

Research Article

Extent of Application of Environmental Impact Detection and Management Cost Allocation Practices for Environmental Protection by Manufacturing Firms in Anambra State

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Article History	Abstract
Received: August 08, 2026 Accepted: August 30, 2026 Published: September 05, 2026	This study examined the extent of application of environmental impact detection and environmental management accounting cost allocation practices for environmental protection by manufacturing firms in Anambra State, Nigeria. The study was guided by two research questions and two null hypotheses tested at the 0.05 level of significance. Descriptive survey research design was adopted. The population comprised 292 managers of registered manufacturing firms in Anambra State, from which a sample of 169 managers was determined using Taro Yamane's formula and selected through proportionate sampling. Data were collected using a 16-item structured questionnaire validated by three experts. The reliability of the instrument was established using Cronbach's alpha, yielding an overall coefficient of 0.91. Of the 169 questionnaires administered, 163 representing 98%, were retrieved and used for analysis. Mean and standard deviation were used to answer the research questions, while Analysis of Variance (ANOVA) was used to test the hypotheses. The findings revealed that manufacturing firms in Anambra State applied environmental impact detection practices to a moderate extent. Environmental management accounting cost allocation practices were, however, applied to a high extent. The findings of the study also found a significant difference in managers' ratings of environmental impact detection practices based on educational qualification ($F = 13.462$, $p = .001$), resulting in the rejection of the first null hypothesis. However, no significant difference was found in managers' ratings of environmental management accounting cost allocation practices based on qualification. The study concluded that although manufacturing firms demonstrated a relatively high application of environmental management accounting cost allocation practices, environmental impact detection practices remained insufficient. It was therefore recommended among others that manufacturing firms strengthen environmental monitoring and impact detection systems, enhance the capacity of managers and accounting personnel through relevant training, and adopt systematic procedures for identifying, measuring and tracing environmental impacts and their associated costs. These measures would improve environmental protection, resource efficiency and sustainable manufacturing practices in Anambra State. Keywords: Environmental Impact Detection, Environmental Management Accounting, Cost Allocation Practices, Environmental Protection and Manufacturing Firms.

Introduction

Environmental sustainability has become a major global concern due to the need to balance economic development with environmental protection. The United Nations Conference on the Human Environment held in Stockholm in 1972 drew international attention to environmental problems and encouraged governments, particularly those in developing countries such as Nigeria, to formulate measures for environmental protection. This concern was further reinforced by the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, which emphasized the integration of environmental considerations into economic development. Consequently, environmental protection has become an important consideration in organizational operations and decision-making, especially among manufacturing firms whose activities depend extensively on natural resources.

The environment provides essential resources such as land, water, energy, minerals and raw materials required for production. However, manufacturing activities can generate air and water pollution, solid and hazardous waste, noise, resource depletion and other forms of environmental degradation. Environmental protection therefore involves measures adopted to prevent, control or reduce the adverse effects of human activities on the environment. In manufacturing firms, such measures include pollution prevention, waste management, recycling, energy conservation, emission control, environmental monitoring and auditing, employee training and regulatory compliance. Hamilton *et al.*, (2018) described environmental protection as the practice of protecting the natural environment by individuals, organizations and governments. In the context of this study, environmental protection refers to measures aimed at conserving natural resources, controlling environmental impacts and protecting ecosystems from the adverse effects of manufacturing activities.

An important requirement for effective environmental protection is the identification and detection of environmental impacts arising from business activities. Environmental impact detection involves identifying, assessing and monitoring the actual or potential effects of a firm's activities, products and processes on the environment. It enables management to recognize sources of pollution, waste generation, excessive resource consumption and other environmental consequences and to take appropriate corrective measures. Environmental impact detection is therefore essential for integrating environmental considerations into operational and strategic decisions. Karimi *et al.*, (2017) specifically found that environmental management practices are influenced by “the knowledge and qualifications of personnel.”

Environmental impact detection is closely associated with environmental management accounting (EMA), which provides both physical and monetary information on environmental activities for internal management decision-making. EMA enables firms to identify environmental costs that may otherwise remain hidden within general production overheads. Such costs include waste management, pollution control, environmental monitoring and auditing, remediation, regulatory compliance, environmental training and investments in pollution-prevention technologies. The identification of these costs enables management to understand the financial implications of environmental activities and make decisions that promote waste reduction, resource efficiency and improved environmental performance.

Beyond identifying environmental costs, firms need to allocate such costs appropriately to the products, processes, departments or activities responsible for generating them. Environmental cost allocation is important because environmental costs do not arise uniformly across production activities. When such costs are pooled under general overheads and allocated using conventional methods, management may be unable to determine the actual environmental cost associated with particular products or processes. This may result in inaccurate product costing, inappropriate pricing and ineffective production decisions. Proper environmental cost allocation consequently provides more reliable information for controlling environmental expenditure and improving both operational and environmental performance. Igbodo *et al.*, (2018) noted that “there is a growing tendency to evaluate organizational performance not only in terms of economic effectiveness but also according to social and environmental effectiveness.”

Empirical evidence has demonstrated the relevance of environmental cost identification and allocation to the performance of Nigerian manufacturing firms. Ijeoma (2015) noted that environmental cost accounting assists organizations in managing the negative effects of waste discharge on the environment. Similarly, Okore (2021) reported that environmental training costs, waste-management costs and corporate social responsibility costs had positive and significant effects on the performance of manufacturing firms in Nigeria. However, Okoye and Adeniyi (2017) found that “inappropriate accounting systems that failed to incorporate environmental factors affected product pricing decisions.” These findings suggest that environmental expenditure becomes more useful to management when it is properly identified, measured and allocated.

Despite these benefits, environmental cost accounting has not been fully integrated into conventional accounting practices in many Nigerian manufacturing firms. Okafor *et al.*, (2013) found that many selected manufacturing companies had not substantially embraced environmental cost accounting and allocation practices. Similarly, Igbodo *et al.*, (2018) reported that firms commonly grouped indirect costs under general overheads and relied on conventional allocation bases that might not adequately reflect the causes of environmental costs. Such practices can conceal the financial consequences of pollution, waste generation and inefficient resource use. Tran *et al.*, (2021) further observed that environmental management accounting tools can be complex and require appropriately qualified personnel.

The application of environmental impact detection and cost allocation practices is also relevant to Nigeria's environmental regulatory framework. The Environmental Impact Assessment Act provides for the assessment of potential environmental impacts of relevant projects, while the National Environmental Standards and Regulations Enforcement Agency (NESREA) is responsible for environmental standards, compliance and enforcement. Depending on the nature of their activities, manufacturing firms may therefore be required to undertake environmental assessments, prepare environmental management plans, conduct environmental audits and monitor environmental performance. These activities generate environmental information and costs that should be properly identified, measured and incorporated into managerial decisions. Ezenekwe (2020) reported significant positive effects of economic and technological environments on firm productivity, while the political environment had a significant negative effect.

The issue is particularly important in Anambra State, an industrial and commercial centre in South-East Nigeria. Manufacturing activities in the state include food and beverages, plastics, chemicals, metal products, building materials, pharmaceuticals, textiles and other industries. Although these firms contribute substantially to employment and economic development, their operations may also generate waste, emissions and other environmental pressures. Effective environmental impact detection and appropriate allocation of associated environmental costs are therefore necessary to promote sustainable industrial development in the state.

Evidence from Anambra State suggests that manufacturing firms encounter challenges in applying environmental management accounting practices. Nwandu *et al.*, (2021) specifically identified lack of environmental accounting standards, poor environmental legislation and poor specification of environmental information as challenges to EMA application, and recommended clearer environmental accounting standards. They consequently recommended clearer environmental accounting standards to improve its application. Ezeibe and Umenweke (2015) similarly recognized the importance of environmental management practices to manufacturing operations and technological innovation in South-Eastern Nigeria. Other studies, including Adegbe and Nwobodo (2020) and Erhomosele and Rahim (2021), have examined environmental compliance costs, environmental protection expenditure, waste-management costs and environmental impact measures, demonstrating the continuing relevance of environmental accounting information to manufacturing organizations.

The competence of managers and accounting personnel may also influence the effective application of environmental impact detection and cost allocation practices. Tran *et al.*, (2021) emphasized that environmental management accounting tools require appropriate knowledge and skills. Where managers and accounting personnel lack sufficient knowledge of environmental costs and their implications, environmental considerations may not be adequately integrated into accounting systems. Inadequate skills, weak organizational commitment and unclear environmental accounting requirements may therefore limit the effective identification, measurement and allocation of environmental costs.

Although existing studies have examined environmental accounting, environmental protection expenditure, waste management and environmental compliance among Nigerian manufacturing firms, there remains a need to establish the actual extent to which manufacturing firms in Anambra State apply environmental impact detection and management cost allocation practices specifically for environmental protection. Compliance with environmental regulations does not necessarily imply that firms systematically identify environmental impacts, recognize related costs and allocate those costs to the products, processes or activities responsible for generating them. This distinction constitutes an important empirical gap.

The identification of environmental impact costs associated with a product, process, system or organization is important for determining environmental performance and supporting sound managerial decision-making. Effective identification and allocation enable firms to understand the environmental consequences of their

operations, control related expenditure, improve resource efficiency and integrate environmental considerations into business decisions. Conversely, insufficient knowledge among managers, inadequate accounting systems and weak institutional requirements may limit the integration of environmental issues into organizational accounting practices. It is therefore necessary to determine the extent to which manufacturing firms in Anambra State apply environmental impact detection and management cost allocation practices for environmental protection. Establishing the level of application will provide empirical evidence on the extent to which firms identify environmental impacts, recognize associated costs and allocate them appropriately for managerial and environmental decision-making. The findings may assist manufacturing firms, accountants, regulators and other stakeholders in strengthening environmental management practices and promoting sustainable industrial development. Against this background, this study examines the extent of application of environmental impact detection and management cost allocation practices for environmental protection by manufacturing firms in Anambra State.

Statement of the Problem

Manufacturing firms contribute to economic development but depend heavily on natural resources and may generate pollution, waste and other forms of environmental degradation. Effective environmental protection therefore requires firms to identify environmental impacts and properly manage the associated costs. However, environmental costs are often absorbed into general production overheads rather than separately identified and allocated to the products, processes or activities that generate them. This may result in inaccurate product costing, inefficient resource use and inadequate environmental protection. Okafor *et al.*, (2013) and Igbodo *et al.*, (2018) reported inadequate adoption of environmental cost accounting and the continued use of conventional overhead allocation practices among Nigerian manufacturing firms.

The application of environmental impact detection and cost allocation may also be constrained by inadequate knowledge and skills. Tran *et al.*, (2021) noted that environmental management accounting tools can be complex and require qualified personnel, while Ezenekwe (2020) found that education influences the intention to apply environmental management accounting. In Anambra State, Nwandu *et al.*, (2021) identified inadequate environmental accounting standards, weak legislation and poor environmental information as challenges affecting environmental management accounting. Despite these concerns, limited evidence exists on the extent to which manufacturing firms in Anambra State apply environmental impact detection and management cost allocation practices for environmental protection. It remains unclear whether firms systematically identify environmental impacts, recognize related costs and allocate them appropriately. This knowledge gap necessitates an empirical assessment of the extent of application of these practices among manufacturing firms in Anambra State.

Purpose of the Study

The main purpose of the study was to determine the extent of application of environmental impact detection and management cost allocation practices for environmental protection by manufacturing firms in Anambra State, Nigeria. Specifically, the study determined the extent to which:

- 1) Environmental impact detection practices are applied for environmental protection by manufacturing firms in Anambra State.
- 2) Environmental management cost allocation practices are applied for environmental protection by manufacturing firms in Anambra State.

Research Questions

The following research questions guided the study:

- 1) To what extent are the environmental impact detection practices applied for environmental protection by manufacturing firms in Anambra State?
- 2) To what extent are the environmental management cost allocation practices applied for environmental protection by manufacturing firms in Anambra State?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

- 1) There is no significant difference between the mean responses of managers of manufacturing firms on environmental impact detection practices applied by manufacturing firms in Anambra State based on their qualification.

- 2) There is no significant difference between the mean responses of managers of manufacturing firms on environmental management cost allocation practices applied by manufacturing firms in Anambra State based on their qualification.

Methods

The study adopted a descriptive survey research design and was conducted in Anambra State, Nigeria. The population comprised 292 managers from registered manufacturing firms, based on records obtained from the Ministry of Commerce and Industry and the Corporate Affairs Commission, Awka. A sample of 169 managers was determined using Taro Yamane's formula and selected through proportionate sampling. Data were collected using a 16-item structured questionnaire based on a five-point scale ranging from Very High Extent (5) to Very Low Extent (1). Three experts from Nnamdi Azikiwe University, Awka, validated the instrument, while a pilot test established its internal consistency using Cronbach's alpha, which yielded an overall reliability coefficient of 0.91. Out of the 169 questionnaires administered, 163 (98%) were retrieved and used for analysis. Data were analyzed using mean and standard deviation to answer the research questions, while Analysis of Variance (ANOVA) was used to test the null hypotheses at the 0.05 level of significance. Mean ratings of 4.50–5.00, 3.50–4.49, 2.50–3.49, 1.50–2.49 and 1.00–1.49 were interpreted as very high extent, high extent, moderate extent, low extent and very low extent, respectively. In testing the null hypotheses, where the calculated p-value is less than the stipulated level of significance (0.05), it meant that there was a significant difference and the null hypothesis was rejected. Conversely, where the calculated p-value is greater than or equal to the stipulated level of significance (0.05), it meant that there was no significant difference and the null hypothesis was not rejected.

Results

Research Question 1: To what extent are the environmental impact detection practices applied for environmental protection by manufacturing firms in Anambra State?

Table 1. Managers' mean ratings on the extent they applied environmental impact detection practices for environmental protection (N = 163).

S/N	Environmental impact detection practices	$\bar{X}$	SD	Remarks
1	Ensure our firm regularly identifies sources of environmental pollution arising from its manufacturing activities	3.62	0.37	High extent
2	Ensure our firm identifies activities that may result in air pollution	3.52	0.41	High extent
3	Conducting contamination tests for production processes	2.77	0.49	Moderate extent
4	Ensure our firm uses environmental performance indicators to detect potential environmental problems	4.69	0.32	Very high extent
5	Ensure assessment of relevant supply chain management	3.57	0.40	High extent
6	Monitoring of environment against pollution	2.54	0.53	Moderate extent
Cluster mean		3.45	-	Moderate extent

Data in Table 1 show the cluster mean score of 3.45 indicating that managers rated they applied environmental impact detection practices for environmental protection by manufacturing firms in Anambra State to a moderate extent. The analysis of the items further indicates that managers rated one item out of the six listed items to very high extent. The mean rating for the one item ranged of 4.69, while they rated three items to a high extent with the mean rating ranged from 3.52 to 3.62. Remaining two items were rated by managers to a moderate extent with mean ratings ranged from 2.54 to 2.77. The standard deviation of 0.32 to 0.53 showed that respondents are not wide apart in their mean ratings which indicate homogeneity.

Research Question 2: To what extent are the environmental management cost allocation practices applied for environmental protection by manufacturing firms in Anambra State?

Data in Table 2 show the cluster mean score of 3.53 indicating that managers rated they applied environmental management accounting cost allocation practices for environmental protection by manufacturing firms in Anambra State to a high extent. The analysis of the items further indicates that managers rated two items out of the 10 listed items to very high extent. The mean rating for the two items ranged of 4.50 and 4.69, while they rated three items to a high extent with the mean rating ranged from 3.70 to 4.38. Two items were rated by managers to a moderate extent with mean ratings ranged of 2.69 and 3.38 while the remaining two items were rated to a low extent with mean ratings ranged of 1.50 and 1.70. The standard deviation of 0.28 to 0.68 showed that respondents are not wide apart in their mean ratings which indicate homogeneity.

Table 2. Managers' mean ratings on the extent they applied environmental management accounting cost allocation practices for environmental protection (N = 163).

S/N	Items on application of EMA cost allocation practice	$\bar{X}$	SD	Remarks
Activity based costing (ABC)				
1	Assigning resources to each environmental activity	3.70	0.43	High extent
2	Analysis of environmental cost for each activity	4.69	0.28	Very high extent
Full cost accounting				
3	Identification of direct and indirect economic costs	1.50	0.68	Low extent
4	Identification of health costs	4.38	0.38	High extent
Life cycle assessment				
5	Matching product usage against environmental impact	1.70	0.66	Low extent
6	Assessing the disposal mechanism for recycling and waste management	2.69	0.54	Moderate extent
Material flow costing accounting				
7	Identification of waste management cost	4.54	0.34	Very high extent
8	Identification of system cost	3.38	0.51	Moderate extent
Environmental impact assessment				
9	Scoping the project to identify possible environmental issues	4.50	0.36	Very high extent
10	Screening products for environmental impact	4.24	0.40	High extent
Cluster mean		3.53	-	High extent

Hypothesis 1: There is no significant difference between the mean responses of managers of manufacturing firms on the extent they applied environmental impact detection practices in Anambra State based on their qualification.

Table 3. Summary of analysis of variance on the mean ratings of managers of manufacturing firms on the extent they applied environmental impact detection practices in Anambra State based on their qualification.

	Sum of squares	df	Mean square	F	P-value	Remarks
Between groups	21.254	2	2.367	10.462	.001	Significant
Within groups	14.327	160	2.220			
Total	35.581	162	-			

Table 3 shows that there is a significant difference among the three groups (NCE/OND, HND/B.Sc., M.Sc./Ph.D.) in terms of their mean ratings on the extent they applied environmental impact detection practices of manufacturing firms in Anambra State based on their qualification. It was observed that at 0.05 level of significance, 2 is numerator and 160 of denominator, the calculated F-ratio is 10.462 and *P-value* .001 which is less than the 0.05 alpha level. Therefore, the null hypothesis is rejected.

Hypothesis 2: There is no significant difference between the mean responses of managers of manufacturing firms on the extent they applied environmental management accounting cost allocation practices in Anambra State based on their qualification.

Table 4. Summary of analysis of variance on the mean ratings of managers of manufacturing firms on the extent they applied environmental management accounting cost allocation practices in Anambra State based on their qualification.

	Sum of squares	df	Mean square	F	P-value	Remarks
Between groups	11.492	2	1.033	1.107	.13	Not significant
Within groups	7.105	160	1.028			
Total	18.597	162				

Table 4 shows that there is no significant difference among the three groups (NCE/OND, HND/B.Sc., M.Sc./Ph.D.) in terms of their mean ratings on the extent they applied environmental management accounting

cost allocation practices in Anambra State based on their qualification. It was observed that at 0.05 level of significance, 2 is numerator and 160 of denominator, the calculated F-ratio is 1.107 and *P-value* .13 which is greater than the 0.05 alpha level. Therefore, the null hypothesis is not rejected.

Discussion of Findings

Findings of the study revealed that managers applied environmental impact detection practices for environmental protection by manufacturing firms in Anambra State to a moderate extent. This signifies a moderate extent on application of environmental impact detection practices for environmental protection by managers which is unremarkable. This indicates that managers of manufacturing firms in Anambra State do not give adequate attention on environmental costs under the firm's overhead cost and how these cost can be reducing. This finding is in line with Ezenekwe (2020) who revealed that firm's productivity is affected significantly in a positive way by economic environment and technological environment.

The findings of the study further revealed that there is a significant difference in managers of manufacturing firms mean ratings on the extent they applied environmental impact detection practices for environmental protection in Anambra State based on their qualification. These findings agree with Karimi *et al.*, (2017) who stated that environmental impact detection practices for environmental protection has a significant level on the culture of the society in dealing with environmental issues which resulted to the great impact based on qualification on the use of environmental management accounting tools. The reason for the similarities in test of hypotheses is because most of the environmental impact detection practices for environmental protection applied are in compliance with environmental standards and regulations.

Findings of the study revealed that managers applied environmental management accounting cost allocation practices for environmental protection by manufacturing firms in Anambra State to a high extent. This signifies a high extent on application of environmental management accounting cost allocation practices for environmental protection by managers of manufacturing firms which is remarkable. This implies that managers of manufacturing firms in Anambra State have adequately applied environmental management accounting cost allocation practices for environmental protection as been effective in environmental costing. This finding is in line with Ijeoma (2015) who revealed that environmental cost accounting helps in managing negative effects of companies' waste discharge in the environment.

The findings of the study further revealed that there is no significant difference in in managers of manufacturing firms mean ratings on the extent they applied environmental impact management and prevention practices for environmental protection in Anambra State based on their qualification. These findings agree with Okore (2021) who revealed that donations and charitable cost, environmental training cost, waste management cost and corporate social responsibility cost had positive and significant impact on return on asset of manufacturing firms in Nigeria irrespective of their qualification obtained. In support, Tran *et al.*, (2021) noted that applying EMA tools is considered too complicated and requires highly qualified staff.

Conclusion

Based on the findings of this study, it was concluded that manufacturing firms in Anambra State apply environmental impact detection practices to a moderate extent, with inadequate contamination testing and continuous pollution monitoring. However, environmental management accounting cost allocation practices are applied to a high extent, although full-cost accounting and life-cycle assessment remain underdeveloped. The study further found that managers' educational qualification significantly influences the application of environmental impact detection practices, but has no significant influence on environmental management accounting cost allocation practices. This suggests that organizational procedures, regulatory requirements and accounting systems may play a greater role in cost allocation practices.

Overall, manufacturing firms in Anambra State have made considerable progress in environmental cost allocation but need to strengthen environmental impact detection, monitoring and measurement. Improved environmental accounting systems and staff capacity development will enhance environmental protection, resource efficiency, cost control and sustainable industrial development in the State.

Recommendations

Based on the findings and conclusion of the study, the following recommendations are made:

- 1) Manufacturing firms strengthen environmental monitoring and impact detection systems, enhance the capacity of managers and accounting personnel through relevant training, and adopt systematic

procedures for identifying, measuring and tracing environmental impacts and their associated costs. These measures would improve environmental protection, resource efficiency and sustainable manufacturing practices in Anambra State.

- 2) Environmental performance indicators should be integrated into managerial decision-making. Firms should continue to use environmental performance indicators and expand their application to production planning, resource utilization, waste management and performance evaluation.
- 3) Firms should strengthen the application of full-cost accounting and life-cycle assessment. The relatively low application of direct and indirect economic cost identification and matching product usage with environmental impact indicates the need for greater use of these techniques in environmental cost management.
- 4) Manufacturing firms should invest in staff training and capacity development. Managers, accountants and other personnel involved in environmental management should receive regular training in environmental management accounting, environmental impact assessment, life-cycle assessment, material flow cost accounting and other relevant environmental management techniques.

Declarations

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