

## AN ASSESSMENT OF THE ROLE OF LOGISTICS ON GREEN PROCUREMENT MANAGEMENT AT KENYA AGRICULTURAL RESEARCH INSTITUTE

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### ABSTRACT

This study sought to assess the role of logistics on green procurement management at public institutions in Kenya: A Case study of Kenya Agricultural Research Institute (KARI). In previous researches into green procurement the main efforts have been directed towards private purchasing, as opposed to public procurement. The specific objectives of this study was to evaluate the contribution of vendor managed inventory to green procurement at public institutions, to establish the effects of management of transport services on green procurement at public institutions, to determine the contribution of packaging logistics to green procurement at public institutions and to find out the role of information sharing management on green procurement at public institutions. The target population of the study was the work force of KARI, Njoro. A sample was selected from this population using the stratified random sampling technique and data collected from members of this sample using interview schedules. The data was analyzed using both descriptive and inferential statistics. Results showed that Vendor Managed Inventory, Packaging Logistics and Information Sharing play a significant role in supporting green procurement at KARI. The ratings showed that VMI formed a support tool for Green Procurement, employees' awareness of the Practice of Vendor Managed Inventory and training on green procurement through Inventory Management are significant determinant of how VMI contributes to green procurement at public institutions. On transport management contribute to green procurement and its effects on cost and that the management of transport services was significant to green Procurement management. Information sharing was critical to implementation of green procurement and its implementation would not only reduce the associated costs but also add value to public procurement through cost reduction and enriching of employees knowhow on green public procurement. Finally, it was evident from the findings of the study that the stakeholders were informed of the already existing methods of attaining green procurement by using packaging logistics in an organizational setup. There was need to employ other innovative ways of Inventory Management techniques besides Vendor Managed Inventory in adding value and in the improvement of green procurement. On the management of transport services for a greener procurement, the employees and other stakeholders in public organizations will be part of the achievement of green procurement upon their active involvement in the use of cleaner and safer fuels in the transport sector. Finally, there is need for investment in modern information systems that

will not only help in information sharing but also on real time basis. The use of technology will significantly improve packaging logistics for green procurement and hence the need for allocation of resources within public organizations based on the pre-defined goals for greener logistics for greener public procurement.

**Key Words:** *role of logistics, green procurement management, Kenya Agricultural Research Institute*

## Introduction

The greening of procurement can yield higher profitability, which is an important reason why the topic has reached increased attention over the past decade (Theyel et al , 2001) & (Vachon & Klassen, 2006). For example, (Carter et al., 2000) shows that environmental purchasing can lead both to increased net income and lower costs, thus promoting improved firm performance. In previous researches into green procurement the main efforts have been directed towards private purchasing, as opposed to public procurement, (Walker et al., 2008). When in its cradle research on green procurement focused on product suppliers, where the interest has somewhat shifted to include services, (Bjorklund, 2011).

Common drivers in green procurement are regulatory compliance, customer pressure, risk minimization and monitoring of green performance (Walker et al., 2008). An investigation of the greening of purchasing can yield higher profitability, which is an important reason why the topic has reached increased attention over the past decade (Theyel et al 2001) and (Vachon & Klassen, 2006). For example, (Carter et al., 2000) shows that environmental purchasing can lead both to increased net income and lower costs, thus promoting improved firm performance. In previous researches into green procurement the main efforts have been directed towards private purchasing, as opposed to public purchasing (Walker et al. 2008). When in its cradle research on green procurement focused on product suppliers, where the interest has somewhat shifted to include services. However, research on the purchasing of transport services is still scarce. Common drivers in green procurement are regulatory compliance, customer pressure, risk minimization and monitoring of green performance (Walker et al., 2008).

An investigation of (Bjorklund, 2011) among Swedish purchasing managers reveals, that management, customers and carriers are among the most influential aspects for greening the performance of purchasing. The barriers for green procurement seem to vary more depending on specific cases; however costs and lack of resources occur more commonly, Walker et al., (2008). In green procurement, as in general, supplier evaluations of different types are important (Zsidisin & Siferd, 2001) and efficient tools can be helpful in the evaluation process. Large et al. (2011) suggest that a high level of supplier assessment influences the environmental performance. In more specific, (Foerstl et al., 2010) argue that in assessing the suppliers from a sustainability perspective, risk assessment is crucial, and hence risk assessment abilities become a key to success.

While environmental assessment of suppliers has grown in importance over the past years, there is still a lack of tools that facilitates the assessment of suppliers. One example is a benchmarking tool, which can support companies in improving their environmental considerations in purchasing. The greening of purchasing can yield higher profitability,

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### Statement of the Problem

Public procurement in Kenya has been fairly streamlined in the recent past following the creation of Public Procurement and Disposal Act of Kenya (2005) and its enactment in the year 2007. The emergence of climatic changes have had enormous effects on today's world economies and this has inevitably called for measures that are aimed at conserving the environment and at the same time ensuring the attainment of customer requirements in procurement processes. The introduction of environmental concerns in the purchasing activities contributes not only to the improvement of the overall company performance (Green et al., 1996). It may have positive effects on greening the supply chain through suppliers' involvement and cooperation (Theyel 2001), (Klassen & Vachon, 2003), (Vachon & Klassen, 2006). Nevertheless, most of the existing studies have focused on the product suppliers rather than service suppliers. Among the latter, third party logistics service providers (3PLs) are known to make a substantial contribution to the environmental stress that is considered harmful for the environment. In fact, transport and logistics activities contribute substantially to greenhouse gas emission at global level, (World Economic Forum, 2009).

For this reason, it is of critical importance to incorporate green considerations into purchasing decisions when companies source transport and logistics services, (Foerestl et al., 2010). The past studies have not focused on a critical assessment of logistics variables such as packaging logistics, distribution logistics and information sharing especially on a public procurement scale. The need to lower costs against inflationary trends and the pressure to acquire quality goods and services to meet consumer needs amid climate change due to environmental degradation are some but a few of the new set of challenges. This study therefore comes in to bridge this gap in knowledge by assessing the role of logistics in green procurement management by Kenya Agricultural Research Institute.

### General Objective

To assess the role of logistics management on strategic green procurement at public institutions.

### Specific Objectives

- 1 To evaluate the contribution of vendor managed inventory to green procurement at Kenya Agricultural Research Institute.
- 2 To establish the effects of management of transport services on green procurement at Kenya Agricultural Research Institute.
- 3 To determine the contribution of packaging logistics management to green at Kenya Agricultural Research Institute.
- 4 To find out the role of information sharing management on green procurement at Kenya Agricultural Research Institute.

## Literature Review

### Green Procurement and Green Consumer

The process of greening the supply chain begins, obviously, with the suppliers whose practice and products must become environmentally friendly. Thus, procurement of eco materials is the starting stage for manufacturing green products within a supply chain, (Huang & Keskar, 2007). (Russel, 1998) defines green procurement as the integration of environmental considerations into purchasing policies, standards (i.e. ISO 14000 series) and actions. Furthermore, green procurement is directly connected to suppliers product aspects related to eco-label, energy use, recyclability, re-usability, use of environmental management systems (EMS), use of harmful substances, product lifecycle and other processes that support the product creation (Nagel, 2003).

The first green procurement initiatives emerged in the public organizations in 1980s, 1990s, (Erdmenger et al., 2001) and today in EU, a survey has estimated up to 85 % public respondents that involve environmental consideration into their procurement process, Ochoa & Erdmenger, (2003). Private organizations are less responsive to the environmental issues, except those influenced by stakeholders, NGOs and government. (Min & Galle, 2001) found that the larger company is, the bigger probability that it will adopt green procurement strategies. Moreover, the firms that have serious engagement with the environmental regulations are more likely to adopt green supplier selection. However, green criteria are rarely incorporated in purchasing decisions, unless there are clearly defined benefits for the buyer or there are strict governmental regulations, (Porter & Van der Linde, 1995).

Environmental regulations enhance and force the eco-conscience of manufacturers, who, in order to find eco-alternatives for the materials that do not meet environmental criteria, initiate even suppliers environmental design. Selecting Green products is heavily based on behavior and values on Green behavior, (Barber, 2010). He states that individual and collective values are the two major values that influence the Green behavior of consumers. He also states that recycling is a behavior driven by strong values. Sweden is considered to be one of the top developed markets with environmentally sensitive consumers, (Pugh & Fletcher, 2002) where more than 90% of the population express and emphasize environmental friendly actions (Carlsson, 2008). According to (Barber, 2010), consumers might consider themselves 'Green' but it is uncertain if they truly will select seemingly environmentally friendly products especially when quality is the main factor. (Barber, 2010) also informs that the perception of the quality of wine as a product is an essential factor in the decision process.

## Theoretical Review

### Theory of Altruism

Altruism is a subset of pro-social behavior, (Schwartz', 1977). Theory of altruism suggests that pro-environmental behavior becomes more probable when an individual is aware of harmful consequences to others and when that person takes the detrimental influence of individualism in this context, (Borden & Francis, 1978) hypothesized that: Person with strong selfish and competitive orientation are less likely to act ecologically.

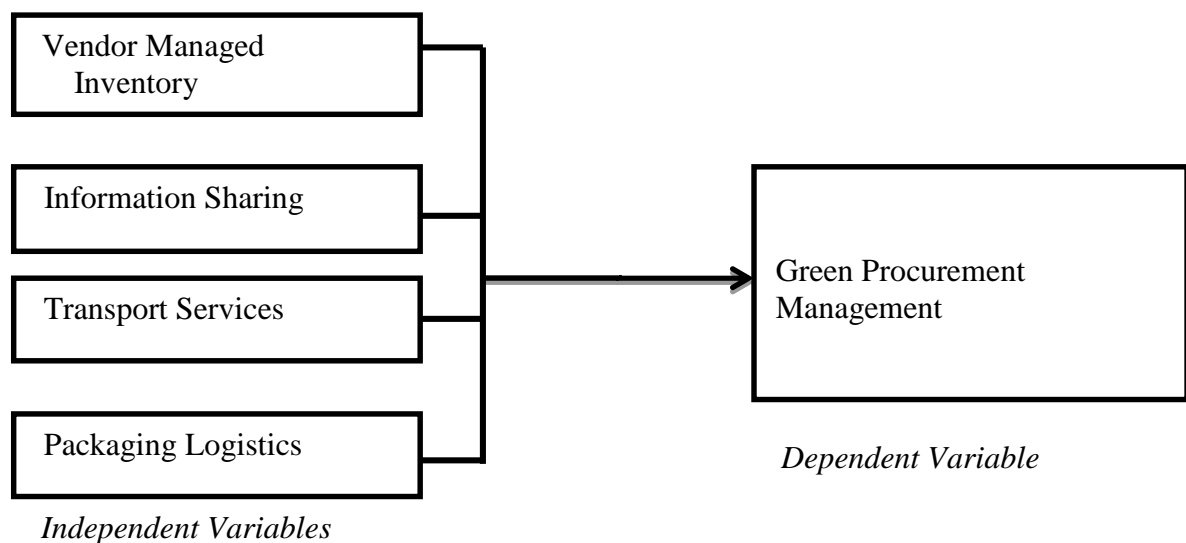
People who have satisfied their personal needs are more likely to act ecologically because they have more resources (time, money and energy) to care about bigger, less personal social and pro-environmental issues. Relating back to Schwartz' work, the study of Stern, (Dietz &

Kalof, 1993) examined the role that social altruism (concern of the welfare of others) and biospheric altruism (a concern for the non human elements of the environment) play in influencing green behavior. In the same vein, (Mostafa, 2009) found that altruism has a significant positive influence on the intention to buy green products.

### Theory of Collectivism

Individualistic or collectivistic orientations have been found to influence a variety of social behaviors. Likewise, person level tendencies of individualism or collectivism appeared to influence their motivation to engage in environmentally conscious behaviors. (McCarthy & Shrum, 2001) found a positive impact of collectivism on consumer benefits about recycling and their recycling behaviors because they tend to be more co-operative, willing to help others, and emphasize groups' goals over personal ones. By contrast, people with individualistic tendencies tend to view recycling less important (McCarthy & Shrum, 2001) and are less likely to participate in behaviors for resource conservation (Dunlap & Van Liere, 1984). Similar results were also found for ecological commitments (Li, 1997). Confirming the findings of the aforementioned authors (Kim & Choi, 2005) concluded that collectivism has an influence on the consumer's green buying behaviors.

### Conceptual Framework



**Figure2.1: Conceptual Framework**

The conceptual framework that guided the study as detailed above indicates the relationship between the dependent variable and the dependent variables. The dependent variable in this study was green procurement management whereas independent variables included; vendor managed inventory, information sharing, transport services and packaging logistics.

## Empirical Literature

### Transportation Services and Green Procurement

The negative environmental impacts of transportation have gained wide recognition and are at the core of issues of sustainability, especially in urban areas” (Rodrigue, Slack & Comtois, 2001). Many prior researches have been carried out on negative impact of transportation on environment. To minimize and to mitigate environmental concerns, green logistics and green transportation has been introduced in recent time. Logistics companies are becoming more flexible and slowly started moving towards green implementation. Implementation of this new strategy has definite challenges for logistics companies. Logistical structural changes were implemented as a model in order for the company to be successful in their green implementation.

The problems caused by freight transportation were noise, air pollution and climate change. The challenges of green implementation were identified as financial, employees’ inflexibility, distribution delay, taxation and fuel pricing. Over the last 30 years probably the term globalization has changed the business dynamic of the world (Rodrigue et al., 2001)

Globalization often described as the increase flow of knowledge, resources, goods and services among the nations. Few researchers have described this as greater integration of global economy build by free trade, free flow of capital, necessary to catch up new market and finally desire to find cheaper foreign labor markets. This transition of globalization has many other side effects on environment, economy, society and culture. Globalization has major impact on environment concerning the carbon dioxide and other greenhouse gas emission. A study, done by a cross section of 63 countries suggested that 1% increase in trade leads to a 0.58% increase in CO<sub>2</sub> emission mainly for the developing country (Magani, 2004).

To mitigate environmental issue, “Green Logistics” was introduced in recent time and there was an argument that “Green Logistic” can develop environmental friendly transportation systems. (Rao P. & Holt D., 2005) also summed up some environmental elements should be considered in logistic management from a transportation system such as type of transport, fuel sources, infrastructure, operational practices and organization.

Environmental-friendly waste management include; environmental improvement of packaging, taking- back packaging, Eco-labeling, Recovery of company’s end-of-life products, providing consumers with information on environmental friendly products and/ or production methods and use of environmentally-friendly transportation. Even though logistics operations have expanded significantly over the years, very little importance is still given to transportation when it comes to literature research. In spite of the fact that governments introduced several policies in order to decrease the impact of the pollution generated by transportation, there are several authors who question the efficiency of these measures, considering that their only contribution is to lead to the development of inefficient markets and increase the costs of companies, (Bayliss, 1998).

As technology progressed and worldwide transportation evolved, the amount of pollution generated to the environment by the means of transport increased dramatically. Therefore, most of the governments have formulated policies in the area of transportation regarding the reduction of these emissions. Because policies at international level were not being adopted

fast enough, the option has been to implement own policies at local level in order to decrease the negative impact that transportation has on the environment, (Carvalho et al., 2012).

In order to decrease the negative impact that transportation has on the environment, governments introduce new regulations in order to reduce the level of CO<sub>2</sub> and greenhouse emissions. According to some authors, these measures come in contradiction to the other measures that have been taken over the years regarding transportation, measures which were mostly about the liberalization and deregulation of transport, as opposed to regulation (Bayliss, 1998). The observation is that in all the other sectors of transportation, with the exception of green transport where new rules are forcing contractors to reduce the impact on the environment, deregulation policies were adopted during the years and the results were more than satisfactory for the companies involved. In this case it is easy to understand why the general fear of these authors is that these new regulations will not lead to overall progress and why they question the logic behind it (Bayliss, 1998).

Another problem that the regulation of transport is facing is the fact that applying all the new rules in the policies in the targeted countries is not very easy at all. Until a new regulation passes, it faces problems of a different nature such as competitive, political, social, economic and geographical problems. All these parameters need to be met in order for a new policy in the area of green transportation to be adopted, leading to increased costs, while its efficiency is questionable according to some authors (Carvalho et al., 2012).

Transportation plays a key role in the supply chain, because without the efficient movement of finished goods and raw materials the entire system would not be able to work at its full potential (Randall et al., 2010). There are problems however when it comes to implementing green transportation strategies in the case of some companies because the managers of these companies do not fully understand what are the measures that need to be taken so that their firm will be more effective in using green policies. The managers have problems in identifying the right drivers and barriers that they need to take into consideration in order to make their companies perform better from a green perspective. These problems seem to occur because there is apparently not enough knowledge in the domain of green transport among managers in order for them to be able to take the right decisions for their companies (Berns, 2009).

As technology progressed and governments and companies became more aware of the importance of protecting the environment, there have been new approaches towards value adding in green transportation. For quite some time, transport companies have identified the core values as being time and place utility, but there are authors who suggest that there are also other elements that need to be taken into account regarding the potential value that can be added to transportation in addition to time and place utility, Randall et al., (2010). It seems that along with the development of modern transportation, companies in this domain have identified new elements that have the potential of bringing value to their business. Because the importance of green logistics started to grow in the last couple of years, it is fair to say that this did not remain unnoticed by the transportation companies and they became aware of the fact that area of green logistics such as green transportation could represent the future, (Randall et al., 2010).

As technology and infrastructure change, the focus of green transportation should also include the changes that take place when it comes to traffic capacity and volume or the



condition of the pavement. Transport companies can add value through green logistics policies by coming up with solutions for modern day problems related to transport. As the awareness towards the use of these policies grew over the years, transport companies tried to add value by improving their services in different areas in order to minimize negative effects such as air pollution, congestion or greenhouse emissions, (Donaghy & Schintler, 1998).

According to (Randall et al., 2010), in the case of motor carrier transportation the concept of value is being developed around four themes: place, value-add, value management and time. The authors also managed to find other elements that might have the potential of serving as value-adders such as reliability, technology or type equipment. In the case of transportation it is very important for a company that has activities in this domain to have capabilities such as these in order to differentiate itself from other companies because in the case of the motor carrier industry price is not considered to be a distinguishing factor (Randall et al., 2010). Transport companies realized that they can use technology in order to add value through their green logistics policies. In the past three decades quite a lot of progress has been achieved in the area of ozone pollution, but it seems that at ground level there is still a lot left to be done regarding ozone concentrations. Local authorities can help transport companies in this area by informing them about the change of the levels of these emissions during the day, (Gao & Niemeier, 2008).

Another area where transport organizations can add value through green logistics is represented by the use of bio-fuels. This type of fuel presents several advantages and is less harmful to the environment compared to regular fuels. Bio-fuels enable land carriers to lower their emissions of pollutant gases that result in raised greenhouse levels and acid rain, and thus limiting the negative impact on the environment. Companies that use bio-fuels have the advantage of offering superior services to their customers and they also respect government regulations. Furthermore, bio-fuel is harvested from farms and forests and then is transported in order to be processed and this automatically implies that the most suitable means of transporting it would be by road carrier (Allen et al., 1998).

The activities of producing bio-fuel are interconnected and it is better for transport companies to take part in all these operations, instead of only incorporating a few into its strategy, because this way they will be able to limit their costs. This represents another reason for transport companies to consider exploiting the advantages brought by this fuel. However, the use of these bio-fuels has the disadvantage of the costs that it brings to the company, because all the operations involved in order to harvest and produce these bio-fuels involves a great financial investment from the companies that are willing to use them (Allen et al., 1998). Transportation companies use several methods of analyzing their activities, one of these being represented by benchmarking. One of the uses of benchmarking is also to identify the areas where a company can use green transport policies in order to add value.

(Menachof & Wassenberg, 2000) conducted a research in order to find out more about the activities that companies benchmark, what type of benchmark they are using and what are the areas where using benchmarking proved to be successful. When it comes to benchmarking, they identified that the greatest barrier is represented by time, and not employee commitment, while the second greatest barrier is represented by organizational complexity. Even though a lot of progress has been made in establishing the methods of adding value in the case of transport companies, there is still a long way to go

until the concept is fully understood by everyone. Several authors discovered that when it comes to value adding, there are a lot of companies that do not know exactly what value adding really represents, let alone what value adding from green logistics is or the advantages that different types of green logistics such as green transportation can bring to their companies (Rutner et al., 2000).

### **Logistics and Packaging Logistics**

(Johansson et al., 1997) defined logistics as: The process of planning, implementing and controlling the efficient, effective flow and storage of raw materials, in-process inventory, finished goods, services and related information from point of origin to point of consumption for conforming to customer requirements. It considers the materials flow as a whole rather than the single activities and sub-flows separately, and has the focus on the total result of the flow. In the same way (Johansson et al., 1997) defined packaging logistics as; (a field of study) aiming at developing (creating) packaging and packaging systems that support the objectives of logistics to plan, implement and control the efficient and effective materials flow. Packaging can be divided into three main categories, which are; primary packaging, secondary packaging and transit packaging. Primary packaging is the container or wrapping handled by consumer. It is the initial level product packaging like bottle, can, jar, tube, etc., that contains the item sold. It is the last packaging thrown by the consumer.

Secondary packaging is the outside of primary and used to describe large boxes or cases that are used to group quantities of primary packaged goods used for distribution and display in shops. In short it encloses the primary packaging like calculator in its box; (Rutner et al., 2000). Transit packaging works as wooden pallets, plastics wrapping and containers which are used to group the products in larger loads of transport and in turn helps in the loading and unloading of the goods. It can be used for warehouse storage or transport shipping. Packaging waste is very visible according to its large volume.

Almost 70% of primary packaging is used for food and drink purposes, which is often discarded in a dirty state and contaminated by residues of the original contents. Packaging is a coordinated system of preparing goods for safe, secure, efficient and effective handling, transport, distribution, storage, retailing, consumption and recovery, reuse or disposal combined with maximizing consumer value, sales and hence profit. Above its fundamental function of protecting, containing and preserving the product, the functions of packaging are manifold and complex and the definition here can be related to three main categories namely; logistics, marketing and environment. Logistics majorly describes the processes that involves the movement of the product, goods and services to the final consumer but with consideration of other business establishments that would facilitate this movement, while marketing entails a combination of activities that would ensure the satisfaction consumer needs at the right place and time. Finally the environmental element is concerned with the influences that come about that would dictate the consumption of the product as well the overall objectives of an organization (Saghir, 2002). Johnson (2000) presents an overview of important packaging functions in table below:

**Table2.1: Overview of different packaging functions**

|                               |  |
|-------------------------------|--|
| Logistical function           | Facilitate distribution<br>Protect both product and the environment<br>Provide information about conditions and locations                      |
| Marketing function            | Graphic design, format<br>Legislative demands and marketing<br>Customer requirements/ consumer convenience for end use as well as distribution |
| Environmental function/aspect | Recovery/recycling<br>Dematerialization<br>One-way vs reusable package<br>Toxicity   |

Source: Johnson (2000)

The packaging system is considered as one of other logistical sub-systems as transport system, inventory management system, order-processing system and warehousing system. Packaging is also considered as “an important warehousing and materials management concern” (Lambert et al. 1998). (Ballou 1998) considers packaging as a supportive activity to Business Logistics, where he calls it “protective packaging”. This gives some examples of efforts to recognize the role of packaging on various levels, but fails to stretch its influence beyond traditional limited thinking. Besides enabling the logistical function, the challenge lies in the fulfilling the marketing and environmental function of the packaging system throughout the supply chain. When it comes to packaging, trade-offs among logistical, marketing and environmental issues are present, although complex to comprehend and explain, (Prendergast, 1996).

The packaging system has to fulfill demands from a number of dependent areas and customers, which makes it hard to isolate relationships and functions in a cause and effect manner. In order to gain insight in the influence of packaging system in the supply chain, it is necessary to explore and analyze the packaging related activities on an operational level. The interactions between packaging, logistics and marketing are especially important due to the trade-offs that often must be made when choosing a packaging concept (Prendergast & Pitt, 1996). The dominating strategy found today is the logistical packaging (Johannson, 1998). “Logistical packaging affects the cost of every logistical activity, and has a significant impact on the productivity of logistical systems. Transport and storage costs are directly related to the size and density of packages. Handling costs depends on unit loading techniques.

Inventory control depends on the accuracy of manual or automatic identification systems. Customer service depends on the protection afforded to products as well as the cost to unpack and discard packaging materials. And the packaging postponement/speculation decision affects the cost of the entire logistics system. Furthermore, the characteristics of the logistics system determine the requirements and costs for packaging. An integrated logistics approach to packaging can yield significant logistics value.” (Twede & Parsons, 1997). The recycling of packaging waste is regulated in the EU by the Packaging Directive (94/62/EC). This

packaging directive sets targets for packaging recycling in all over EU and it needs the Member States feedback in the shape of report on the recycling of packaging waste annually. For instance, in Belgium, rate of total recycling packaging waste is the highest, almost 80%. In Austria, Sweden, Denmark, Luxembourg and the Netherlands, the recycling target of the Packaging Directive for the year 2008 has been achieved, almost 55% (European Environment Agency, 2010)

### **Vendor Managed Inventory for Green Procurement**

VMI is a supply chain strategy whereby the vendor or supplier is given the responsibility of managing the customer's stock, (Disney & Towill, 2003). The vendor is given access to its customer's inventory and demand information for the reason of monitoring the customer's inventory level. Furthermore, the vendor has the authority and the responsibility to replenish the customer's stock according to jointly agreed inventory control principles and objectives (Smaros et al., 2003). This is further supported by (Pohlen & Goldsby, 2003), who explains that vendors generate purchase orders on an as-needed basis according to an established inventory level plan and shared forecast data, consumption data and historical sales data. Once the purchase order is made, an advance shipping notice informs the buyer of materials in-transit (Waller et al., 1999). The merchandise is then shipped, delivered and "logged", according to the shipment strategy (Cetinkaya & Lee, 2000), supplier selection is the basic component of green procurement.

Finding the green source becomes much more problematic because of the environmental consideration and more important for further green performance. Investigations has shown that suppliers are becoming increasingly critical for the competitive success of the firm (Handfield & Pannesi, 1995) and purchasing managers are the key personnel in strategic sourcing and in advancing environmental bidding in supplier selection, Zhu & Geng (2001). Noci (1997) distinguish two types of environmental purchasing strategies: reactive and proactive environmental strategies. Even though VMI started out as a replenishment of inventory at the retailer's shelves, today the concept is usually applied to replenishment of inventories at retailer's distribution center (Pohlen & Goldsby, 2003).

"Inventory at the customer site may be owned by the supplier and bought by the customer only when used, or owned by the customer and simply monitored by the supplier for replacement" Warkentin, (2001). "In the conventional business model, suppliers will bill their customers once shipment is made, depending on the agreed payment terms. However, in some VMI, payment will only be made based on what the manufacturers have pulled from the hub" (Kuk, 2004) Inventory management aims to buffer organizations from uncertainties in forecasting consumer demand and vendor deliveries, (Benedict & Margeridis, 1999). VMI can help dampen the peaks and valleys, allowing smaller buffers of capacity and inventory. Furthermore, VMI can be used to resolves the dilemma of conflicting performance measures for example end-of-month inventory level verses out-of-stock measure, (Waller et al., 1999). When describing VMI some researchers make it synonymous with other concepts.

(Waller et al., 1999), say that Vendor-managed inventory is one of the most widely discussed partnering initiatives for improving multi-firm supply chain efficiency and that it is also known as continuous replenishment or supplier-managed inventory (SMI). But according to (Pohlen & Goldsby, 2003) this is wrong. They claim that VMI involves the coordination of management of finished goods inventories outbound from a manufacturer, distributor or

reseller to a retailer while SMI involves the flow of raw materials and component parts inbound to a manufacturing process. As technology advances so does the integrated relationships. The sharing of Point-of-sale data (POS) have facilitated consignment selling agreements where the product is not sold to the customer until an end user purchases the goods, (Pohlen & Goldsby, 2003) VMI moves supply chain management to the next level by aligning functional performance with process across multiple companies; requiring a shift of functions to the lowest cost firm as well as performing cost trade-off across company boundaries, (Pohlen & Goldsby, 2003)

(Cetinkaya & Lee, 2000) believe that VMI is an important coordination initiative. It can be used as one of the initial steps in a supply chain streamlining exercise or as a stand-alone process between trading partners, (Benedict & Margeridis, 1999). VMI relationship can be harder to enter into with manufactures that have a lot of customers. (Småros et al., 2003) shed some light on the problem in their investigation of the vendors. They claim that one major challenge for manufacturing companies is that usually only part of their customer base is involved in VMI. This means that the vendors need to set up their operations in a way that both VMI and non-VMI customers simultaneously can be efficiently served; this is both hard and costly have reported inventory reductions, improved customer service, and reduced obsolescence as the results of VMI adoption.

Disney & Towill (2003) mention that the upside of VMI is that main benefits are visible shortly after an implementation, investment pays off shortly and the software tool is fast to implement (weeks-month). Furthermore, they believe that the customers and suppliers in the network gain a greater knowledge and understanding of each other's working processes and businesses and the work load for the people working with operative logistics has less fluctuating. Traditional ordering errors are reduced. The customer does not have to wait for the right product to arrive; saving both time and money and the Vendor does not have to pay for costly return (Levin, 2004). Furthermore, the vendor's salespeople are no longer encouraged to push large inventory quantities to the customer. The customer will not encounter "overstock" that has to be sold with discounts (Waller et al., 1999) or merchandise that become obsolete over time (Pohlen & Goldsby, 2003).

However, it is important to mention that the inventory plan has dynamic changes in demand. It is influenced, among others, by product life cycle, promotional activities (Waller et al., 1999) and seasonal changes. These factors need to be known by the vendor in order to manage the stock properly. VMI is not only good for the customer it also has advantages for the vendor. Since the vendor has more freedom to consolidate resupply shipments over time and geographical regions, full vehicles are more likely to be dispatched and transportations scale economies are easier reached (Cetinkaya & Lee, 2000).

Waller et al., (1999) agrees and say that transportation managed properly will reduce costs because vendors can increase the percentage of low-cost full truckload shipments and eliminate the higher-cost less than truckload shipments because they are free to choose the timing of the replenishment shipments. (Småros et al., 2003) explain similar advantages and say that the vendor can further dampen demand peaks, for example, by delaying non-critical replenishments. In addition, as one level of order batching is removed the vendor receives more accurate, more rapidly available, and more level demand information making internal planning easier and more accurate.

Although the concept is easy to understand, accepting the change of working procedures and shift of responsibility takes time, (Disney & Towill, 2003). (Benedict & Margeridis, 1999) raise a warning finger for the reduced inventory control and flexibility the purchaser will face and the fact that vendor and purchaser are required to place significant trust in the ability of each other to meet their obligations. (Kraiselburd et al., 2004) claim that research shows that if contracts have not been clear on goal of inventory levels, VMI tend to lead to higher inventory levels. Participants should also consider that “the effect of stretching and delaying the payment can have adverse effects on the suppliers’ cash flow” and there is a danger in focusing on inventory reduction to the point that it cause more harm than good” (Kuk, 2004). VMI transfers the burden of asset management from the customer to the vendor, who may be obliged to meet a specific customer service goal (usually some sort of in-stock target), (Waller et al., 1999).

### **Information Sharing**

The information in a supply chain can be classified in different ways; strategic or tactical; logistical; or pertaining to consumers, (Mentzer, 2004). (Lee & Whag, 2000) discuss various types of shared information and their potential benefits. For example, sharing order status can improve the quality of customer service, reduce payment cycles and reduce labor cost. Sharing retail sales data can mitigate the bullwhip effect. (Huang et al., 2003) sort information into six categories pertaining to product, process, resource, inventory, and order planning. The value of information sharing depends on several conditions. For example, (Simchi-Levi & Zhao’s, 2003) showed that demand sharing has no significant benefits for a manufacturer under tight capacity. (Lee, So & Tang, 2000) found that demand information sharing has more value if demand is highly correlated over time, highly variable, or the lead time is long.

The product’s characteristics also affect the value of different kinds of information. Sharing forecasts of demand of products that have high demand variability brings significant benefits. The relationship between trading patterns also influences the selection of the type of shared information. For example, sharing production schedules with part suppliers can reduce part inventories without risking stock-out. Sharing shipping information with logistics agents can improve customer service levels.

Information sharing arrangements are dictated by circumstances. Most of the existing studies only analyze the sharing production information can be important. Most of the existing studies only analyze the sharing of production information, but other information for example, market and consumer information can be important (Mentzer, 2004). Sharing market knowledge can improve promotion planning. Sharing information and close coordination between retailers and manufacturers may facilitate developing new products. The previous studies have analyzed a number of types of shared information however there is still a critical question that needs more investigation i.e. what information should be shared with supply chain partners that give most benefits? An attribute of information is its timeliness. Delayed transmission of information exacerbates the effects of volatility afflicting the upstream level of supply chain.

Chen (1999) examines the impact of delay of information transmission (also called information lead-times) between supply chain stages. Reducing lags in the transfer of information from downstream is highly beneficial. (Bourland et al., 1996) found that timely

demand information affects suppliers' inventory control policy and that sharing demand information daily can decrease suppliers' expected inventory cost especially when demand variability is high. Another attribute of information is the level of detail or completeness of information.

If the information is transmitted every week, for example, there would be a question whether data should be provided on daily basis or aggregated per week. It is obvious that aggregate data has different variance than daily data and this could affect the operating decision of companies in a supply. There is possibility that some companies might not want to share their detail data with partners, fearing that the data could leak to their competitors, (Foerstl et al., 2010).

Numerous studies analyze the value of information sharing in a supply chain factors and affect the value. The overall objective of information sharing is to achieve efficiency in the whole supply chain. Ideally, all members of a supply chain should share the benefits equally but members with monopoly power may obtain most of the benefits. Under intense competitions, savings may flow through to customers. The unbalanced benefits of information sharing can discourage information sharing. Most studies on the value information sharing suggest that companies who gain most benefits give their trading partners incentives in various forms such as lower wholesale prices, flexible payment terms, (Bourland & Powell et al., 1996), suggests that manufacturers offer subsidies to retailers and incorporate the amount of subsidies into calculating the optimal number of retailers. Therefore, there is a strong need for more investigation on how to share the benefits of information sharing amongst partners, (Borg & Gall, 1974)

### **The Implication of Information Sharing for Organizations**

Realizing the benefits of information sharing depends on companies' ability to utilize shared information in their business processes, (Kuk, G., 2004) did a survey to investigate the impact of information sharing on companies' performance. They found that the highest profit margin companies are not simply exchanging information but they combine it with close collaboration. (Lee & Wang, 2000) argue that information sharing is only enabler for achieving supply chain efficiency. (Gavirmeni, 2002) showed that the benefits of information sharing can be obtained if companies change their operational policy. To take full advantages of information sharing, some significant changes in organization need to be implemented once information sharing in place. Companies should move towards collaboration with their partners to achieve common goals of supply chain efficiency that is built based on high level of trust between companies.

(Lee, 2000) argues that collaboration and coordination can be achieved through exchanging decision rights, work and resources. Exchanging decision rights, such as in a VMI program, should not be considered merely to alleviate the bullwhip effects or simply shift costs and responsibility to other parties, rather it should be noted that other parties are in the best position to accomplish such decisions. Work realignment can only be effective if information sharing is in place. This work realignment needs a cultural shift in organization to treat supply chain partners as if they are parts of organizations. (Mentzer, 2004) further argues that people can impede or facilitate collaboration. Information sharing will not bring significant benefits if people in organization still persist with past behaviors, exemplified by functional silos thinking.

## Research Methodology

### Research Design

Descriptive research design was used to carry out the research. Descriptive research is used to obtain information concerning the current status of the phenomena with respect to variables or conditions in a situation. The respondents were expected to give responses on the role of logistics on green procurement at KARI. This design was crucial for this study because the issue at hand needed to be described and the phenomenon analyzed for conclusions. The design was appropriate because according to (Mugenda & Mugenda, 2003), descriptive research design enables subjects to give more information on the issue of interest to the researcher.

### Target Population

Population has been defined by (Mugenda & Mugenda, 2003) as an entire group of individuals, events or objects having observable characteristics. In this research, the target population was the workforce of KARI drawn from various sections according to the organizational organogram.

### Sample Size

The sample the population to be studied was determined using Yamane (1967) sample size formula. This provides a simplified formula to calculate sample sizes. A 95% confidence level and  $P = 0.05$ . The sample was arrived at using the following formula

$$n = \frac{N}{1 + N(e)^2}$$
$$n = \frac{119}{1 + 119 (0.05)^2} = 92$$

Where  $n$  is the sample size,  $N$  is the population size, and  $e$  is the level of standard error. In this study, the target population comprised of 119 persons from which a sample size of 92 was arrived at using Yamane (1967) sample size formula.

### Sampling Design

Stratified random sampling method was used to select the sample. The top management, middle level management and procurement section and other relevant departments within each section were treated as strata. Finally, simple random sampling was used to pick actual respondents from each stratum after which data was collected by a way of interview schedules from the resultant sample.



### Data collection Instrument

The researcher used both primary and secondary sources to collect data for this study. The primary data was deemed suitable due to its nearness to the truth and ease for control over errors (Mutai, 2000). Primary data was collected through the use of interview schedules. In this case, the researcher administered interview schedules, with mainly closed ended questions to the sampled respondents. Secondary data was sourced by referring to existing materials such as, financial reports, journals, empirical researches in the area and other relevant document that relates to the role of logistics on green procurement.

### Data collection Procedures

Permission was obtained from the National Council of Science and Technology and the Ministry of Education through Jomo Kenyatta University of Agriculture and Technology (JKUAT). An introductory letter was written to Management of KARI request for permission to conduct the study. The letter explained the objectives of the study. Once permission was granted, a work plan for data collection was agreed. The researcher used the drop-and-pick method so that the personal touch, essential for maximum response rate, is enhanced. The drop-and pick method also allowed room for clarifications. Follow ups were done by use of emails and personal phone calls to the respondents to ensure the highest response rate possible.

### Data Analysis Procedures

The collected data was thoroughly examined and checked for completeness and comprehensibility. The data was then coded, summarized and tabulated. Descriptive statistics were used to identify and establish patterns, trends and relationships, and to make it easier to understand and interpret implications of the study. Measures of central tendency (mean, mode and median) were used to establish any similarities in the data, while measures of dispersion (standard deviation and variance) were used to establish any variations (deviations) from the data. Pie charts and bar graphs, as well as, percentages were used to represent data in a format that can be easily understood by other users.

## Results and Discussion

### Demographic Characteristics

By using Yamane (1967), a sample size of 92 was selected from a target population of 100, from which 78 respondents successfully interviewed. This translated to a proportion of 84.8% response rate. As regards the gender of the respondents who participated in the study, 47.4 % were male while 52.6% were female. On matters education and qualifications, the research findings indicated that 34.6 % of the respondents were Masters Holders and Diploma holders each. 25.6% Degree holders, while those with certificate qualifications were 5.1%. 52.6 % of the respondents at Kenya Agricultural Research Institute had worked for a period of within 0-3 Years and that 30.8% had worked for between 4-7 years. Finally, 16.7% had worked for the longest period of between 8-11 years.

### Vendor Managed Inventory

When the respondents were asked to respond to various aspects in Vendor Managed Inventory, mean responses showed that the respondents strongly agreed (1.53) that inventory management was an important aspect to green procurement. Also, the respondents showed the indication that the respondents were strongly of the opinion that they were aware of the practice of Vendor Managed Inventory at KARI. Further and by a way of average, the research findings showed that VMI ratings were a strong tool to support green procurement. Vendor managed inventory transfers the responsibility of managing the inventory level from the customer to the supplier. Waller et al. (1999) noted that vendor managed inventory can lead to efficient transportation management, which can significantly reduce the transport requirement during procurement. Småros et al. (2003) explains that vendor managed inventory enables the vendor receive more accurate, more rapidly available, and more level demand information making internal planning easier and more accurate. Vendor managed inventory, therefore, a factor that can impact to green procurement.

### Regression model on Vendor Managed Inventory Variables for Green Procurement

Regression was conducted on the vendor managed inventory variables in order to understand the inferential outcome of the research data. The variables under study on Vendor Managed Inventory for green procurement such as; VMI ratings as a support tool for green procurement, awareness and the practice of Vendor Managed Inventory and the attendance of training on green procurement through inventory management, predicted the practice of Vendor Managed Inventory at KARI by a proportion of 38.5%. This implied a situation where the predictors were slightly below average in predicting the practice of VMI at KARI.

### Management of Transport Services

The regression model on management of transport services as detailed here showed that management of transport services was influenced by cost management and that the effect of cost management influenced green procurement up to 20.5% proportion between the dependent variable and the independent variable. Transportation is a critical part the supply chain, which enables efficient movement of finished goods and raw materials through the entire system Randall et al., (2010). However, this component of the supply chain raises significant environmental concern such as air pollution, noise and congestion. From the regression model shown, the independent variables explain the dependent variable by a proportion of 20.5%.

From a total of 78 respondents interviewed as regards the management of cost for a greener procurement, 13 of them said that it reduced cost while 17 respondents thought that the action of management of transport services decreased cost. On the female category and their responses, 14 argued that it increased the related the operational cost while 21 asserted that the management of transport services decreased the related cost.

### Packaging Logistics

Packaging logistics is also a critical component of the supply chain. Packaging logistic seek to develop packaging and packaging systems that support the planning, implementation and control of the efficient and effective flow of information (Johansson et al,1997). Theory identifies packaging logistics as a prime target for efforts directed towards greening the supply chain since this component raises environment concerns related with disposal of packaging materials. The results showed that the mean average of the Likert scale used

1 being Strongly Agree while 5 being No idea, the respondents interviewed pointed out that packaging logistics were important factor of green procurement (1.44) and further the respondents agreed strongly to training of the relevant employees on green procurement sustainability. Notably also were the results that the respondents said that logistics were important and that the respondents, on average on a scale of 1-5 on the awareness of packaging logistics for green procurement.

### **Information Sharing Management**

As regards the best way to convey information on green procurement within the organization, the respondents strongly agreed that print media was the best option to employ in circulating information on green procurement. The ratings on the level of information sharing when scored on a Likert scale of 1-5, 1 being excellent and 5 being very poor, majority of the respondents on average (2.28) implied that the level of information sharing was rated good. Also, as regards the efficiency of information sharing on green procurement, the efficiency levels were responded to as good (2.35). Most of the respondents interviewed also argued that that there lacked enough media to exchange information on green procurement.

Theory suggests that information sharing can assist in the implementation of the green procurement concept. Lee & Wang (2000) argue that information sharing is the only enabler for achieving supply chain efficiency. For instance, sharing retail sales data can mitigate the bullwhip effect. Regarding to the information sharing variables, respondents were asked to rate the extent to which information sharing is practiced at the organization; whether they felt that information sharing was important to green procurement; whether there were enough media for information sharing within the organization, and whether the current information sharing systems are efficient.

### **Correlation of Study variables**

The inferential statistics on the study variables, correlation analysis, showed that there was a positive correlation of 0.367 between Vendor Managed Inventory and Information Systems, Management of transport services and Information System also exhibited a positive correlation of 0.366 and that there was a positive correlation between packaging logistics and information systems. More significantly was the fact that there were also positive correlations between Information and Vendor Managed Inventory, Management of Transport services and Packaging logistics at measures of 0.367, 0.366 and 0.502 respectively. The correlation of the study variables were computed at 0.01 significant levels.

### **Summary of Findings**

This study sought to assess the role of logistics on green procurement management at public institutions in Kenya: A Case study of Kenya Agricultural Research Institute (KARI). The study was motivated by the recognition that previous researches on green procurement have focused on private procurement. Data was analyzed using both descriptive and inferential statistics. As relates to Vendor Managed Inventory for green procurement, the results indicated that there was a significant relationship between these factors and the practice of VMI at KARI, Njoro. This implied that the rating of VMI as a support tool for Green Procurement, employees' awareness of the Practice of Vendor Managed Inventory, and training on green procurement through Inventory Management are significant determinant of how VMI contributes to green procurement at public institutions.

The study also sought to establish the effects of management of transport services on green procurement at public institutions. Several factors were brought out during the research. These factors included; the extent to which transport management contribute to green procurement and effects of transport management services on cost. Further, the results showed that there was a significant relationship between these factors. This implied that the management of transport services was significant to green Procurement management.

As regards packaging logistics, there was a significant relationship between these factors and employees perception about the significance of packaging logistics to green procurement. This implies that the identified factors have a significant impact on how packaging logistics contributes to green procurement at public institutions. Information sharing showed how information sharing influenced green procurement. These findings will make significant contributions towards supporting the development of green procurement at public institutions, in Kenya.

### Conclusions

From the summary of findings, the research study made the following conclusions:

The ratings showed that VMI formed a support tool for Green Procurement, employees' awareness of the Practice of Vendor Managed Inventory and training on green procurement through Inventory Management are significant determinant of how VMI contributes to green procurement at public institutions. On transport management contribute to green procurement and its effects on cost and that the management of transport services was significant to green Procurement management.

Information sharing was critical to implementation of green procurement and its implementation would not only reduce the associated costs but also add value to public procurement through cost reduction and enriching of employees knowhow on green public procurement. Finally, it was evident from the findings of the study that the stakeholders were informed of the already existing methods of attaining green procurement by using packaging logistics in an organizational setup.

### Recommendations

The study arrived at the following possible recommendations after its completion:

- 1 There was need to employ other innovative ways of Inventory Management techniques besides Vendor Managed Inventory in adding value and in the improvement of green procurement.
- 2 On the management of transport services for a greener procurement, the employees and other stakeholders in public organizations will be part of the achievement of green procurement upon their active involvement in the use of cleaner and safer fuels in the transport sector.
- 3 As relates to packaging logistics, the study recommends the application of information technology in order to improve the packaging of inventory.
- 4 Finally, there is need for investment in modern information systems that will not only help in information sharing but also on real time basis.

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