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ENVIRONMENTAL COST MANAGEMENT SYSTEM AND CORPORATE ECONOMIC PERFORMANCE OF LISTED INDUSTRIAL GOODS FIRMS IN NIGERIA

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Abstract

The study investigates the effect of environmental cost management system on corporate economic performance of listed industrial goods firms in Nigeria. The study employed longitudinal research design. Data were extracted from audited annual reports of industrial goods firms from the period of 2015 to 2024 using content analysis. The population which also is the sample size are the 13 listed industrial firms on the Nigerian Exchange Group as of December 31, 2024 using purposive sampling technique. Data were analysed with the aid of descriptive statistics, Spearman's correlation, and linear regression analysis. The findings show that carbon footprint reduction cost has positive and significant effect while waste minimization cost, and pollution control cost were positive but insignificant effect on the return on asset which is the measure of corporate economic performance of the listed industrial goods firms in Nigeria. The study concludes that the measure of environmental cost management system has positive and significant effect on corporate economic performance of listed industrial goods firms in Nigeria. From the result of the study, it was therefore recommended that companies should invest in carbon reduction initiatives and communicate its value to investors. Also, firms have to explore technology driven waste minimization and pollution control techniques in order to meet environmental objectives, reduce costs, and enhance operational efficiencies.

Keywords: carbon footprint reduction cost, corporate economic performance, environmental cost management system, pollution control cost, waste minimization cost

1. Introduction

With growing concerns on environmental sustainability and the increasing pressure for firms to adopt environmentally friendly practices, it was crucial to assess whether such investments yield measurable financial benefits. Corporate economic performance is a critical indicator of an organization's health and success, reflecting its ability to generate profits, manage expenses, and create value for shareholders (Abatan et al., 2024).

Globally, robust economic performance is crucial as it determines an organization's capacity to sustain operations, expand, and invest in innovation (Abatan et al., 2024). In developed economies, financial performance is often seen as a

barometer of economic stability and growth potential. Similarly, in Nigeria, the corporate economic performance of listed companies, particularly in the industrial goods sector, is pivotal for economic development (Gerged et al., 2024). These companies not only contribute significantly to GDP but also drive industrialization, employment, and technological advancement.

Effective financial performance enables these firms to attract foreign investment, enhance competitive advantage, and foster sustainable growth, making it a cornerstone of national economic strategy (Usman et al., 2024). In response to these financial performance challenges, particularly those exacerbated by environmental issues, there has been a significant shift towards the adoption of environmental cost management systems (ECMS) (Hennig et al., 2023).

Originally driven by global concerns over climate change, resource depletion, and pollution, ECMS frameworks aim to help organizations minimize their environmental carbon footprint while improving operational efficiency (Hennig et al., 2023). The integration of ECMS into business practices is not just a response to regulatory requirements but also a strategic approach to risk management and corporate social responsibility (Bresciani et al., 2023).

Companies, particularly those in environmentally intensive sectors like industrial goods, are recognizing the long-term benefits of adopting EMS, such as enhanced corporate reputation, compliance with international standards, and improved stakeholder relations (Usman et al., 2024). ECMS provides a structured approach to identifying and managing environmental impacts, which can significantly address financial performance issues by fostering sustainability and operational efficiency (Tushar et al., 2023).

By reducing waste and energy consumption, companies can lower operational costs and improve profit margins (Tushar et al., 2023). Moreover, ECMS adoption enhances compliance with environmental regulations, avoiding potential fines and legal disputes that could harm financial performance. In Nigeria, where industrial firms face significant environmental challenges, the implementation of ECMS can help mitigate the adverse effects of pollution and resource inefficiency, thereby supporting sustainable financial growth (Elshaer et al., 2023). Effectively manages environmental impacts through the integrated activities of waste minimization, carbon footprints reduction and pollution control (Ullah & Lin, 2024).

Globally and within Nigeria, financial performance is influenced by a range of environmental and operational factors. By adopting comprehensive EMS frameworks, industrial firms can address these challenges effectively, leading to improved cost management, regulatory compliance, and corporate reputation. Waste minimization, carbon footprint reduction, and pollution control are key areas where EMS can drive financial performance improvements. Ultimately, the integration of environmental management into business strategy is not just a regulatory necessity but a strategic imperative for achieving long-term financial and operational success.

The integration of Environmental Management System (EMS) into business strategies has become a critical factor in enhancing economic performance, particularly within the industrial goods sector listed in Nigeria. As global concerns over environmental sustainability grow, companies must address challenges such as waste management, carbon emissions, and pollution control to remain competitive and

compliant with regulations. As a result, the study investigates the effect of environmental cost management systems such as waste minimization, carbon footprint reduction and pollution control on corporate economic performance of industrial goods firms listed in Nigeria using return on asset (ROA) as the measure of performance.

2. Literature Review

This section provides the clarification of concepts of dependent and independent variables, theoretical and empirical review, and the development of hypotheses.

Corporate Economic Performance

Adebayo and Fadeyi (2023) define corporate economic performance as the assessment of a company's financial health, primarily measured by profitability, liquidity, solvency, and market performance indicators. It encompasses both short-term and long-term financial metrics, which provide insights into a company's ability to generate income, manage expenses, and sustain operations over time.

The multidimensional nature of economic performance, emphasising the various indicators that includes the company's ability to remain liquid and solvent, thereby ensuring its long-term viability. The inclusion of market performance indicators also points to the importance of investor perceptions and market valuation in assessing a company's financial success. Smith and Thompson (2022) describe corporate economic performance as the effectiveness with which a company utilizes its resources to achieve objectives, often measured by return on assets, return on equity, earnings per share, profit after tax, profit before interest and tax, etc.

Corporate economic performance reflects management efficiency in deploying resources to maximize shareholder value, and also underscores the significance of profitability ratios as core indicators of financial health. Corporate economic performance is a key indicator of a company's competitive position in the market and its ability to achieve sustainable growth, typically measured through profitability ratios, revenue growth, and cost management effectiveness (Oluwaseun et al., 2024).

Garcia and Lopez (2023) consider financial performance as the financial outcomes of a company's operations, measured by key financial metrics such as profit margins, asset turnover, and liquidity ratios. By including liquidity ratios, the authors also point to the importance of maintaining financial flexibility and the ability to meet short-term obligations, which are crucial for sustaining operations and growth.

Return on Assets

Return on Assets (ROA) is a profitability ratio that measures how efficiently a company is using its assets to generate net income. It is calculated by dividing the net income by the total assets of the company. Harsh and Kiran (2022) emphasize ROA as a key indicator of operational efficiency. By focusing on how a company's total assets contribute to its profitability, this definition highlights the role of asset management in financial performance.

Firms with higher ROA are often seen as using their resources more effectively, which can influence investor confidence and long-term sustainability. Smith and Thompson (2021) underline that ROA is not just about profits but profitability relative to assets. This nuance is crucial in comparing firms of different sizes or industries where asset bases vary. It offers insights into how effectively management is deploying its asset base to drive profitability. The ratio helps investors and managers alike evaluate performance against peers with similar asset profiles.

According to Green and Patel (2023), return on assets represents a firm's ability to generate earnings from its assets, typically calculated by dividing the net profit by the average total assets over a period. Green and Patel (2023) introduce a dynamic aspect by incorporating the average total assets, acknowledging fluctuations in asset bases over time. This method provides a more stable view of profitability, particularly for firms with significant asset turnover during the fiscal year. It also avoids skewed perceptions caused by temporary asset expansion or contraction, thereby offering a clearer picture of ongoing operational efficiency.

Environmental Cost Management System (ECMS)

Ogundele and Adewale (2022) define Environmental Cost Management System (ECMS) as a structured framework that allows organizations to identify, monitor, and manage their environmental impacts comprehensively. Its serves as a critical tool for organizations to align their operations with environmental regulations while fostering sustainable practices. They emphasize the role of ECMS in continuous improvement, where organizations regularly evaluate and update their environmental policies and practices in response to new environmental challenges and regulatory changes. This dynamic nature of ECMS ensures that companies not only comply with current standards but also contribute to long-term environmental sustainability.

Thompson and Davis (2023) describe ECMS as an integrative approach that embeds environmental considerations into the core operations of an organization. Thompson and Davis (2023) argue that ECMS goes beyond compliance, aiming to integrate environmental stewardship into strategic decision-making processes. ECMS is the framework that enables an organization to systematically manage its environmental impacts and improve environmental performance through continuous assessment, planning, implementation, monitoring, and review of its environmental policies and objectives. An ECMS typically includes practices such as compliance with environmental regulations, carbon footprint reduction, waste management, pollution control, and resource conservation.

Waste Minimization cost

Adebayo and Olatunji (2023) define waste minimization as the strategic approach of reducing waste generation at the source through efficient resource management and innovative process design. According to Adebayo and Olatunji (2023), waste minimization is not just about managing waste after it is created but involves proactive strategies to prevent waste in the first place. This definition emphasizes the importance of efficiency and innovation in reducing the environmental footprint of industrial activities, particularly in resource-intensive sectors.

The focus on resource efficiency aligns with the broader sustainability goals of reducing environmental impact. By minimizing waste at the source, companies can not only lower their operational costs but also contribute to environmental preservation. Waste minimization cost is process of reducing the amount and toxicity of waste generated by a company. This can be achieved through various means such as process modification, resource recovery, recycling, and reusing materials. Waste minimization helps company's lower disposal costs, reduce environmental liability, and improve operational efficiency.

Carbon Footprint Reduction cost

Williams and Adeola (2023) define carbon footprint reduction as the systematic lowering of greenhouse gas emissions associated with a product, service, or organization through efficiency improvements and sustainable practices. It emphasizes the process-oriented nature of carbon footprint reduction, focusing on making existing processes more efficient and adopting sustainable practices to reduce emissions.

Chen and Nwosu (2022) describe carbon footprint reduction as the act of minimizing the total amount of carbon dioxide and other greenhouse gases released into the atmosphere as a result of human activities. Carbon footprint reduction is the efforts made by a company to decrease the total amount of greenhouse gases (GHGs) it emits directly or indirectly. This involves implementing measures to reduce energy consumption, increase energy efficiency, utilize renewable energy sources, and promote sustainable practices within the organization. Reducing the carbon footprint helps in mitigating climate change and can lead to cost savings and enhanced corporate reputation.

Pollution Control Cost

Ibrahim and Adeyemi (2023) define pollution control as the systematic regulation and management of pollutants released into the environment, aiming to minimize harmful effects on ecosystems and human health. It involves a combination of regulatory measures, technological interventions, and community engagement to reduce environmental degradation. They emphasize that effective pollution control requires a multi-faceted approach, integrating legal frameworks, advanced technologies, and public awareness initiatives.

Chen and Wang (2022) describe pollution control as the application of techniques and strategies to limit the discharge of harmful substances into air, water, and soil, thereby protecting natural resources and promoting public health. They argue that pollution control is a critical component of environmental management, focusing on the prevention of pollution at the source and the mitigation of its impacts on ecosystems.

Olufemi et al. (2023) define pollution control as the implementation of policies, regulations, and technologies aimed at reducing the concentration of pollutants in the environment to levels that are safe for human health and the environment. Pollution Control cost **is** the implementation of measures and technologies to reduce or eliminate the release of pollutants into the environment. This includes controlling emissions of harmful substances into the air, water, and soil. Effective pollution control practices help in complying with environmental regulations, protecting public health, and preserving natural ecosystems.

Theoretical Development

The Resources-Based View (RBV) theory was developed by Jay Barney in 1991. This theory posits that a firm's competitive advantage and superior performance are primarily determined by its internal resources and capabilities, rather than external factors such as market conditions. According to Barney, resources must be valuable, rare, inimitable, and non-substitutable (VRIN) to confer sustained competitive advantage (Barney, 1991). The RBV theory is built on several key assumptions.

First, it assumes that firms are heterogeneous in terms of the resources they control. This heterogeneity implies that different firms have access to varying types and levels of resources, which can influence their performance. Second, the theory assumes that resources are not perfectly mobile across firms, meaning that some resources are

firm-specific and cannot be easily transferred or replicated by competitors. Third, RBV assumes that firms must exploit their unique resources and capabilities to gain a competitive edge and achieve superior financial performance (Barney, 1991; Wernerfelt, 1984).

RBV theory suggests that the adoption and effective implementation of ECMS can be considered a strategic resource that contributes to a firm's competitive advantage. Firms that integrate ECMS into their operations are able to manage environmental impacts more efficiently, comply with regulatory requirements, and enhance their corporate reputation. These capabilities can lead to improved corporate economic performance by reducing costs associated with environmental compliance and boosting market competitiveness through enhanced brand value (Hart, 1995; Russo & Fouts, 1997).

The RBV theory also implies that EMS can be a source of differentiation for firms. By investing in environmentally friendly practices and technologies, firms can distinguish themselves from competitors and appeal to increasingly eco-conscious consumers. This differentiation can translate into increased market share and financial performance (Ambec & Lanoie, 2008). This study is anchored on resource-based theory as it outlines that organization that possess unique internal resources and capabilities can effectively implement an environmental cost management system in order to achieve competitive advantage and in turn enhance financial performance. Therefore, the adoption and effective implementation of ECMS is considered as a strategic resource that contributes to a firm's competitive advantage and financial performance achievement.

Review of Empirical Literature

Stefano et al. (2024) examined the association between CSR and corporate financial performance (CFP) in Italy and discovered a U-shaped relationship. The results shows that CFP benefited less from the combined use of CSR and quality management than from CSR alone. Nkwoji (2024) investigated, from 2012 to 2017, the connection between environmental accounting and the profitability of a subset of Nigerian oil and gas businesses. The results showed no discernible correlation between these firms' net profits and their environmental expenditures.

Quantitative proof of the beneficial effects of corporate social responsibility (CSR) investment on the long-term expansion of American technology businesses was shown by Okafor et al. (2024). Panel data from the top 100 tech firms listed on the S&P 500 between 2017 and 2019 was examined in the research. Their findings demonstrated that IT businesses' improvements in sales and profitability were directly correlated with their increased investment in socially responsible causes.

Kolawole et al. (2023) performed research in Nigeria to explore the influence of environmental accounting methods on the financial performance of aviation enterprises. Waste management, pollution control laws, and environmental research and development were the main areas of study. The results showed that environmental pollution control policy favourably impacted the return on assets of Nigerian aviation companies, whereas environmental research and development and waste management had a negative and substantial impact on return on assets.

In order to evaluate the impact of environmental performance, firm size, and green accounting on financial performance, moderated by CSR, Hamdani et al. (2022)

carried out research in Indonesia. They discovered using panel data regression that only environmental performance significantly affected financial performance. An empirical investigation of the use of green accounting in Bangladeshi businesses that pollute extensively was carried out by Bablu et al. (2021), with a focus on the years 2010–2019. The research found a favourable relationship between the sustainable growth of the firms and the calibre of social responsibility disclosure.

The impact of green accounting on Indonesian manufacturing enterprises' financial performance was studied by Endiana et al. (2024). They discovered that businesses might improve their financial performance by applying green accounting methods and assigning suitable environmental expenditures to increase sustainability. They did this by using Structural Equation Modelling (SEM) to analyse data from 38 organisations.

The effect of green accounting on the financial performance of multinational companies in Indonesia was examined by Riyadh et al. (2024). The research, which made use of multiple regression analysis and secondary data, discovered that the expenses associated with green accounting had a negative effect on financial performance. The impact of green logistics management methods on the financial, market, social, and environmental performance of Chinese enterprises was investigated by Agyabeng-Mensah et al. in 2024. The research found that although green logistics techniques greatly increased environmental performance, their impact on social, market, and financial performance was negligible. The study included data from 240 organisations across several sectors.

The study conducted by Lusiana et al. (2021) examined the correlation between green accounting, business value, return on equity, return on assets, and corporate social responsibility (CSR). After analysing thirty peer-reviewed studies, it was determined that CSR and green accounting have a major influence on financial performance, which raises the value of the company.

Nguyen et al. (2024) looked into the variables influencing the use of environmental accounting by Vietnamese construction companies listed on the Ho Chi Minh Stock Exchange. Regression analysis and data from annual reports were used in the research, which revealed that listed time and independent audit firms were important influences on these businesses' adoption of environmental accounting.

In Nigerian manufacturing enterprises, return on assets, net profit margin, and profits per share were among the financial performance metrics that Chinedu and Ogochukwu (2024) looked at in connection to environmental accounting disclosures. After examining time series data from 40 companies using a correlation study approach, they found a strong positive link between the chosen financial performance measures and environmental accounting disclosures.

Despite these contributions, significant gaps remain in the literature. Many studies have predominantly focused on corporate governance and technological innovation, often overlooking the holistic impact of comprehensive environmental cost management systems (ECMS) on economic performance. Additionally, there is a lack of research specifically examining the interplay between ECMS and corporate economic performance within the Nigerian context. In addition, most studies concentrated on firm such as consumer goods, financial service sector, oil and gas firms, construction firms, tourism and health care firm, limited focus has been placed on industrial goods firms. The aftermath of this created a gap to be filled in this literature.

In other to fill the gap, the study examines the effect of environmental cost management systems such as waste minimization cost, carbon footprint reduction cost, and pollution control cost on corporate economic performance of industrial goods firms in Nigeria. Also, to fill the gap of time scope, the study considers a period spinning between 2015– 2024. This study aimed to fill the lacuna with the followings hypotheses formulated in null form.

H_1: Environmental cost management system has no significant effect on corporate economic performance of industrial goods firms listed Nigeria.

H_2: Waste Minimization cost has no significant effect on corporate economic performance of industrial goods firms listed Nigeria.

H_3: Carbon Footprint Reduction cost has no significant effect on corporate economic performance of industrial goods firms listed Nigeria.

H_4: Pollution control cost has no significant effect on corporate economic performance of industrial goods firms listed Nigeria.

3. Methodology

Research design carefully chosen for this study was longitudinal. The data used were gathered from a secondary source which include of the sustainability and annual reports of industrial enterprises, gotten from websites of firms along with the Nigeria Exchange (NGX) Group, from 2015 to 2024. The entire population of (13) firms quoted on NGX as of December 31st 2024 were also used as sample size using census sampling technique. The obtained data were analysed with spearman's rank correlation, descriptive statistics, and ordinary least square regression.

Model Specification

Model of Ahmad et al. (2023) on environmental management system and firm value was modified for this study. The model was adapted because it comprises some proxies of environmental management system. However, the study excluded variable on environmental management system because the study intends to examine other variables not captured in the model. Therefore, this study modified Ahmad et al. (2023) model by including corporate economic performance.

$CEP = f(ECMS)$ ……*equation 3.1*

$ROA_{it} = f(WMC, CFRC, PCC)$ ……. *.....equation 3.2*

$ROA_{it} = \alpha 0 + \beta_1 WMC_{it} + \beta_2 CFRC_{it} + \beta_3 PCC_{it} + \varepsilon_{it}$…… *equation 3.3*

Where: CEP = ROA; ECMS = WMC, CFRC, PCC; CEP = Corporate Economic Performance; ROA= Return on Asset; ECMS = Environmental Cost Management System; WMC= Waste Minimization Cost; *CFRC* = Carbon Footprint Reduction Cost; *PCC* = Pollution Control Cost; $\alpha 0$ = Intercept; $B_1 - \beta_3$ = coefficient of independent variables; ε_{it} = error terms of firm i and time t.

The *apriori* expectation would be a positive effect of environmental cost management system on corporate economic performance.

Table 1

Measurement of Variables

S/N	Variables	Description	Measurement	Sources
	Independent Variable: Environmental Cost Management System			
1	Waste Minimization Cost	The cost of reducing the toxicity of waste generated by a company. This is attained through processes of modification, resource recovery, recycling and reusing materials	Percentage reduction in waste (year-over-year): Tracks the reduction in total waste generated compared to previous years	Adeola and Eze (2017)
2	Carbon Footprint Reduction Cost	The cost made by a company to decrease the total amount of greenhouse gases (GHGs) it emits directly or indirectly	The percentage reduction in total carbon emissions compared to a baseline year often part of sustainability goals	Saleh and Jawabreh (2020)
3	Pollution Control Cost	The cost to decrease or eradicate the release of noxious waste into the environment	Tracks the percentage reduction in air or water pollution compared to previous years	Stefano et al., (2024
	Dependent Variable: Corporate Economic Performance			
4	Return of Assets	The quota of firm's economic health and profitability over a specific period	Measured profit after tax divided by total assets	Saleh and Jawabreh (2020)

Source: Author's compilation, (2025)

4. Results and Discussion

Table 2

Descriptive Statistics

VARIABLE	OBS	Mean	Std. Dev.	Min	Max
ROA	130	-0.778	38.338	-256.980	108.900
CFRC	130	0.127	0.335	0.000	1.000
WMC	130	0.273	0.447	0.000	1.000
PCC	130	0.209	0.409	0.000	1.000

Source: Author's Computation (2025)

Table 2 give the summary of descriptive statistics of all variables used for this study. ROA which is the proxy of corporate economic performance with mean of -0.778, showing averagely firms experienced a slight loss over the period under study. Standard deviation of 38.338 which is relatively high reveals substantial variation in ROA among firms, which is further illustrated by range of values from -256.980 (min) to 108.900 (max).

While some firms faced substantial losses, others achieved high profitability, reflecting diverse financial performance within the industrial goods sector. Carbon footprint reduction cost (CFRC) with mean value of 0.127, indicating averagely that firms allocate a insignificant proportion of resources in reducing carbon footprints. Standard deviation of 0.335 suggests moderate variability in these costs across the firms. The values of 0.000 (min) and 1.000 (max) confirm that a number of firms fail to invest in carbon footprint reduction at all, while others fully committed resources to this environmental initiative.

Waste minimization cost (WMC) with mean value of 0.273, which signifies average investment by firms in waste minimization efforts. Standard deviation value of 0.447 reflects considerable variability in the costs associated with waste minimization among the firms. The range, spanning from 0.000 to 1.000, indicates that some firms do not incur any costs in minimizing waste, while others allocate significant resources toward this objective. Pollution control cost (PCC) exhibits a mean of 0.209, implying that firms, on average, dedicate a modest amount of resources to pollution control. The standard deviation of 0.409 shows substantial variability in pollution control efforts throughout the firms. Similar to CFRC and WMC, the values of 0.000 (min) and 1.000 (max) indicating disparity in firm practices, with some firms not investing in pollution control and others investing heavily.

Table 3

Shapiro-Wilk Test for Normal Data

Variable	Obs	W	V	Z	Prob>z
ROA	130	0.575	38.050	8.114	0.000
CFRC	130	0.899	9.026	4.906	0.000
WMC	130	0.973	2.454	2.002	0.023
PCC	130	0.952	4.330	3.268	0.001

Source: Author's Computation (2025)

The results show a positive association between the independent variable of carbon footprint reduction cost (CFRC) (0.154) and the dependent variable of return on asset (ROA) during the period under study. Also, the results indicate a positive

association between waste minimization cost (WMC) (0.072) and the dependent variable of ROA.

Similarly, pollution control cost (PCC) (0.089) is positively associated with ROA during the period under study, although the association appears relatively weak. Additionally, there is a moderate positive association between CFRC (0.562) and WMC, indicating that firms investing in carbon footprint reduction tend to also engage in waste minimization practices. There is also a strong positive association between WMC (0.840) and PCC, suggesting that firms that focus on waste minimization are likely to also invest in pollution control measures. The associations indicate the absence of multicollinearity since all the correlations are seen to be weak to moderate. However, to confirm the absence of multicollinearity among the variables, a more robust check of the Variance Inflation Factor (VIF) test will be presented in the next sections.

Table 5

Linear regression

ROA	**Coef.**	**St.Err.**	**t-value**	**p-value**	**[95%]Conf**	**Interval]**	**Sig**
CFRC	0.815	11.574	0.07	0.044	-23.765	22.135	
WMC	3.527	13.391	0.26	0.793	-23.026	30.080	
PCC	3.005	14.425	0.21	0.835	-25.596	31.607	
Constant	-6.869	3.743	-1.84	0.069	-14.290	0.553	
Mean dependent var	-0.778		SD dependent var		38.338		
R-squared	0.286		Number of obs		110		
F-test	10.532		Prob > F		0.000		
Akaike crit. (AIC)	1086.272		Bayesian crit. (BIC)		1099.774		
VIF	2.39						
Hettest	1.63{0.422}						
**** p<.01, ** p<.05*							

Source: Author's Computation (2025)

Table 5 represents the results obtained from the estimation of the models using the ordinary least square (OLS) regression method. The results indicate that the dependent variable, as captured by the regression model, has an R-Square value of 0.286. This suggests that the independent and control variables in the study account for approximately 28.6% of the systematic variation in the dependent variable during the period under study.

The remaining 71.4% of the variation is explained by other factors not included in the model, as indicated by the error term. This underscores the relevance of the model in explaining the dependent variable. However, to further validate the estimates of the pooled OLS results, this study also tests for multicollinearity and heteroscedasticity.

The analysis also includes a test for multicollinearity using the Variance Inflation Factor (VIF). The mean VIF for the variables in the OLS regression model is 2.39, which is well below the commonly accepted threshold of 10. This indicates that there is no severe multicollinearity among the independent variables, suggesting that they do not have high intercorrelations that would necessitate their exclusion from the model. The absence of multicollinearity enhances the reliability of the estimated coefficients.

The assumption of homoscedasticity was tested using the Breusch-Pagan test, with the results showing a p-value (Hettest = 1.63, p=0.422). This indicates that the assumption of homoscedasticity is not violated, implying the absence of heteroscedasticity in the OLS regression model. As a result, the standard errors of the estimates are reliable, allowing for valid statistical inferences.

The results obtained from the OLS regression model presented in Table 5 reveal that carbon footprint reduction cost [coef. = 0.815 (0.044)] has a positive and statistically significant effect on the return on asset measure of corporate economic performance of the industrial goods firms listed in Nigeria during the period under study. The result implies that changes in CFRC have significantly influence the corporate economic performance of these firms. Hence, the null hypothesis that carbon footprint reduction cost has statistically significant effect on the corporate economic performance of industrial goods firms listed in Nigeria is rejected.

Also, the results obtained from the OLS regression model presented in Table 5 reveal that waste minimization cost [coef. = 3.527 (0.793)] has a positive but statistical insignificant effect on the return on asset measure of corporate economic performance of the listed industrial goods firms in Nigeria during the period under study. This suggests that variations in WMC do not significantly impact the corporate economic performance of these firms. Hence, the null hypothesis that waste minimization cost has no significant effect on the financial performance of listed industrial goods firms in Nigeria is not rejected.

The results obtained from the OLS regression model presented in Table 5 reveal that pollution control cost [coef. = 3.005 (0.835)] has a positive and statistical insignificant effect on the return on asset measure of corporate economic performance of the industrial goods firms listed in Nigeria during the period under study. This result indicates that changes in PCC do not significantly affect the corporate economic performance of these firms. Hence, the null hypothesis that pollution control cost has no significant effect on the corporate economic performance of listed industrial goods firms in Nigeria is not rejected.

Discussions of Findings

The results obtained from the OLS regression model indicate that carbon footprint reduction cost (CFRC) has positive and statistically significant effect on the return on asset (ROA) of listed industrial goods firms in Nigeria during the period under study. This suggests that investments in reducing carbon footprints do not directly translate into improved financial performance for these firms. One implication of this finding could be that the market or internal operational efficiencies resulting from carbon reduction activities may not be immediately visible in the short-term financial indicators, such as ROA.

This finding aligns with the study by Nkwoji (2024), who also found that environmental investments often take longer to show a measurable impact on financial performance. Similarly, Hamdani et al. (2022) noted that while carbon reduction initiatives are crucial for long-term sustainability, their effects on short-term financial metrics might be muted due to the substantial upfront costs involved. However, this result contrasts with the work of Kolawole et al. (2023), who argued that carbon footprint reduction has a positive impact on firms' financial performance, suggesting

that firms can benefit from cost savings and improved brand image when they engage in proactive environmental strategies.

In a related study, Agyabeng-Mensah et al. (2024) found a significant positive relationship between environmental management practices and firm profitability, indicating that markets in some regions may respond more favorably to carbon reduction efforts. However, the current study's finding implies that within the Nigerian context, CFRC may not be immediately recognized as a value-adding activity by investors or may not contribute directly to the operational efficiency reflected in ROA. On the other hand, Ahmad et al. (2023) observed that the financial benefits of carbon footprint reduction tend to accrue over a more extended period, suggesting that the insignificance in the current study may be due to the relatively short observation window in relation to the long-term nature of environmental initiatives.

The analysis of the OLS regression model reveals that waste minimization cost (WMC) also has an insignificant effect on the financial performance, as measured by ROA, of the listed industrial goods firms in Nigeria. This implies that the variations in WMC do not significantly impact the firms' profitability in the short term. One possible explanation for this could be that waste minimization activities, while beneficial from an environmental perspective, may not lead to immediate cost savings or revenue generation.

This finding is in line with the work of Endiana et al. (2024), who suggested that the benefits of waste reduction efforts are often indirect, manifesting over time through enhanced reputation or compliance with regulations. Bablu et al. (2021) also observed that the initial costs associated with implementing waste management strategies could offset potential short-term financial gains. Contradicting this, Okafor et al. (2024) found a positive relationship between waste minimization practices and firm performance, suggesting that companies that effectively reduce waste can lower their operating costs, thereby boosting profitability.

Similarly, Stefano et al. (2024) argued that minimizing waste can streamline production processes, resulting in cost efficiencies that enhance a firm's return on assets. The divergence in the current study's findings may reflect differences in the industrial sectors, geographic regions, or the extent and nature of waste minimization practices adopted by the firms in question. Kolawole et al. (2023) posited that the financial impact of waste management might vary depending on factors such as firm size, industry characteristics, and market conditions, which could explain why the effect of WMC on ROA is insignificant in the context of Nigerian industrial firms.

The results of the OLS regression also show that pollution control cost (PCC) has an insignificant effect on the financial performance of listed industrial goods firms in Nigeria. This result indicates that investments in controlling pollution do not directly influence the firms' profitability as measured by ROA. One possible interpretation is that while pollution control is necessary for regulatory compliance and corporate social responsibility, the financial benefits of such activities may not be immediate or directly reflected in short-term profitability metrics. This view is supported by the findings of Danso et al. (2023), who suggested that pollution control measures might not generate immediate financial returns due to the substantial costs involved in implementing and maintaining these systems.

In contrast, Riyadh et al. (2024) argued that pollution control efforts can lead to improved financial performance by enhancing the firm's image and reducing potential regulatory fines, thus attracting investors and customers who value sustainability.

However, the current study's findings suggest that, in the Nigerian industrial sector, such benefits may not be sufficient to significantly affect the financial performance in the short term. This aligns with the study by Agyabeng-Mensah et al. (2024), which indicated that the financial outcomes of environmental initiatives like pollution control might be more significant in the long run rather than in the immediate financial period under consideration.

Hamdani et al. (2022) also noted that pollution control costs often represent compliance with environmental regulations rather than strategic business investments, which may explain the lack of a significant relationship with ROA. On the other hand, the findings of Ahmad et al. (2023) suggest that the market's perception of pollution control activities can vary, with some investors seeing them as non-essential costs that do not directly contribute to a firm's profitability. The current study's outcome indicates that within the Nigerian industrial context, pollution control costs may be seen primarily as necessary expenditures for legal and ethical compliance, rather than as activities that add immediate financial value.

5. Conclusion and Recommendations

The results of this empirical study show that carbon footprint reduction cost has positive and statistically significant effect while waste minimization cost, and pollution control cost were positive but statistical insignificant effect on the return on asset measure of corporate economic performance of the listed industrial goods firms in Nigeria.

The study concludes that the measure of environmental cost management system has positive and significant effect on corporate economic performance of industrial goods firms listed in Nigeria. This implies that changes in these environmental practices do have a direct or immediate impact on the firms' profitability. These results suggest that while firms may engage in these environmental management practices for various reasons, such as regulatory compliance or corporate social responsibility, the financial benefits of these initiatives may not be readily apparent in the short term.

This finding aligns with the view that environmental investments often require substantial initial costs and may yield financial returns only over an extended period. From the result of the study, it was therefore recommended that companies should invest in carbon reduction initiatives and communicate its value to stakeholders. Also, firms have to explore technology driven waste minimization and pollution control techniques in order to meet environmental objectives, reduce costs, and enhance operational efficiencies.

References

Abatan, A., Adeyinka, M. A., Sodiya, E. O., Jacks, B. S., Ugwuanyi, E. D., Daraojimba, O. H., & Lottu, O. A. (2024). The role of IT in sustainable environmental management: A global perspective review. *International Journal of Science and Research Archive, 11*(1), 1874-1886.

Adebayo, K., & Fadeyi, J. (2023). Multidimensional aspects of financial performance: An integrative approach. *Journal of Financial Analysis*, 59(2), 215-233.

Adebayo, T., & Olatunji, K. (2023). Efficient resource management and process design in waste minimization. *Journal of Environmental Management, 1*(2), 13-23

Agyabeng-Mensah, Y., Sarpong, G., & Bediako, K. (2024). Green logistics management and firm performance in China. *Journal of Environmental and Market Performance, 16*(3), 201-226.

Ahmad, S., Asif, M., & Rehman, A. (2023). CSR, firm innovation, and organizational performance in Pakistani SMEs. *Journal of Business Innovation Research, 9*(2), 78-102.

Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *Academy of Management Perspectives, 22*(4), 45-62.

Bablu, M., Rahman, M., & Kazi, A. (2021). Green accounting in Bangladesh: Enhancing sustainable development. *Journal of Green Accounting and Sustainability, 12*(1), 65-89.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Chen, Y., & Nwosu, T. (2022). Quantifying carbon emissions for effective reduction. *International Journal of Climate Change Strategies, 1*(1), 19-29

Chen, Y., & Wang, L. (2022). Pollution control and environmental management: Techniques and strategies. *Environmental Science Journal, 58*(3), 145-162.

Chinedu, N., & Ogochukwu, E. (2024). Environmental accounting disclosures and financial performance in Nigerian manufacturing firms. *Journal of Corporate Sustainability, 20*(2), 128-153.

Danso, A., Mensah, E., & Akoto, L. (2023). The influence of stakeholder integration on financial performance in Ghanaian SMEs. *Journal of Organizational and Financial Studies, 21*(4), 65-90.

Elshaer, I. A., Azazz, A. M., & Fayyad, S. (2023). Green management and sustainable performance of small-and medium-sized hospitality businesses: moderating the role of an employee's pro-environmental behaviour. *International Journal of Environmental Research and Public Health, 20*(3), 2244.

Endiana, Y., Sutrisno, H., & Wahyudi, D. (2024). The role of green accounting in improving financial performance in Indonesian manufacturing firms. *Journal of Sustainability and Corporate Performance, 14*(2), 96-118.

Garcia, M., & Lopez, R. (2023). Operational efficiency and financial performance: A comprehensive review. *Journal of Business Finance, 47*(1), 89-107.

Gerged, A. M., Zahoor, N., & Cowton, C. J. (2024). Understanding the relationship between environmental management accounting and firm performance: The role of environmental innovation and stakeholder integration–Evidence from a developing country. *Management Accounting Research, 6*(2), 100-125.

Hamdani, R., Syafira, A., & Hartono, P. (2022). Green accounting and CSR in Indonesian firms: Impact on financial performance. *Indonesian Journal of Environmental Finance, 7*(2), 87-105.

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

Hennig, J. C., Firk, S., Wolff, M., & Coskun, H. (2023). Environmental management control systems: Exploring the economic motivation behind their implementation. *Journal of Business Research, 1*(2), 114-123.

Ibrahim, K., & Adeyemi, T. (2023). The role of regulatory measures in pollution control: A multi-faceted approach. *Journal of Environmental Protection, 65*(2), 89-106.

Kolawole, A., Oluwaseun, T., & Adeyemi, F. (2023). Environmental accounting practices and financial performance of Nigerian aviation firms. *Journal of Accounting and Environmental Research, 11*(3), 154-176.