

Environmental Management Systems and Manufacturing Companies' Performance in Nigeria

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Abstract

Purpose: The purpose of this study was to investigate the environmental management systems and environmental performance of manufacturing firms in Abuja City, Nigeria.

Methodology: The study adopted a longitudinal research design that was descriptive in nature. Stratified sampling technique was used to select a sample size of 88 respondents who were employees of the manufacturing firms in Abuja City, Nigeria. Structured questionnaires with open and closed ended questions were used as instruments of data collection.

Findings: The findings of this study revealed that there was a positive statistical correlation between green manufacturing systems, pollution prevention systems, management systems and pollution control systems and environmental performance of manufacturing firms in Abuja City, Nigeria.

Conclusion: The study concluded that environmental management systems have become drivers of competitive organizations in the changing business environment.

Recommendation: The study recommended that manufacturing companies should ensure that employees are trained on ISO 14001 regulations, appropriate technology is adopted and industry partnership is based on best environmental practices rather than on the sole revenues gain objective.

Keywords: *Certification, environmental management system, manufacturing, performance.*

1.0 INTRODUCTION

There has been increasing environmental concern from the government and the general public in the recent past and even today (Sarkis, Torre & Diaz, 2010). Much of this concern has been on the impact of corporate activities on the natural environment. This is due to the negative impacts some of these activities have on the environment such as global warming and scarcity of some critical resources. This has led to environmental management becoming a critical business consideration for any company that aims to survive from many regulations and tough business requirements (Mohamed, 2011).

Many business firms worldwide have adopted formal environmental management systems (EMSs) as procedures for systematically identifying environmental aspects and impacts of their operations, setting explicit goals for compliance, performance, and continuous improvement, and managing for them throughout these operations. This procedure has been standardized and promoted by the International Organization for Standardization (ISO: 14001). Manufacturers Association of Nigeria (MAN) (2012) asserts that environmental management system helps organizations identify, manage, monitor and control their environmental issues in a holistic manner. Chang, Kenzhekhanuly and Park (2013) suggest that ISO 14001 is suitable for organizations of all types and sizes, be they private, not-for-profit or governmental. It requires that an organization considers all environmental issues relevant to its operations, such as air pollution, water and sewage issues, waste management, soil contamination, climate change mitigation and adaptation, and resource use and efficiency (Baines, Brown, Benedettini & Ball, 2012).

Hasan (2013) argues that organizations and people must adopt environmentally responsible production and consumption in order to recover environmental quality, reduce poverty and bring about economic growth, with resultant improvements in healthy working conditions, and sustainability. Every organization including tea processing firms must put measures in place to ensure all dimensions of its operations are environmentally friendly (Okemba & Namusonge, 2014). Like all ISO management system standards, ISO 14001 includes the need for continual improvement of an organization's systems and approach to environmental concerns (Murphy, 2012). The standard has recently been revised, with key improvements such as the increased prominence of environmental management within the organization's strategic planning processes, greater input from leadership and a stronger commitment to proactive initiatives that boost environmental performance (Mwaura, Letting, Ithinji & Orwa, 2015).

Jaju (2011) argues that every organization must make better use of natural resources for sustainable growth. Every organization must incorporate environmentally friendly practices in all its activities. Just like other business activities, Supply Chain activities are no exception. Since the early 1990's, manufacturers have been forced to address Environmental Management in their supply chains. Being environmentally conscious in supply chain operations is not only associated with reduced negative impacts on the environment but also improvement in overall company performance.

While many organizations have in the past have concentrated on reverse logistics, there is need to adopt green supply chain management (GSCM) practices that looks at the entire supply chain (KIPRA, 2013). Environmental Management Systems (EMSs) are a collection of management processes that enable facilities to continually reduce their impact to the natural environment (KNBS, 2015). Most EMSs involve implementing a written environmental policy, environmental performance indicators/goals, and environmental training program in place for employees, and internal environmental audits. EMSs have the potential to encourage

facilities to adopt more sophisticated environmental strategies that build on their basic pollution prevention principles. EMS can improve a business internal operations, achieve greater efficiencies, and create opportunities to reduce their environmental impacts by way of pollution prevention (Momanyi, 2013). Mohamed (2011) argue that there are many reasons why an organization should take a strategic approach to improving its environmental performance.

Pietro *et al.* (2012) avers that ISO 14001 helps organizations to demonstrate compliance with current and future statutory and regulatory requirements, increase leadership involvement and engagement of stakeholders, improve company reputation and the confidence of stakeholders, achieve strategic business aims by incorporating environmental issues into business management, provide a competitive and financial advantage through improved efficiencies and reduced costs and encourage better environmental performance of suppliers by integrating them into the organization's business systems (Moutray, 2015).

ISO 14001:2015 sets out the criteria for an environmental management system and can be certified to (Mputhia, Mukulu & Keriko, 2012). It maps out a framework that a company or organization can follow to set up an effective environmental management system. It can be used by any organization regardless of its activity or sector. Using ISO 14001:2015 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved. ISO 14001 provides a framework for environmental management best practice to aid organizations to prevent pollution, minimize environmental footprint, conform to environmental legislation and develop their business in a sustainable manner (Mwaura, Letting, Ithinji & Orwa, 2015).

Odeh and Smallhood (2012) ascertains that applicable to all sectors of industry, ISO 14001 helps organizations review their practices to mitigate against environmental risk and ensure sustainability (Nee, & Wahid, 2010). Benefits of ISO 14001 certification to competitive firms range from: quantifying, monitoring & controlling impact of operations on the environment; ensuring legislative awareness & compliance; improving environmental performance of supply chain; identifying cost savings with greater emphasis on resource, waste & energy management; involving people in minimizing negative impacts; protecting the company, assets, shareholders & directors; improving corporate image and credibility among stakeholders, regulators, customers, prospective clients and the public (Otieno, 2011).

ISO 14001 defines environmental performance as measurable results of the environmental management systems relating to the management of the environmental aspects performed by the organization based on its environmental policies and objectives, (UNDP, 2015). It is focused on reduced levels of environmental pollutants. Environmental performance of an organization may be achieved through reduction of air emission, reduction of waste water, reduction of solid wastes, decrease of consumption for hazardous materials, decrease of frequency for environmental accidents. Environmental performance may be enhanced through among other factors assigning environmental responsibility to general managers, and they provide environmental training to non-environmental workers as well as environmental specialists (Hasan, 2013).

1.2 Statement of the Problem

Environmental Management Systems provides a framework for environmental management best practice to aid organizations to prevent pollution, minimize environmental footprint, conform to environmental legislation and develop their business in a sustainable manner (MAN, 2012). Application of EMS in the manufacturing sector has contributed to improved environmental performance of firms locally and internationally. Despite the challenge of

implementing EMS by many firms around the world, a survey conducted by ISO (2013) revealed that firms are likely to achieve increased productivity based on compliance to ISO 14001 standards.

In the Nigerian context, a number of studies have been conducted. For instance, Otieno (2011) studies on green supply chain management practices in the food manufacturing industry in Nigeria and revealed that green supply chain management practices adoption was at a low stage. Mohamed (2012) studied on green supply chain management and performance of manufacturing in Mombasa and noted that green supply chain management has a positive impact on manufacturing firms' performance. Ong'ong'o (2012) studied on factors affecting adoption of green technology by firms in Nigeria and established that regulatory policy is the major factor affecting adoption of green technology. However, the studies focused on green supply chain but not environmental management systems.

However, from the findings of the previous studies, it is revealed that little has been done by previous researchers to address the problem under investigation. Most of the studies were conducted in different countries like Malaysia and United States. Some adopted different research methodologies like cross-sectional and causal research designs and data analysis methods which cannot be relied in this study. Therefore, it is on this background this study sought to investigate environmental management systems and performance of manufacturing firms in Abuja City, Nigeria. The purpose of this study was to establish the influence of environmental management systems and performance of manufacturing firms in Nigeria.

2.0 LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Ecological Modernization Theory

Ecological Modernization Theory was established in 1980's by a group of scholars such as Huber, Janickie and Simonis. The theory argues that the economy benefits from moves towards environmentalism (Watson *et al.*, 2004). It is based on the assumption that organizations are environmental dependent but not vice versa. Organizations that observe and comply with environmental regulations are likely to perform well and vice versa. Ecological modernization relates to environmental preadaptation of economic growth and industrial development.

On the basis of enlightened self-interest, economy and ecology can be favorably combined (UNDP, 2015). The fundamental philosophy of the theory emphasizes on resource efficiency as well as product and process innovations such as environmental management and sustainable supply chain management, clean technologies, benign substitution of hazardous substances, and product design for environment (Santos & Brito, 2012). Radical innovations in these fields can not only reduce quantities of resource turnover and emissions, but also change the quality or structure of the industrial metabolism. In the coevolution of humans and nature, and in order to upgrade the environment's carrying capacity, ecological modernization gives humans an active role to play, which may entail conflicts with nature conservation (Toke, Gupta & Dandekar, 2012). Therefore, this theory was underpinned on Green Manufacturing Systems and pollution prevention systems variable of this study.

2.1.2 Stakeholder Theory

The Theory was established by Freeman in (1983) and later was reviewed by other proponents such as Mile (Samantha, 2012). Florida and Davison (2001) argue that stakeholder approach to corporate environmental management to include any individual or group who can affect the

firm's performance or who is affected by the achievement of the organizations' objectives. The stakeholder theory is grouped into two: strategic stakeholder who emphasizes the active management of stakeholder interests and moral stakeholder interested in balancing stakeholder interests' corporations should not focus narrowly their strategic management decisions on creating shareholder value; rather broaden their objectives to tackle the expectations and interest of a wide variety of salient stakeholders (Freeman & Phillips, 2002).

Chang, Kenzhekhanuly and Park (2013) argue that poor environmental performance leads to poor company's relationship with its stakeholders. This will affect the firm's reputation and shareholders will suffer financial losses on their investments if a firm's is found liable to environmental damage. Consequently shareholders and financial institutions perceive companies with a poor environmental record as riskier to invest in and may demand a higher risk premium. Also companies with a poor reputation of environmental management will find it harder to attract and retain highly qualified employees who may have a strong proactive environmental management.

Chang et al. (2013) suggest that a firm with a reactive environmental strategy may face big loss of competitive advantage if proactive environmental management becomes a common practice among its competitors. The threats posed by various stakeholders in response to the poor environmental management may thus induce firms to improve their corporate environmental practice. The assumption of this theory is that organizations interact with people within the system and those outside the system and they have to be represented in the corporate decision making process. Therefore, manufacturing firms should embrace ISO 14001 practices for them to be judged by stakeholders as socially responsible (Murphy, 2012). Therefore, this theory was underpinned on pollution control systems variable of this study.

2.1.3 Total Quality Management Theory

The theory was established by Deming and Juran (1931). They propose that quality is perceived from different perspectives by different customers. TQM theory is applied by competitive organizations in managing service quality in the dynamic business environment. The theory holds that environmental performance is enhanced by designing products and services to meet or exceed customer expectation by empowering workers to find and eliminate all factors that undermine product or service. TQM promotes organizational effectiveness through; promoting stakeholder satisfaction, pursuing continuous improvement; and fostering proactive leadership (Murphy, 2012).

Boer and Zandberg (2012) argue that organizational managers should engage their staff in identifying the organization's internal and external stakeholders and by determining the criteria that each uses to judge the organization to be successful. This process suggests that the effective competitive organization is one that satisfies the expectations of its customers and stakeholders without environmental pollution. Quality is a complex phenomenon based on perception by individuals with different perspectives on products companies produce and their impact to the environment. Consequently, quality encapsulates time and other contextual dimensions that add to the complexity of what is essentially a subjective evaluation of the quality of good and/or service by the consumer (Lalinsky, 2012).

Delmas and Toffel (2008) assert that Environmental Management System strategies for managing quality therefore need to consider this inherent complexity, and build complexity into its models. Any single paradigm provides a too narrow view to capture complexity, and the multi-faceted nature of reality. The complexity of managing quality in this type of service is further increased if there is continuous change in the external environment due to intense

competition and changing customer needs. Therefore, this theory was underpinned on management systems variable of this study.

2.2 Empirical Review

Lalinsky (2012) posits that green manufacturing systems are production equipment, methods and procedures, product designs and product delivery mechanism that conserves energy and natural resources, minimize environmental load of human activities, and protect the natural environment. They include both hardware such as pollution control equipment, ecological measurement instrumentation, and cleaner production technologies. They also include operating methods such as waste management practices and conservation-oriented work arrangements used to conserve and enhance nature (Okemba & Namusonge, 2014).

The classification of green manufacturing practices is a necessary first step in the process of discussing them. Esty and Winston (2009) proposed classifying green manufacturing practices into five themes based on their general management orientation: design for disassembly, manufacturing for the environment, total quality environmental management, industrial ecosystems, and technology assessment. However, these themes are difficult to measure over time, cannot be easily overlaid onto existing manufacturing strategy research. Most studies support a more straightforward typology for characterizing green manufacturing practices as belonging to three general categories: pollution prevention management systems and pollution control (Sarkis, Torre & Diaz, 2010).

Ferron, Funchal, Nossa and Teixeira (2012) revealed that companies that invest in pollution prevention systems are more likely to perform well compared to firms that react to environmental pollution. It was established that pollution prevention had a direct positive impact on return on investments. Mohamed (2011) revealed that pollution prevention systems are likely to reduce or eliminate pollutants by using cleaner alternatives than those currently in place. Pollution prevention practices can be further characterized as product or process adaptation, although the two are related. Product adaptation encompasses all investments that significantly modify an existing product's design to reduce any negative impact on the environment during any stage of the product's manufacture, use, disposal, or reuse. Process adaptation refers to fundamental changes to the manufacturing process that reduce any negative impact on the environment during material acquisition, production, or delivery (Otieno, 2011).

Sarkis, Zhu and Lai (2011) established that some management systems, such as improved housekeeping practices, might be considered to be pollution prevention or to be part of implementing a product or process adaptation. The emphasis here is the physical product and/or process change. This narrow definition reflects the structural/infrastructural distinction made in manufacturing strategy research, which has earned broad theoretical and managerial acceptance in operations management. Delmas and Toffel (2008) revealed that some organizations have found a match between environmental considerations and profitability. Further, they argue that green supply management helps reduce the ecological impacts of industrial activities thereby enhancing environmental performance.

Okemba et al. (2014) established that green manufacturing is passively correlated with organizational performance. Efforts to formalize procedures for evaluating environmental impacts during capital decision budgeting, to increase outside stakeholder involvement in managing operations, to increase employee training for spill prevention and waste reduction, to establish an environmental department, and to develop new procedures for cross-functional coordination. Monitoring, internal and external reporting, and related compliance systems are also examples of management systems practices. Santos and Brito (2008) suggest that

management systems practices also include: use of environmental systems as the primary management approach for addressing environmental aspects of internal operations and activities, environmental aspects, establishment of environmental objectives and targets and implementation, collection, analysis, and reporting of information to measure performance in the implementation.

Momanyi (2013) indicated that pollution control systems were drivers of organization efficiency and effectiveness. However, in contrast to prevention practices, pollution control practices treat or dispose of pollutants or harmful by-products at the end of a manufacturing process, either immediately or later, to accomplish this, a plant must add operations or equipment to the end of an existing manufacturing process, thereby leaving the original product and process virtually unaltered (Chang et al., 2013). Pollution control practices can be further characterized as either remediation or end-of-pipe controls. Remediation refers to cleaning up environmental damage caused by crises or past practices, and it is often driven by regulation or by improvement in scientific understanding of environmental damage. End-of-pipe controls refer to using equipment that is added as a final process step to capture pollutants and wastes prior to their discharge (MAN, 2012).

3.0 METHODOLOGY

The study adopted a longitudinal research design that was descriptive in nature to establish the effect of environmental management systems on performance of manufacturing firms in Abuja City, Nigeria for the period 2011-2015. Stratified sampling technique was used to select a sample size of 88 respondents who were employees of the manufacturing firms in Abuja City, Nigeria. Structured questionnaires with open and closed ended questions were used as instruments of data collection. Validity of the instrument was tested using industry experts and University supervisors, while reliability was tested using Cronbach Alpha formula. Quantitative data collected was analyzed using Statistical Package for Social Sciences (SPSS version 22) where multiple regression method was adopted to determine the statistical relationship between variables. Means, percentages and standard deviation were used during data analysis and the information was presented in form of tables. Further, qualitative data was analyzed using content analysis method where key themes of written and spoken word were reviewed and conclusions were made.

4.0 DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Demographic Characteristics

Target population of this study was 44 manufacturing firms which were operating in Abuja City, Nigeria and Unit of observation were employees of manufacturing firms operating in Abuja City, Nigeria. Out of the 44 manufacturing companies a target population of 176 employees was used. The respondents were directors, production managers, occupational and safety managers and quality assurance managers. Majority (51%) of the respondents indicated their manufacturing companies had operated for a period of between 5-10 years, 20% of them indicated that their manufacturing companies had operated for a period between 10-20 years while 17% indicated that their companies had operated for a period more than 20 years and 12% indicated that their companies had operated for a period less than 5 years. (53%) of the respondents indicated that their companies comprised of 25-100 employees also 26% indicated that their companies comprised of less than 25 employees and 21% comprised of 300-1000 employees.

4.2 Descriptive Statistics

4.2.1 Green Manufacturing Practices

The study sought to establish the effect of green manufacturing practices on environmental performance in the sampled manufacturing companies. The findings are presented in table 1.

Table 1: Green manufacturing practices

Items	Mean	SD
Recycling of production materials	3.78	.884
Proactive measures in waste reduction	3.61	.664
Treatment of wastes or emission reduction	3.58	.587
Usage of recyclable materials in packaging products	3.47	.673
Energy conservation by use of modern equipment in production	3.33	.596
Production of eco-friendly products	2.10	.498
Leadership support on environmental regulations	2.10	.491
Employee awareness on ISO 14001 practices	2.03	.411

As illustrated in table 1, it was revealed that majority of the respondents agreed that green manufacturing practices had a significant positive effect on environmental performance the low extent of implementation. For instance, majority of the respondents indicated that; recycling of production materials influenced environmental performance of their companies with a mean of 3.78, proactive measures in waste reduction with a mean of 3.61, treatment of wastes or emission reduction with a mean of 3.58, usage of recyclable materials in packaging products with a mean of 3.47, energy conservation by use of modern equipment in production with a mean of 3.33, production of eco-friendly products with a mean of 2.10, leadership support on environmental regulations with a mean of 2.10 and finally employee awareness on ISO 14001 practices with a mean of 2.03.

4.2.2 Pollution Prevention Practices

The study sought to establish the effect of pollution prevention practices on environmental performance in the sampled manufacturing companies. The findings are presented in table 2.

Table 2: Pollution prevention practices

Items	Mean	SD
Reduction in air pollution	3.13	.665
Reduction of waste water	3.13	.654
Reduction of solid waste	3.18	.623
Reduction of frequency of environmental accidents	3.21	.584
Environmental certification	3.11	.453
Continuous improvement	3.21	.486
Decrease in the cost of energy consumption	3.41	.781
Decrease in fine for environmental accidents	3.41	.744

As illustrated in table 2, the findings indicate that the majority of the respondents that pollution prevention practices by manufacturing were adopted on a small extent. For instance, it was indicated that reduction in air pollution with a mean 3.13, waste water with a mean of 3.13,

waste solid with a mean of 3.18, frequency of environmental accidents with a mean of 3.21, environmental certification with a mean of 3.11, continuous improvement with a mean of 3.2, energy consumption with a mean of 3.41 and environmental accident fines with a mean of 3.41.

4.2.3 Management System Practices

The study sought to establish the effect of management system practices on environmental performance in the sampled manufacturing companies. The findings are presented in table 3.

Table 3: Management system practices

Items	Mean	SD
Compliance to governments environmental regulations	3.18	.544
Leadership participation in environmental forums	3.11	.487
Formulation of green marketing policies	2.80	.421
Desire to improve product quality	2.80	.374
Public sensitization on environmental conservation	2.11	.343
Compliance to procurement and disposal Act	1.15	.203
Technology integration in Production	2.02	.185
Employee training on health and safety measures at the workplace	1.06	.156

As illustrated in table 3, it was revealed that majority of the manufacturing firms operating in Nigeria adopted management system practices that were inefficient and ineffective. For instance, it was indicated compliance to government environmental regulations was on a small extent with a mean of 3.18, leadership participation in environmental forums with a mean of 3.11, formulation of green marketing policies with a mean of 2.80, desire to improve product quality with a mean of 2.80, public sensitization on environmental conservation with a mean of 2.11, compliance to procurement and disposal Act with a mean of 1.15, technology integration in production 2.02 and employee training on health and safety measures at the workplace with a mean of 1.06.

4.2.4 Pollution Control Practices

The study sought to establish the effect of pollution control practices on environmental performance in the sampled manufacturing companies. The findings are presented in table 4.

Table 4: Pollution control practices

Items	N	Mean	S.D
Treatment of waste products before disposal	81	4.26	.884
Compliance to ISO 14001 practices	81	4.21	.664
Conducting environmental research	81	3.23	.587
Partnerships with ISO 14001 certified firms	81	3.11	.673
Investment in modern production equipment	81	3.04	.596
Employee awareness on ISO 14001 Standards	81	2.59	.498
Stakeholder engagement before production	81	2.41	.345
Compliance to Standard Organization of Nigeria	81	2.22	.354

As illustrated in table 4, it was revealed that majority of the manufacturing firms operating in Nigeria adopted pollution control practices on small extent. For instance, it was indicated that

most of the manufacturing companies did not treat waste products before disposal with a mean of 4.26, compliance to ISO 14001 practices with a mean of 4.21, conducted environmental research with a mean of 3.23, partnered with ISO 14001 certified firms with a mean of 3.11, invested in modern production equipment with a mean of 3.04, created employees awareness on ISO 14001 Standards with a mean of 2.59, engaged stakeholder before production with a mean of 2.41, complied to Standard Organization of Nigeria with a mean of 2.22.

These findings implied that most of the manufacturing companies operating in Nigeria were not sensitive on pollution control practices since they disposed waste products before treatment and this resulted to pollution of the air and water. Non-treatment of waste products also exposed members of the public to contaminated water leading to health complications. It emerged that environmental research among manufacturing firms was not a common practice since it was associated with costs. Partnership with ISO compliant firms and stakeholder involvement before production of goods and services were rare practices. It was noted that most manufacturing firms did not comply with Standard Organization of Nigeria regulations like packaging of products with environmental friendly materials.

4.2.5 Environmental Performance

The study sought to establish the effect of environmental performance indicators in the sampled manufacturing companies. The findings are presented in table 5.

Table 5: Environmental performance

Items	Mean	S.D
Minimal level of environmental pollutants emission	3.26	.384
Minimal number of complaints	3.21	.364
Minimal number of environmental law suits	3.23	.487
Stakeholder satisfaction	3.11	.373
Firm participation in social corporate responsibility	3.04	.496

As illustrated in table 5, it was revealed by majority of respondents that environmental performance was measured by a number of indicators. For instance, minimal level of environmental pollutants emission 3.26, minimal number of complaints 3.21, and minimal number of environmental law suits 3.23, stakeholder satisfaction 3.11 and firm participation in social corporate responsibility with a mean of 3.04. This is supported by Mohamed (2011) who revealed that environmental performance was the standard measure of global competitive firms in the changing business environment. They also noted that stakeholder involvement was the only way manufacturing firms will use to compete in the 21st Century. Firms should cooperate in environmental issues rather than compete for short term gains that ruin environmental resources.

4.3 Inferential Statistics

Multiple regression analysis was carried out to test the statistical effect of the independent variables (Green Manufacturing Systems, Pollution Prevention Systems, Management Systems and Pollution Control Systems) on the dependent variable (environmental performance of manufacturing firms in Abuja City, Nigeria) the study applied the statistical package for social sciences (SPSS version 22) to code, enter and compute the measurements of the multiple regressions for the study. Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (environmental performance of

manufacturing firms in Abuja City, Nigeria) that is explained by all the four independent variables (Green Manufacturing Systems, Pollution Prevention Systems, Management Systems, Pollution Control Systems).

4.4 Correlations Analysis

Pearson's Product Moment Correlation analysis was also used to assess the relationship between the variables while multiple regressions was used to determine the predictive power of the environmental management systems on the environmental performance of manufacturing firms in Abuja City, Nigeria as shown in table 6.

Table 6: Correlations analysis

		Environmental performance of manufacturing firms	Green manufacturing systems	Pollution prevention system	Management system	Pollution control system
Environmental performance of manufacturing firms in Abuja City, Nigeria.	Pearson Correlation	1				
	Sig. (2-tailed)					
Green Manufacturing Systems	Pearson Correlation	.710	1			
	Sig. (2-tailed)	.0012				
Pollution Prevention Systems	Pearson Correlation	.693	.027	1		
	Sig. (2-tailed)	.0017	.799			
Management Systems	Pearson Correlation	.579	.560	.762	1	
	Sig. (2-tailed)	.0023	.000	.530	.	
Pollution Control Systems	Pearson Correlation	.556	.540	.742	.723	1
	Sig. (2-tailed)	.0021	.000	.540	.	

As illustrated in table 6, the four independent variables were correlated with the dependent variable using Pearson Correlation Analysis at 95% confidence interval and 5% significance level. After correlation, it was established that there was a positive correlation between Green Manufacturing Systems, Pollution Prevention Systems, Management Systems, and Pollution Control Systems on performance of manufacturing firms in Abuja City, Nigeria. For instance, as illustrated in Table 6, there is a positive relationship between environmental performance of manufacturing firms in Abuja City, Nigeria, and Green Manufacturing Systems, Pollution Prevention Systems, Management Systems, Pollution Control Systems of magnitude 0.710, 0.693, 0.579 and 0.556 respectively.

4.5 Model Summary

Table 7: Model summary

Model	R	R Square	Std. Error of the Estimate
1	0.923	0.852	0.6273

As illustrated in table 7, it was established that the four independent factors that were studied explain only 78.9% of environmental management systems and environmental performance of manufacturing firms in Abuja City, Nigeria, as represented by the R^2 . This therefore means that other factors not studied in this research contribute 21.1% of environmental management systems and environmental performance of manufacturing firms in Abuja City, Nigeria. Therefore, further research should be conducted to investigate the other factors (21.1%) that influence performance of manufacturing firms in Nigeria.

Table 8: ANOVA test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.003	12	.001	3.867	.015 ^b
Residual	0.068	173	.021		
Total	0.071	185			

From the ANOVA statistics in table 8, the processed data, which is the population parameters, had a significance level of 0.015 which shows that the data is ideal for making a conclusion on the population's parameter as the value of significance (p-value) is less than 5%. The calculated was greater than the critical value ($2.262 < 3.869$) an indication that the four variables were significantly influenced by performance of manufacturing firms in Abuja City, Nigeria. The significance value was less than 0.05, an indication that the model was statistically significant and fit for forecasting purposes.

Table 9: Regression coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.139	1.2235		1.515	0.0133
Green Manufacturing Systems	0.887	0.1032	0.152	4.223	0.0122
Pollution Prevention Systems	0.752	0.3425	0.154	3.424	0.0112
Management Systems	0.645	0.2178	0.116	3.236	0.0111
Pollution Control Systems	0.612	0.2012	0.113	3.111	0.0001

From the finding in table 9, the established regression equation was: Performance of Manufacturing Firms in Nigeria = $1.139 + 0.887 \text{ Green Manufacturing Systems} + 0.752 \text{ Pollution Prevention Systems} + 0.645 \text{ Management Systems} + 0.612 \text{ Pollution Control Systems}$.

From the above regression model, holding Green Manufacturing Systems, Pollution Prevention Systems, Management Systems, Pollution Control Systems to a constant zero performance of manufacturing firms in Abuja City, Nigeria would be at 0.139. It was established that a unit increase in Green Manufacturing Systems would cause an increase in performance of manufacturing firms in Abuja City by a factor of 0.887, while a unit increase in Pollution Prevention Systems would cause an increase in performance of manufacturing firms in Abuja City by a factor of 0.752, a unit increase in management Systems would cause an increase in performance of manufacturing firms in Abuja City by a factor of 0.645 and a unit increase in Pollution Control Systems would cause an increase in performance of manufacturing firms in Abuja City by a factor of 0.612.

Table 10: Performance measurement outputs

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	0.119	1.2225		1.415	0.0123
Level of environmental pollutants emission	0.737	0.1132	0.132	3.113	0.0112
Number of complaints	0.622	0.3325	0.134	2.224	0.0122
Number of environmental law suits	0.575	0.3278	0.196	2.136	0.0131
Stakeholder satisfaction	0.548	0.221	0.189	2.123	0.000
Firm participation in social corporate responsibility	0.512	0.211	0.123	2.143	0.000

As illustrated in table 10, the study sought to establish the effect of environmental management systems on the environmental performance of manufacturing firms in Abuja City, Nigeria, using level of environmental pollutants emission, number of complaints, number of environmental law suits, stakeholder satisfaction and firm participation in social corporate responsibility as indicators of performance measurement.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

From the findings of the study, it can be concluded that manufacturing companies operating in Nigeria should adopt green manufacturing systems, pollution prevention systems, management systems and pollution control systems to enhance their performance. For green manufacturing systems to be efficient and effective, management should embrace ISO 1400 practices that emphasize on production of green products. Employees should be trained on the benefits of green manufacturing models. Pollution prevention systems should be effective, all stakeholders should be sensitized on the benefits of environmental conservation. Firms should focus on the society rather than producing products that are harmful to consumers.

5.2 Recommendations

The study recommends that manufacturing and processing should develop environmental management policies that should be well communicated and shared across the organizations. Specifically, this study recommends that management of manufacturing firms should establish electronic waste management systems that invest in modern production technological equipment, focus on production of green products, train workers on ISO 14001 standards in order to promote environmental performance. The study established that most of the manufacturing firms did not have pollution prevention mechanisms. Therefore, this study recommends that top leadership of manufacturing firms should steer initiatives intended to enhance environmental performance like compliance to National Environmental Standards and Regulations Enforcement Agency (NESREA) and Standard Organization of Nigeria regulation. Stringent measures should be put in place by NESREA and Standard Organization of Nigeria to ensure that formulated policies are not violated by industry players. Firms compliant to regulations should be accredited and certified. It is also recommended that multi-sectorial synergies should be encouraged by environmental authorities to enhance environmental performance.

It was established that management systems adopted by manufacturing firms in Nigeria were ineffective and inefficient. Therefore this study recommends that top leadership of manufacturing companies should weigh-in and ensure appropriate management regulations are adhered to. Adherence to Procurement and Disposal Act, integration of technology in production process, formulation of green marketing policies and employee training on ISO 14001 series should be emphasized.

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