

Green Human Resource Management Practices and Performance of Manufacturing Firms in South-West Nigeria

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HIGHLIGHTS

- Integrated environmental management significantly reduces average operational costs in South-West Nigerian manufacturing firms.
- Eco-design has a significant positive effect on customer patronage of manufacturing products.
- Green HRM practices support the triple-bottom-line (economic, social, and environmental) sustainability framework.
- Descriptive survey of 452 respondents across six manufacturing firms in South-West Nigeria.
- R² values of 88.5% (IEM model) and 94.3% (eco-design model) confirm strong predictive fit.

Abstract

This study examines the impact of Green Human Resource Management (GHRM) practices on the performance of manufacturing firms in South-West Nigeria. Specifically, it investigates the effect of integrated environmental management on the average cost of operations and the influence of eco-design on customer patronage. A descriptive survey research design was adopted, utilising both primary and secondary data sources. Primary data were collected through structured questionnaires administered to workers and management staff across six selected manufacturing firms in the region, with a sample size of 452 respondents determined using Yamane Taro's formula. Secondary data were sourced from relevant literature, including journals, textbooks, and reports. Data analysis revealed that integrated environmental management significantly reduces the average cost of operations, while eco-design has a significant positive effect on customer patronage. The findings highlight the growing awareness and adoption of environmentally sustainable practices among manufacturing firms in Nigeria, underscoring their contribution to economic, social, and environmental sustainability in line with the triple-bottom-line approach. The study recommends that manufacturing firms fully integrate environmental management into their operational strategies and adopt eco-design principles to enhance competitiveness and long-term performance.

Keywords: *Green Human Resource Management; Integrated Environmental Management; Eco-design; Manufacturing Firms; South-West Nigeria; Sustainability*

1. Introduction

1.1 Background of the Study

Organisations have been experiencing increased attention and the resultant social, political, and economic pressure to address and improve their overall environmental performance. As a result, more organisations are re-evaluating the way they operate, with the onus being on senior management to identify, understand, and assess environmental risks. Going green has become a key business strategy as organisations consider the incentives to address environmental issues and sustainability (Nishii, 2018).

Green human resource management encompasses all of the practices required for creating, using, and continuously maintaining a system established with the purpose of making the representatives of a company green. It is that part of human resource management involved with transforming ordinary employees into green employees for the purpose of accomplishing the environmental objectives of the company and making a commitment to sustainability. It relates to

the approaches, activities, and frameworks that orient the workers of the company into the green movement for the benefit of the individual, society, the natural environment, and the business (Opatha, 2017).

Without creating personal accountability and integrating practical techniques, it is rather difficult to turn an organisation green. That is why HR practices are a crucial segment of sustainable business development. The idea of sustainable development focuses on fostering economic progress while at the same time preserving the quality of the environment; it establishes a framework for incorporating environmental policies and strategies for development (United Nations General Assembly, 2017). Green Human Resources Management (GHRM) can be defined as a set of policies, practices, and systems that stimulate the green behaviour of a company's employees in order to create an environmentally sensitive, resource-efficient, and socially responsible organisation (Jackson, 2017).

With the rise in awareness of sustainable development through environmental management, GHRM has received considerable attention in contemporary research. The development of GHRM is not limited to the scope of environmental awareness; it also addresses improvements in the economic and social well-being of human life. The paradigmatic comprehension of the triple-bottom-line concept is supported by green HRM. The greening of HRM thus constitutes policies and practices of HR that are aligned with economic, social, and environmental balance - the three pillars of sustainability (Muster and Schrader, 2011). Wilkinson and Muller-Camen (2016) confirmed that human resource scholars are undertaking serious discussions and practical interventions that may extend global debates on the HRM role in reducing ecological degradation.

1.2 Statement of the Problem

Organisations have numerous reasons to adopt and implement green human resource management practices that benefit both the organisation and its employees. GHRM makes employees aware of the intricacies of environmental management - what action is needed, how it functions, and how it helps the environment. Organisations that have implemented green practices have developed their brand as eco-friendly entities and thus offered socially responsible incentives. In the race to attract creative and innovative employees, organisations are providing environmentally friendly cultures and practices.

However, the practices of the manufacturing industry - both product-related and process-related - are not usually environmentally friendly. This can be traced to their mode of operations, which has caused several environmental issues such as carbon emissions, land crises, material shortages, water crises, ecological problems, and waste problems in the form of toxic chemicals, non-biodegradable solids, and poisonous liquids. These are identified as being caused by the unsustainable exploitation of raw materials and the use of large quantities of fuel as a source of manufacturing energy to meet increasing production demand.

The consequences of not adopting GHRM practices in a manufacturing firm include a decline in average cost efficiency, a decline in customer patronage, a decline in operational efficiency, and a decline in market share. It is based on these observations that this study examines green human resource management practices and performance of manufacturing firms in South-West Nigeria.

1.3 Objectives of the Study

The broad objective of this study is to examine green human resource management practices and performance of manufacturing firms in South-West Nigeria. The specific objectives are to:

- Ascertain the effect of integrated environmental management on the average cost of operation of manufacturing firms in South-West Nigeria.
- Determine the effect of eco-design on customer patronage of products of manufacturing firms in South-West Nigeria.

1.4 Research Questions

Based on the objectives of the study, the following research questions are raised:

- What is the effect of integrated environmental management on the average cost of operation of manufacturing firms in South-West Nigeria?
- What is the effect of eco-design on customer patronage of products of manufacturing firms in South-West Nigeria?

1.5 Research Hypotheses

Ha1: Integrated environmental management has a significant positive effect on the average cost of operation of manufacturing firms in South-West Nigeria.

Ha2: Eco-design has a significant positive effect on customer patronage of products of manufacturing firms in South-West Nigeria.

1.6 Significance of the Study

The following stakeholders stand to benefit from this study:

Business Development Experts:

This study will enable project managers and project advisors to acclimatise themselves with environmental limits and learn from experience. The work is also relevant to organisational managers in practice who would need an environmental sustainability template to guide their organisations in their respective transformation agendas.

Policy Makers:

This study will enhance the ability of decision-makers with respect to formulating policies relative to environmental sanity, based on an understanding of environmental potentials and limits and of the needs of business players. It will also allow policy makers to use their offices as platforms to spearhead reforms that will be a win-win for a sustainable business environment.

General Public:

The general public will benefit from this study because it will help in the preservation of the environment at a time when the world is highly interested in climate change. Finally, this study makes an original contribution to the literature by developing a practical framework on how the human resource function can employ its strategies in assisting organisations to become green and to achieve their sustainability goals.

2. Review of Related Literature

2.1 Conceptual Review

2.1.1 Green Human Resource Management

Green human resource management is the integration of environmental management with traditional human resource management (HRM) (Bombiak and Kluska, 2018). GHRM uses HRM policies to promote sustainability. It can also be referred to as those policies and practices that can create a green workforce in order to benefit individuals, businesses, and the natural environment. Specifically, it refers to the policies, practices, and systems that make employees of the organisation green for the benefit of the individual, society, the natural environment, and the business (Opatha, 2015).

Green human resource management is considered a broader framework of corporate social responsibility. Renwick (2018) proposed a framework incorporating HRM functions such as recruitment and selection, training and development, reward systems, performance management, and employee relations, which are considered powerful tools for linking employees with organisational environmental strategy. Various researchers have approved the significance of environmental training and communication, organisational learning, and the execution of environmental management programmes (Sammalisto and Brorson, 2018; Triana and Ortolano, 2020).

The concept of GHRM is relatively new for academicians, professionals, and many others. Sustainability and environmental issues are becoming critical factors of HRM practices; however, there is comparatively limited evidence in the form of literature and academic research. HR practices must be aligned with environmental and sustainability issues to gain a competitive edge and achieve environmental sustainability of the organisation (Ulrich, Brockbank, and Johnson, 2019). HR management practices, such as training, selection, recruitment, and compensation, are considered key factors in achieving green organisational goals and sustainable performance (Cherian and Jacob, 2018).

Green human resource management is emerging as a significant area in management (Mehta and Chugan, 2015). It is defined as the process of ensuring that the management system practising in an organisation is ecologically balanced and environmentally affable (Kapil, 2015). Opatha and Arulrajah (2014) define GHRM as the policies, practices, and

systems that make employees of the organisation green for the benefit of the individual, society, natural environment, and the business. Similarly, Rana and Jain (2014) perceived GHRM from a model perspective, defined as an employment model designed to assist industry professionals in retaining, recalling, preserving, and developing the talent needed to ensure future business initiatives and strategies are met. Prasad (2013) describes GHRM as the contribution of human resource policies and practices towards the broader corporate environmental agenda of sustainable use of natural resources. Renwick et al. (2008) concluded that GHRM is the integration of corporate environmental management into HRM. According to Mandip (2012), GHRM is the use of every employee interface to promote sustainable practices and increase employee awareness and commitment to sustainability issues.

2.1.2 Integrated Environmental Management

Integrated environmental management (IEM) is a holistic and goal-oriented approach to environmental management that addresses interconnections through a strategic approach. IEM is based on the concept that environmental regions - whether defined by catchment boundaries, bioregions, or other criteria - need to be managed holistically. Born and Sonzogni (1995) state that integrated environmental management is a response to much of traditional natural resource management, which has been largely reactive, disjointed, and purposely narrow.

The IEM concept is often used to refer to increased efforts being made at aligning and giving common direction to the policies, programmes, plans, projects, and institutional arrangements of government with regard to the environment. In South Africa, the administration of legislation applying to environmental media at the national level remains substantially fragmented. NEMA recognises this fragmented nature and responds by providing various mechanisms and forums for promoting integration in order to achieve alignment amongst organs of the state, recognising that control over environmental issues is vested in numerous organs of state operating in different spheres of government.

2.1.3 Eco-design

Companies need to demonstrate their respect and commitment to the environment and natural resources, strengthening their whole product life cycle with actions that reflect such commitment. The most outstanding action in this regard is eco-design, which has become the main methodology that companies can use to make their products more sustainable and eco-friendly. Eco-design can be defined as the systematic incorporation of environmental aspects into product design, with the aim of reducing its impact throughout the entire life cycle. Eco-design asserts the need to incorporate environmental and sustainability criteria into the basic requirements of product design, such as costs, function, utility, aesthetics, reliability, and safety. These environmental criteria range from minimising all consumptions and resources to the reduction of emissions and pollutants throughout the product life cycle, not only during manufacturing but until the end of its useful life.

Design for Environment (DfE) or eco-design has grown its contribution to sustainable manufacturing over the last decades. Product design has been identified as an important life-cycle stage in contributing to life-cycle environmental impacts; it has been estimated that 80% of environmental burdens are determined during this early stage (Tischner et al., 2000). The EU Directive on eco-design was first developed as Directive 2005/32/EC on Eco-design of Energy-used Products (European Council, 2005).

2.1.4 Organisational Performance

Organisational performance comprises the actual output or results of an organisation as measured against its intended outputs, goals, and objectives. According to Richard (2020), organisational performance encompasses three specific areas of firm outcomes: (a) financial performance (profits, return on assets, return on investment, etc.); (b) product market performance (sales, market share, etc.); and (c) shareholder return (total shareholder return, economic value added, etc.). Organisational performance is the ultimate dependent variable of interest for researchers concerned with virtually any area of management (Devinney, 2020). This broad construct is essential in allowing researchers and managers to evaluate firms over time and compare them to rivals.

2.1.5 Average Cost of Operation

Operating costs are the expenses related to the operation of a business, or to the operation of a device, component, piece of equipment, or facility (Anderson, 2009). They are the cost of resources used by an organisation just to maintain its existence. The average cost of operation is derived by dividing the total operating costs by the quantity of output produced. Manufacturing firms with effective environmental management frameworks tend to realise reductions in average operating costs through waste reduction, energy efficiency, and optimised resource utilisation.

2.2 Theoretical Framework

2.2.1 Stakeholder Theory

Stakeholder theory focuses on an organisation's morality and its values. The principle states that an organisation has several stakeholders, each of which is involved in and influenced by the organisation's performance. Since stakeholders' interests are always self-centred, they can have divergent or even conflicting interests. The environment is the most important concern for stakeholders, as the balanced scorecard necessitates a multi-dimensional research framework for human resource management, with different teams rating several organisational sustainability metrics. Employee motivation, green practices, and corporate social responsibility (CSR) activities boost employee involvement and work efficiency.

Freeman (1984) argues that the stakeholder approach suggests that stakeholders are groups or policies that directly or indirectly influence the organisation's activities and decision-making. Prior scholars have investigated various stakeholder perspectives to assess how they influence the financial outcome of the organisation. The internal and external stakeholders influence the individual performance of the organisation when affective commitment and job satisfaction indirectly affect CSR and employee performance.

2.2.2 The Resource-Based View (RBV)

This theory derives from the ideas of economist Edith Penrose. The theory argues that resources, including employees, systems, and business partners, are combined into ways of working which are rare, inimitable, valuable, and non-substitutable, so that they become sources of competitive advantage (Tyson and York, 2006). HR systems create the human capital pool of skilled people so that they can sustain what Wright (2001) described as strategically relevant behaviours. The Resource-Based Approach focuses on internal resources that are viewed as the principal factor for a sustainable competitive advantage.

In effect, the value brought by human resources is the core of this approach, where flexibility is optimised in order to reduce costs and increase efficiency. Human resources, by adding value, uniqueness, and effective resource utilisation, tend to increase the competitive advantage of a company (Porter, 1991). The RBV tends to ignore the baseline of specific industries as it takes into account the differences of firms in the same sector as a competitive advantage. However, competitive advantages are also gained by the rightsizing process (Hamel and Prahalad, 1993), implying that an organisation obtains more output from its existing resources and optimises the way in which they are used. According to the RBV, managers seek to gain a competitive advantage through the quality of the people employed, with a skills and capability focus, so that firms learn faster than their rivals and protect and enlarge their intellectual capital.

2.3 Empirical Review

Balogun (2019) conducted a study in Lagos State on the effect of integrated environmental management on the average cost of operation in the brewery industry. Using a structured questionnaire administered to a population of 250 employees via a survey method, and applying the non-parametric chi-square technique, the study found that integrated environmental management has a significant positive effect on the average cost of operation in the brewery industry.

Caughlin (2019) conducted a related study in New Jersey on the effect of integrated environmental management on the average cost of operation in the textile industry. Using secondary data from a population of 280 employees and applying regression analysis, the study found that integrated environmental management has a significant positive effect on the average cost of operation in the textile industry.

Cloven (2019) conducted research in New Orleans on the extent to which integrated environmental management affects the average cost of operation of the manufacturing industry. Using a survey of 320 employees and t-test statistics, the study found that integrated environmental management affects the average cost of operation of the manufacturing industry to a large extent.

Shola (2020) conducted a study in Ogun State on the effect of eco-design on customer patronage of products in the manufacturing industry. Using a survey of 360 employees and regression analysis, the study found that eco-design has a significant positive effect on customer patronage of products in the manufacturing industry.

Afifi (2020) carried out a study in Lagos State on the effect of eco-design on customer patronage of products in the brewery industry. Using a survey of 250 employees and the z-test statistical tool, the study found that eco-design has a significant positive effect on customer patronage of products in the brewery industry.

Deer (2020) conducted a related study in New York on the effect of eco-design on customer patronage of products in the beverage industry. Using a survey of 450 employees and the chi-square statistical tool, the study found that eco-design has a significant positive effect on customer patronage of products in the beverage industry.

2.4 Research Gap

Many studies have been conducted on this topic; however, there is a paucity of literature specifically addressing the proxies and constructs used in this study - namely, integrated environmental management and eco-design. Furthermore, the majority of studies on this topic have focused on developed parts of the world. This study is conducted specifically in South-West Nigeria, and thereby contributes to the empirical literature by filling this contextual gap.

3. Materials and Methods

3.1 Research Design

This study adopts a descriptive research design of the survey type. Survey research focuses on people and their perceptions, opinions, beliefs, attitudes, motivations, and behaviour (Osuala, 2005). A survey design was adopted because the problem under study demands the technique of a questionnaire as the principal means of collecting data, and because it is cost-effective for both large and small populations. The method is considered adequate and most appropriate in that it helps the researcher to describe, examine, record, analyse, and interpret the variables that exist in the study in order to draw conclusions.

3.2 Sources of Data

Two sources of data are used for the study: primary and secondary data.

3.2.1 Primary Sources of Data

The primary source comprises responses from workers and management staff of the selected manufacturing firms, where data were obtained through the use of a structured questionnaire.

3.2.2 Secondary Sources of Data

The secondary source of data includes data drawn from textbooks, journals, seminars, and symposia.

3.3 Population of the Study

A total of six (6) manufacturing firms were selected from the six states in the South-West geographical zone of Nigeria. The population of the study comprises the workers and management staff of the selected firms. The breakdown of the population is presented in Table 3.1.

Table 3.1: Distribution of the Population

S/No	Manufacturing Firm	Sector	No. of Staff
1	Unilever Brothers Nigeria Ltd, Lagos State	Beverages	276
2	Phoenix Steel Mills, Ogun State	Iron and Steel	452
3	African Paints, Ondo State	Paint Sector	201
4	Emzor Pharmaceuticals, Lagos State	Pharmaceuticals	212
5	British American Tobacco Company	Tobacco	241
6	Rice Mill Aromoko, Ekiti State	Agriculture	241
	Total		1,623

Source: Field Survey, 2025

3.4 Sample Size Determination

Since the population of the study was large, the researcher adopted Yamane Taro's formula (Taro Yamane, 1964), which states that the sample size of a definite population is given by:

$$n = N / [1 + N(e)^2]$$

Where n = sample size, N = population of the study, and e = error limit. In this study, $N = 1,623$ and $e = 0.04$ (4%). Substituting:

$$n = 1623 / [1 + 1623 \times (0.04)^2] = 1623 / [1 + 2.5968] = 1623 / 3.5968 \approx 452$$

The sample size of the different manufacturing firms was determined using Kumar's proportional allocation formula (Kumar, 1976):

$$nh = (n \times Nh) / N$$

Where nh = sample size for each firm, Nh = population for each firm, n = total sample size, and N = total population of all firms. The distribution of the sample size is presented in Table 3.2.

Table 3.2: Distribution of Sample Size

S/No	Manufacturing Firm	Population	Sample Size
1	Unilever Brothers Nigeria Limited, Lagos State	276	77
2	Phoenix Steel Mills, Ogun State	452	125
3	African Paints, Ondo State	201	56
4	Emzor Pharmaceuticals, Lagos State	212	59
5	British American Tobacco Company	241	67
6	Rice Mill Industry, Ekiti State	241	67
	Total	1,623	451

Source: Field Survey, 2023

3.5 Sampling Technique

The study adopted the random sampling technique, whereby every respondent had an equal chance of being selected. Each selection was controlled by probability or chance. Of the 451 copies of the questionnaire distributed to respondents across the manufacturing firms, 439 copies were successfully retrieved, while 12 were lost, yielding a response rate of 97.3%.

3.6 Statistics

Data collected via the structured questionnaire were analysed using descriptive statistics including frequency distributions, percentages, and cumulative percentages. For hypothesis testing, Ordinary Least Squares (OLS) regression analysis was employed, with the F-statistic used to determine the statistical significance of the models. The coefficient of determination (R^2) was adopted as a measure of goodness of fit. All analyses were conducted using IBM SPSS Statistics Version 25.0, with a significance level set at 5% ($p < 0.05$). The tabulated F-value at the 5% significance level (df: 1, 438) was 2.7858.

4. Results

4.1 Data Relating to Research Questions

Research Question One: Effect of Integrated Environmental Management on the Average Cost of Operation

Table 4.1: Distribution of Respondents on Whether Integrated Environmental Management Has a Significant Effect on the Average Cost of Operation of Manufacturing Firms in South-West Nigeria

Response	Frequency	Percent	Valid Percent	Cumulative Percent
SA	132	30.1	30.1	30.1
A	176	40.1	40.1	70.2
UD	22	5.0	5.0	75.2
DA	44	10.0	10.0	85.2
SD	65	14.8	14.8	100.0
Total	439	100.0	100.0	

Source: Field Survey, 2025. SA = Strongly Agree; A = Agree; UD = Undecided; DA = Disagree; SD = Strongly Disagree.

Table 4.1 reveals that 132 respondents (30.1%) strongly agree that integrated environmental management has a significant effect on the average cost of operation of manufacturing firms in South-West Nigeria, 176 respondents (40.1%) agree, 22 respondents (5.0%) were undecided, 44 respondents (10.0%) disagree, and 65 respondents (14.8%) strongly disagree. Cumulatively, 70.2% of respondents agree or strongly agree with the statement, indicating broad support for the hypothesised relationship.

Research Question Two: Effect of Eco-design on Customer Patronage

Table 4.2: Distribution of Respondents on Whether Eco-design Has a Significant Effect on Customer Patronage of Products of Manufacturing Firms in South-West Nigeria

Response	Frequency	Percent	Valid Percent	Cumulative Percent
SA	136	31.0	31.0	31.0
A	198	45.1	45.1	76.1
UD	35	8.0	8.0	84.1
D	40	9.1	9.1	93.2
SD	30	6.8	6.8	100.0
Total	439	100.0	100.0	

Source: Field Survey, 2025. SA = Strongly Agree; A = Agree; UD = Undecided; D = Disagree; SD = Strongly Disagree.

Table 4.2 shows that 136 respondents (31.0%) strongly agree that eco-design has a significant effect on customer patronage of products of manufacturing firms in South-West Nigeria, 198 respondents (45.1%) agree, 35 respondents (8.0%) were undecided, 40 respondents (9.1%) disagree, and 30 respondents (6.8%) strongly disagree. Cumulatively, 76.1% of respondents agree or strongly agree, demonstrating substantial consensus on the positive relationship between eco-design and customer patronage.

4.2 Test of Hypotheses

Hypothesis One: Effect of Integrated Environmental Management on Average Cost of Operation

Ha1: Integrated environmental management has a significant positive effect on the average cost of operation of manufacturing firms in South-West Nigeria.

Table 4.3: Model Summary - Integrated Environmental Management and Average Cost of Operation

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	.941 ^a	.885	.885	.37687

a. Predictors: (Constant), Integrated Environmental Management

Table 4.4: ANOVA - Integrated Environmental Management and Average Cost of Operation

Model	Source	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	478.418	1	478.418	3368.322	.000 ^a
	Residual	62.069	437	.142		
	Total	540.487	438			

a. Predictors: (Constant), Integrated Environmental Management. b. Dependent Variable: Average Cost of Operation.

The R^2 value of .885 indicates that integrated environmental management accounts for approximately 88.5% of the variation in the average cost of operation, demonstrating excellent goodness of fit. The F-calculated value (3368.322) is substantially greater than the F-tabulated value (2.7858) at the 5% significance level, leading to the rejection of the null hypothesis. It is therefore concluded that integrated environmental management has a significant positive effect on the average cost of operation of manufacturing firms in South-West Nigeria.

Hypothesis Two: Effect of Eco-design on Customer Patronage

Ha2: Eco-design has a significant positive effect on customer patronage of products of manufacturing firms in South-West Nigeria.

Table 4.5: Model Summary - Eco-design and Customer Patronage

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	.971 ^a	.943	.943	.27734

a. Predictors: (Constant), Eco-design

Table 4.6: ANOVA - Eco-design and Customer Patronage

Model	Source	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	556.541	1	556.541	7235.331	.000 ^a
	Residual	33.614	438	.077		
	Total	590.155	439			

a. Predictors: (Constant), Eco-design. b. Dependent Variable: Customer Patronage.

The R^2 value of .943 indicates that eco-design accounts for approximately 94.3% of the variation in customer patronage, indicating an excellent goodness of fit. The F-calculated value (7235.331) is substantially greater than the F-tabulated value (2.7858) at the 5% significance level, leading to the rejection of the null hypothesis. It is therefore concluded that eco-design has a significant positive effect on customer patronage of products of manufacturing firms in South-West Nigeria.

5. Discussion

The findings of this study demonstrate that integrated environmental management has a significant positive effect on the average cost of operation of manufacturing firms in South-West Nigeria ($R^2 = 0.885$; $F = 3368.322$; $p < 0.05$). This finding is consistent with the results of Balogun (2019), who found similar effects in the brewery industry in Lagos State, and Caughlin (2019), whose study of the textile industry in New Jersey yielded comparable conclusions. Cloven (2019) likewise established that integrated environmental management affects the average cost of operation of the manufacturing industry to a large extent. Together, these studies suggest that IEM is a robust, cross-industry determinant of operational cost efficiency.

The mechanism through which IEM reduces average operational costs is explained in part by stakeholder theory (Freeman, 1984), which posits that organisations responsive to stakeholder expectations - including environmental concerns - develop more efficient processes and build stronger institutional legitimacy. The Resource-Based View

(Tyson and York, 2006) further supports this finding: firms that embed environmental management into their human capital strategies develop rare, inimitable capabilities that translate into cost advantages. Environmentally managed firms reduce waste, optimise energy consumption, and minimise regulatory compliance costs, all of which contribute to lower average costs.

The second major finding - that eco-design has a significant positive effect on customer patronage ($R^2 = 0.943$; $F = 7235.331$; $p < 0.05$) - is consistent with Shola (2020), Afifi (2020), and Deer (2020), all of whom documented significant positive relationships between eco-design and customer patronage in different industries and geographies. The very high R^2 value suggests that eco-design is a particularly powerful determinant of customer patronage within the Nigerian manufacturing context, potentially reflecting growing consumer consciousness about environmental responsibility. Eco-design enhances product appeal by signalling environmental stewardship, reduces lifecycle costs that can be passed to consumers, and builds brand equity as an eco-friendly organisation, all of which stimulate patronage.

Taken together, these findings provide empirical support for the integration of GHRM practices into the strategic operations of manufacturing firms. The triple-bottom-line framework - economic, social, and environmental sustainability - gains practical expression through both IEM and eco-design. Manufacturing firms that embed these practices do not merely fulfil compliance obligations; they generate measurable competitive advantages in cost efficiency and market responsiveness.

Figure 1: Distribution of respondents on the effect of Integrated Environmental Management on average cost of operation



Figure 1. Distribution of respondents on the effect of integrated environmental management on average cost of operation of manufacturing firms in South-West Nigeria (n = 439).

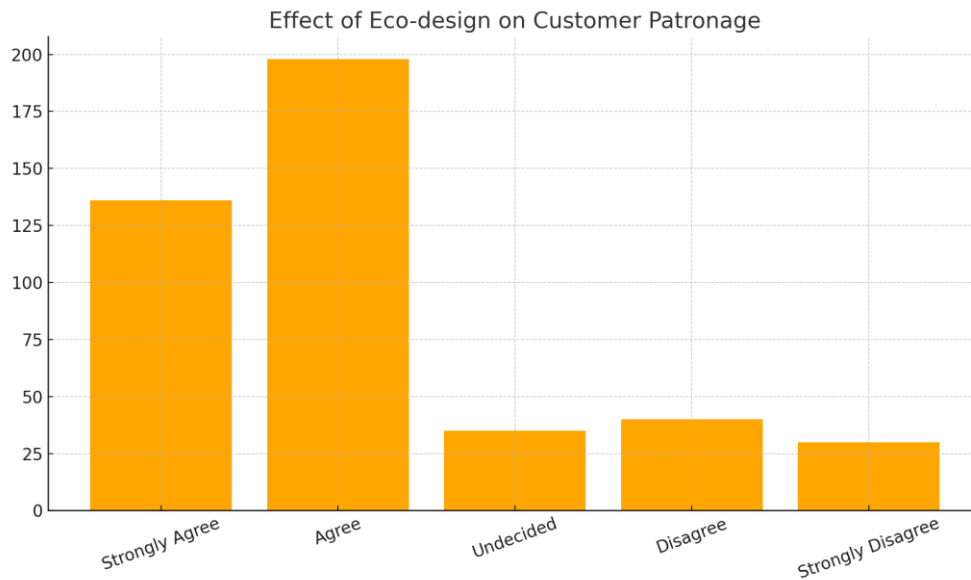
Figure 2: Distribution of respondents on the effect of Eco-design on customer patronage

Figure 2. Distribution of respondents on the effect of eco-design on customer patronage of products of manufacturing firms in South-West Nigeria (n = 439).

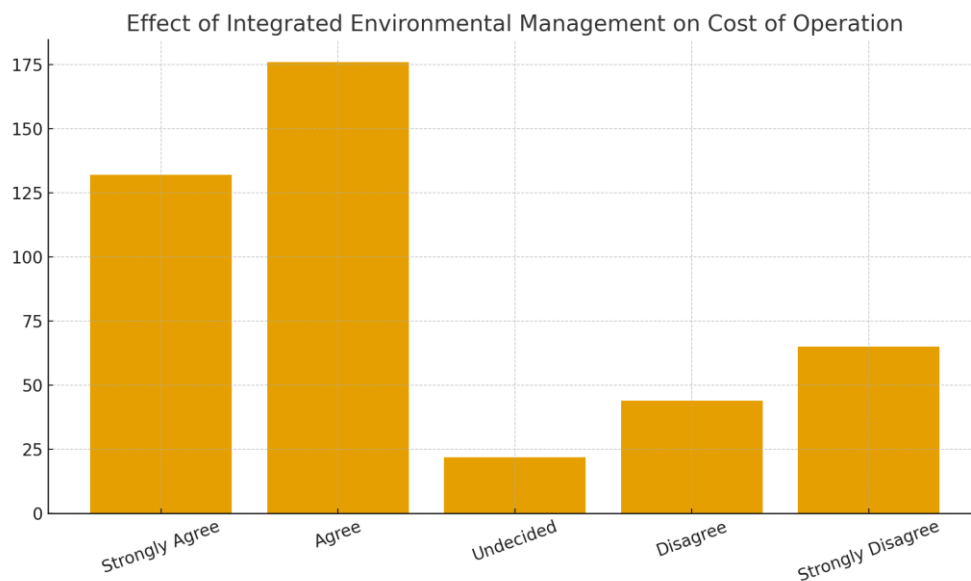
Figure 3: Regression model summary showing R^2 values for both predictors

Figure 3. Regression model summary showing R^2 values for integrated environmental management (0.885) and eco-design (0.943) as predictors of organisational performance.

6. Conclusion

Manufacturing firms in Nigeria are beginning to understand the importance of green human resource management, even though the concept remains relatively new in this context. Manufacturing firms are now aware of the importance of recycling waste and carrying out environmentally friendly practices. The development of GHRM is not limited to the scope of environmental awareness; it also addresses improvements in the economic and social well-being of human life. The greening of HRM constitutes policies and practices of HR aligned with economic, social, and environmental balance - the three pillars of sustainability.

The negative impact of human activities on the environment is a matter of growing concern globally. Governments worldwide are making efforts to minimise human impact on the environment, and businesses have begun to modify their behaviour by integrating environmental issues into organisational activities. This study concludes that green human resource management practices have a significant positive effect on the performance of manufacturing firms in South-West Nigeria, as evidenced by the strong relationships observed between integrated environmental management and average cost of operation, and between eco-design and customer patronage.

7. Recommendations

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

- Management of manufacturing firms should integrate environmental management into their day-to-day activities, as evidence from this study confirms that it significantly reduces the average cost of operation.
- Management of manufacturing firms should incorporate eco-design principles into their production processes, as this study establishes a strong positive effect on customer patronage, thereby enhancing competitiveness.
- Policy makers should formulate and enforce environmental management regulations that incentivise manufacturing firms to adopt GHRM practices, creating an enabling environment for sustainable business operations.
- Future studies should extend this research to other geopolitical zones of Nigeria and to additional constructs of GHRM, such as green training, green recruitment, and green performance management, to provide a more comprehensive understanding of GHRM effects.

Author Contributions

Ozoukata Onyedikachi Daniel: Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review and editing.

Hongxi Di: Supervision, Validation, Writing - review and editing.

Cole Ernestine Bintu: Data curation, Investigation, Writing - review and editing.

Souaibou Al'assan: Resources, Data curation, Writing - review and editing.

Conflict of Interest

The authors declare no conflict of interest.

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