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# GREEN SUPPLY CHAIN PRACTICES AS A SUPPLY CHAIN PERFORMANCE TOOL IN STATE CORPORATIONS IN KENYA, CASE STUDY OF KENYA ELECTRICITY GENERATING COMPANY LIMITED

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## Abstract

This study aimed to bridge such gaps by establishing the role of green supply chain management practices on supply chain performance at Kenya Electricity Generating Company Limited. A case study research design was adopted. The study populations for this study were 166 employee of Kenya Electricity Generating Company Limited at their head office in Nairobi. The study sampled 50 respondents through stratified random sampling. The research used questionnaires. The research administered a questionnaire to each member of the target population. The research carried out a pilot study to pretest and validates the questionnaire Quantitative data collected was analyzed using SPSS (Version 20) and presented through percentages, means, standard deviations and frequencies. The information was displayed by use of bar charts, graphs and pie charts and in prose-form. Content analysis was used to test data that is qualitative nature or aspect of the data collected from the open ended questions. Reverse logistics influences the supply chain performance through controlling of environmental risks, proper utilization of materials by customers, results to customer satisfaction and ensures recycling of materials. Green procurement affects the supply chain performance by ensuring production with low environmental impacts, products which are using environmental friendly processes, environmental collaboration with the suppliers, eco-labelled products and adoption of environmental criteria into the supplier assessment systems. Green packaging influences supply chain performance through reducing environmental impact by products within the supply chain, proper use of products by consumers, appropriate product design to minimize consumption of materials and energy, facilitates reuse, recycle and recovery of component materials. Waste management systems affects supply chain performance through recycling and re-using waste created, treating and controlling post combustion emissions, use of alternative fuels and encourages implementation of waste to energy process. The study recommends that the management of Kenya electricity generating company should encourage proper utilization of materials and recycling of materials. The study recommends that the management of KenGen should integrate green procurement process in all its purchasing processes since it's characterized by a low environmental impact that is products environmentally friendly in nature and produced using environmentally friendly processes. The study recommends that the management of KenGen should purchase products from manufacturers whose design products minimize consumption of materials and energy, that facilitate the reuse, recycle and recovery of component materials. The study recommends that the management of Kengen should invest more in waste management systems.

**Keywords:** Green Distribution, Green Purchasing and Reverse Logistics.

## Introduction

There has been increasing emphasis on environment-friendly corporate activity in today's business world and many progressive companies are embracing green supply chain management. The rise in greenhouse emissions and pollution of the environments by firms has precipitated the need for organizations to realign their supply chain operations with a view of conserving the scarce resources. Green supply Chain Management (GSCM) is an approach to improve performance of the process and products according to the requirements of the environmental regulations (Hsu & Hu, 2008). As customers begin to demand that products and services be provided without damaging the environment, managers need make decisions that support the integration and coordination of environmental practices throughout the supply chain (Vachon & Klassen, 2007). Consequently, a sudden rise of environmental movements, legislations and concerns during the past decade, consensus is forming that issues of environmental pollution accompanying industrial development should be addressed together with supply chain management, thus contributing to the initiative of Green Supply Chain Management (Sheu et al., 2005).

GSCM emerges as a new systematic environmental approach in supply chain management and has been increasingly accepted and practiced by forward thinking organizations. The current environmental requirements that influenced manufacturing activities has increased attention in developing environmental management (EM) strategies for supply chain. Thus the concept of GSCM arises and becoming an important factor for business activities today (Seman et al., 2012). Zhu et al. (2008) also claimed that GSCM can be regarded as an environmental innovation. By integrating green concept to the supply chain concept, it has created a new research agenda where supply chain will have a direct relation to the environment. Kenya is one of the developing countries in the world and is becoming increasingly industrialized. Despite Kenya being a major manufacturing country which brings opportunities, it faces substantial burden on the environment. The multinational organizations and developed countries are using third world countries as a point for disposal of end-of-life products and this result to environmental impact (Puckett & Smith, 2002).

Awareness of the world's environmental issues such as global warming, carbon emissions, toxic substance usage, and resource scarcity has escalated over the past decades. Policy makers and activists are advocating for going green, and many organizations throughout the world have responded to this by applying green principles (Xie and Breen, 2012). Supply chain management has traditionally been viewed as a process where raw materials are converted into final products, and then delivered to the end-consumer. This process involves extraction and exploitation of the natural resources. It is important to note however that we live in a decade where environmental sustainability has been an important issue to business practice. The waste and emissions caused by the supply chain have become one of the main sources of serious environmental problems including global warming and acid rain. Green supply chain policies are desirable since reactive regulatory, to proactive strategic and competitive advantages. Green supply chain management (GSCM) is gaining increasing interest among researchers and practioners of operations and supply chain management (Kumar and Chandrakar, 2012).

Green supply chain is defined as the process of integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the product after its useful life (Srivastava, 2007). This process develops outputs that can be reclaimed and re-used at the end of their life-cycle, thus creating a sustainable supply chain. The whole idea of a sustainable supply chain is to reduce costs while conserving the environment. In recent times, the concept has been gaining significance among manufacturing companies due to the diminishing raw materials; deterioration of environment; increasing levels of pollution; among other factors. Green supply chains focus on balancing marketing performance with environmental conservation. In countering the challenges of energy conservation and pollution abatement, companies have tried to green their supply chains through creation of networks of Suppliers so as to purchase environmentally superior products and/or build common approaches to waste reduction and operational efficiencies (Srivastava, 2007).

Supply chains are value chains extending from suppliers' suppliers to ultimate customers. As such, supply chain managers must work to integrate and coordinate the production, marketing, and finance functions of their individual organizations with those of supply chain partners (Whitten, Green Jr and Zelbst, 2012). The concept of Green SC Management (GSCM) emerged in the late 1990s, and encompasses the reactive monitoring of general environmental management programs, moving to more proactive practices such as the recycling, reclamation, remanufacturing and reverse logistics (RL), as well as incorporating innovations (Zhu and Sarkis, 2004). Green Supply Chain Management is where firms seek to minimize negative environmental impacts in their supply chains. It also includes the consideration of social issues in the supply chain, such as ensuring suppliers have decent working conditions, or ensuring goods are sourced ethically and fairly along the supply chain. The economic aspect of sustainable SCM can include buying from local suppliers to support local economic regeneration. Organizations vary in the focus of their sustainable supply chain activities, with some firms putting greater emphasis on green issues and others prioritizing social aspects (Walker and Jones, 2012).

Environmental sustainability is a supply chain imperative rather than an organizational imperative. Development of environmentally friendly processes, products, and services requires a unified effort by all members of the supply chain to avoid sub-optimization at the partner level. The implementation of GSCM practices is expected to result in improved environmental performance as measured by reductions in air emissions, effluent waste, solid waste, and the consumption of toxic materials (Green Jr and Zelbst, 2012). Supply chain management is the coordination and management of a complex network of activities involved in delivering a finished product to the end-user or customer. All stages of a product's life cycle will influence a supply chain's environment burden, from resource extraction, to manufacturing, use and reuse, final recycling, or disposal (Ninlawan and Seksan, 2010). Supply chain performance refers to the evaluation of supply chain management, and includes both tangible for example cost and intangible for example utilization factors (Chang, Tsai and Che- Hsu, 2013).

Sustainable SCM incorporates a variety of concepts such as environmental or green SCM, where firms seek to minimize negative environmental impacts in their supply chains. It also includes the consideration of social issues in the supply chain, such as ensuring suppliers have decent

working conditions, or ensuring goods are sourced ethically and fairly along the supply chain. The economic aspect of sustainable SCM can include buying from local suppliers to support local economic regeneration. Organizations vary in the focus of their sustainable supply chain activities, with some firms putting greater emphasis on green issues and others prioritizing social aspects (Walker and Jones, 2012).

Supply Chain Performance Measurement can be done through Triple-A supply chain construct which are those supply chains that exhibit agility, adaptability, and alignment. Agility is the ability to respond to short-term changes in demand or supply quickly and handle external disruptions smoothly. Adaptability is the ability to adjust the supply chain's design to meet structural shifts in markets and modify the supply network to reflect changes in strategies, technologies, and products. Alignment is the ability of great firms to align the interests of all of the firms in their supply chains with their own (Whitten, Green Jr and Zelbst, 2012).

The power industry in Kenya dates back to early 1900 when the East African Power and Lighting Limited, was incorporated to generate and distribute power (KenGen, 2015). The company changed its name to The Kenya Power and Lighting Company Limited (KPLC) through special resolutions in 1983. The reforms in the Kenya's power sub-sector that commenced in 1996 were meant to create commercial type-relationships between the sector entities and to create legal and regulatory framework to enhance efficient use of resources dedicated to the supply of electricity to the economy. In addition, the reforms were aimed to encourage private sector investment to the industry. In this respect, the Kenya government engaged the services of consultants to advice on the separation of the generation from transmission and distribution function as well as on respective management organization structures for the two functions of generation and transmission and distribution on the other side. This happened in 1998 when KenGen was separated from KPLC (KenGen, 2015).

Today, KenGen is the leading public electricity generating company in Kenya that produces 80% of all electricity consumed in the country. It has employed more than 2,000 staff members who are located in 20 different places where the power plants are located. The plants are divided into four groups namely: hydropower stations, thermal plants, geothermal plants and off-grid stations, and wind (KenGen, 2015). However, due to the liberalization of the energy sector KenGen is facing stiff competition from four Independent Power Producers (IPPs): *Iberafrica Power, Westmont Power, Qrpower 4* and *Tsavo Power Company Limited;* that produce about 20% of the country's electric power between them (KenGen, 2015). *Olkaria Geothermal Area* currently has an installed capacity of 565MW, which contributes to 45% of KenGen's total installed capacity of 1650 MW. Due to reliability and environmental benefits of green energy, the country has focused on geothermal resource development to power the country for achievement of vision 2030. One of KenGen major challenges is to earn back its market share by reordering its business strategy. One of the challenges in carrying out this is to institute a desired behavior that would introduce a culture that is competitive within the industry and hence enhance environmental supply within its operations (KenGen, 2015)

To facilitate this competitive culture within the industry, KenGen introduced a transformation strategy called *'Good to Great'* popularly known as G to G in the year 2006. Under this strategy

KenGen aspires to be the market leader in the provision of green, reliable, safe and quality competitively priced electric energy within the East African region. The strategy is structured into three overarching pillars which include capital planning and execution, regulatory management and operational excellence. The pillars are supported by organizational effectiveness from improved processes (among them green supply), structure and culture. The strategy focuses on achieving sustainability in value creation from one generation of Kenyans to the next generation of Kenyans by ensuring that things are done right the first time, defects and wastes are eliminated or minimized at operations (KenGen, 2015).

**Statement of the Problem**

Globally Green Supply Chain Management (GSCM) has emerged as an important component of the environmental and supply chain strategies for a number of companies and they have been aiming at integrating environmental concerns in their business operations and in interactions with their stakeholders in embracing environmental sustainability into business strategies (Xie and Breen, 2012). Awareness of the world's environmental issues such as global warming, carbon emissions, toxic substance usage, and resource scarcity has escalated over the past decades (Xie and Breen, 2012). GSCM in itself is not a new concept since literature has been developed in this area from as early as 1989 (Chien and Shih, 2007). However, this literature has not been broadly developed making it difficult to understand the relationship between GSCM and supply chain performance.

In Africa region climate change is increasingly recognized as one of the most critical challenges ever to face humankind. Climatic changes are a problem that requires a global response embracing the needs and interests of all countries. The United Nations Framework Convention on Climate Change, which came into effect in 1994, and its Kyoto Protocol that came into effect in 2005 – sharing the objective of the Convention to stabilize atmospheric concentrations of greenhouse gases – enable such a global response to climate change (Kyoto Protocol Reference Manual, 2008). In Kenya, very limited research has been done on the role of green supply chain management practices on supply chain performance. Specifically, no such research has been done on Kenya Electricity Generating Company Limited. To enhance supply chain performance, Kenya Electricity Generating Company Limited has adopted green initiatives. Despite these initiatives, there is continued outcry on supply chain performance at Kenya Electricity Generating Company Limited (KenGen, 2014). The big question is, does green supply chain practices affect supply chain performance at Kenya Electricity Generating Company Limited. It is clear that there is need for further exploration on this area through research so as to bridge the existing gaps. This study aims to bridge such gaps by establishing the role of green supply chain management practices on supply chain performance at Kenya Electricity Generating Company Limited.

Previous studies in Kenya have not focused and concentrated much on GSCM for instance, a research conducted by Kirop (2013) , Kenyatta University Msc student on GSCM in Kenya's Cement industry, it emerged that, the green practice helps the supply chain system to reduce costs associated with production besides conserving the environment by reducing pollution. A research by Muma et al. (2014), University of Nairobi Master of Science student also investigated green supply chain management and environmental performance among tea

processing firms in Kericho County, Kenya, and found that the impact that the practice has to the environment is huge in terms of conservation as well as cost minimization for the firms. With the imperative adaptability of green supply chain management by companies and the global concern to go green in their operations, then this study is geared and motivated to bridge the gap in knowledge by trying to study the role of GSCM practices in Kenya Electricity Generating Company (KenGen). Therefore, it aims to analyze the significance of GSCM in the company, establish the effects of green procurement on the supply chain performance in leveraging its operational activities as well as an attempt to identify GSCM practices in the company.

**Objective of the Study**

The general objective of the study was to establish how green supply chain management practices as a tool affects supply chain performance in state corporations in Kenya. The study was guided by the following objective

i. To determine how reverse logistics affects supply chain performance at Kenya Electricity Generating Company Limited
ii. To establish how green procurement affects supply chain performance at Kenya Electricity Generating Company Limited
iii. To examine the effects of green packaging on supply chain performance at Kenya Electricity Generating Company Limited
iv. To evaluate how waste management system affects supply chain performance at Kenya Electricity Generating Company Limited

**Theoretical Review**

This section focused on four theories that are related to green supply chain and green procurement. Both theories are based on procedures for selecting suppliers.

**Supply Chain Management Theory**

A number of researches discuss logistics outsourcing from the Supply Chain Management point of view. Rao and Young (2013) suggest that firms consider outsourcing of logistics to an external Logistics Services Provider (LSP) when logistics complexity is high. Wilding and Juriado (2011) observe that cost reduction is the main motivation for logistics outsourcing. Welch and Nayak (2012) mentions that firms which outsource for operational and cost-based reasons will tend to restrict the Logistics Service Provider's involvement to the basic logistics functions. Therefore, an outsourcing decision might be influenced by a firm's supply chain characteristics logistics complexity and demand uncertainty or logistics strategy.

**Logistics Theory**

Logistics is defined as the planning, organization, and control of all activities in the material flow, from raw material until final consumption and reverse flows of the manufactured product, with the aim of satisfying the customer's and other interest party's needs and wishes i.e., to provide a good customer service, low cost, low tied-up capital and small environmental consequences (Christopher, 2012). Logistics is also defined as those activities that relate to receiving the right product or service in the right quantity, in the right quality, in the right place,

at the right time, delivering to the right customer, and doing this at the right cost (Jumadi & Zailani, 2010).

Logistics management is that part of procurement management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer's requirements (Walker & Jones, 2012). Logistics management activities typically include inbound and outbound transportation management, fleet management, warehousing, materials handling, order fulfilment, logistics network design, inventory management, supply or demand planning, and management of third party logistics service providers (Cagno & Micheli, 2012).

**Multi-Attribute Utility Theory**

The complexity stems from a multitude of quantitative and qualitative factors influencing supplier choices as well as the intrinsic difficulty of making numerous trades-offs among these factors. One analytical approach often suggested for solving such complex problems is MAUT (Ellram, 1990). MAUT enables the decision maker to structure a complex problem in the form of a simple hierarchy and to subjectively evaluate a large number of quantitative and qualitative factors in the presence of risk and uncertainty. The major strength of MAUT is its ability to deal with both deterministic and stochastic decision environments. In particular, MAUT has three distinctive advantages over MOP in handling multiple and conflicting criteria.

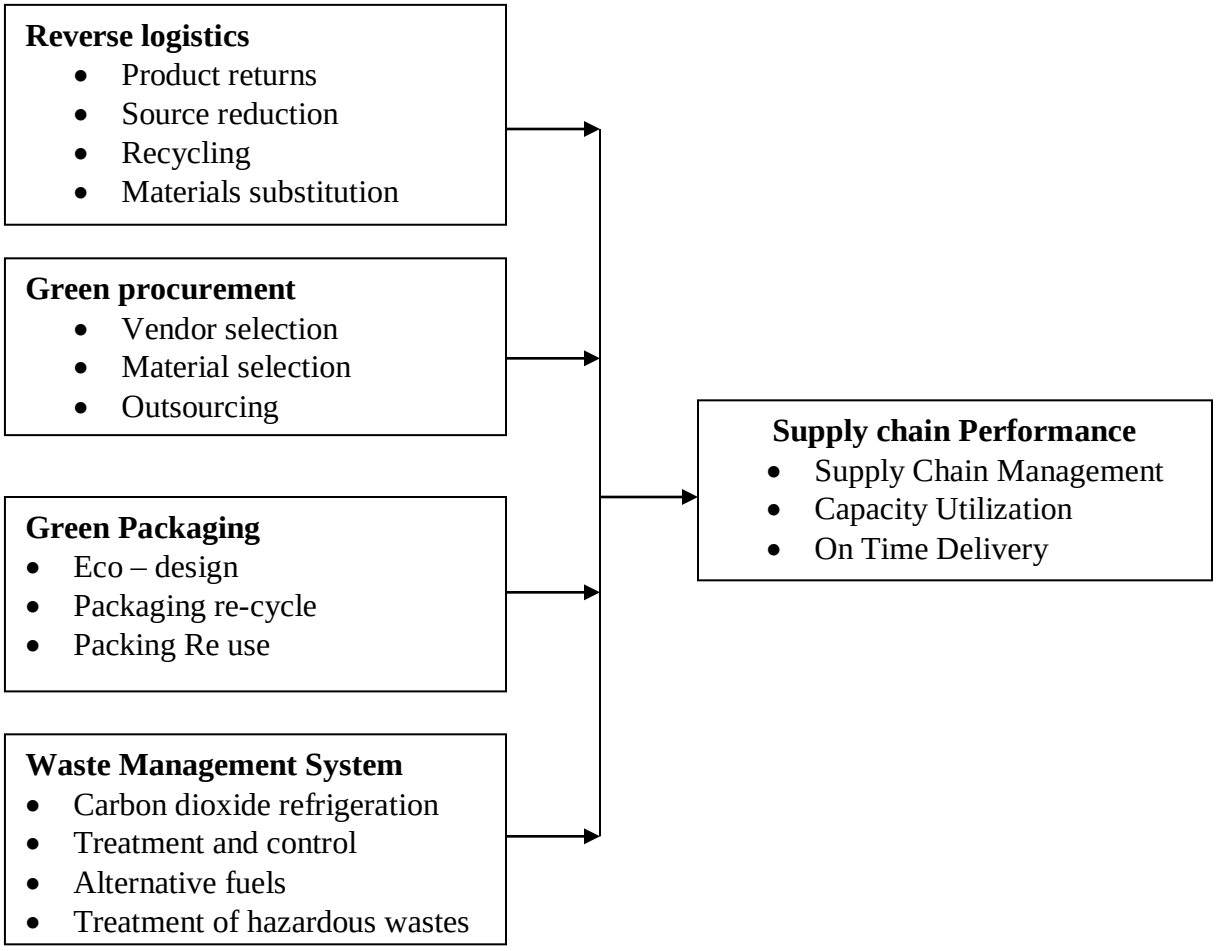
The application of MAUT to the complex problem usually involves identification of the objectives or goals of the decision and defines the problem scope, define a finite set of relevant attributes affecting the decision outcome and structure them into a hierarchical form called a "value tree". Elicit preference information concerning the attributes from the decision maker(s) and determine the relative importance of the attributes. Develop the decision maker′s utility function by establishing functional relationships between the attributes and the utility scores. If this relationship is uncertain, the expected utility score for each attribute will be determined by using the appropriate type of probability distributions.

**Price Premium Theory**

Considerable work has posited that some social and environmental attributes of products may serve as a differentiation strategy for the firm (Laroche, Bergeron, and Barbaro-Forleo, 2001; Reinhardt, 1999). This type of strategy implies that the firm is able to charge a price premium in comparison to competitors. This price premium has been defined as "a percentage over the willingness to pay for the base commodity". Thus, in the case of certification, if certified wood commands a price premium, then some consumers are willing to pay some percentage over and above what they are willing to pay for the base commodity without certification. The willingness to pay a price premium usually has been explained by both psychological variables as well as demographic variables. Our focus here is on developing theory with respect to the variables regarding psychological attitudes toward the environment. The price premium is related to consumer preferences. From a psychological point of view, the price premium that consumers are willing to pay for public goods is a behavioral intention. However, little research has actually

tried to investigate the nature of environmental attitudes and the price premium that an environmentally friendly product is able to command.

**Conceptual Framework**




**Independent variables** **Dependent variable**

**Figure 1: Conceptual Framework**

Green or sustainable supply chain management is defined as the strategic, transparent, integration and achievement of an organization's social, environmental, and economic objectives in the systemic coordination of key inter-organizational business processes for improving the long-term performance of the firm and its supply chain partners. This implies that specific criteria have to be applied by all supply chain partners. At the same time, responsible environmental and social behavior must be promoted as well for the good of the entire chain (Wu and Dunn, 2012).Green supply chain management practices can refer to a variety of activities and initiatives implemented by an organization in an attempt to reduce their impact on the natural environment (Awaysheh and Klassen, 2010).

**Research Methodology**

A case study research design was adopted. Case approach helps to narrow down a very broad field or population into an easily researchable one, and seeks to describe a unit in details, in

context and holistically, (Kombo & Tromp, 2006). The study hence considers case study design suitable since data was gathered from gathered from a single source; Kenya Electricity Generating Company Limited and used to represent, the influence of green supply chain management practices on supply chain performance. The target population for this study is employee of Kenya Electricity Generating Company Limited. Keya (1989) states that individuals or things or elements that fit a research specification. The population can be divided into sets, population or strata and which are mutually exclusive. The study population composes of 166 members of staff in different managerial levels currently working at Kenya Electricity Generating Company Limited.

**Table 1: Target Population**

| Level | Frequency | Percentage |
|---|---|---|
| Top Management | 15 | 7.2 |
| Middle Level Management | 69 | 34.8 |
| Low Level Management | 82 | 58.0 |
| **Total** | **166** | **100.0** |

**Source: Kenya Electricity Generating Company Limited HR, (2015)**

Stratified random sampling technique was used to select the sample. From each stratum the study used simple random sampling to select 50 respondents; this comprised of 30% of the entire population, According to Mugenda and Mugenda (2008), a representative sample is one that represents at least 10% of the population of interest.

**Table 2: Sample Size**

| Level | Frequency | Sample reference | Sample size in % |
|---|---|---|---|
| Top Management | 15 | 30 | 5 |
| Middle Level Management | 69 | 30 | 21 |
| Low Level Management | 82 | 30 | 25 |
| **Total** | **166** | **30** | **50** |

The choice of a tool and instrument depends mainly on the attributes of the subjects, research topic, problem question, objectives, design, expected data and results (Ngechu, 2004). This is because each tool and instrument collects specific data. The researcher administered a questionnaire to each member of the target population. The research carried out a pilot study to pretest and validates the questionnaire. Quantitative data collected was analyzed using SPSS (Version 20) and presented through percentages, means, standard deviations and frequencies. The information was displayed by use of bar charts, graphs and pie charts and in prose-form. This involved tallying up responses, computing percentages of variations in response as well as describing and interpreting the data in line with the study objectives and assumptions through use of SPSS. Content analysis was used to test data that is qualitative nature or aspect of the data collected from the open ended questions. According to Baulcomb, (2003), content analysis uses a set of categorization for making valid and replicable inferences from data to their context.

**Results and Discussion**

Descriptive and inferential statistics have been used to discuss the findings of the study. The study targeted a sample size of 50 respondents from which 40 filled in and returned the questionnaires making a response rate of 80%. This response rate was satisfactory to make conclusions for the study. The response rate was representative.

**Reliability Analysis**

A pilot study was carried out to determine reliability of the questionnaires. The pilot study involved the sample of 14 respondents from target population. Reliability analysis was subsequently done using Cronbach's Alpha which measured the internal consistency by establishing if certain item within a scale measures the same construct.

**Table 3: Reliability Analysis**

| Scale | Cronbach's Alpha | Number of Items |
|---|---|---|
| Reverse logistics | 0.824 | 5 |
| Green procurement | 0.820 | 4 |
| Green packaging | 0.780 | 4 |
| Waste management systems | 0.812 | 4 |

Gliem and Gliem (2003) established the Alpha value threshold at 0.7, thus forming the study's benchmark. Cronbach Alpha was established for every objective which formed a scale. The table shows that reverse logistics had the highest reliability (α= 0.824), followed by green procurement (α=0. 820), green packaging (α=0. 812) and waste management systems (α=0. 780). This illustrates that all the four variables were reliable as their reliability values exceeded the prescribed threshold of 0.7.

**Reverse Logistics**

**Table 4: Statements on Practices of Reverse Logistics**

| **Reverse Logistics** | **Mean** | **Standard deviation** |
|---|---|---|
| Inventory deemed unsuitable are located by customers and returned to suppliers in a timely and cost effective manner | 1.93 | 0.205 |
| The company ensures proper utilization of material by customers | 1.78 | 0.190 |
| It is our responsibility to develop the reverse logistics networks and the flow options in order to avoid the dissatisfaction of the customers | 1.93 | 0.257 |
| The company controls environmental risk associated with supplier operations. | 1.60 | 0.119 |
| Kenya Electricity Generating Company Limited ensures materials are reused whenever possible | 1.80 | 0.268 |

From the findings the study established that the respondents agreed to a large extent that the Company controls environmental risk associated with supplier operations shown by a mean of

1.60, the company also ensures proper utilization of material by customers shown by a mean of 1.78, Kenya Electricity Generating Company Limited ensures materials are reused whenever possible shown by a mean of 1.80 and that inventory deemed unsuitable are located by customers and returned to suppliers in a timely and cost effective manner and it is our responsibility to develop the reverse logistics networks and the flow options in order to avoid the dissatisfaction of the customers shown by a mean of 1.93. These findings were supported by a low standard deviation which is an indication that the respondents held similar views. This findings concur with that of Xie and Breen, (2012) who found that product recall requires organization to be able to reverse the normal logistics flow from suppliers to customers so that inventory deemed unsuitable can be located by customers and returned to suppliers in a timely and cost effective manner .

**Green Procurement**

**Table 5: Statements on Practices of Green Procurement**

| **Green Procurement** | **Mean** | **Standard deviation** |
|---|---|---|
| The company ensures production with low environmental impact and environmentally friendly in nature, using environmentally friendly processes | 1.43 | 0.157 |
| The company products are eco-labelled | 1.83 | 0.211 |
| The company ensures adoption of environmental criteria into the supplier assessment system | 1.90 | 0.273 |
| The company ensures there is environmental collaboration with suppliers | 1.48 | 0.147 |

From the findings, the respondents agreed to a very large extent that the company ensures production with low environmental impact and environmentally friendly in nature, using environmentally friendly processes shown by a mean of 1.43. The respondents further agreed to a large extent that the company ensures there is environmental collaboration with suppliers shown by a mean of 1.48, our products are eco-labelled shown by a mean of 1.83 and that we ensure adoption of environmental criteria into the supplier assessment system shown by a mean of 1.90. These findings were supported by a low standard deviation which is an indication that the respondents held similar views. These findings correspond with those of Colicchia *et al,* (2011) who states that initiatives to minimize environmental impact in inbound supply chain, according to the "green procurement" approach include eco-labeled product purchase, adoption of environmental criteria into the supplier assessment system environmental and collaboration with suppliers.

**Green Packaging**

**Table 6: Statements on Practices of Green Packaging**

| **Green Packaging** | **Mean** | **Standard deviation** |
|---|---|---|
| Kenya Electricity Generating Company Limited uses biodegradable materials for its products | 1.83 | 0.239 |
| The products are designed to minimize consumption of materials and energy, hence facilitate reuse, recycle, and recovery of component materials | 2.05 | 0.223 |
| The company ensures not only an appropriate product design, but also proper use by consumers | 1.78 | 0.270 |
| The company have strategies that aim at reducing product environmental impact within the supply chain | 1.75 | 0.206 |

From the findings, the respondents agreed to a large extent that we have strategies that aim at reducing product environmental impact within the supply chain shown by a mean of 1.75, the company ensures not only an appropriate product design, but also proper use by consumers shown by a mean of 1.78, Kenya Electricity Generating Company Limited uses biodegradable materials for its products shown by a mean of 1.83 and that the company's products are designed to minimize consumption of materials and energy, hence facilitate reuse, recycle, and recovery of component materials shown by a mean of 2.05. These findings were supported by a low standard deviation which is an indication that the respondents held similar views. These findings concur with that of Jumadi and Zailani (2010) who depicts that a reduction in the product environmental impact may be achieved not only through an appropriate product design, but also a proper use by consumers.

**Waste Management System**

**Table 7: Statements on Practices of Waste Management Systems.**

| **Waste Management System** | **Mean** | **Standard deviation** |
|---|---|---|
| The company has adopted the use of alternative fuels e.g. cleaner fuels to manage wastes | 1.78 | 0.270 |
| Implementation of waste-to-energy process is highly encouraged in the company | 1.80 | 0.175 |
| The company have programs such as recycle and re-use waste management that focuses on management of waste after it has been created | 1.43 | 0.157 |
| There are systems that treat and control post combustion emissions | 1.58 | 0.149 |

From the findings the study established that to a very large extent we have programs such as recycle and re-use waste management that focuses on management of waste after it has been

created shown by a mean of 1.43. the respondents further revealed to a large extent that there are systems that treat and control post combustion emissions shown by a mean of 1.58, the company has adopted the use of alternative fuels e.g. cleaner fuels to manage wastes shown by a mean of 1.78 and that implementation of waste-to-energy process is highly encouraged in the company shown by a mean of 1.80. These findings were supported by a low standard deviation which is an indication that the respondents held similar views. These findings concur with that of Muchiri (2011) who notes that waste management may also involve source reduction the recycle and re-use waste management programs focuses on management of waste after it has been created.

**Supply Chain Performance Measurement**

**Table 4.8: Statements on the Influence of Supply Chain on Performance.**

| **Performance Parameter** | **Mean** | **Standard deviation** |
|---|---|---|
| Deliveries to customers are always made in time | 1.85 | 0.250 |
| In case of a complaint from the customer, the appropriate actions are taken in time | 1.83 | 0.250 |
| Supply Chain decisions in the company are always made in time | 1.80 | 0.228 |
| We ensure quality products are produced and distributed to the customers | 1.48 | 0.137 |
| In our company, Inventory control and Security of stocks is up to standard | 1.23 | 0.171 |
| There is flexibility in the ordering process | 1.70 | 0.109 |
| Accuracy of orders delivered is highly maintained | 1.95 | 0.297 |
| There is accurate and timely information dissemination within the company and the customers | 2.00 | 0.267 |

From the findings the study established to a very large extent that, in the company, Inventory control and Security of stocks is up to standard shown by a mean of 1.23. The study further revealed to a large extent that the company ensures quality products are produced and distributed to the customers shown by a mean of 1.48, there is flexibility in the ordering process shown by a mean of 1.70, supply Chain decisions in the company are always made in time shown by a mean of 1.80, in case of a complaint from the customer, the appropriate actions are taken in time shown by a mean of 1.83, deliveries to customers are always made in time shown by a mean of 1.85, accuracy of orders delivered is highly maintained shown by a mean of 1.95 and that there is accurate and timely information dissemination within the company and the customers shown by a mean of 2.00. These findings were supported by a low standard deviation which is an indication that the respondents held similar views.

**Regression Analysis**

**Table 9: Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .883[a] | .779 | .756 | .00850 |

Adjusted R squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the table below the value of adjusted R squared was 0.756 an indication that there was variation of 75.6% on the supply chain performance due to changes in reverse logistics, green procurement, green packaging and waste management systems at 95% confidence interval. This shows that 75.6 % changes in supply chain performance could be accounted to changes in reverse logistics, green procurement, green packaging and waste management systems. R is the correlation coefficient which shows the relationship between the study variables, from the findings shown in the table below there was a strong positive relationship between the study variables as shown by 0.883.

**Table 10: ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.780 | 4 | 0.445 | 5.427 | .024[b] |
| | Residual | 2.870 | 35 | 0.082 | | |
| | Total | 4.650 | 39 | | | |

From the ANOVA statics in the table below, the processed data, which is the population parameters, had a significance level of 2.4% which shows that the data is ideal for making a conclusion on the population parameters as the value of significance (p-value) is less than 5%. The calculated value was greater than the critical value (5.426 >1.645) an indication that there was significant difference between supply chain performance and reverse logistics, green procurement, green packaging and waste management systems, this an indication that reverse logistics, green procurement, green packaging and waste management systems were significantly influencing supply chain performance.

**Table 11: Coefficients**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .686 | 0.207 | | 3.314 | .048 |
| | Reverse logistics | .371 | 0.105 | .312 | 3.533 | .006 |
| | Green procurement | .486 | 0.118 | .480 | 4.119 | .002 |
| | Green packaging | .229 | 0.071 | .178 | 3.225 | .010 |
| | Waste management systems | .057 | 0.013 | .044 | 4.385 | .030 |

The established regression equation was

$Y = 0.686 + 0.371 X_1 + 0.486 X_2 + 0.229 X_3 + 0.057 X_4$

From the above regression equation, it was revealed that reverse logistics, green procurement, green packaging and waste management systems to a constant zero, supply chain performance would stand at 0.686, a unit increase in reverse logistics would lead to increase in supply chain performance by a factor of 0.371. A unit increase in green procurement would lead to increase in supply chain performance by factors of 0.486. A unit increase in green packaging would lead to increase in supply chain performance by a factor of 0.229 and unit increase waste management systems would lead to increase in supply chain performance by a factor of 0.057. The study

further revealed that reverse logistics, green procurement, green packaging and waste management systems were statistically significant to affect supply chain performance, as all the p value (sig) were less than 0.05%. The study also found that there was a positive relationship between supply chain performance and reverse logistics, green procurement, green packaging and waste management systems

**Conclusion**

Reverse logistics influences the supply chain performance through controlling of environmental risks, proper utilization of materials by customers, results to customer satisfaction and ensures recycling of materials. The study concludes that reverse logistics affects supply chain performance to a great extent. Green procurement affects the supply chain performance by ensuring production with low environmental impacts, products which are using environmental friendly processes, environmental collaboration with the suppliers, eco-labelled products and adoption of environmental criteria into the supplier assessment systems. The study concludes that green procurement affects supply chain performance to a great extent.

Green packaging influences supply chain performance through reducing environmental impact by products within the supply chain, proper use of products by consumers, appropriate product design to minimize consumption of materials and energy, facilitates reuse, recycle and recovery of component materials. The study concludes that green packaging affects supply chain performance to a great extent. Waste management systems affects supply chain performance through recycling and re-using waste created, treating and controlling post combustion emissions, use of alternative fuels and encourages implementation of waste to energy process. The study concludes that waste management systems affects supply chain performance to a great extent.

**Recommendations**

The study recommends that the management of Kenya electricity generating company should encourage proper utilization of materials and recycling of materials as the study found that reverse logistics affects the supply chain performance to a great extent. The study recommends that the management of KenGen should integrate green procurement process in all its purchasing processes since it's characterized by a low environmental impact that is products environmentally friendly in nature and produced using environmentally friendly processes.

The study recommends that the management of KenGen should purchase products from manufacturers whose design products minimize consumption of materials and energy, that facilitate the reuse, recycle and recovery of component materials as the study found out that green packaging influences supply chain performance to a great extent. The study recommends that the management of Kengen should invest more in waste management systems as the study found out that waste management systems treats an controls post combustion emissions, treatment and recycle of waste created and allows for use of alternative fuels.

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