DETERMINANTS OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES ON PERFORMANCE OF GAS MANUFACTURING FIRMS IN KENYA

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Abstract

Purpose: This study aimed to assess the determinants of green supply chain management practices on the performance of gas manufacturing companies in Kenya.

Methodology: This research study adopted a descriptive research design approach. The researcher prefers this method because it allows an in-depth study of the subject. There are twenty-eight (28) gas manufacturing firms in Kenya according to the Petroleum Institute of East Africa (PIEA) directory in 2021. The unit of analysis was the individual gas manufacturing firms. The unit of observation was five (5) procurement officers from each of the twenty-eight (28) gas manufacturing firms in Kenya. The total number of respondents was one hundred and forty (140). The study in its data collection used questionnaires. After data collection, quantitative data was coded using Statistical Package for Social Science (SPSS) version 20. Data were analyzed through descriptive statistical methods such as means, standard deviation, frequencies, and percentages. Inferential analyses were used in relation to correlation analysis and regression analysis to test the relationship between the four explanatory variables and the explained variable. Results were presented using tables, graphs, and charts

Results and conclusion: The response rate of the study was 85%. The independent variables reported-value of .775 indicating that there isa perfect relationship between the dependent variable and independent variables. R square value of 0.6   means that 60% of the corresponding variation in performance of gas manufacturing firms can be explained or predicted by green product design, green distribution, green warehousing and reverse logistics, which indicated that the model fitted the study data.

The findings of the study indicated that green product design, green distribution, green warehousing,g, and reverse logistics have a positive relationship with performance in gas manufacturing firms

Policy recommendation: The study recommended that gas manufacturing firms should embrace green supply chain management practices so as to improve performance and furtherresearchs should be carried out in other institutions to find out if the same results can be obtained.

1.1 Introduction

Green supply chain management practices (GSCM) are the incorporation of environmentally friendly processes in the supply chain of the firm to ensure that the organization operations do not impact the environment negatively. The use of GSCM is done from the onset of the SC processes to the end and also continues to be incorporated even after the products shelf life with the aim of not only enhancing the performance of the organization supply chain processes but also the firm products (Gilbert, 2017).

In the last few years more publicity has been given on environmental issues with the public being sensitized about it. Further, firms are also expected to perform their operations with the environment in mind. It is common to hear firms being asked on how they intend to make their processes greener to reduce their carbon footprint and how they intend to use recycled materials or come up with products that are easy to recycle (Sung, 2019).

This has led to companies being more conscious of the environment and how their business processes are viable in relation to the environmental regulations put in place. If environmentally-friendly supply chain processes are used by the firm, the organization is likely to succeed even when it comes to other processes (Harris & Crane, 2016). Customers and governments have put lots of pressure on firms to ensure their processes are more environmentally friendly. This calls for the use of environmentally friendly and sustainable processes in the supply chain firm processes.

Globally, more awareness has been made of firms and their effects on global environmental challenges. This has seen customers change their buying habits opting to buy products that are eco-friendly. Further, stakeholders have increased pressure on firms to use more environmentally friendly practices which is why it is important for firms to embrace GSCM practices (Sarkis, 2017).

Moreover, organizations are under pressure to come up with environmental regulations and strategies which has seen the provision of social responsibility and environmental requirements and guidelines such as the Kyoto Protocol among others (Wu & Pagell, 2017). Organizations can study several factors when it comes to the evaluation of SC performance. Such factors include lead time, quality, customer service ce, and customer loyalty among others.

In the Kenyan business environment, GSCM is not a well-known concept. Those firms that have embraced it often look at the practice in two ways; the environmental management and the supply chain management concepts. GSCM involves the incorporation of environmental management in the process of SCM (DiMaggio, 2018). The goal of GSCM is to ensure that the waste of the supply chain process does not go beyond this process in order to conserve energy and prevent the release of dangerous materials into the environment (Obiso, 2017).

The use of GSCM by Kenyan manufacturing firms is way below the expectation. Kenya boasts of the most vibrant mobile telecommunications industry in the region that rakes in billions of profits. The players are usually embroiled in price wars and the consumers tend to enjoy the competitive prices. Little concern is given to the effect of these practices on the environment and very few

players have adopted GSCM (Chege, 2016). In Kenya, GSCM practices have been widely adopted in both the private and public sector by the official certifying body Kenya Bureau of Standards (KEBS) among other international certifying bodies (Mwaura & Ithinji, 2016).

KEBS was established to provide standardization and conformity assessment services that consistently meet its customers' requirements. KEBS provides the necessary resources towards the effective implementation and continual improvement of the GSCM practices that complies with ISO 14001. It started its certification operations and it has been in the fore front in certification on different green supply management systems in Kenya (Muchiri, 2017).

Many large and small organizations that are part of the supply chain process do not have critical information on GSCM and they need theoretical and practical training in this field (Lembke, 2016). Based on the fact that manufacturing sector is among the largest contributor of the Kenyan GDP, 26% of GDP in 2018, governmental policies in Kenya should strive towards the implementation of GSCM approaches in pursuit of acquiring greener service excellence in this sector (Mahulo, 2018).

1.2 Statement of the Problem

As explained by ROK (2018) the Kenyan manufacturing sector makes a notable contribution to the country's economic development. The downside is that this sector is known to be a great contributor to the country's environmental deterioration (OECD, 2016). It is estimated that one in eight deaths (12.5%), worldwide resulted from air pollution (OECD, 2016). Manufacturing companies are the most commonly perceived enemy to environmental protection because of waste generation, ecosystem disruption and depletion of natural environment in Kenya (MoH, 2017).

According to USAID environmental report (2016), NEMA's major challenges were solid waste disposal (61%) and emerging environmental health issues (32%), whereas those faced by Nairobi County were plastic bags menace (78%), water (12%) and air pollution (6%). The need to minimize these notable effects on the environment has led to more emphasis being put on the firms need to embrace GSCM. Those firms that will take up this concept will reduce the negative effects their operations have on the environment and will also gain a competitive advantage against their rivals (World Bank, 2017).

According to KIPPRA (2018), green supply chain management practices has become a necessity in the manufacturing industry; due to legislations and environmental concerns. Many firms look for new possibilities to create and improve their return systems in order to gain a competitive advantage. Companies are now looking into green supply chain management practices in order to optimize their return flows (OECD, 2017).

In the global scene there has been a few studies done related to the study tropic. Zhu and Sarkis (2018) examined the GSCM pressures, practices and performance in the Chinese automobile industry and found that increasing pressures from a variety of directions have caused the Chinese automobile supply chain managers to consider and initiate implementation of GSCM practices to improve their environmental and revenue performance.

Locally, Epusi (2017) focused on green supply chain management practices by mobile phone dealers in Nairobi and observed that most of the firms had subscribed to the environmental bodies and customers influenced the choice of packaging material adopted but the firms did not use environmental issues in the criteria for selecting suppliers. GSCM research among public companies exist (Nasiche & Ngugi, 2018) and also among agricultural firms (Langat & wanyoike, 2018). These two studies were case studies and they reported that 80% of the Kenyan manufacturing organizations have not embraced the green supply chain processes. All the above studies have been done in different contexts which are impacted differently depending on the industry and the environment. It is against this back drop that this study seeks to examine the determinants of green supply chain management practices on the performance of gas manufacturing firms in Kenya.

1.3 Objectives of the Study

i. To establish the effect of green product design on the performance of gas manufacturing firms in Kenya.

ii. To evaluate the effect of green distribution on the performance of gas manufacturing firms in Kenya.

iii. To assess the effect of green warehousing on the performance of gas manufacturing firms in Kenya.

iv. To determine the effect of reverse logistics on the performance of gas manufacturing firms in Kenya.

2.0 LITERATURE REVIEW

2.1 Resource advantage (R-A) theory

Resource advantage (R-A) theory is a developmental process theory of competition which stresses that inventions; organizational llearningand innovations emerge from within. It also assumes that customers and companies have no perfect information, and that institutions, systems, entrepreneurship and public policy affect the firm's economic performance. The theory appreciates that in an industry, resources of the firms are very different and immobile. This therefore leads to some firms having a competitive advantage to differentiate and comparative advantage to provide a less costly way of production over others and hence produce better quality products to the market (Chin, 2020).

The reason is that while the ISO 14001 standards are specifications to manage the environmental aspects of an organization; the GRASS model is aimed at improving environmental decision making within organizations. This is a crucial difference that one should notice. The theoretical underpins behind the GRASS model are supported by the disciplines of environmental management, systems thinking (decision making science), and strategic operations management (Henriques & Sadorsky, 2019).

As the previous section has shown, operations strategy will need to be seen under the context of sustainability, and based upon a more systemic approach. Therefore, the GRASS model comes to join those disciplines to help better strategic environmental decision-making in operations. The

GRASS model focus on the strategic issues and decisions for an organization to improve its environmental performance, therefore, non-environmental factors such as customer satisfaction, competitors' actions, image, could be integrated as "key elements for environmental strategy" (Buysse & Verbeke, 2018).

2.2 Determinants Of Green Supply Chain Management Practices

2.1.1   Green Product Design and Performance of Gas Manufacturing Firms

Packaging now is regarded as an essential component of our modern lifestyle and the way business is organized. Packaging is the enclosing of a physical object, typically a product that will be offered for sale. It is the process of preparing items of equipment for transportation and storage and which embraces preservation, identification and packaging of products. According to Saliba (2017) packaging is the act of containing, protecting and presenting the contents through the long chain of production, handling and transportation to their destinations in as good a state, as they were, at the time of production packaging is an important part of the branding process as it plays a role in communicating the image and identity of a company.

2.1.2 Green Distribution and Performance of Gas Manufacturing Firms

Mwaura, Letting and Ithinji (2016) examined green distribution processes and their impact on the Kenyan food manufacturing companies. The cross-sectional study used survey and factor analysis methods to test construct validity and a linear regression model was constituted to test criterion validity. The results showed that technology had a significant impact on the organizations distribution processes and that interned was one of the distribution methods used. The suppliers greatly supported green distribution processes indicating that they were committed to going green in their distribution operations..

2.1.3 Green Warehousing and Performance of Gas Manufacturing Firms

The adoption of green infrastructure helped the automotive practitioners to improve their green performance. Yan and Yazdanifard (2021) established whether green marketing and storage was successful and how it related to the performance of firms. Through interviews, questionnaires and secondary information, the scholars realized that majority of the firms believed that such ideas of going green would be beneficial to the society and that those who implemented, performed better than those who did not.

In the logistics industry, green industrial buildings practices are commonly associated with green warehouse practices (GWP) and it is important to study GWP as it brings positive impact to the environment, economy, and societies. Additionally, because of the increasing pressure and environmental concerns over carbon footprint, the need for GWP within the logistics industry is of main priority.

2.1.4 Reverse Logistics and Performance of Gas Manufacturing Firms

As Sung (2019) notes that more attention on reverse logistics is due to the many regulations related to environmental protection put up and the pressure on firms to comply with them. For most industries these regulations require that the manufacturer take responsibility for their product even after the product is sold or the product life cycles comes to an end.

The interest on this topic is also due to the growth in the number of environmental conscious customers who are interested in not only the products price and quality but also the environmentally friendliness of the product and the environmentally conscious decisions the firm has made in the process of producing the product. More customers are willing to be loyal to firms that embrace initiatives such as the recycling of products to improve environment or the use of environmentally friendly processes in their packaging and design of their product minimizing waste disposal to the environment (Wu et al., 2017).
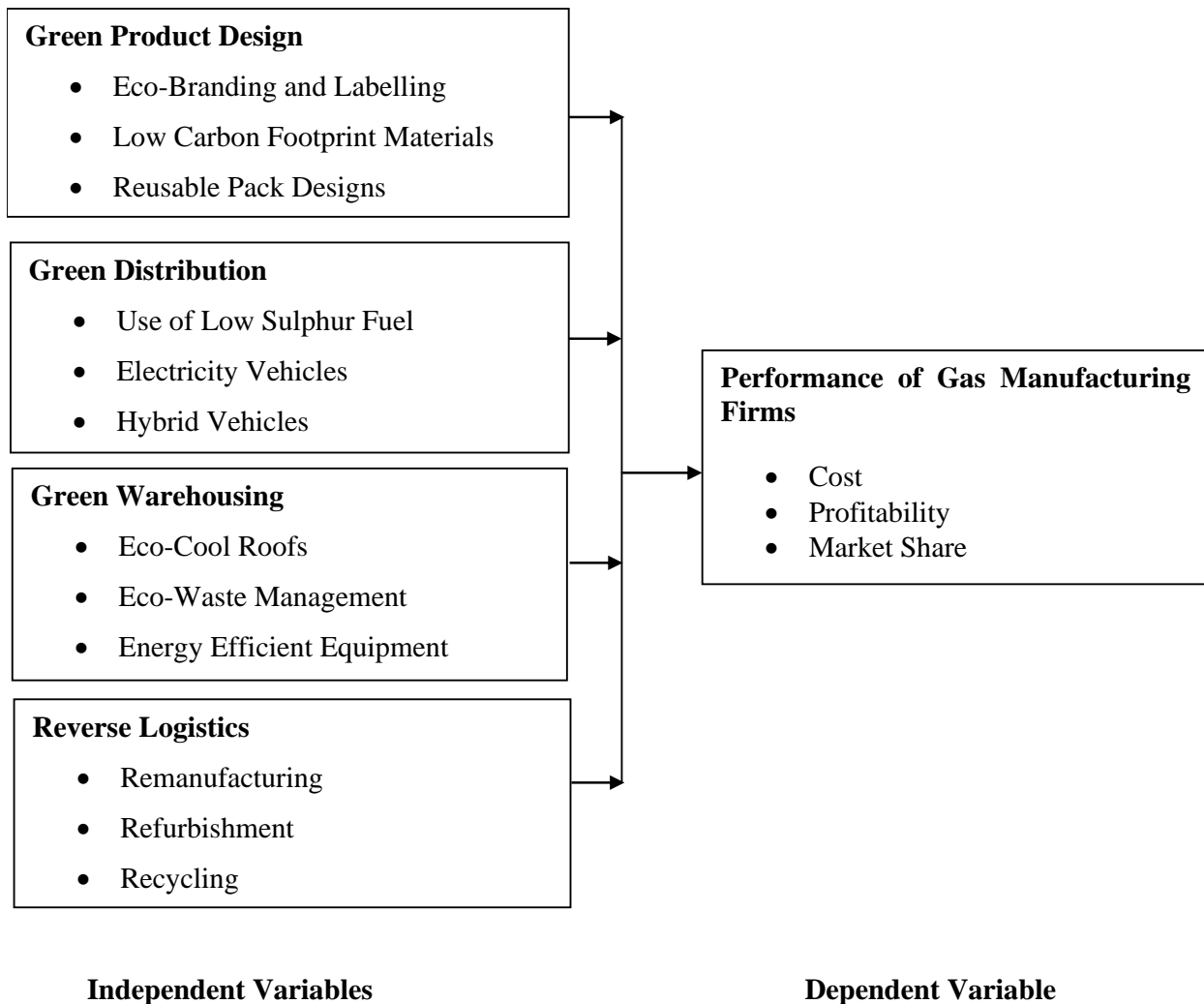
2.3 Conceptual Framework

Green Product Design
- Eco-Branding and Labelling
- Low Carbon Footprint Materials
- Reusable Pack Designs

Green Distribution
- Use of Low Sulphur Fuel
- Electricity Vehicles
- Hybrid Vehicles

Green Warehousing
- Eco-Cool Roofs
- Eco-Waste Management
- Energy Efficient Equipment

Reverse Logistics
- Remanufacturing
- Refurbishment
- Recycling

Performance of Gas Manufacturing Firms
- Cost
- Profitability
- Market Share

Independent Variables   **Dependent Variable**

Figure 1: Conceptual Framework

3.0 METHODOLOGY

This research study adopted a descriptive research design approach. The researcher prefers this method because it allows an in-depth study of the subject. There are twenty-eight (28) gas manufacturing firms in Kenya according to the Petroleum Institute of East Africa (PIEA) directory in 2021. The unit of analysis was the individual gas manufacturing firms. The unit of observation was five (5) procurement officers from each of the twenty-eight (28) gas manufacturing firms in Kenya. The total number of respondents was one hundred and forty (140). The study in its data collection used questionnaires. After data collection, quantitative data was coded using Statistical Package for Social Science (SPSS) version 20. Data was analyzed through descriptive statistical methods such as means, standard deviation, frequencies and percentage. Inferential analyses were used in relation to correlation analysis and regression analysis to test the relationship between the four explanatory variables and the explained variable. Results were presented using tables, graphs, and charts

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

Y   = Performance of Gas Manufacturing Firms

β_0 = Constant

X1   = Green Product Design

X2   = Green Distribution

X3   = Green Warehousing

X4   = Reverse Logistics

ε = Error Term

4. 0 RESULTS FINDINGS

4.1 Introduction

This chapter presents results arising from the analysis of data collected using questionnaires.

4.2 Response Rate

A sample of 140 respondents were interviewed using questionnaires that allowed the researcher to drop the questionnaire to the respondents and then collect them at a later date when they had filled the questionnaires. A total of 140 questionnares were distributed to procurement officers. Out of the population covered, 119 were responsive respresenting a response rate of 85%. This was above the 50% which is considered adequate in descriptive statistics according to (Mugenda & Mugenda, 2020).

Table 1: Response Rate of Respondents

Response	Frequency	Percentage
Actual Response	119	85
Non-Response	21	15
Total	140	100%

4.3 Pilot Study

The cronbach's alpha was computed in terms of the average inter-correlations among the items measuring the concepts. The rule of thumb for cronbach's alpha is that the closer the alpha is to 1 the higher the reliability (Serekan, 2018). A value of at least 0.7 is recommended. Cronbach's alpha is the most commonly used coefficient of internal consistency and stability. Consistency indicated how well the items measuring the concepts hang together as a set. Cronbach's alpha was used to measure realibilty. This was done on the four objectives of the study. The higher the coefficient, the more reliable is the test.

Table 2 Reliability Results

Variable	No of Items	Respondents	α=Alpha	Comment
Green Product Design	9	9	0.893	Reliable
Green Distribution	9	9	0.987	Reliable
Green Warehousing	9	9	0.974	Reliable
Reverse Logistics	9	9	0.976	Reliable

4.4 Demographic Information

This section presents the personal details of the respondents and it provides data regarding the study and is necessary for the determination of wether the individuals in a particlar study are a respresentative sample of the target population and testing appropriateness of repondent in answering the questions for generalisation. The study sought to determine the demographic characteristics of the respondents as they are considered as categorical variables which give some basic insight about the respondents. The characteristics considered in the study were; gender, age, their highest level of education attained and their work experience.

4.4.1 Distribution of Respondents by Gender

The study also determined the gender of the respondents. The results are submitted in figure 4.1 where 57% of the respondents were male while 43% of the respondents were female. The statistics may raise the issue of gender equity in oil industry in this country, but that is outside the scope of

this study. A study on North American organizations found that women and men do not differ in their ability to perform tasks, but rather bring a different perspective to green supply chain management practices (William, 2019).
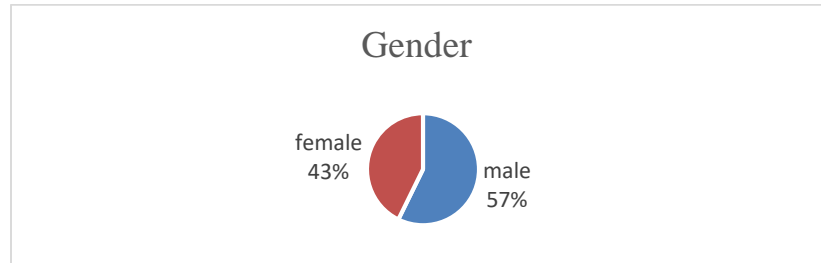

Figure 2: Distribution of Respondents by Gender

4.4.2 Distribution of Respondents by Age

The study determined the age distribution of the respondents. The results are summarized in the table3 below. The findings indicate the respondents aged between 41-50 were 33.6%. 26.1% of the respondents indicated that they were aged 31-40 years. The age group of 18 -30 years accounted for 19.3%. Above fifty years was shown at 21%. Again this shows that those interviewed are adults capable of making independent judgments and the results of a research process involving them are deemed to be valid. The findings are in agreement with those of Saunders (2020) who established that there are two natural age peaks of the late 20s to early 40s which correlated to employee performance.

Table 3: Distribution of Respondents by Age

Age	Frequency	Percent
18-30 Years	23	19.3
31-40 Years	31	26.1
41-50 Years	40	33.6
50 Years and above	25	21.1
Total	**119**	**100**

4.4.3 Distribution of Respondents by Level of Education

The respondents were asked to state their highest level of education and the results were as captured in Table 3. The results indicated that majority of the respondents 23.5% had a degree certificate, 22.7% percent had acquired a master's degree, and results further showed that 23.5% had a certificate while finally 30.3% were diploma holders. These findings concur those of Rotich (2019) who established that majority of who run gas manufacturing firms are highly educated and that there is evidence linking education and performance in gas manufacturing firms.

Table 4: Distribution of Respondents by Level of Education

Level of Education	Frequency	Percent
Certificate Level	28	23.5
Diploma Level	36	30.3
Degree Level	28	23.5
Master Level	27	22.7
Total	**119**	**100**

4.4.4 Distribution of Respondents by Length of Service

The study determined the number of years the respondents had worked in the gas manufacturing firms in Kenya. From the findings the majority of the respondents had worked at oil industry at 28.6% for 6 to 8 years. 26.9% had worked for zero to two years. 26.9% had been in active service for 3-5 years. 17.6% and above had worked for 9 and above years. The findings of the study are in tandem with literature review by Patron (2020) who indicated that a duration and experience of employee helps him or her to have better knowledge and skills which contribute to performance.

Table 5: Distribution of Respondents by Length of Service

Length of Service	Frequency	Percent
0-2 Years	32	26.9
3-5 Years	32	26.9
6-8 Years	34	28.6
9 Years and above	21	17.6
Total	**119**	**100**

4.5 Descriptive Statistics

4.5.1 Green Product Design

The first objective of the study was to assess the influence of green product design on performance of gas manufacturing firms in Kenya. The respondents were asked to indicate to what extent green product design influenced performance of gas manufacturing firms in Kenya. Results indicated that majority of the respondents 33% agreed that it was to a very great extent, 19% said that it was to a great extent, 30% said it was moderate, while little extent was 11% and not all was at 7% respectively.
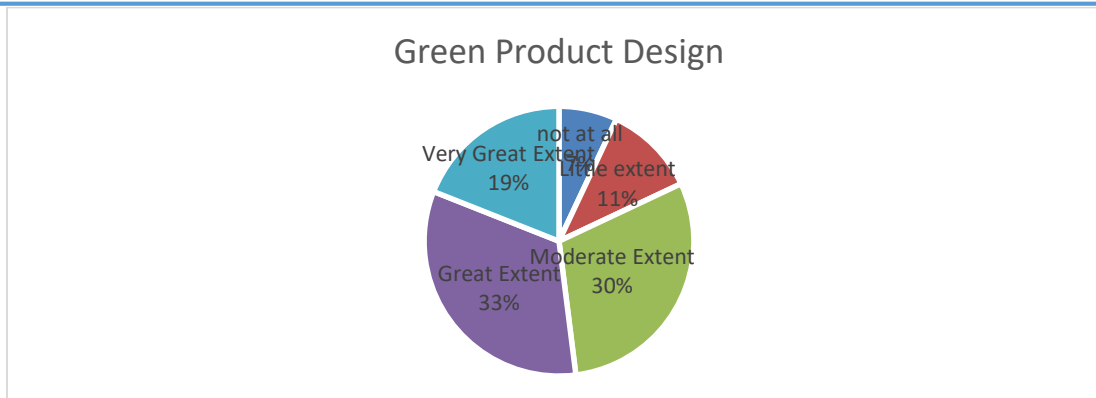
Figure 3: Green Product Design

The respondents were also asked to comment on statements regarding green product design influence on performance of gas manufacturing firms. The responses were rated on a likert scale and the results presented in table 6 below. and was rated on a 5 point Likert scale ranging from; 1 = strongly disagree to 5 = strongly agree. The scores of ' strongly disagree' and 'disagree' have been taken to represent a statement not agreed upon, equivalent to mean score of 0 to 2.5. The score of 'neutral' has been taken to represent a statement agreed upon, equivalent to a mean score of 2.6 to 3.4. The score of 'agree' and 'strongly agree' have been taken to represent a statement highly agreed upon equivalent to a mean score of 3.5 to 5.

Results indicated that majority of the respondents as indicated by a mean of 4.2 agreed on the statement that eco-branding and labelling plays a significant influence in cost reduction. The variations in the responses were shown by a standard deviation of 1.0. Results indicated that majority of the respondents as indicated by a mean of 3.6 agreed on the statement that low carbon footprint materials plays a significant influence in cost reduction The variations in the responses was shown by a standard deviation of 1.3 Results indicated that majority of the respondents as indicated by a mean of 3.6 agreed on the statement that reusable pack designs plays a significant influence in cost reduction The variations in the responses was shown by a standard deviation of 1.3.

Results indicated that majority of the respondents as indicated by a mean of 3.3 agreed on the statement that eco-branding and labelling plays a significant influence in attaining higher profits. The variations in the responses were shown by a standard deviation of 1.3. Results indicated that majority of the respondents as indicated by a mean of 4.2 agreed on the statement that low carbon footprint materials play a significant influence in attaining higher profits. The variations in the responses were shown by a standard deviation of 0.9. Results indicated that majority of the respondents as indicated by a mean of 3.8 agreed on the statement that reusable pack designs play a significant influence in attaining higher profits. The variations in the responses were shown by a standard deviation of 0.6.

Results indicated that majority of the respondents as indicated by a mean of 4.1 agreed on the statement that eco-branding and labelling plays a significant influence in improving market share. The variations in the responses were shown by a standard deviation of 0.6. Results indicated that majority of the respondents as indicated by a mean of 3.9 agreed on the statement that reusable

pack designs play a significant influence in improving market share. The variations in the responses was shown by a standard deviation of 0.6. The average result for statements on green product design was 3.8 while the standard deviation was 1.4. The findings agree with Odundo (2020) that practicing green product design when designing products can be smart but if not done well can prove to be expensive and time consuming.

Table6: Green Product Design

Statements	N	Mean	Std. Deviation
Eco-branding and labelling play a significant influence in cost reduction	119	4.2	1.0
Low carbon footprint materials play a significant influence in cost reduction	119	3.6	1.3
Reusable pack designs play a significant influence in cost reduction	119	3.8	1.3
Eco-branding and labelling play a significant influence in attaining higher profits	119	3.3	1.4
Low carbon footprint materials play a significant influence in attaining higher profits	119	4.2	0.9
Reusable pack designs play a significant influence in attaining higher profits	119	3.8	0.6
Eco-branding and labelling play a significant influence in improving market share	119	3.6	1.3
Low carbon footprint materials play a significant influence in improving market share	119	4.1	3.9
Reusable pack designs play a significant influence in improving market share	119	3.9	1.1
Average	**119**	**3.8**	**1.4**

4.5.2 Green Distribution

The second objective of the study was to investigate the influence green distribution on performance of gas manufacturing firms in Kenya. The respondents were asked to indicate to what extent did green distribution influenced performance of gas manufacturing firms in Kenya. Results indicated that majority of the respondents 37% agreed that it was to a very great extent, 33% said

that it was to a great extent, 19% said it was moderate, while little extent and not all tied were at 4 and 7% respectively.
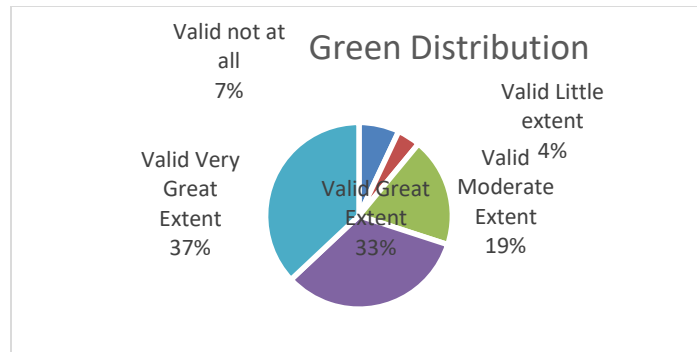

Figure 4: Green Distribution

The respondents were also asked to comment on statements regarding the influence of green distribution on performance of gas manufacturing firms in Kenya. Results indicated that majority of the respondents indicated by a mean of 3.8 agreed on statements that use of low sulphur fuel plays a significant influence in cost reduction. The variation was 1.2. Results indicated that majority of the respondents indicated by a mean of 3.5 agreed on the statement that electricity vehicles play a significant influence in cost reduction. The variation was 1.1. Results indicated that majority of the respondents indicated by a mean of 3.7 agreed on the statement that hybrid vehicles play a significant influence in cost reduction. The variation was 1.

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The variation was 0.5. The average of the statements on green distribution was 3.6 while the variations in the responses were given at 1.1. These findings agree with Nyariki (2018) that organizations must look toward green distribution for improvements. The opportunities for cost savings can be enormous as the impact on margins and bottom line is considerable.

Table 7: Green Distribution

Statements	N	Mean	Std. Deviation
Use of low sulphur fuel plays a significant influence in cost reduction	119	3.8	1.2
Electricity vehicles plays a significant influence in cost reduction	119	3.5	1.1
Hybrid vehicles plays a significant influence in cost reduction	119	3.7	1.0
Use of low sulphur fuel plays a significant influence in attaining higher profits	119	3.5	1.1
Electricity vehicles plays a significant influence in attaining higher profits	119	3.6	1.2
Hybrid vehicles plays a significant influence in attaining higher profits	119	3.5	1.3
Use of low sulphur fuel plays a significant influence in improving market share	119	3.5	1.3
Electricity vehicles plays a significant influence in improving market share	119	3.4	1.4
Hybrid vehicles plays a significant influence in improving market share	119	3.6	0.5
Average	**119**	**3.6**	**1.1**

4.5.3 Green Warehousing

There was also need to establish how green warehousing influenced performance of gas manufacturing firms in Kenya as the third objective. The respondents were asked to comment on extent of green warehousing influence performance of gas manufacturing firms in Kenya. Results indicated that majority of the respondents 48% agreed that it was to a very great extent, 45% said that it was to a great extent, 2% said it was moderate, little extent was 2% and not all at 3%.
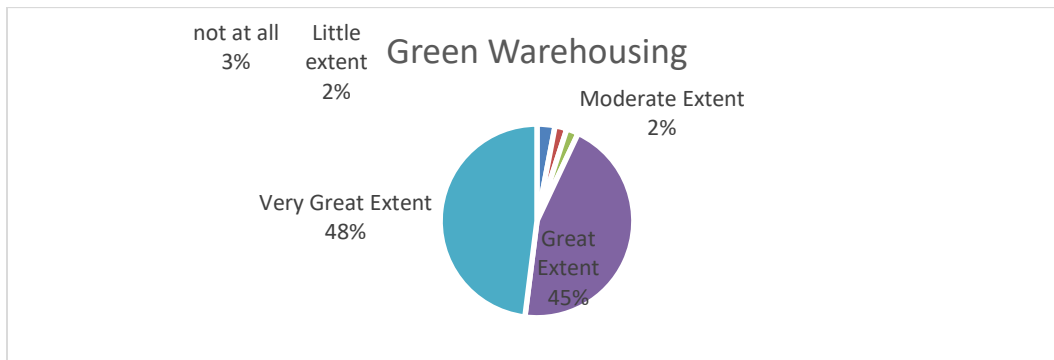

Figure 4: Green Warehousing

The respondents were also asked to comment on statements regarding: green warehousing influence performance in gas manufacturing firms in Kenya. Results indicated that majority of the respondents as shown by a mean of 4.0 agreed on the statement that eco-cool roofs play a significant influence in cost reduction. The standard deviation for the results responses was 1.1. Results indicated that majority of the respondents as shown by a mean of 4.4 agreed on the statement that eco-waste management plays a significant influence in cost reduction. The standard deviation for the results responses was 1.3. Results indicated that majority of the respondents as shown by a mean of 3.4 agreed on the statement that energy efficient equipment plays a significant influence in cost reduction. The standard deviation for the results responses was .8.

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The standard deviation for the results responses was 1.3. The average for all the responses was 3.6 and a standard deviation of 1.2. These findings imply that through green warehousing, companies can improve competitive positioning, gain entry to new dynamic, technology driven markets, supplement critical skills and share the risk (Noor, Guyo & Amuhaya, 2018).

Table 8: Green Warehousing

Statements	N	Mean	Std. Deviation
Eco-cool roofs play a significant influence in cost reduction	119	4.0	1.1
Eco-waste management plays a significant influence in cost reduction	119	3.4	1.3
Energy efficient equipment plays a significant influence in cost reduction	119	4.1	0.8
Eco-cool roofs play a significant influence in attaining higher profits	119	4.1	1.0
Eco-waste management plays a significant influence in attaining higher profits	119	3.7	0.7
Energy efficient equipment plays a significant influence in attaining higher profits	119	2.8	1.3
Eco-cool roofs play a significant influence in improving market share	119	3.2	1.2
Eco-waste management plays a significant influence in improving market share	119	3.4	1.2
Energy efficient equipment plays a significant influence in improving market share	119	3.6	1.3
Average	**119**	**3.6**	**1.1**

4.5.4 Reverse Logistics

There was also need to establish how reverse logistics influences performance among gas manufacturing firms in Kenya. Results also showed that majority of the respondents indicated great extent performance of the company was 10%, very great extent was 3%, not at all was 30% while little extent and moderate extent was 22% and 35% respectively.
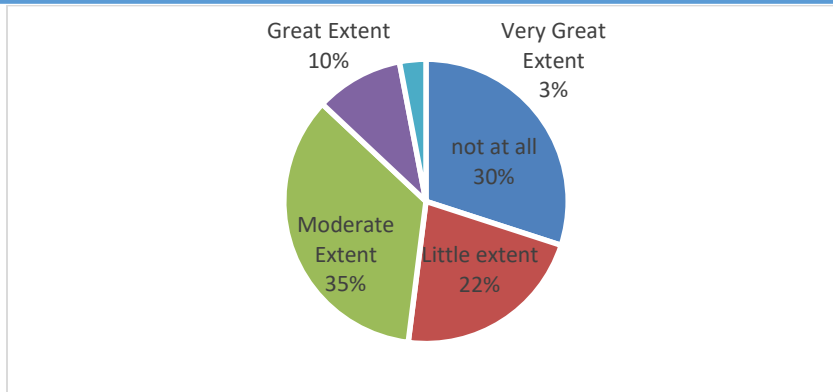
Figure 5: Reverse Logistics

Results indicated that majority of the respondents agreed on the statement that remanufacturing plays a significant influence in cost reduction. The mean for this statement was 2.8 while the standard deviation the variation in the responses was 1.4. Results indicated that majority of the respondents agreed on the statement that refurbishment plays a significant influence in cost reduction. The mean for this statement was 3.3 while the standard deviation the variation in the responses was 1.4. Results indicated that majority of the respondents agreed on the statement that recycling play a significant influence in cost reduction. The mean for this statement was 3.3 while the standard deviation the variation in the responses was 1.1.

Results indicated that majority of the respondents agreed on the statement that remanufacturing plays a significant influence in cost reduction. The mean for this statement was 4.2 while the standard deviation the variation in the responses was .9. Results indicated that majority of the respondents agreed on the statement that refurbishment plays a significant influence in attaining higher profit. The mean for this statement was 4.1 while the standard deviation the variation in the responses was 1.2. Results indicated that majority of the respondents agreed on the statement that recycling plays a significant influence in attaining higher profits. The mean for this statement was 4.3 while the standard deviation the variation in the responses was .7.

Results indicated that majority of the respondents agreed on the statement that remanufacturing plays a significant influence in improving market share. The mean for this statement was 4.4 while the standard deviation of the variation in the responses was .8. Results indicated that majority of the respondents agreed on the statement that refurbishment plays a significant influence in improving market share. The mean for this statement was 4.4 while the standard deviation the variation in the responses was .6. Results indicated that majority of the respondents agreed on the statement that recycling plays a significant influence in improving market share. The mean for this statement was 4 while the standard deviation the variation in the responses was .6.

The average for the statements on reverse logistics was 4.0 with a standard deviation of .9. The results imply that an organization benefits greatly when reverse logistics is embraced to reduce costs, introduce reverse logistics to address the organization's needs, and work with the organization to streamline sourcing management (Mwenda, 2020).

Table 9 Reverse Logistics

Statements	N	Mean	Std. Deviation
Remanufacturing plays a significant influence in cost reduction	119	2.8	1.4
Refurbishment plays a significant influence in cost reduction	119	3.3	1.1
Recycling plays a significant influence in cost reduction	119	4.2	0.9
Remanufacturing plays a significant influence in attaining higher profits	119	4.1	1.2
Refurbishment plays a significant influence in attaining higher profits	119	4.2	0.9
Recycling plays a significant influence in attaining higher profits	119	4.3	0.7
Remanufacturing plays a significant influence in improving market share	119	4.4	0.6
Refurbishment plays a significant influence in improving market share	119	4.4	0.8
Recycling plays a significant influence in improving market share	119	4.4	0.6
Average	**119**	**4.0**	**0.9**

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4.6 Correlation Analysis

Correlation analysis was used to determine both the significance and degree of association of the variables and also predict the level of variation in the dependent variable caused by the independent variables. The correlation technique is used to analyze the degree of association between two variables. The results of the correlation analysis are summarized in Table 10

Table 410: Summary of Correlations

		Green Product Design	Green Distribution	Green Wareh ousing	Reverse Logistics	Performanc e of Gas Manufactur ing Firms
Green Product Design	Pearson Correlation	1				
Green Distribution	Pearson Correlation	. 289**				
	Sig. (2-tailed)	0				
Green Warehousing	Pearson Correlation	.368**	.344**	1		
	Sig. (2-tailed)	0	0			
Reverse Logistics	Pearson Correlation	.352**	.457**	.520**	1	
	Sig. (2-tailed)	0	0	0		
Performance of Gas Manufacturi ng Firms	Pearson Correlation	.479**	.323**	.628**	.676**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	

** Correlation is significant at the 0.05 level (2-tailed).

The correlation summary shown in Table 4.10 indicates that the associations between each of the independent variables and the dependent variable were all significant at the 95% confidence level. The correlation analysis to determine the determinants of green supply chain management

practices on the performance of gas manufacturing firms in Kenya, Pearson Correlation Coefficient computed and tested at 5% significance level. The results indicate that there is a positive relationship (r=0.479) between green product design and performance of gas manufacturing firms in Kenya. In addition, the researcher found the relationship to be statistically significant at 5% level (p=0.000, <0.05). The correlation analysis to determine the relationship between green product design and performance of performance of gas manufacturing firms in Kenya, Pearson Correlation Coefficient computed and tested at 5% significance level.

The results indicate that there is a positive relationship (r=0.323) between green distribution and performance of gas manufacturing firms. In addition, the researcher found the relationship to be statistically significant at 5% level (p=0.000, <0.05). The correlation analysis to determine the relationship between green warehousing and performance of gas manufacturing firms, Pearson Correlation Coefficient computed and tested at 5% significance level. The results indicate that there is a positive relationship (r=0.628) value for green warehousing and performance of gas manufacturing firms. In addition, the researcher found the relationship to be statistically significant at 5% level (p=0.000, <0.05). The correlation analysis to determine the relationship between reverse logistics and performance of gas manufacturing firms, Pearson Correlation Coefficient computed and tested at 5% significance level. The results indicate that there is a positive relationship (r= 0.676) between reverse logistics and performance of gas manufacturing firms. In addition, the researcher found the relationship to be statistically significant at 5% level (p=0.000, <0.05). Hence, it is evident that all the independent variables could explain the changes in the performance of gas manufacturing firms on the basis of the correlation analysis.

4.7 Regression Analysis

In this study multivariate regression analysis was used to determine the significance of the relationship between the dependent variable and all the independent variables pooled together. Regression analysis was conducted to find the proportion in the dependent variable (performance of gas manufacturing firms) which can be predicted from the independent variables (green product design, green distribution, green warehousing and reverse logistics.)

Table 11 presents the regression coefficient of independent variables against dependent variable. The results of regression analysis revealed there is a significant positive relationship between dependent variable (performance and the independent variables (green product design, green distribution, green warehousing and reverse logistics).

The independent variables reported R value of .775 indicating that there is perfect relationship between dependent variable and independent variables. R square value of 0.6 means that 60% of the corresponding variation in performance of gas manufacturing firms can be explained or predicted by green product design, green distribution, green warehousing and reverse logistics, which indicated that the model fitted the study data.

Adjusted R square in table 4.11 is called the coefficient of determination which indicates how performance of gas manufacturing firms varied with variation in effects of factors which includes green product design, green distribution, green warehousing and reverse logistics. The results of regression analysis revealed that there was a significant positive relationship between dependent variable and independent variable at (β = 0.309), p=0.002 <0.05.

Table 11: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.775[a]	.60	.586	.16769

Predictors: (Constant), Green Product Design, Green Distribution, Green Warehousing and Reverse Logistics

Dependent Variable: Performance of Gas Manufacturing Firms

Table 12: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.809	4	1.202	42.749	.000[b]
	Residual	3.206	114	0.028		
	Total	8.014	118			

Predictors: (Constant), Green Product Design, Green Distribution, Green Warehousing and Reverse Logistics

Dependent Variable: Performance of Gas Manufacturing Firms

The significance value is 0.000 which is less that 0.05 thus the model is statistically significance in predicting how green product design, green distribution, green warehousing, reverse logistics influence performance among gas manufacturing firms in Kenya. The F critical at 5% level of significance was 26.80. Since F calculated which can be noted from the ANOVA table above is 42.749 which is greater than the F critical (value = 26.80), this shows that the overall model was significant. The study therefore establishes that; green product design, green distribution, green warehousing, reverse logistics were all important factors influencing performance of gas manufacturing firms. These results agree with Asaari and Razak (2019) results which indicated a positive and significant determinants of green supply chain management practices on the performance of gas manufacturing firms in Kenya.

Table 13: Coefficients of Determination

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.44	0.198		1.317	0.000
	Reverse Logistics	0.215	0.035	0.455	0.081	0.000
	Green Product Design	0.146	0.045	0.214	0.27	0.000
	Green Warehousing	0.11	0.024	0.334	0.662	0.020
	Green Distribution	0.03	0.033	0.062	0.921	0.030

Predictors: (Constant), Green Product Design, Green Distribution, Green Warehousing and Reverse Logistics

Dependent Variable: Performance of Gas Manufacturing Firms

The research used a multiple regression model

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mathcal{E}$

Where **Y**= Performance of Gas Manufacturing Firms

β_0= Constant

X_1= Green Product Design

X_2= Green Distribution

X_3= Green Warehousing

X_4= Reverse Logistics

$\mathcal{E}$= Error Term at 95% confidence level.

The regression equation is;

$Y = 2.44 + 0.146 X_1 + 0.03 X_2 + 0.11 X_3 + 0.215 X_4$

The regression equation above has established that taking all factors into account (green product design, green distribution, green warehousing and reverse logistics) constant at zero, performance of gas manufacturing firms will be an index of 2.44

The findings presented also shows that taking all other independent variables at zero, a unit increase in green product design will lead to a 0.146 increase in performance of gas manufacturing firms. The P-value was 0.00 which is less than 0.05 and thus the relationship was significant.

The study also found that a unit increase in green distribution will lead to a 0.03 increase in in performance of gas manufacturing firms. The P-value was 0.03 and thus the relationship was

significant. In addition, the study found that a unit increase in green warehousing will lead to a 0.11 increase in the performance of gas manufacturing firms. The P-value was 0.00 and thus the relationship was significant.

Lastly, the study found that a unit increase in reverse logistics will lead to a 0.215 increase in the Performance of gas manufacturing firms. The P-value was 0.00 and hence the relationship was significant since the p-value was lower than 0.05. The findings of the study show that, reverse logistics contributed most to the performance of gas manufacturing firms in Kenya.

5. 0 Conclusion And Recommendations

Based on the study findings, the study concludes that performance of gas manufacturing firms can be improved by green product design, green distribution, green warehousing and reverse logistics.

To ensure that gas manufacturing firms have better performance they should focus more on using their green product design so as to ensure that eco-branding and labelling strategies are clear and ensure that there is consistency of quality in goods supplied. In the same regard, they should involve suppliers early enough to enable them to come up with green product design systems.

With regard to the second objective, it would be constructive for gas manufacturing firms to invest more in green distribution to reduce the cost of procurement through unnecessary re-routing and scheduling and get it right the first time. This should be done consistently with the partnerships, training and capacity building. This will include issues such as electricity vehicles

5In relation to green warehousing, the organizations should align their goals with their vendors so as to have a more improved working relationship characterized by eco-waste management and energy-efficient equipment. If gas manufacturing firms embrace green warehousing among its suppliers, then there will be cost reduction and timing of delivery will improve.

Concerning reverse logistics, there is need for gas manufacturing firms to always set aside a substantial part of their resources for activities that spend a huge number of total resources, and this entails remanufacturing and recycling. This is because decisions made here have major effects on sustainability measures.

The study is a milestone for further research in the field of performance of gas manufacturing firms in Africa and particularly in Kenya. The findings demonstrated the important green supply chain management practices to performance of gas manufacturing firms to include; green product design, green distribution, green warehousing and reverse logistics. The current study obtained an R^2 of 60% and should therefore be expanded further in future in order to include other green supply chain management practices that may as well have a positive significance to performance of gas manufacturing firms. Existing literature indicates that as a future avenue of research, there is need to undertake similar research in other institutions in Kenya and other countries in order to establish whether the explored green supply chain management practices herein can be generalized to affect performance in other institutions.

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