not lie in immediate financial gains but rather in its long-term strategic, reputational, and sustainability benefits, which are not fully captured in short-run accounting

measures. Thus, the study recommended that since environmental management accounting (EMA) showed negative and significant effects on ROA and EPS, it is important for corporate leaders to adopt EMA process gradually and strategically, ensuring that environmental investments are aligned with operational efficiency. This will help minimize short-term financial strain while positioning the firm for long-term sustainability gains. This is because the legitimizing advantage that accrues from being environmentally responsible will surely promote financial performance in the long term.

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Appendices

Appendix 1: Descriptive results of winsorized variables

	EMA	ROA	EPS	FS	AGE	LEV
Mean	3.485294	-0.029888	-0.692118	24.40951	51.20588	0.881882
Median	3.000000	0.035500	0.280000	24.84000	52.00000	0.660000
Maximum	8.500000	0.206500	5.563500	28.29000	101.0000	4.588500
Minimum	0.000000	-0.672100	-17.23000	18.00040	7.000000	0.243500
Std. Dev.	2.577125	0.230672	5.464673	2.631518	23.45498	0.974125
Skewness	0.361614	-1.695058	-2.073672	-0.786334	0.030630	3.253396
Kurtosis	2.033914	5.045404	6.788155	2.944204	2.430583	12.74121
Jarque-Bera	4.126409	44.41694	89.39330	7.016456	0.929300	388.8169
Probability	0.127046	0.000000	0.000000	0.029950	0.628355	0.000000
Sum	237.0000	-2.032400	-47.06400	1659.847	3482.000	59.96800
Sum Sq. Dev.	444.9853	3.565034	2000.798	463.9674	36859.12	63.57758
Observations	68	68	68	68	68	68

Appendix 2: Cross-section dependence tests

Probability	EMA	ROA	FS	EPS	LEV	AGE
Breusch-Pagan LM	NA	0.0001	0.0000	0.0000	0.0000	0.0000
Pesaran scaled LM	NA	0.0000	0.0000	0.0000	0.0000	0.0000
Bias-corrected scaled LM	NA	0.1017	0.0000	0.0276	0.0206	0.0000
Pesaran CD	NA	0.0000	0.0000	0.0022	0.4449	0.0000

Appendix 3: Multicollinearity test (Variance Inflation Factor)

Variable	VIF	1/VIF
FS	1.63	0.614622
LEV	1.55	0.645518
EMA	1.26	0.793739
AGE	1.05	0.955400
Mean VIF	1.37	

Appendix 4: Fixed-Effects Regression and Robustness Checks of ROA Model

Appendix 4A: Fixed-Effect Regression with Driscoll-Kraay

```
. xtsc ROA EMA FS AGE LEV, fe
```

```
Regression with Driscoll-Kraay standard errors   Number of obs   =       68
Method: Fixed-effects regression                 Number of groups =       17
Group variable (i): firmid                      F( 4, 3)        =      11.45
maximum lag: 1                                  Prob > F         =      0.0367
                                                within R-squared =      0.2244
```

ROA	Drisc/Kraay				
	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
EMA	-.0511881	.0155359	-3.29	0.046	-.1006304 -.0017458
FS	-.0189652	.0175527	-1.08	0.359	-.0748257 .0368953
AGE	-.0013872	.0110294	-0.13	0.908	-.0364877 .0337134
LEV	-.444721	.1778743	-2.50	0.088	-1.010797 .1213545
_cons	1.074672	1.082576	0.99	0.394	-2.370567 4.519911

Appendix 4B: Hausman Test of the ROA Model

```
. hausman fe re
```

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
EMA	-.0511881	-.0016109	-.0495772	.0312784
FS	-.0189652	-.005356	-.0136092	.0188054
AGE	-.0013872	-.0018645	.0004773	.0107339
LEV	-.444721	-.1037854	-.3409356	.1614071

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\begin{aligned} \text{chi2}(4) &= (b-B)' [(V_b-V_B)^{-1}] (b-B) \\ &= 11.61 \\ \text{Prob}>\text{chi2} &= 0.0205 \end{aligned}$$

Appendix 4C: Bootstrapping Regression with the ROA Model (With 1000 Replications)

```

Fixed-effects (within) regression      Number of obs   =      68
Group variable: firmid                Number of groups =      17

R-sq:  within = 0.2244                Obs per group: min =      4
      between = 0.1496                    avg =      4.0
      overall = 0.0977                    max =      4

Wald chi2(4) =      6.84
corr(u_i, Xb) = -0.9034                Prob > chi2 =    0.1447
    
```

(Replications based on clustering on firmid)

ROA	Observed	Bootstrap	Normal-based			
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
EMA	-.0511881	.043708	-1.17	0.242	-.1368543	.0344781
FS	-.0189652	.116368	-0.16	0.871	-.2470423	.2091119
AGE	-.0013872	.0286973	-0.05	0.961	-.0576328	.0548584
LEV	-.444721	.2988223	-1.49	0.137	-1.030402	.1409598
_cons	1.074672	3.096064	0.35	0.729	-4.993501	7.142845
sigma_u	.35019323					
sigma_e	.19426951					
rho	.76467391 (fraction of variance due to u_i)					

Appendix 4D: Panel-Corrected Standard Errors (PCSE) Regression with the ROA Model

Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)

```

Group variable:  firmid                Number of obs   =      68
Time variable:  Year                  Number of groups =      17
Panels:         correlated (balanced)  Obs per group: min =      4
Autocorrelation: common AR(1)        avg =      4
                                          max =      4

Estimated covariances =      153      R-squared =      0.0894
Estimated autocorrelations =      1      Wald chi2(4) =      2.24
Estimated coefficients =      5          Prob > chi2 =      0.6923
    
```

ROA	Panel-corrected				
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
EMA	-.0085158	.013343	-0.64	0.523	-.0346676 .0176361
FS	-.0042067	.0164667	-0.26	0.798	-.0364808 .0280674
AGE	-.0023654	.0019237	-1.23	0.219	-.0061359 .001405
LEV	-.1242154	.1019842	-1.22	0.223	-.3241008 .07567
_cons	.3238697	.4636208	0.70	0.485	-.5848103 1.23255
rho	.4520335				

Appendix 5: Fixed-Effects Regression and Robustness Checks of EPS Model

Appendix 5A: Fixed-Effect Regression with Driscoll-Kraay

```

Regression with Driscoll-Kraay standard errors   Number of obs   =       68
Method: Fixed-effects regression                Number of groups =       17
Group variable (i): firmid                     F( 4, 3)       =    26.64
maximum lag: 1                                 Prob > F       =    0.0111
                                                within R-squared =    0.3181
    
```

EPS	Drisc/Kraay					[95% Conf. Interval]	
	Coef.	Std. Err.	t	P> t			
EMA	-1.205994	.3003584	-4.02	0.028	-2.161869	-.2501195	
FS	-1.132223	.4012456	-2.82	0.067	-2.409165	.1447199	
AGE	-.1136248	.2351551	-0.48	0.662	-.8619932	.6347436	
LEV	-14.38427	5.245563	-2.74	0.071	-31.07799	2.309454	
_cons	49.65162	24.98089	1.99	0.141	-29.84871	129.1519	

Appendix 5B: Hausman Test of the EPS Model

```
. hausman fe re
```

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
EMA	-1.205994	.2257647	-1.431759	.7524049
FS	-1.132223	-.5362126	-.5960101	.4632637
AGE	-.1136248	-.0659862	-.0476386	.254207
LEV	-14.38427	-1.538862	-12.84541	3.841576

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

```

chi2(4) = (b-B)' [(V_b-V_B)^(-1)] (b-B)
          = 23.25
Prob>chi2 = 0.0001
    
```

Appendix 5C: Bootstrapping Regression with the EPS Model (With 1000 Replications)

```

Fixed-effects (within) regression      Number of obs      =      68
Group variable: firmid                Number of groups   =      17

R-sq:  within = 0.3181                Obs per group: min =      4
      between = 0.0181                    avg =      4.0
      overall  = 0.0306                    max =      4

corr(u_i, Xb) = -0.9454                Wald chi2(4)      =      7.60
                                           Prob > chi2       =      0.1072
    
```

(Replications based on clustering on firmid)

EPS	Observed Coef.	Bootstrap Std. Err.	z	P> z	Normal-based [95% Conf. Interval]	
EMA	-1.205994	1.238042	-0.97	0.330	-3.632512	1.220524
FS	-1.132223	2.101622	-0.54	0.590	-5.251327	2.986881
AGE	-.1136248	.7820717	-0.15	0.884	-1.646457	1.419208
LEV	-14.38427	8.051957	-1.79	0.074	-30.16581	1.397277
_cons	49.65162	64.93337	0.76	0.444	-77.61545	176.9187
sigma_u	11.810912					
sigma_e	4.5904383					
rho	.86876655	(fraction of variance due to u_i)				

Appendix 5D: Panel-Corrected Standard Errors (PCSE) Regression with the EPS Model

Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)

```

Group variable:  firmid                Number of obs      =      68
Time variable:  Year                  Number of groups   =      17
Panels:         correlated (balanced)  Obs per group: min =      4
Autocorrelation: common AR(1)        avg =      4
                                           max =      4

Estimated covariances =      153      R-squared          =      0.0780
Estimated autocorrelations =      1      Wald chi2(4)      =      22.65
Estimated coefficients =      5          Prob > chi2       =      0.0001
    
```

EPS	Panel-corrected					
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
EMA	-.1086138	.357109	-0.30	0.761	-.8085346	.5913071
FS	-.4652446	.4566753	-1.02	0.308	-1.360312	.4298225
AGE	-.0812101	.063505	-1.28	0.201	-.2056775	.0432574
LEV	-2.416256	1.307265	-1.85	0.065	-4.978449	.1459371
_cons	17.02523	12.92864	1.32	0.188	-8.314426	42.36489
rho	.473631					